RECLAMATION

Managing Water in the West

Drop 2 Storage Reservoir Canal and Structures

Colorado River Front Work and Levee System - California

U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Denver, Colorado

TECHNICAL SPECIFICATIONS

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SECTION 00321 - GEOLOGIC INVESTIGATIONS

PART 1 GENERAL

1.01 GENERAL

A. General

1. The geologic descriptions, drawings, logs of subsurface explorations, water level data, and test data in these specifications include information and records of geologic investigations for the work, and are the geologic data upon which the design of this work is based. These data supersede any previous versions which may be available for examination by Offerors. Only the data that are specific to the needs of these specifications are included in these specifications. These data are contained in Section 00322 - Records of Geologic and Subsurface Investigations.

2. Selected samples recovered during investigations were tested by the Bureau of Reclamation (Reclamation) laboratories in Yuma, Arizona. Summaries of Physical Properties Test Results from laboratory tests performed on these samples are contained in Section 00322, Records of Geologic and Subsurface Investigations. Samples are available for examination at Bureau of Reclamation, Yuma Area Office, 7301 Calle Agua Salada, Yuma, Arizona. Offerors wishing to inspect the samples, visit the site, or take samples at the site should make arrangements with Mr. John English, at the Yuma Area Office, telephone no. (928) 343-8271.

3. Offerors are encouraged to inspect the site and to obtain their own samples and perform tests on the materials to evaluate properties which the Offerors believes to be significant.

4. Copies of the following reports and memoranda which contain pertinent information on the area, site geology, and materials properties may be examined at Yuma Area Office, 7301 Calle Agua Salada, Yuma, Arizona. Offerors wishing to inspect the reports and memoranda should make arrangements with Mr. John English, at the Yuma Area Office, telephone no. (928) 343-8271. Reference to these reports, that have been made within these specifications, are by alphabetic letter below enclosed in brackets.

   a. "All American Canal, Drop 1 Reservoir Investigation," U.S. Department of the Interior, Bureau of Reclamation, Lower Colorado Region, Boulder City, Nevada, February 2004.

   b. "All American Canal, Drop 2 Reservoir Investigation," U.S. Department of the Interior, Bureau of Reclamation, Lower Colorado Region, Boulder City, Nevada, July 2005.

   c. "All American Canal, Drop 2 Storage Reservoir, Siphon, and County Road Investigations, Geology Report," Colorado River Front Works and

Levee System Project, U.S. Department of the Interior, Bureau of Reclamation, Technical Service Center, Denver, Colorado, June 2007.

d. "Transmittal of Contractor's Report – Resistivity Surveys – All American Canal – Drop 2 Reservoir – Boulder Canyon Project, California," Prepared for the Bureau of Reclamation, Prepared by MGC, Lakewood, Colorado, November 2007.

e. "Laboratory Studies of Soil-Cement Materials for Drop 2 Storage Structures," Colorado River Front Works and Levee System, CA, All American Canal Drop 2 Storage Reservoirs, Lower Colorado Region, Technical Memorandum No. ZE-8180-3, U.S. Department of the Interior, Bureau of Reclamation, Technical Service Center, Materials Engineering and Research Laboratory, Denver, Colorado, January 2008.

f. "Probabilistic Ground Motions for Final Design – All-American Canal Reservoir Site, California," Technical Memorandum No. D8330-2005-15, U.S. Department of the Interior, Bureau of Reclamation, Technical Service Center, Denver, Colorado, October 2005.

5. The geologic logs of standard penetration testing holes (SPT), cone penetrometer holes (CPT), and test pits (TP), water-level data, and other available geologic information indicate the conditions encountered during the investigations. The water-level data show the conditions at the particular time or times the information was obtained and may not indicate variations such as those caused by drought, precipitation, changes in the surface elevation, irrigation, flooding or lining of the nearby All American Canal.

6. Geologic drawings included in these specifications portray generalized geologic conditions. The geologic logs of explorations should be consulted for specific details. Engineering geology and geotechnical considerations are discussed in article Engineering Geology and Geotechnical Considerations below. A discussion of water occurrence occurs in article Water Occurrence below.

7. General Geologic Legend, Explanation, and Notes, including general geologic unit definitions, explanations of geologic symbols, and geologic notes are shown on drawing 423-D-758.

8. Surface geology and location of explorations, cross sections, and note drawings for the work are included in these specifications on drawing 423-D-759 through 423-D-763, Reference Drawing Nos. 212-D-8154 through 212-D-8161, and including specifications Reference Drawing designation G15 which has no official drawing number.

9. Surficial materials recorded in all geologic exploration logs included in these specifications were classified under current Unified Soil Classification System procedures as described in USBR 5000 (laboratory classification) and USBR 5005 (visual classification). These two procedures are similar to ASTM D 2487 and ASTM D 2488, respectively. Copies of the above Reclamation procedures

are available for review at the Bureau of Reclamation, Yuma Area Office, 7301 Calle Agua Salada, Yuma, Arizona.

10. Reclamation has established standard descriptors and descriptive criteria for rock and standard descriptors and descriptive criteria for discontinuities. These standards are available for review at Yuma Area Office, 7301 Calle Agua Salada, Yuma, Arizona. The standards provide the basis for classification and description of rock and discontinuities logged after September 1984.

1.02 REFERENCES

A. ASTM International (ATSM)

1. ASTM D 2487-06 Classification of Soils for Engineering Purposes (Unified Soil Classification)
2. ASTM D 2488-06 Description and Identification of Soils (Visual-Manual Procedure)

B. Bureau of Reclamation (USBR)

1. USBR EM – Earth Manual, Part 2, Third Edition (1990)
2. Procedure No. and Title
   a. USBR 5000-86 Determining Unified Soil Classification (Laboratory Method)
   b. USBR 5005-86 Determining Unified Soil Classification (Visual Method)

1.03 GEOLOGIC INVESTIGATIONS

A. Geologic investigations conducted for the All American Canal Drop 2 Storage Reservoir site are listed below; and available logs of investigations are contained in Section 00322 - Records of Geologic and Subsurface Investigations.

1. Reclamation has conducted two previous exploration programs associated with the Drop 2 Storage Reservoir work. The first program was conducted in the winter of 2003 in the vicinity of Drop 1 on the All American Canal. Nine Standard Penetration Testing (SPT) drill holes and four test pits were excavated for this program Hollow stem augers were used to advance the holes between SPT test intervals. All SPT intervals were laboratory tested for physical properties at the Yuma Area Office (YAO), Yuma, Arizona. The predominate materials type is Poorly Graded Sand (SP) with scattered intervals of Poorly Graded Sand with Silt (SP-SM) and a few intervals of Poorly Graded Sand with Gravel (SP)g. SPT uncorrected blow counts per foot (bpf) of penetration are summarized in Table 00321A – Drop 1 Data. Six of these holes were completed as piezometer locations.

Table 00321A - Drop 1 Data

Depth interval (ft.)	# of tests all holes	highest blow count	lowest blow count	average blow count value of all tests
0 - 10	28	14	4	7.8
10 - 20	27	18	5	11.6
20 - 30	17	38	8	16.6
30 - 40	18	36	12	21.6
40 - 50	27	62	12	31.5

2. Four test pits were excavated to a depth of 15 feet each, using a D-9 dozer. A Nuclear Density gage was used to determine in-place density of materials within these test pits. Standard properties and specific gravity tests were conducted in the laboratory using foundation materials collected from the same locations within the test pits. A summary of all test pit data are included in Section 00322 - Records of Geologic and Subsurface Investigations.

3. One hole from this program (SPT-3-AACR) was about one-quarter mile north of the county road bridge crossing. Eleven sample intervals were laboratory tested as Poorly Graded Sand (SP) with a maximum fines content of 6 percent and gravel content of 7 percent both in different intervals. Uncorrected blow count data ranged from 8 blows per foot at near surface to 35 blows per foot at the depth of 46.0 feet. Water was recorded at 32.6 feet.

4. A second exploration program was conducted by Reclamation in the spring of 2004, and included the Drop 2 Storage Reservoir site, the 6.5-mile-long inlet canal alignment and the inlet structure near Drop 1 on the All American Canal and the Coachella Canal. These explorations included 16 SPT holes, 12 test pits and 48 cone penetrometer testing (CPT) holes [b]. Sixteen of these holes were completed as piezometer locations. A dewatering test was conducted near Drop 1, and the existing Coachella Turnout Structure, to evaluate design requirements for construction of a new Coachella canal turnout. The analysis of this dewatering test and all cone penetrometer testing data are included in the "All American Canal, Drop 2, Reservoir Investigation" report [b]. A summary of all SPT hole and test pit data are included in Section 00322 - Records of Geologic and Subsurface Investigations.

5. Additional geotechnical investigations were conducted along a 23.2 mile re-alignment of the All American Canal for the purpose of concrete lining of the canal prism. These investigations were conducted by Geotechnics Incorporated, El Centro, California, and included 60 hollow stem borings, three seismic refraction surveys and 15 cone penetrometer test soundings. Laboratory testing included particle size analysis, maximum density and optimum moisture content, direct shear tests, tri-axial shear tests, soluble sulfate content, pH, resistivity, and

soluble chloride content. A report for these explorations was completed in August 2005, but is not included in these specifications.

6. Five SPT holes (SPT-06-01 through SPT-06-05) and two undisturbed sample holes (DH-06-06 and DH-06-07) were drilled in August of 2006, to explore the county road bridge site, and the steel pipe alignment and provide site specific data for structure design purposes. SPT testing was started after the augers were aligned, seated and centered to a depth of 3.5 feet. Testing was conducted at 2.5-foot intervals continuously to the total depth of 50 feet. The seating and testing intervals were recorded as penetration per blow on the field penetration resistance testing chart with associated graph for each interval of every hole tested [c].

7. The two undisturbed sample holes collected foundation materials by using a two-foot long, clear acrylic liner placed inside a 2.5-foot long, steel spilt-tube sampling barrel. This assembly was then placed inside the hollow stem augers. The sampler was pushed downward, ahead of the augers, by using the drill rig hydraulic system, and not rotating the augers. The sample was then retrieved from the hole and each two-foot long acrylic liner sample removed, capped on both ends, sealed with duct tape and labeled with proper depths on each end. The samples were stored vertically, bound together, and are presently stored at the Yuma Area Office for future observation or testing. These holes were backfilled with native soils while pulling the augers after sampling was completed.

8. An additional exploration program was conducted in April of 2007 to find a borrow source for soil-cement from the reservoir excavation. Thirty-nine auger holes (AH-TP-07-1 through AH-TP-07-26 and AH-TP-07-28 through AH-TP-07-40) were drilled within the southern one-third of the proposed reservoir area to a depth of ten feet each; see drawing 423-D-763. For each auger hole, a representative sample of the upper five feet and another representative sample of the lower five feet were sent to the Yuma Area Office laboratories for gradation analysis. The Summary of Gradational analysis and graph of Grain Size Distribution are included in Section 00322 - Records of Geologic and Subsurface Investigations.

9. A series of eleven test pits (TP-07-01 through TP-07-11) were distributed across the same reservoir investigations area to confirm results from the auger holes and provide a better physical view of the vertical distribution of foundation materials. Representative samples of these test pits were also tested for physical properties analysis. The Summary of Gradational analysis and graph of Grain Size Distribution are included in Section 00322 - Records of Geologic and Subsurface Investigations.

10. Geophysical investigations were conducted during November 2007, in the form of nine surface electrical resistivity surveys, to provide design data for the cathodic protection system associated with the siphon for with this project [d]. The locations of these investigations are shown on drawing 423-D-761.

1.04 REGIONAL GEOLOGY

A. The proposed inlet canal, reservoir, steel pipe crossing, and outlet canal areas are located in the Imperial Valley which is part of the topographic and structural Salton Trough of Southern California. The Salton Trough is within the Basin and Range physiographic province. The trough is bounded on the northeast side by the San Andreas, Sand Hills and Calipatria Faults and on the southwest side by the San Jacinto, Coyote Creek and Superstitions Hills Faults. These faults are semi-parallel and are strike-slip in nature.

B. The trough is a rift valley about 130 miles long and up to 70 miles wide, and is a landform extension of the depression filled by the Gulf of California. Approximately five million years ago the San Andreas fault system and the East Pacific Rise split the Baja Peninsula from the mainland of Mexico. The northern hinge point of this fault system is the Salton Trough. All of the area north of the Mexican border would be part of the Gulf of California today, if it had not been for the sediments carried to and deposited in the Salton Trough over millions of years by the Colorado River.

1.05 SITE GEOLOGY

A. The foundation for the proposed work area is identified as recent alluvium (Qal) on the Geologic Map of California, San Diego-El Centro Sheet, dated 1962. This alluvium is composed of predominately Poorly Graded Sand (SP) with minor interbeds of coarse to fine grained gravel. Lenses to thin layers of silty and/ or clayey fines are recovered in subsurface drilling and spotty on the ground surface as hardpan ground. The percent of silty fines content changes throughout the near surface foundation and has been a target for explorations associated with soil-cement production for the project.

B. There are two types of geomorphic surfaces expressed at the work site. Near surface to greater than 75 feet of depth is dominated by alluvial materials derived from millions of years of Colorado River flows, delta and floodplain accumulation. These materials are currently being reworked by mostly eolian processes. The area east of the All American Canal Drop Structure Number 1 (Drop 1), is part of the Imperial Sand Dunes National Recreational Area, and dominated by large continuous eolian sand dunes. The area immediately north of the proposed Drop 2 Storage Reservoir site is also dominated by moderate sized sand dunes, averaging 20 feet horizontally and 3 to 6 feet high, accumulating around small bushes and creating a trough and mound topography. To the west of the reservoir site the landform is commonly wind-blown desert pavement with abundant gravel, higher fines content and a typical sheet-flow drainage pattern.

C. Natural ground, not influenced by human development, is predominately composed of cohesionless, fine- to medium-grained, quartz sand with generally less than five percent nonplastic fines. These deposits extend to several tens of feet deep throughout the exploration sites. Gravel content is variable but predominately less than ten percent by dry mass. The reservoir site was previously used as an experiential agricultural research area, and therefore, contains surficial cut and fill to level the ground surface and provide drainage to crop areas. This activity does not extend much more than two feet at any

exploration site and was mostly composed of native alluvial materials, which are hard to differentiate from undisturbed foundation materials.

D. Bedrock was not recorded at any exploration site and will not be encountered in any foundation for any structure on this project.

1.06 WATER OCCURRENCE

A. Water was not recorded within any of the test pits dig for this work area. Water was recorded in all SPT holes drilled in the work area. Water ranged in depth from 12.8 feet to 43.0 feet below ground surface. When plotting all water level data versus distance from the All American Canal or the Coachella Canal, a correlation was shown. In general the water table was deeper with distance from these water sources. The variation in depth to the water table related to surface precipitation is unknown due to the lack of periodic piezometric readings.

B. Summary of Draw Down Test near Coachella Turnout

1. Reclamation conducted a draw down test on the foundation materials in the northeast corner of the intersection of the All American Canal (AAC) and the Coachella Turnout (CT) in January 2005. The pump well was set nearest this corner at 150 feet off the upper bank of the AAC and 1,000 feet away from the upper bank of the CT. The pump well was drilled to 100 feet of depth with the pump installed at 95 feet of depth in the hole. The upper 85 feet of foundation materials consisted of predominately Poorly Graded Sand (SP), with isolated zones of material with gravel content to as much as 13 percent and fines content to as much as 8 percent. At the bottom of the pumping well, about 15 feet of a lean clay with silt (CL-ML) was recorded. This lean clay formed a confining unit that was considered the base of the aquifer for testing purposes. However, the lateral extent of this clay is not known.

2. Summary of draw down test is provided for information only. The Government assumes no responsibility for deductions, interpretations, or conclusions made by the Contractor based on information made available by the Government, in accordance with the clause at FAR 52.236-3 “Site Investigations and Conditions Affecting the Work.”

3. One line of three observation wells was placed at 25, 50 and 100 feet, roughly on a north bearing, from the pumping well. A second set of three observation wells were placed at 25, 50 and 100 feet, roughly on a east bearing, from the pumping well. All of the observation wells were drilled to 50 feet depth. The foundation materials, for all wells, consisted predominately of poorly graded, medium sands (SP) with minor amounts of gravel and fines.

4. The static water level in the pump well was 31.3 feet below ground surface (bgs). Static water levels in all observation wells were between 27 and 28 feet of depth bgs. The pump was rated at 400 gallons per minute with a Total Dynamic Head

of 60 feet. Pressure transducers were placed in the pump well and all of the observation wells and hooked to a Hermit 3000 Data Logger.

5. Test procedures and testing results are contained in Reclamations Drop 2 Reservoir Investigations Report [b]. Offerors are encouraged to obtain a copy of this report at Yuma Area Office, 7301 Calle Agua Salada, Yuma, Arizona.

6. The conclusion stated in the report is that "… the materials respond as an unconfined aquifer although locally at individual wells they may be more like semi-confined or leaky confined aquifer materials."

7. All of the information presented in this section, or taken from this test report is for information only. Offerors are responsible for conducting their own testing to satisfy data needs for design and operation of the dewatering/ unwatering system chosen by the Offeror for these specifications.

1.07 ENGINEERING GEOLOGY AND GEOTECHNICAL CONSIDERATIONS

A. All of the data presented below are for information purposes only. Offerors are encouraged to inspect the site and to obtain their own samples and perform tests on the materials to evaluate properties which the Offeror believes to be significant.

B. Excavation

1. Foundation Materials

a. Foundation materials for all excavations contained in this project are considered common excavations. There are no rock foundations within the project area, and therefore no blasting will be incorporated into any of the foundation excavations. Foundation materials are predominately fine- to medium-grained, hard sand composed of quartz and feldspar. Laboratory classifications of materials from explorations were predominately Poorly Graded Sand (SP). Generally there is less than ten percent of either fine grained silt and clay or of gravel in the soils classification of these materials

b. All test pit and test trench explorations provided for design were excavated with equipment ranging from a Caterpillar D9 Dozer to a Caterpillar Backhoe. None of these explorations were terminated by refusal of equipment on hard foundation materials. Exploration logs are included in Section 00322 – Records of Geologic and Subsurface Investigations.

c. Visual observations from test pits and samples retrieved from drill holes indicate thin zones, lenses and/ or layers of clay are present throughout the foundation. Clays are classified as Clayey Sand (SC), Lean Clay (CL) and Fat Clay (CH). These clayey materials should be eliminated from embankment and structure backfill and soil-cement borrow. However, these materials can be used as soil cover for the geomembrane liner within

the reservoir bottom, provided that they are not placed next to the gravel filter.

d. Avoid placing continuous lifts of embankment material which contain fines content greater than 40 percent by weight. This condition would most likely only occur if materials were taken from the area designated for soil-cement stockpile on drawing 423-D-763. If these materials are used in embankments they shall be placed on the outer, dry side slopes.

2. Groundwater

a. An evaluation of drill hole water levels indicates a correlation between distance from either the Coachella Canal or the existing All American Canal and increased depth of groundwater. Those activities that are near either of these two water delivery systems have the potential for water to be present in the excavations.

b. Groundwater levels from recent field investigations indicate that dewatering and unwatering features may be needed to construct the modifications to the Coachella turnout structure. Groundwater levels from recent field investigation indicate that dewatering and unwatering features may be needed to construct the Interstate 8 pipe crossing, the siphon outlet transition, and the Drop 2 outlet canal.

c. Groundwater levels recorded to date reflect the influence of the unlined All American Canal. Construction of the lined All American Canal should be completed prior to start of construction on the Drop 2 Storage Reservoir project. Lining of the All American Canal is likely to have some influence on groundwater levels measured on the south side of Interstate 8. However, the affect of lining the All American Canal on groundwater levels is unknown at this time. The Contractor should review groundwater levels prior to design of the dewatering program.

d. Poorly Graded Sand (SP) foundations will not stand open in the presence of either water from surface runoff or from groundwater.

e. The results of the Reclamation pump out test have been discussed above, but Offerors are encouraged to investigate testing by other agencies and private concerns within this reach of the All American Canal, the Coachella Canal and water well records of yield to provide a more complete assessment of unwatering and dewatering needs.

3. Prewetting

a. The natural moisture content of foundation materials averages 2 percent. To facilitate excavation of these predominately sandy soils, prewetting the depth of excavation has been beneficial on the All American Canal lining project. The addition of water increases the firmness of the soil and allows more efficient operation of equipment.

C. Slope Stability

1. The upper 5 to 15 feet of excavation within the test pits is predominately in cohesionless and dry Poorly Graded Sand (SP). Excavation in this material often meant that side slopes of the test pit were required to be laid back at a minimum of 1½ horizontal to 1 vertical and often were at 2 horizontal to 1 vertical or greater. The foundation material would continue to ravel into the test pit and often made continued excavation difficult due to limitations of reach of equipment and unstable upper lip of the trench where the equipment was supported.

2. The Contractor shall maintain all excavations in a safe manner in accordance with the Reclamation Safety and Health Standards, with emphasis on Section 22 - Excavation Operations. Shoring systems may be required to effectively complete work items. Construction traffic shall remain a safe distance from the edge of the excavation to insure that no cave-ins or sloughing of the side walls occurs related to bearing weight or vibration from movement. Minor caving or sloughing will occur if the excavation is left open for an extended period of time, because of drying of the foundation materials and the action of wind which is often persistent at the project site.

3. Raveling and rilling will occur if water is allowed to come in contact with the excavation slopes because of their dry cohesionless nature.

D. Abandonment of Existing Explorations

1. All known explorations have been shown on the drawings. Many of these locations are within areas to be excavated during this project. Any existing exploration site that is disturbed during the excavation process will be removed in accordance with Section 02226 – Removing Existing Well Protective Pipes and Grouting Standpipes.

E. Soil-Cement Borrow Materials

1. Thirty-nine auger holes shown on the drawings and designated as AH-TP-07-01 through AH-TP-07-26 and AH-TP-07-28 through AH-TP-07-40 were completed to investigate foundation materials with soil classifications suitable for soil-cement borrow materials. Eleven test pits (TP-07-01 through TP-07-11) were also included in this investigation. Other explorations may meet the soil-cement borrow requirement, but their locations are scattered and un-economical to collect, transport and process.

2. Reclamation has evaluated all of the explorations and determined the most acceptable area within the reservoir and associated structures excavation for obtaining soil-cement borrow materials, as shown on drawing 423-D-763. The requirement for fines content in soil-cement is described in Section 02377 – Soil-Cement. It is the responsibility of the Contractor to ensure that the proper

materials requirements can be met by excavating, stockpiling and processing of the area designated for soil-cement borrow.

F. Rockfill Stockpile Site

1. The Government will provide the materials designated as rockfill on the drawings related to the inlet/outlet structure area. This material is discussed in Section 02331 – Rockfill and in Section 01640 – Government Furnished Materials. Geologically this material is a Quartz Monzonite which was quarried from Pilot Knob in 1984, and currently stockpiled at the Drop 2 Storage Reservoir site by separate contract. No blasting will be allowed within any of the stockpile area. Offerors are encouraged to visit this stockpile site. Offerors should make arrangements with Mr. John English, at the Yuma Area Office, telephone no. (928) 343-8271.

2. Specifications require that rockfill range in size from 6 inches to 2 feet in maximum dimension. Material smaller than 6 inches is allowed provided that the quantity does not exceed that which will fill the voids in the larger material. The stockpile contains material larger than 2 feet in maximum dimension. On site processing the material will be required to handle larger material. The Contractor may use a hoe-ram excavator or other mechanical means to break oversize to required dimensions.

G. Foundation Stability

1. Thirty standard penetration test (SPT) holes have provided strength of foundation materials data on which these designs have been evaluated. The general trend of this testing indicates that the upper 10 to 20 feet of the project site contains predominately unconsolidated sands with uncorrected blow counts per foot of penetration (bpf) ranging from 4 to 18 and averaging 8 bpf for the upper ten feet and 12 for the depth of 10 to 20 feet. These materials are predominately not saturated and therefore not a great threat to liquefaction in their present state.

H. Materials Distribution

1. The materials distribution drawing shows the anticipated use of excavated materials. The reservoir design is based on balancing cut and fill. If the quantity of suitable material obtained from required excavation should exceed that required for permanent construction, waste areas will be designated. Should additional borrow be required, these materials will be obtained from the designated borrow area, which is located in the northwest corner of the reservoir site.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 00322 – RECORDS OF GEOLOGIC AND SUBSURFACE INVESTIGATIONS

PART 1 GENERAL

1.01 LIST OF DRAWINGS

A. Drop 2 Storage Reservoir – Geologic Investigations

G1.	423-D-758	General Geologic Legend, Explanation and Notes
G2.	423-D-759	Location of Geologic Explorations-Calendar Years 2003 to 2006
G3.	423-D-760	County Road Relocation – Geologic Plan and Profile
G4.	423-D-761	Forebay/Afterbay, Siphon Crossing & Outlet Canal – General Geologic Plan
G5.	423-D-762	Siphon Crossing -- Geologic Section E-E’
G6.	423-D-763	Reservoir Area – Soil-Cement Exploration Plan

B. Reference Drawings – Bureau of Reclamation

G7.	212-D-8154	All American Canal – Reservoir Investigations – Location Map, General Geologic Explanation and Notes
G8.	212-D-8155	All American Canal – Reservoir Investigations – Section A-A’
G9.	212-D-8156	All American Canal – Reservoir Investigations – Section B-B’
G10.	212-D-8157	All American Canal – Reservoir Investigations – Section C-C’
G11.	212-D-8158	All American Canal – Reservoir Investigations – Section D-D’, Sheet 1 of 4
G12.	212-D-8159	All American Canal – Reservoir Investigations – Section D-D’, Sheet 2 of 4
G13	212-D-8160	All American Canal – Reservoir Investigations – Section D-D’, Sheet 3 of 4
G14	212-D-8161	All American Canal – Reservoir Investigations – Section D-D’, Sheet 4 of 4
G15.	no number	All American Canal – Drop 1 – Reservoir Feasibility Study Complete SPT Auger Holes and Test Pit Locations

C. Standard Drawings – Bureau of Reclamation

G16.	40-D-7022	Geology for Design & Specifications – Standard Descriptors and Descriptive Criteria for Rock
G17.	40-D-7023	Geology for Design & Specifications – Standard Descriptors and Descriptive Criteria for Discontinuities

1.02 DRILL HOLE LOGS

A. Explorations during Calendar Years 2003 and 2004

G18. SPT-1-AACR, Sheet 1 of 1

G19. SPT-2-AACR, Sheet 1 of 1
G20. SPT-3-AACR, Sheet 1 of 1
G21. SPT-4-AACR, Sheet 1 of 1
G22. SPT-5-AACR, Sheet 1 of 1
G23. SPT-6-AACR, Sheet 1 of 1
G24. SPT-7-AACR, Sheet 1 of 1
G25. SPT-8-AACR, Sheet 1 of 1
G26. SPT-9-AACR, Sheet 1 of 1

G27. SPT-1-AACR2, Sheet 1 of 3
G28. SPT-1-AACR2, Sheet 2 of 3
G29. SPT-1-AACR2, Sheet 3 of 3
G30. SPT-2-AACR2, Sheet 1 of 2
G31. SPT-2-AACR2, Sheet 2 of 2
G32. SPT-3-AACR2, Sheet 1 of 2
G33. SPT-3-AACR2, Sheet 2 of 2
G34. SPT-4-AACR2, Sheet 1 of 2
G35. SPT-4-AACR2, Sheet 2 of 2
G36. SPT-5-AACR2, Sheet 1 of 2
G37. SPT-5-AACR2, Sheet 2 of 2

G38. SPT-1-ICA, Sheet 1 of 2
G39. SPT-1-ICA, Sheet 2 of 2
G40. SPT-2-ICA, Sheet 1 of 2
G41. SPT-2-ICA, Sheet 2 of 2
G42. SPT-3-ICA, Sheet 1 of 2
G43. SPT-3-ICA, Sheet 2 of 2
G44. SPT-4-ICA, Sheet 1 of 2
G45. SPT-4-ICA, Sheet 2 of 2

G46. SPT-1-OCA, Sheet 1 of 2
G47. SPT-1-OCA, Sheet 2 of 2
G48. SPT-2-OCA, Sheet 1 of 2
G49. SPT-2-OCA, Sheet 2 of 2
G50. SPT-3-OCA, Sheet 1 of 2
G51. SPT-3-OCA, Sheet 2 of 2
G52. SPT-4-OCA, Sheet 1 of 2
G53. SPT-4-OCA, Sheet 2 of 2
G54 SPT-5-OCA, Sheet 1 of 2
G55. SPT-5-OCA, Sheet 2 of 2

G56. SPT-1-CCO, Sheet 1 of 2
G57. SPT-1-CCO, Sheet 2 of 2

G58. SPT-1-ICDS, Sheet 1 of 2
G59. SPT-1-ICDS, Sheet 2 of 2

G60. SPT-1-RIDS, Sheet 1 of 2
G61. SPT-1-RIDS, Sheet 2 of 2

B. Explorations during Calendar Years 2006

G62. SPT-06-01, Sheet 1 of 2
G63. SPT-06-01, Sheet 2 of 2
G64. SPT-06-02, Sheet 1 of 2
G65. SPT-06-02, Sheet 2 of 2
G66. SPT-06-03, Sheet 1 of 2
G67. SPT-06-03, Sheet 2 of 2
G68. SPT-06-04, Sheet 1 of 2
G69. SPT-06-04, Sheet 2 of 2
G70. SPT-06-05, Sheet 1 of 2
G71. SPT-06-05, Sheet 2 of 2
G72. DH-06-06, Sheet 1 of 2
G73. DH-06-06, Sheet 2 of 2
G74. DH-06-07, Sheet 1 of 2
G75. DH-06-07, Sheet 2 of 2

C. Explorations for Soil-Cement Borrow

Auger hole logs designated AH-TP-07-# are not available for these specifications. However, Summary of Physical Properties Test Results are included in Article 1.06 of this section.

1.03 TEST PIT LOGS

A. Explorations during Calendar Year 2003 and 2004

G76. TP-1-AACR, Sheet 1 of 4
G77. TP-1-AACR, Sheet 2 of 4
G78. TP-1-AACR, Sheet 3 of 4
G79 TP-1-AACR, Sheet 4 of 4
G80. TP-2-AACR, Sheet 1 of 3
G81. TP-2-AACR, Sheet 2 of 3
G82. TP-2-AACR, Sheet 3 of 3
G83. TP-3-AACR, Sheet 1 of 3
G84. TP-3-AACR, Sheet 2 of 3
G85. TP-3-AACR, Sheet 3 of 3
G86. TP-4-AACR, Sheet 1 of 3
G87. TP-4-AACR, Sheet 2 of 3
G88. TP-4-AACR, Sheet 3 of 3

G89. TP-01-AACR2, Sheet 1 of 3

G90. TP-01-AACR2, Sheet 2 of 3
G91. TP-01-AACR2, Sheet 3 of 3
G92 TP-02-AACR2, Sheet 1 of 3
G93. TP-02-AACR2, Sheet 2 of 3
G94. TP-02-AACR2, Sheet 3 of 3
G95. TP-03-AACR2, Sheet 1 of 3
G96. TP-03-AACR2, Sheet 2 of 3
G97. TP-03-AACR2, Sheet 3 of 3
G98. TP-04-AACR2, Sheet 1 of 3
G99. TP-04-AACR2, Sheet 2 of 3
G100. TP-04-AACR2, Sheet 3 of 3
G101. TP-05-AACR2, Sheet 1 of 3
G102. TP-05-AACR2, Sheet 2 of 3
G103. TP-05-AACR2, Sheet 3 of 3
G104. TP-06-AACR2, Sheet 1 of 3
G105. TP-06-AACR2, Sheet 2 of 3
G106. TP-06-AACR2, Sheet 3 of 3
G107. TP-07-AACR2, Sheet 1 of 3
G108. TP-07-AACR2, Sheet 2 of 3
G109. TP-07-AACR2, Sheet 3 of 3
G110. TP-08-AACR2, Sheet 1 of 3
G111. TP-08-AACR2, Sheet 2 of 3
G112. TP-08-AACR2, Sheet 3 of 3
G113. TP-09-AACR2, Sheet 1 of 3
G114. TP-09-AACR2, Sheet 2 of 3
G115. TP-09-AACR2, Sheet 3 of 3
G116. TP-10-AACR2, Sheet 1 of 3
G117. TP-10-AACR2, Sheet 2 of 3
G118. TP-10-AACR2, Sheet 3 of 3
G119. TP-11-AACR2, Sheet 1 of 3
G120. TP-11-AACR2, Sheet 2 of 3
G121. TP-11-AACR2, Sheet 3 of 3
G122. TP-12-AACR2, Sheet 1 of 3
G123. TP-12-AACR2, Sheet 2 of 3
G124. TP-12-AACR2, Sheet 3 of 3

B Explorations during Calendar Years 2006 and 2007

G125. TP-07-01, Sheet 1 of 1
G126. TP-07-02, Sheet 1 of 1
G127. TP-07-03, Sheet 1 of 2
G128. TP-07-03, Sheet 2 of 2
G129. TP-07-04, Sheet 1 of 1
G130. TP-07-05, Sheet 1 of 1
G131 TP-07-06, Sheet 1 of 1
G132. TP-07-07, Sheet 1 of 1

G133. TP-07-08, Sheet 1 of 1
G134. TP-07-09, Sheet 1 of 1
G135. TP-07-10, Sheet 1 of 2
G136. TP-07-10, Sheet 2 of 2
G137. TP-07-11, Sheet 1 of 2
G138. TP-07-11, Sheet 2 of 2

1.04 CONE PENETROMETER TEST LOGS

G139. AACC01, Sheet 1 of 1
G140. AACC1A, Sheet 1 of 1
G141. AACC02, Sheet 1 of 1
G142. AACC03, Sheet 1 of 1
G143. AACC04, Sheet 1 of 1
G144. AACC05, Sheet 1 of 1
G145. AACC06, Sheet 1 of 1
G146. AACC07, Sheet 1 of 1
G147. AACC08, Sheet 1 of 1
G148. AACC09, Sheet 1 of 1
G149. AACC10, Sheet 1 of 1
G150. AACC11, Sheet 1 of 1
G151. AACC12, Sheet 1 of 1
G152. AACC13, Sheet 1 of 1
G153. AACC14, Sheet 1 of 1
G154. AACC15, Sheet 1 of 1
G155. AACC16, Sheet 1 of 1
G156. AACC17, Sheet 1 of 1
G157. AACC18, Sheet 1 of 1
G158. AACC19, Sheet 1 of 1
G159. AACC20, Sheet 1 of 1
G160. AACC21, Sheet 1 of 1
G161. AACC22, Sheet 1 of 1
G162. AACC23, Sheet 1 of 1
G163. AACC24, Sheet 1 of 1
G164. AACC25, Sheet 1 of 1
G165. AACC26, Sheet 1 of 1
G166. AACC27, Sheet 1 of 1
G167. AACC28, Sheet 1 of 1
G168. AACC29, Sheet 1 of 1
G169. AACC30, Sheet 1 of 1
G170. AACC31, Sheet 1 of 1
G171. AACC32, Sheet 1 of 1
G172. AACC33, Sheet 1 of 1
G173. AACC34, Sheet 1 of 1
G174. AACC35, Sheet 1 of 1
G175. AACC36, Sheet 1 of 1

G176. AACC37, Sheet 1 of 1
G177. AACC38, Sheet 1 of 1
G178. AACC39, Sheet 1 of 1
G179. AACC40, Sheet 1 of 1
G180. AACC41, Sheet 1 of 1
G181. AACC42, Sheet 1 of 1
G182. AACC43, Sheet 1 of 1
G183. AACC45, Sheet 1 of 1
G184. AACC46, Sheet 1 of 1
G185. AACC47, Sheet 1 of 1
G186. AACC48, Sheet 1 of 1
G187. AACC49, Sheet 1 of 1

1.05 PHOTOGRAPHS FROM SOIL-CEMENT TEST PIT INVESTIGATIONS

G188. TP-07-01, Sheet 1 of 2
G189. TP-07-01, Sheet 2 of 2
G190. TP-07-02, Sheet 1 of 1
G191. TP-07-03, Sheet 1 of 1
G192. TP-07-04, Sheet 1 of 1
G193. TP-07-05, Sheet 1 of 1
G194. TP-07-06, Sheet 1 of 1
G195. TP-07-07, Sheet 1 of 1
G196. TP-07-08, Sheet 1 of 1
G197. TP-07-09, Sheet 1 of 1
G198. TP-07-10, Sheet 1 of 1
G199. TP-07-11, Sheet 1 of 1

1.06 SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

A. Soil-Cement Investigations-Auger Hole Data

G200. Laboratory Gradations Data, Sheet 1 of 2
G201. Laboratory Gradations Data, Sheet 1 of 2

B. Soil-Cement Investigations-Test Pit Data

G202. Laboratory Gradations Data, Sheet 1 of 1

C. Drill holes – Calendar Year 2006

G203. Summary of Physical Properties Test Results, Sheet 1 of 6
G204. Summary of Physical Properties Test Results, Sheet 2 of 6
G205. Summary of Physical Properties Test Results, Sheet 3 of 6
G206. Summary of Physical Properties Test Results, Sheet 4 of 6
G207. Summary of Physical Properties Test Results, Sheet 5 of 6

G208. Summary of Physical Properties Test Results, Sheet 6 of 6

D. Test Pits – Calendar Year 2004

G209. Summary Table of Physical Properties and Relative Density Test Results, Sheet 1 of 3
G210. Summary Table of Physical Properties and Relative Density Test Results, Sheet 2 of 3
G211. Summary Table of Physical Properties and Relative Density Test Results, Sheet 3 of 3

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 00331 - CLIMATIC CONDITIONS

PART 1 GENERAL

1.01 PROJECT CONDITIONS

A. Historical climatological data for weather stations in the western U.S. are available on the Internet at the Western Regional Climate Center website, under Western U.S. Climate Historic Summaries, at the address: www.wrcc.dri.edu/climsum.html.

B. The provided climatic data is solely for information of the Contractor.

C. The Government assumes no responsibility for deductions, interpretations, or conclusions made by the Contractor based on information made available by the Government, in accordance with the clause at FAR 52.236-3 "Site Investigations and Conditions Affecting the Work."

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 00332 – ALL AMERICAN CANAL OPERATIONS

PART 1 GENERAL

1.01 ALL AMERICAN CANAL OPERATIONS DURING CONSTRUCTION

A. All American Canal is operated and maintained by Imperial Irrigation District (IID).

B. All American Canal operates 24 hours a day, every day of the year.

C. Disruption of flows in All American Canal is not allowed at any time.

D. Imperial Irrigation District will continue normal operation and maintenance of All American Canal during construction.

E. Construction of concrete lining is ongoing at All American Canal. Refer to Section 01312 – Coordination of Work With Other Contractors.

F. All American Canal average monthly flow rates below Drop 1 are provided in Table 00332A – All American Canal Average Monthly Flow Rates Below Drop 1.

Table 00332A – All American Canal Average
Monthly Flow Rates Below Drop 1

Month	*Flow (cfs)
January	2,054
February	2,811
March	4,303
April	5,592
May	5,362
June	5,249
July	5,421
August	4,819
September	4,059
October	3,893
November	2,900
December	2,113

* Average Flows for 12 years of Data, from 1991 to 2003. No data for 1998.

G. Water surface elevation for the lined All American Canal above Drop 3 is El. 119.67, with a normal variance of plus or minus 0.05 feet.

H. Drop 1 is operated at El. 162.5 (Operating Point). The water surface is allowed to fluctuate between El. 161.5 and El. 163.5.

I. Drop 2 is operated at El. 146.48 (Operating Point). The water surface is allowed to fluctuate between El. 146.43 and El. 146.53.

J. The above vertical elevations are off of datum NGVD 29.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 00333 – COACHELLA CANAL OPERATIONS

PART 1 GENERAL

1.01 COACHELLA CANAL OPERATIONS DURING CONSTRUCTION

A. Coachella Canal is operated and maintained by Coachella Valley Water District (CVWD).

B. Coachella Valley Water District will continue normal operation and maintenance of Coachella Canal during construction.

C. Coachella Canal Turnout Structure is operated and maintained by Imperial Irrigation District.

D. Coachella Canal operates 24 hours a day, every day of the year.

E. Disruption of flows in Coachella Canal is not allowed at any time.

F. Coachella Canal average monthly flow rates, minimum monthly average flow rates, and maximum monthly average flow rates are provided in Table 00333A – Coachella Canal Historic Monthly Flow Data. The flow rates are based on the time period from 1992 through 2000 and are from Coachella Valley Water District records measured at Siphon No. 7.

Table 00333A – Coachella Canal Historic Monthly Flow Data

Month	*Average Flow Rate (cfs)	*Minimum Monthly Average Flow Rate (cfs)	*Maximum Monthly Average Flow Rate (cfs)
January	244	132	310
February	268	166	347
March	388	289	448
April	539	499	568
May	578	520	615
June	551	518	582
July	555	528	593
August	573	533	614
September	502	447	560
October	410	361	458
November	378	343	444

Table 00333A – Coachella Canal Historic Monthly Flow Data

Month	*Average Flow Rate (cfs)	*Minimum Monthly Average Flow Rate (cfs)	*Maximum Monthly Average Flow Rate (cfs)
December	269	225	322

*Measured approximately 48 miles downstream of Coachella Turnout.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 00334 – EARTH MATERIALS DISTRIBUTION DIAGRAM

PART 1 GENERAL

1.01 EARTH MATERIALS DISTRIBUTION DIAGRAM

A. A proposed earth materials distribution diagram has been prepared by the Government and is included in drawings.

B. Diagram shows the anticipated sources of excavated materials and their proposed distribution in earthfill.

C. The provided earth materials distribution diagram is solely for information of the Contractor. Data on diagram is intended to be used only as a guide.

D. The Government assumes no responsibility for deductions, interpretations, or conclusions made by the Contractor based on information made available by the Government, in accordance with the clause at FAR 52.236-3 "Site Investigations and Conditions Affecting the Work."

E. The Contractor is responsible for developing and using the Contractor's own earth materials distribution plan in accordance with the Contractor's materials handling plan. The Contractor may change the Contractor's materials handling plan as work progresses.

F. Upon completion of work, provide to the COR, a marked print of the Government's earth materials distribution drawing showing final quantities in the tables provided. This drawing is an "as-built" to be submitted in accordance with Section 01781 – Project Closeout

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01110 - SUMMARY OF WORK

PART 1 GENERAL

1.01 LOCATION

A. Work is located approximately 20 miles east of El Centro, California in Imperial County along Interstate Highway 8.

1.02 PRINCIPAL COMPONENTS OF WORK

A. Providing traffic control.

B. Providing site security.

C. Interstate 8 Highway Work:

1. Constructing and removing Interstate 8 Highway temporary traffic detour.
2. Reconstructing Interstate 8 Highway at steel pipe crossing.

D. Modifying Existing Coachella Canal Turnout Structure:

1. Diversion and care of Coachella Canal during construction.
2. Furnishing and installing sheet pile wall.
3. Performing earthwork.
4. Modifying existing concrete turnout structure.

E. Constructing Steel Pipe Crossing:

1. Earthwork for pipe trench.
2. Furnishing and laying steel pipes.

F. Constructing Canal:

1. Earthwork for canal.
2. Constructing concrete canal lining.

G. Constructing Reservoir:

1. Earthwork for reservoir.
2. Furnishing and installing geomembrane, geotextile, and geonet composite.
3. Furnishing and placing soil-cement.

H. Roadwork:

1. Earthwork for roadways.

2. Furnishing and placing aggregate base course and asphaltic concrete pavement for roadways.

I. Concrete Structures:

1. Earthwork for cast-in-place concrete structures.
2. Furnishing and placing reinforced cast-in-place concrete for structures.

J. Constructing control building, which includes:

1. Splash blocks.
2. Reinforced concrete unit masonry assemblies.
3. Metal roof deck.
4. Pre-engineered, pre-fabricated cold formed steel roof trusses.
5. Silane water repellant.
6. Batt and blanket insulation.
7. Pre-insulated metal roof and wall panels.
8. Metal soffit panels.
9. Firestopping.
10. Bullet-resistant steel doors and frames, and door hardware.
11. Gypsum board wall assembly.
12. HVAC system.
13. Interior and exterior luminaires.

K. Metalwork:

1. Furnishing and installing miscellaneous metalwork.
2. Furnishing and installing trashracks.

L. Equipment:

1. Furnishing and installing seats and guides for stoplogs.
2. Furnishing and installing stoplogs and lifting beams.
3. Furnishing and installing slide gates.

M. Special Construction:

1. Furnishing and installing water-level measuring devices.
2. Furnishing and installing ultrasonic flowmeters.
3. Furnishing and installing canal-level measuring device.

4. Providing control and monitoring system, including:
    a. PLC to monitor and control gates in forebay/afterbay. PLC will be programmed by others.
    b. RTUs to monitor flow on the siphon outlet, water level in the reservoirs, canal level, and canal flow.
    c. Spread-spectrum radios and antennas to transmit RTU data to PLC.
    d. Solar panels with batteries to provide power to RTUs and monitoring equipment.

N. Conveying Systems:
1. Furnishing and installing hydraulic trash rake.
2. Furnishing and installing trash rake conveyors.

O. Electrical:
1. Furnishing and installing distribution panel board.
2. Furnishing and installing wiring devices, grounding equipment, electrical conduit, conductors, meter socket, and associated electrical equipment.
3. Furnishing and installing engine-generator set with automatic transfer switch.
4. Furnishing and installing exterior luminaries.

1.03 SPECIFICATIONS REQUIREMENTS

A. Requirements in Division 1 – General Requirements apply to Divisions 2 through 16.

B. Imperative statements in these specifications are Contractor requirements, unless otherwise stated.

C. Where specifications are written in streamlined form, the words “shall be” are included by inference where a colon (:) is used within the sentence or phrase.

1.04 DEFINITIONS

A. When the specifications use a word or term defined in the Federal Acquisition Regulations (FAR), the definition of the word or term shall be in accordance with FAR sections in effect at the time the solicitation was issued.

1.05 ACRONYMS

A. The following acronyms apply to specifications Divisions 1 through 16:
1. CO: Contracting Officer
2. COR: Contracting Officer’s Representative

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01111 - DRAWINGS

PART 1 GENERAL

1.01 DISCREPANCIES, ERRORS, OR OMISSIONS

A. Inform the CO of discrepancies discovered on drawings in accordance with clause at FAR 52.236-21 “Specifications and Drawings for Construction.” Promptly inform the CO of discrepancies discovered on the drawings. The CO will make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense.

1.02 PROJECT CONDITIONS

A. Where there are minor differences as determined by the CO between details and dimensions shown on drawings and details and dimensions of existing features at jobsite, use details and dimensions of existing features at jobsite.

1.03 SPECIFICATIONS DRAWINGS

A. Electronic copies of the following drawings are available to offerors upon request, in AutoCAD DWG (.dwg) format.

1. 423-D-631, 423-300-3001, 423-D-642, 423-D-644, 423-D-651, 423-D-659, 423-D-664, 423-D-742, 423-D-667, 423-D-632, 423-D-633, 423-D-698, 423-D-635, 423-D-741, 423-D-694, and 423-D-605.
2. To receive electronic copies of drawings, submit request to COR in writing.
3. Reference drawings and informational drawings are available in Adobe® PDF (.pdf) format.

B. Additional electronic drawings (AutoCAD Format Release 2004) for as built purposes will be made available to the Contractor upon written request and approval by the COR.

C. AutoCad version of standard drawings is not available.

1.04 INFORMATIONAL DRAWINGS

A. Some drawings are marked "for information only" in the drawing list and are included to show some feature about which additional knowledge may be required for the proposal.

B. If there are differences as determined by the CO between details and dimensions shown on these drawings and those of existing features at jobsite, use details and dimensions of existing features at jobsite.

1.05 COPIES OF DRAWINGS

A. Five sets of full-size (22- by 34-inches) drawings, except standard drawings, will be furnished to the Contractor for construction purposes.

B. Upon request, five additional half-size (11- by 17-inches) copies of standard drawings will be furnished to the Contractor for construction purposes.

1.06 LIST OF DRAWINGS

A. Drawings listed in Table 01111A - List of Drawings, are made a part of these specifications.

1.07 DRAWING NUMBERS IN NUMERICAL ORDER

A. Specification drawings are listed in numerical order in Table 01111B - Drawings in Numerical Order.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Table 01111A - List of Drawings

Sheet No.	Drawing No.	Title
General:		
1	423-D-639	Location Map
2	423-D-640	General Notes
3	423-D-807	Summary Logic Diagram – Sheet 1 of 2
4	423-D-808	Summary Logic Diagram – Sheet 2 of 2
5	423-D-629	Materials Distribution Diagram – Sheet 1 of 1
6	423-D-630	Mass Haul Diagram for Drop 2 Inlet Canal – Sheet 1 of 3
7	423-D-833	Mass Haul Diagram for Drop 2 Inlet Canal – Sheet 2 of 3

Table 01111A - List of Drawings

Sheet No.	Drawing No.	Title
8	423-D-834	Mass Haul Diagram for Drop 2 Inlet Canal – Sheet 3 of 3
9	423-D-631	Reservoir - General Plan – Sheet 1 of 1
Civil Site Construction:		
10	423-D-643	Drop 2 Inlet Canal – Right of Way – Data Table
11	423-D-642	Drop 2 Inlet Canal, Reservoir, Siphon, and Outlet Canal – General Plan – Sheet 1 of 16
12	423-D-644	Drop 2 Inlet Canal – Station 4+11.42 to Station 23+00 – Plan and Profile – Sheet 2 of 16
13	423-D-645	Drop 2 Inlet Canal – Station 23+00 to Station 47+00 – Plan and Profile – Sheet 3 of 16
14	423-D-746	Drop 2 Inlet Canal – Station 47+00 to Station 71+00 – Plan and Profile – Sheet 4 of 16
15	423-D-747	Drop 2 Inlet Canal – Station 71+00 to Station 95+00 – Plan and Profile – Sheet 5 of 16
16	423-D-648	Drop 2 Inlet Canal – Station 95+00 to Station 119+00 – Plan and Profile – Sheet 6 of 16
17	423-D-649	Drop 2 Inlet Canal – Station 119+00 to Station 143+00 – Plan and Profile – Sheet 7 of 16
18	423-D-650	Drop 2 Inlet Canal – Station 143+00 to Station 167+00 – Plan and Profile – Sheet 8 of 16
19	423-D-651	Drop 2 Inlet Canal – Station 167+00 to Station 191+00 – Plan and Profile – Sheet 9 of 16
20	423-D-652	Drop 2 Inlet Canal – Station 191+00 to Station 215+00 – Plan and Profile – Sheet 10 of 16
21	423-D-653	Drop 2 Inlet Canal – Station 215+00 to Station 239+00 – Plan and Profile – Sheet 11 of 16
22	423-D-654	Drop 2 Inlet Canal – Station 239+00 to Station 263+00 – Plan and Profile – Sheet 12 of 16

Table 01111A - List of Drawings

Sheet No.	Drawing No.	Title
23	423-D-655	Drop 2 Inlet Canal – Station 263+00 to Station 287+00 – Plan and Profile – Sheet 13 of 16
24	423-D-656	Drop 2 Inlet Canal – Station 287+00 to Station 311+00 – Plan and Profile – Sheet 14 of 16
25	423-D-657	Drop 2 Inlet Canal – Station 311+00 to Station 335+00 – Plan and Profile – Sheet 15 of 16
26	423-D-658	Drop 2 Inlet Canal – Station 335+00 to Station 354+75.76 – Plan and Profile – Sheet 16 of 16
27	423-D-659	Drop 2 Outlet Canal – Station 22+47.12 to Station 31+51 – Plan and Profile – Sheet 1 of 1
28	423-D-660	Typical Canal Sections – Sections and Details – Sheet 1 of 1
29	423-D-661	Canal Wasteway – Plan and Section – Sheet 1 of 3
30	423-D-662	Canal Wasteway - Sections and Detail – Sheet 2 of 3
31	423-D-832	Canal Wasteway – Section and Details – Sheet 3 of 3
32	423-D-731	Canal Lining Joints – Details – Sheet 1 of 1
33	423-D-641	Safety Cable – Plan, Section and Details – Sheet 1 of 1
34	423-D-632	Reservoir – General Excavation Plan – Sheet 1 of 1
35	423-D-633	Reservoir - Forebay/Afterbay and Canal Area – Detailed Excavation Plan – Sheet 1 of 1
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END OF SECTION

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SECTION 01131 - PROTECTED SPECIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.02 PROJECT CONDITIONS

A. Certain native species in the State of California are protected plant or animal species under State law(s). The Government has ascertained that protected species may exist in the areas to be disturbed by construction activities. A list of these species may be found in the Lower Colorado River Drop 2 Storage Reservoir Project Final Environmental Assessment, Section 3.2 Biological Resources. A hard copy of this FEA may be requested from the Government, or in the alternative may be viewed on line at http://www.usbr.gov/lc/yuma/environmental_docs/environ_docs.html#drop2

B. The Contractor shall comply with all Compensation Measures as outlined in the Lower Colorado River Drop 2 Storage Reservoir Project Final Environmental Assessment, Section 3.2 Biological Resources.

C. In accordance with State law, the Government may arrange for removal of protected species, and the Contractor shall cooperate with those performing such removal. If these species are not removed, the Contractor shall cooperate with and abide by protection plans developed by appropriate State entities to avoid damage to or disturbance of protected species.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01141 - USE OF SITE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.02 REFERENCE

A. Bureau of Reclamation (USBR)

1. USBR RSHS-2001 Reclamation Safety and Health Standards

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 01141-1, Land use and landscape rehabilitation plan:

1. For each Contractor use site on Government land.

a. Show use location and extent of impact. Uses include but are not limited to the following:

1) Buildings and service areas including offices, shops, warehouses, storage areas, fuel and oil storage areas, and fabrication yards.

2) Parking areas, temporary roads, and haul routes.

3) Utilities including air, power, and water lines; fire hydrants; and compressor station.

4) First-aid and medical facilities.

5) Areas for processing, storing, and disposing of waste materials from construction operations.

6) Temporary fences.

b. Describe methods to preserve, protect, and repair if damaged, vegetation (such as trees, shrubs, and grass) and other landscape features on or adjacent to the jobsite, which are not to be removed and which do not interfere with the work required under this contract. Include methods to mark work area limits, protect disturbed areas, and prevent erosion.

c. Describe methods to protect, and repair if damaged, existing improvements and utilities at or near the jobsite.

d. Describe methods for removing temporary structures and facilities, cleanup, and rehabilitating site after completion of construction activities.

2. Submit revised drawings of changes in use of Government land made during design and erection stages or after use of Government land is in operation.

1.04 PROJECT CONDITIONS

A. Government land as shown on drawings may be used for required construction facilities.

B. When private land is used for construction facilities, or other construction purposes, make necessary arrangements associated with use of private land.

C. Location, construction, operation, maintenance, and removal of construction facilities on Government land will be subject to approval of the COR.

D. Do not interfere with work of other contractors or the Government in vicinity, or with reservations made by the Government for use of such land.

E. Housing for construction personnel will not be permitted on Government land, except housing for guards or watchmen as may be approved by the COR.

F. Areas designated as archeological locations will be fenced by others. The Contractor shall protect and keep out of the fenced designated archeological areas at all times.

1. Archeological locations shall be preserved and protected in accordance with the clause at WBR1452-236-84 - Preservation of Cultural Resources.

G. Provide silt fences and hay bales for erosion control in accordance with approved pollution prevention plan.

H. Comply with USBR RSHS.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CLEANING

A. Construction equipment: Pressure wash to remove dirt and vegetation before bringing on site to limit introduction of noxious weeds.

3.02 STAKING SITE

A. Prior to mobilization, stake the entire work site temporary right-of-way area.

B. Physically stake the limits of construction a minimum of every 500 feet.

C. Maintain right-of-way markers during construction operations.

3.03 RESTORATION

A. Restore temporary construction roads to original contours and make impassable to vehicular traffic when no longer required.

B. Remove temporary right-of-way markers at end of construction.

C. Scarify and regrade, after completion of work, Government land used for construction purposes and not required for completed installation so that surfaces blend with natural terrain and are in a condition that will facilitate natural revegetation, provide proper drainage, and prevent erosion.

END OF SECTION

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SECTION 01142 – WORK RESTRICTIONS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.02 WORK RESTRICTIONS AND LIMITATIONS

A. Complete Coachella Canal Turnout Structure Modification work in accordance with the following sequence and as shown on the drawings. The time period for the initial sequence of structure modification shall coincide with the low flow period occurring in Coachella Canal.

1. The diversion and care of Coachella Canal work between December 1, 2008 and February 28, 2009 shall be provided to allow the initial sequence of construction for the Coachella Canal Flume and Transition work to be completed to a condition that canal water can be conveyed through the new structure to the existing Coachella Canal by February 28, 2009. This work shall include installation of the new stoplogs at station 21+21.00 of the Coachella Canal Flume.

   a. The Contractor shall schedule construction activities for allowance of normal flow to be returned to the existing Coachella Canal no later than March 1, 2009 by Coachella Valley Water District.

   b. Any work not completed by the Contractor to meet this work limitation shall be the Contractor's responsibility and completion of the remaining work shall be planned and scheduled during the next low flow season beginning December 1, 2009. All necessary salvage, cleanup, or recovery activities shall be at the expense of the Contractor.

2. All remaining work to complete the Coachella Canal Combined Turnout Modifications shall be complete by the contract completion date. Begin Coachella Canal Turnout Structure work (Drop 2 Inlet Canal flume and transition) by March 1, 2009 and complete Coachella Canal structure work by November 30, 2009.

3. Perform Coachella Canal lining repair if not completed during first low flow season if required from December 1, 2009 to February 28, 2010.

B. Sequence construction of Coachella Canal Turnout Structure modification with Drop 2 Inlet Canal construction in order to maintain access to west side of the existing Coachella Canal for Coachella Valley Water District to perform maintenance in accordance with Section 01313 – Coordination of Work With Other Agencies.

C. Electric power that will be provided by Imperial Irrigation District at the site in accordance with Section 01510 – Temporary Utilities will be available to the Contractor by January 1, 2009.

D. Perform clearing and grubbing in work areas only during the time period from August 16 through January 31 unless approved by the COR.

E. Level 3 Communications, Inc. will relocate existing fiber optic cable in work area by January 1, 2009. The Contractor shall begin work in outlet canal area after existing fiber optic cable is relocated. Refer to Section 01727 – Relocation of Existing Fiber Optic Cable.

F. Existing power poles located in the work area will be relocated or removed by others by January 1, 2009.

G. The Government will provide a training program covering environmental commitments and requirements, cultural monitoring, and clearing before commencement of any work for the project.

1. The training will be conducted by Governmental environmental monitors and will be held at a time and location designated by the Government.
2. All Contractor and Subcontractor personnel working onsite are required to participate in and comply with the training program.
3. Estimated time for each training session for each person working onsite is 1 to 2 hours.

H. Maintain public access across the existing Coachella Canal Turnout Structure to provide access to Sand Dunes Recreational Area at all times.

I. The following holidays are considered peak recreation/visitation periods to the Sand Dunes Recreational Area by the public. The Contractor shall restrict construction vehicles and equipment in the work areas from impacting public access to the Sand Dunes Recreational Area on these holidays, which include the weekends on either side (before and after) of the actual holiday.

1. Thanksgiving Day.
2. Christmas Day.
3. New Year’s Day.
4. Martin Luther King Day.
5. President’s Day.
6. Easter Day.
7. Columbus Day.

J. No Contractor activities shall encroach upon or be performed within Section 36, T16S, R19E unless prior approval is made by Contractor with a copy of a signed agreement provided to the CO.

K. All Contractor activities are to be within the established right-of-way shown on drawings.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01312 – COORDINATION OF WORK WITH OTHER CONTRACTORS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost in prices offered in the schedule for other items of work.

1.02 COORDINATION

A. During progress of work under this contract, the following additional work will be performed concurrently by other contractors:

1. Imperial Irrigation District Construction Contract for construction of new All American Canal, a lined canal parallel to and replacing existing All American Canal. There are two active construction contracts issued by Imperial Irrigation District that will be within Project limits.

B. Fully cooperate and coordinate with other contractors to minimize impacts to the work on use of access and haul routes, use of water and electrical power sources, use of staging areas and stockpile areas, maintaining roads, complying with environmental requirements, and abiding by all applicable safety regulations, especially during hauling operations.

C. In addition to requirements of this section, fully cooperate and coordinate with all other contractors and the Government in accordance with the clause at FAR 52.236-8 Other Contracts (APR 1984) (DEVIATION).

D. Principal activities to be performed under this contract which overlap with other contracts include:

1. Work performed at and near Existing Coachella Canal Turnout Structure at the All American Canal.
2. Work performed at or near the Outlet Canal Confluence Structure at the All American Canal.
3. Work performed by fencing contractor to install perimeter fencing around the reservoir and along the inlet canal.

E. Ensure safe crossing of access roads by other contractors as they access their work areas.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01313 – COORDINATION OF WORK WITH OTHER AGENCIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost in prices offered in the schedule for other items of work.

1.02 COORDINATION

A. During progress of work under this contract, fully cooperate and coordinate with other agencies to minimize impacts to the work and other agencie's operation and maintenance requirements and other agencies's work requirements.

B. Other agencies include, but may not be limited to:

1. State of California Department of Transportation (CALTRANS)
2. Imperial County.
3. Coachella Valley Water District.
4. Imperial Irrigation District.
5. U.S. Bureau of Land Management.
6. U.S. Border Patrol.
7. U.S. Fish and Wildlife Service.
8. State of California Department of Fish and Game.

C. Principal activities to be performed under this contract which may interfere with other agencies' work and operation and maintenance requirements include, but may not be limited to:

1. Use of access and haul routes within Imperial County and State of California easements.
2. Use of construction water and electrical power sources under Imperial Irrigation District jurisdiction.
3. Coordination of water delivery outages and electrical utility outages.

D. Principal activities to be performed by other agencies during performance of work under this contract which may interfere with performance of work under this contract include, but may not be limited to:

1. Imperial Irrigation District Operation and Maintenance of the existing All American Canal and power facilities.

2. Coachella Valley Water District Operation and Maintenance of the existing Cocahella Canal.

3. Bureau of Land Management environmental requirements and their management of recreational areas within the Project area.

4. U.S. Border Patrol security of area.

E. Ensure safe roadways and crossing of haul roads by other agencies as they access their work areas.

F. Maintain vehicle access for Coachella Valley Water District personnel to the existing west side of Coachella Canal Operations and Maintenance road at all times.

1. Includes the ability to accommodate light vehicles as well as semi-trailer trucks and low boys.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01321 - CONSTRUCTION PROGRAM

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Developing Baseline Schedule: Include in lump sum price offered in the schedule for mobilization and preparatory work.

2. Management, Updating and Implementation of Construction Program: Include as an element of Contractor's overhead.

1.02 REFERENCES

A. Associated General Contractors of America (AGC)

1. AGC Manual Construction Planning and Scheduling Manual, 2004

1.03 DEFINITIONS

A. Schedule: The Critical Path Method (CPM) of planning and scheduling a construction project where activities are arranged based on activity relationships and network calculations determine when activities can be performed and the critical path of the project.

B. Project Calendar: Cross reference of numerical work days with calendar days. The project calendar serves as the basis for the day/date conversion and assigns work days, rest days, and holidays.

C. Resources: Equipment, labor or crews, materials, subcontractors, fabricators, manufacturers, and consultants.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

1. Furnish data on CD-ROM disc.

2. Furnish database files in format compatible with Primavera Project Planner, Version 3.0 or higher.

B. RSN 01321-1, Representative Information:

1. Designation of authorized representative to coordinate with CO and/or COR to develop and maintain Construction Program.

C. RSN 01321-2, Baseline Schedule:

1. Include:
    a. Construction Program database with activity and milestone data.
    b. Definition of workday calendars.
    c. Bar chart for project or bar charts for each subnetwork.
    d. Activity report including all logic constraints.
    e. RSN submittal register.
    f. Table listing equipment, manpower, and material limitations used to produce baseline schedule. This listing may be independent of the schedule database.

D. RSN 01321-3, Updated Schedule:
1. Include:
    a. Construction Program database with updated activity and milestone data.
    b. Definition of workday calendars.
    c. Bar chart for project or bar charts for each subnetwork.
    d. Narrative report specifically stating status of project in terms of total float.
        1) If negative float exists, cite specific actions and conditions which caused the "behind schedule" condition and provide proposed course of action to complete the project within the specified delivery time.
        2) List of Contractor-initiated changes to the current schedule stating the reason for the action taken and any unresolved issues relating to the Construction Program. Government reserves the right to reject Contractor-initiated changes to the current schedule which negatively impact any Government action which was initiated on the basis of the current schedule.
    e. Updated Submittal Register.

E. RSN 01321-4, Time Impact Analysis:
1. Include:
    a. Construction Program database with proposed revised activity and milestone data.
    b. Proposed revised schedule due to the change or delay with added, changed, or deleted activities highlighted.
    c. Table comparing results of two mathematical analyses.

1.05 QUALIFICATIONS

A. Representative: Full-time, on site employee with minimum three years experience in developing and maintaining construction schedules.

1.06 SCHEDULES AND TIME IMPACT ANALYSIS

A. Develop, maintain, and use approved Construction Program to plan, monitor, and evaluate, and report accomplishment of work.

B. Prepare Construction Program using Critical Path Method, under concepts and methods outlined in AGC Manual.

1. Use the Precedence Diagramming Method (PDM) in preparing the CPM networked schedule.
2. Prepare detailed activity network for accomplishing required work.
3. All activities except “Award” shall have predecessor activities and all activities except “Contract Complete” shall have successor activities.
4. Meet contract requirements; milestone(s) in accordance with the clause at FAR 52.211-10 - Commencement, Prosecution, and Completion of Work; and funding constraints in accordance with the clause at WBR 1452.232-80 - Limitation of Funds.
5. Prepare schedule based on required sequence and interdependence of activities that are in compliance with specifications requirements.
6. Include work of subcontractors, Government interfaces, and contract milestones.
7. Adjust Construction Program/Schedule for seasonal weather conditions and other activities that may impact regular work schedules.
8. Define activities to a level of detail resulting in their durations being no greater than 15 workdays or 20 shifts unless otherwise accepted by CO.
    a. Durations for administrative activities (e.g., submittals and reviews, fabrication, manufacturing), or other specific activities identified in the contract will not be subject to the 15-workday or 20-shift limitation.
    b. Include activities for Government reviews and approvals in accordance with Section 01330 - Submittals.

C. Failure to include any element of the work will not release Contractor from completing all required work under the contract.

D. Performance will be evaluated by the Government using CPM schedules.

E. Upon request, provide all information and data used to develop and maintain the Construction Program to the CO.

F. Include contract title, contract number, and Contractor's name on each sheet.

G. Include table of abbreviations used in the schedule, listed and defined alphabetically.

H. Use a computer software program to perform a mathematical analysis of the scheduling data.

1. Use only finish to start logic relationships between activities. Do not use negative lead or lag times.

2. Use durations in units of whole workdays.

3. Provide best estimate of time required to complete the activity considering the quantity of work and planned resources for the activity.

4. Equate durations of Government reviews and other identified actions to the maximum number of calendar days specified in their respective paragraphs.

5. Establish workday calendar(s) and use these in the mathematical analysis to translate the activity's workday duration into calendar dates.

I. Baseline Schedule:

1. Represents Contractor's as-planned approach to accomplishing the work. Do not include actual start dates, percent completes, or actual finish dates.

2. Include interim milestone dates, Government interface dates, contract completion date, and other time constraints specified in the contract documents.

3. For each activity, display identification number, description, duration, early start date, early finish date, total float, and calendar identification.

J. Updated Schedule:

1. Meet monthly with COR at Government's project office to review progress made to the end date of the progress payment period.

a. Establish dates that activities were started and completed and remaining duration for each activity started but not completed during the period.

b. Discuss and mutually agree upon changes in logic and schedule.

c. Update schedule and Construction Program database with mutually agreed upon changes.

2. Perform mathematical analysis on the updated database to determine current project status.

3. Following receipt of an executed contract modification, incorporate the activity data and logic relationships stipulated in the modification into the current schedule for inclusion in the next scheduled progress update.

K. Time Impact Evaluation:

1. The CO will use time impact evaluation to determine if a time extension or reduction to the contract milestone dates is justified.
2. Provide a time impact evaluation for any contract change, e.g., a change order, proposed modification, or value engineering proposal. Provide a time impact evaluation to support a claim or request for an equitable adjustment to the contract which involves a delay or accelerated schedule.
3. A time impact evaluation is applicable whether the Contractor's current schedule milestone dates are the same as, earlier, or later than, those required under the contract.
4. Changes, additions, or deletions to activities; activity durations; or activity time frames will not automatically mean that an extension or reduction of contract time is warranted or due the Contractor.
5. Time extensions for performance will be considered only to the extent that the Contractor's current scheduled milestone dates exceed the contract milestone dates.
6. For all activities directly affected by the change or delay, include the current and proposed items:
    a. Activity description.
    b. Type and quantities of major pieces of equipment, principal manpower, and pacing material.
    c. Activity duration.
    d. Earnings.
    e. A narrative containing the rationale used in developing the proposed logic relationships and activity data.
7. Float is not for the exclusive use by or benefit of either the Government or the Contractor.
8. Prepare a single time impact evaluation for all modifications issued after Notice to Proceed (NTP) and prior to approval of the baseline schedule. Submit the time impact evaluation with the first progress update.
9. Perform time impact evaluations using data in the most recent approved schedule prior to change or delay event.
    a. Prepare proposed revised schedule and narrative description describing and highlighting where changes or delays will be included.
    b. Prepare table comparing the results of two mathematical analyses: One using current schedule data from the last approved schedule prior to event requiring evaluation, and one using proposed schedule data incorporating the changes or delays.

1) Show contract milestones and activities whose periods of performance have shifted as a result of any change which affects production and/or manufacture schedules, material orders, construction seasons, and labor and/or equipment utilization.

2) Base mathematical analyses on status of work and available float at the time the CO directs or proposes a change to the work, the Contractor submits a value engineering proposal, or when a delay occurs.

1.07 GOVERNMENT-FURNISHED LOGIC DIAGRAM

A. Government's basic assumptions used in designing and planning the work are depicted on the Government-developed summary logic diagram shown on the drawings.

B. Government-developed summary logic diagram is furnished for information purposes and is not binding as a procedure for accomplishing the work.

1. Government does not recommend or require that the work under this contract be performed in the manner and sequence shown on Government-developed summary logic diagram.

2. Government does not represent that the manner and sequence of performing the work shown on this diagram is the best or only way to proceed with the required work.

1.08 REVIEW AND EVALUATION

A. Baseline Schedule:

1. Within 20 calendar days after receipt of baseline schedule:

a. CO will accept or reject the proposed baseline schedule.

b. Upon request from the CO or COR, meet with COR for a joint review of the proposed baseline schedule.

c. If schedule is rejected, revise and resubmit within 7 calendar days following the date of the rejection letter.

2. Do not proceed with onsite work, except mobilization and surveying, until baseline schedule has been approved by the Government.

B. Updated schedules:

1. The Government will require 7 calendar days after receipt of each monthly update to review and approve or reject the updated schedule.

2. If the updated schedule is rejected, revise and resubmit updated schedule within 7 calendar days following the date of the rejection letter.

1.09 FAILURE TO COMPLY

A. Failure to comply with the requirements of this section shall be grounds for a determination by the CO that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the specified time.

B. The CO may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of this contract.

C. The CO may withhold progress payments.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01330 - SUBMITTALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

B. Progress Payments:

1. If submittals are not submitted in a timely manner, the CO may retain appropriate amounts of applicable progress payments.

1.02 REFERENCES

A. California Department of Transportation (CALTRANS)

1. CALTRANS SS Standard Specifications, State of California, Business, Transportation, and Housing Agency, Department of Transportation, May 2006
2. CALTRANS SSP Standard Special Provisions, State of California, Business, Transportation, and Housing Agency, Department of Transportation, May 2006

1.03 DEFINITIONS

A. Days: Calendar days.

B. Required Submittal Number (RSN): RSN identifies items to be submitted together as a complete submittal.

C. Submittal Types, as listed in Table 01330A – List of Submittals:

1. A – Approval:
   a. Government approval is required.
   b. Within the terms of the clause at FAR 52.236-21 “Specifications and Drawings for Construction,” Approval submittals are considered to be “shop drawings.”
   c. Approval however does not relieve the Contractor of the responsibility to perform the work.
2. I – Informational:
   a. Government approval is not required.

b. Within the terms of the clause at FAR 52.236-21 “Specifications and Drawings for Construction,” Informational submittals are not considered to be “shop drawings.”

c. The Government may return an Informational submittal or ask for additional information when an Informational submittal does not comply with the specifications.

1.04 SUBMITTAL REQUIREMENTS

A. In case of conflict between requirements of this section and requirements included elsewhere in these specifications, requirements included elsewhere take precedence.

B. General:

1. Prepare in English.
2. Label with contract number and title, and RSN.
3. Measurement units: US Customary Units.

C. Drawings:

1. Minimum identification in title block:
   a. Contract number and title.
   b. Contractor's or supplier's title and drawing number.
   c. Date.
2. Allow space for review stamps.
3. Size: D size (22 inches by 34 inches) or similar.
4. Draw to scale with neat lettering using drafting equipment or computer drafting equipment.
5. Final drawings:
   a. AUTOCAD® format (.dwg) or Drawing Transfer Format (.dxf) on CD-ROM disc.
   b. Original D size (22 inches by 34 inches) plots.
   c. Show as-built changes, including revision dates, made during installation.

D. Product Data:

1. Mark manufacturer's data for commercial products or equipment, such as catalog cut sheets.
   a. Identify manufacturer's name, type, model, size, and characteristics.
   b. Illustrate that product or equipment meets requirements of specifications.

c. Mark items to be furnished in a manner that will photocopy (no highlighter).

d. Strike out items that do not apply.

E. Certifications:

1. Submittals requiring certification by a registered professional: Signed and sealed by registered professional.

2. Manufacturer's certifications: Signed by authorized representative of manufacturer.

F. Manuals:

1. Copies: Bound and indexed.

2. Contents:

a. Parts identification lists, lists of special tools, and accessories.

b. Schematics and wiring diagrams.

c. Detailed instructions for installing, operating, lubricating, and maintaining equipment.

d. As-built drawings, photographs, and test records or reports if required by the specifications.

G. Photographs:

1. Prints: Professional quality 8-inch by 10-inch color for each listed view.

a. Identify with adhesive labels on back.

1) Include contract number, name of equipment and view title.

2) Do not type directly on back of photograph.

2. Include negatives, or digital files on CD in .jpeg or similar format.

H. Samples and Color Selection Submittals:

1. Label with complete manufacturer's product and color identification.

2. Include type and quantity of materials specified in the referenced section in each "set" of samples.

3. Samples: Representative of product to be installed.

4. Color chips: Sample paint chips. Ink color reproductions are not acceptable.

5. Label each sample, sample kit, set of color chips, or color chart with contract number and title.

6. The Government will select architectural color and pattern after product approval.

I. Warranties:

1. Provide in accordance with Section 01781 – Project Record Documents.

1.05 SUBMITTALS PROCEDURES

A. Submit only checked submittals. Submittals without evidence of Contractor's approval will be returned for resubmission.

B. Submit complete sets of required materials for each RSN as specified in "Submittals Required" column in Table 01330A - List of Submittals. A complete set includes all listed items for RSNs with multiple parts.

C. Submit number of sets specified in "No. of sets to be sent to:" columns in Table 01330A - List of Submittals.

D. Include the following information in transmittal letters:

1. Contract number and title.
2. RSN for each attached submittal.
3. Responsible code.
4. Number of sets for each RSN.
5. Identify submittal as initial or resubmittal.

E. More than one RSN may be submitted under a transmittal letter, provided the responsible code is the same.

F. For RSNs required by Section 02052 – Interstate 8 Highway, the title indicated in the column “Clause or Section Title” includes the title of the specifications section and the title of the applicable Caltrans Standard Specifications Section or the title of the Caltrans Special Provisions Section.

1.06 REVIEW OF SUBMITTALS

A. Time Required:

1. Submittal review will require 28 days for review of each submittal or resubmittal, unless otherwise specified.
2. Time required for review of each submittal or resubmittal begins when complete sets of materials required for a particular RSN are received and extends through return mailing postmark date.

B. Time in Excess of Specified:

1. The CO may extend the contract completion date to allow additional time for completing work affected by excess review time.

a. The time extension will be to the extent that excess review time caused delay to the contract completion date.

b. The time extension will not exceed the time used in excess of the specified number of days for review of submittals or resubmittals.

c. Concurrent days of excess review time resulting from review of two or more separate submittals or resubmittals will be counted only once in extending the contract completion date.

2. No time extension will be allowed if the Contractor fails to make complete approval submittals in sequence and within time periods specified.

3. Adjustment for delay will be made only to the extent that:

a. Approval was required under the contract, and

b. Requests for approval were properly and timely submitted and were approved.

4. Adjustment will be subject to terms of paragraphs (b) and (c) of the clause at FAR 52.242-14 "Suspension of Work," however, no such delay shall be deemed to be a "suspension order" as the term is used in that clause.

C. Return of Submittals:

1. One set of submittals required for approval will be returned either approved, approved subject to identified changes, or not approved.

2. Submittals not approved:

a. Revise and resubmit for approval.

b. Show changes and revisions with revision date.

c. Describe reasons for significant changes in transmittal letter.

d. Resubmit returned submittals within 28 days after receiving the comments, unless otherwise specified.

e. Requirements for initial submittals apply to resubmittals.

3. Do not change designs without approval of the CO after approval drawings, documentation, and technical data have been approved.

4. The Government will acknowledge Informational submittals.

a. Informational submittals will not be returned when they comply with the specifications.

b. Informational submittals that do not comply with the specifications may be returned for resubmittal or additional information may be requested.

1.07 TRANSMITTAL

A. Addresses for codes listed in Table 01330A - List of Submittals:

1. Contracting Officer (LC-3100), Bureau of Reclamation, PO Box 61470, Boulder City NV 89006-1470; Express Mail: 500 Fir Street, Boulder City NV 89005.
2. Contracting Officer's Representative, Bureau of Reclamation, Yuma Area Office, 7301 Calle Agua Salada, Yuma AZ 85364-9763.
3. Contracting Officer's Representative (LC-6000), Bureau of Reclamation, PO Box 61470, Boulder City NV 89006-1470; Express Mail: 500 Fir Street, Boulder City NV 89005.
4. Technical Service Center, Bureau of Reclamation, Attn 86-68170, PO Box 25007, Denver CO 80225-0007; Express Mail: Sixth and Kipling, Building 67, Room 152, Denver CO 80225.

B. Send original transmittal letter with appropriate number of sets to office listed in "Responsible Code" column in Table 01330A – List of Submittals except as provided below.

1. When COR is responsible code listed in "Responsible Code" column in Table 01330A – List of Submittals, send 2 copies of submittal to COR at Yuma Area Office address shown above, and send 3 copies of submittal to COR, Bureau of Reclamation, Lower Colorado Regional Office, PO Box 61470, 500 Fir Street, Boulder City NV 89006-1470.
2. When COR is not responsible code listed in "Responsible Code" column in Table 01330A – List of Submittals, send 1 copy of submittal to COR at Yuma Area Office address shown above, and send 2 copies of submittal to COR, Bureau of Reclamation, Lower Colorado Regional Office, PO Box 61470, 500 Fir Street, Boulder City NV 89006-1470.
3. Responsible codes starting with "86-" are located in the Technical Service Center. Send these submittals to the address shown above.

C. Send copy of transmittal letter with appropriate number of sets to offices that are not the responsible code, but show "No. of sets to be sent to" in Table 01330A – List of Submittals.

D. When "No. of sets to be sent to" is 0, send a copy of transmittal letter to that office.

E. Submittals required by the specifications, but not listed in Table 01330A - List of Submittals:

1. Submit in accordance with this section.
2. Submit to Contracting Officer's Representative, Bureau of Reclamation, Yuma Area Office, 7301 Calle Agua Salada, Yuma AZ 85364-9763, unless otherwise specified.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

Table 01330A. - List of Submittals

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RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No. of sets to be sent to: **		
						CO	COR	TSC
001	Bonds 52.228-15	Performance and Payment Bonds	Within 15 days of award	A	CO	3	3	0
002	Liability Insurance 1452.228-70	Acceptable certification that the required insurance has been obtained	Submitted and accepted before commencing onsite work	A	CO	1	3	0
003	Personal Identification of Contractor Personnel 52.204-9	Personal Identity Verification	At least 14 days before bringing subject personnel onsite	I	CO	1	3	0
01141-1	Use of Site	Land use and landscape rehabilitation plan	At least 28 days before use of Government land	A	COR	0	5	1
01321-1	Construction Program	Representative information	Within 7 days after receipt of Notice of Award	I	COR	1	5	1
01321-2	Construction Program	Baseline schedule: 1. Blackline prints 2. Reports 3. Data on floppy diskette or CD-ROM	Within 21 days after receipt of Notice to Proceed	A	COR	 0 0 0	 5 5 5	 3 3 1
01321-3	Construction Program	Updated schedule: 1. Blackline prints 2. Reports 3. Data on floppy diskette or CD-ROM	With monthly requests for progress payments.	A	COR	 0 0 0	 5 5 5	 1 1 1

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						CO	COR	TSC
01321-4	Construction Program	Time impact analysis: 1. Blackline prints 2. Reports 3. Data on floppy diskette or CD-ROM	Within 28 days after the CO directs a contract change, with any proposal for a future modification, with any value engineering proposal, or with any request or claim for an equitable adjustment to the contract.	A	COR	 0 0 0	 5 5 5	 1 1 1
01335-1	Material Safety Data Sheets	Complete LHM and MSDS	At least 14 days before jobsite delivery of hazardous material	I	COR	0	5	0
01335-2	Material Safety Data Sheets	Updated LHM and MSDS	At least 14 days before jobsite delivery of hazardous material not previously listed	I	COR	0	5	0
01453-1	Contractor Quality Testing	Resume	At time of preconstruction conference	I	COR	0	5	1
01453-2	Contractor Quality Testing	Contractor quality testing plan	At time of preconstruction conference	A	COR	0	5	1
01510-1	Temporary Utilities	Construction water diversion facility information	At least 28 days before beginning construction water diversion	A	COR	0	5	0
01527-1	Safety and Health	Safety program	Submitted and accepted within 7 days after award and before commencing onsite mobilization. See section 3 of RSHS	A	COR	0	5	0
01527-2	Safety and Health	Monthly accident summary report	First day of each month	I	COR	0	5	0
01527-3	Safety and Health	Job hazard analysis	Before start of work warranted or identified as potentially hazardous	A	COR	0	5	0
01528-1	Contractor's Onsite Safety Personnel	Resumes	Prior to employment	I	COR	0	5	0

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						CO	COR	TSC
01528-2	Contractor's Onsite Safety Personnel	Safety inspection reports	At least once each week	I	COR	0	5	0
01529-1	First-Aid	Medical Facilities Plan	Submitted and approved before start of operations	A	COR	0	5	0
01550-1	Vehicular Access and Parking	Access roads and haul routes plan	At least 28 days before beginning use of access roads	A	COR	0	5	1
01550-2	Vehicular Access and Parking	Preconstruction video	At least 28 days before beginning onsite construction activities	I	COR	0	5	1
01550-3	Vehicular Access and Parking	Post Construction video	Within 2 days after completing onsite construction activities	I	COR	0	5	1
01555-1	Traffic Control	Traffic control plan	At least 28 days before affecting public traffic	A	COR	0	5	0
01562-1	Environ-mental Controls	Air Quality dust control plan	At least 35 days before start of onsite construction	A	COR	0	5	1
01562-2	Environ-mental Controls	Authority to construct (ATC)/Permit to operate (PTO)	At least 35 days before start of onsite construction	A	COR	0	5	0
01562-3	Environ-mental Controls	Equipment inventory	At least 35 days before start of onsite construction	A	COR	0	5	0
01562-4	Environ-mental Controls	Air quality conformance	At least 35 days before start of onsite construction	A	COR	0	5	0
01563-1	Water Pollution Control	Pollution prevention plan	At least 28 days before start of onsite construction work	A	COR	0	5	1
01563-2	Water Pollution Control	Spill Prevention Control and Countermeasure Plan (SPCC)	At least 28 days before delivery or storage of oil	A	COR	0	5	0
01568-1	Site Security	Security plan	At least 35 days before start of onsite construction	A	COR	0	5	0

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						CO	COR	TSC
01568-2	Site Security	Information security plan	At least 35 days before start of onsite construction	A	COR	0	5	0
01721-1	Surveying	Surveying plan	At least 35 days before beginning survey work	A	COR	0	5	0
01721-2	Surveying	Resume	At least 35 days before beginning survey work; At least 35 days before personnel change	I	COR	0	5	0
01721-3	Surveying	Accuracy check results	At least 14 days before beginning survey work	I	COR	0	5	0
01721-4	Surveying	Completed and reduced survey notes	Within 2 days of completing and reducing notes	I	COR	0	5	0
01721-5	Surveying	Original field survey books	Within 2 days of completing a book	I	COR	0	5	0
01721-6	Surveying	Quantity survey notes and computations	Accompanying progress payment requests	I	COR	0	5	0
01721-7	Surveying	Workday's survey notes	At conclusion of workday if requested by Government	I	COR	0	5	0
01725-1	Protection of Existing Installations	Plan for protecting existing installations	At least 28 days before commencing on site construction work	A	COR	0	5	0
01726-1	Protection of Existing Utilities	Utility owner acknowledgment	At least 28 days before stringing conductors or overhead ground lines	I	COR	0	5	0
01740-1	Cleaning	Plan for maintaining site	At least 35 days before start of onsite construction work	A	COR	0	5	0
01740-2	Cleaning	Waste production and disposal records	Within 7 days of waste disposal	I	COR	0	5	0
01740-3	Cleaning	Hazardous waste manifest	Within 7 days of hazardous waste disposal	I	COR	0	5	0
01740-4	Cleaning	Environmental consultant resume	At least 35 days before beginning environmental assessment	I	COR	0	5	0
01740-5	Cleaning	Environmental site assessment	Within 14 days of completion of work	I	COR	0	5	0

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01781-1	Project Record Documents	Progress As-Built Drawings	Within 14 days after construction of a particular structure or work is completed	I	COR	0	5	0
01781-2	Project Record Documents	Final As-built drawings	Within 14 days of completion of work	I	COR	0	5	0
01781-3	Project Record Documents	Warranties	Within 7 days of completion of each feature of work requiring warranty	I	COR	0	5	0
02052-1	Interstate 8 Highway – Section 8-1. Prequalified and tested signing and delineation materials	Certificate of compliance for prequalified and tested signing and delineation material	In conformance with the provisions of Section 6-1.07 "Certificates of Compliance"	I	COR	0	5	1
02052-2	Interstate 8 Highway – Section 10-1. Closure Requirements and Conditions based upon approved closure schedule	Written schedule of closure requirements and conditions based upon approved closure schedule	At least 14 days before proposed closure	A	COR	0	5	1
02052-3	Interstate 8 Highway – Section 10-1. Closure Requirements and Conditions based upon approved closure schedule	Contingency plan for closure requirements and conditions based upon approved closure schedule	At least 14 days before beginning onsite work	A	COR	0	5	1

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						CO	COR	TSC
02052-4	Interstate 8 Highway – Section 10-1. Traffic Plastic Drums	Certificate of compliance for traffic plastic drums	In conformance with the provisions of Section 6-1.07 "Certificates of Compliance"	I	COR	0	5	1
02052-5	Interstate 8 Highway – Section 39-3.03 Hot Mix Asphalt	Hot mix asphalt information	At least 28 days before placement	A	COR	0	5	1
02052-6	Interstate 8 Highway – Section 39-1.04C Asphalt Rubber Binder	Certificate of compliance for asphalt rubber binder	In conformance with the provisions of Section 6-1.07 "Certificates of Compliance"	I	COR	0	5	1
02052-7	Interstate 8 Highway – Section 39-1.04C Asphalt Rubber Binder	Certified weight slips for asphalt rubber binder	Within 7 days after pavement placement	I	COR	0	5	1
02052-8	Interstate 8 Highway – Section 39-1.12C Profilograph	Profilograph	Within 7 days after pavement placement	A	COR	0	5	1
02052-9	Interstate 8 Highway – Section 39-4.03B Quality Control Plan	Written quality control plan	At least 35 days before placement	A	COR	0	5	1

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02052-10	Interstate 8 Highway – Section 39-4.03C Quality Control Inspection, Sampling, and Testing	Written test results of quality control inspection, sampling, and testing	Within 7 days of placement	A	COR	0	5	1
02052-11	Interstate 8 Highway – Section 40-1. Material – Silicone Joint Sealant	Certificate of compliance for materials – silicone joint sealant	In conformance with the provisions of Section 6-1.07 "Certificates of Compliance"	I	COR	0	5	1
02052-12	Interstate 8 Highway – Section 40-1. Material – Joint Filler Material	Certificate of compliance for materials – joint filler material	In conformance with the provisions of Section 6-1.07 "Certificates of Compliance"	I	COR	0	5	1
02052-13	Interstate 8 Highway – Section 84-3.02 Materials – Paint for Stripping	Certificate of compliance for materials – paint for stripping	In conformance with the provisions of Section 6-1.07 "Certificates of Compliance"	I	COR	0	5	1
02052-14	Interstate 8 Highway – Section 90-1 Concrete pavement Mix Proportions	Concrete pavement mix proportions	At least 28 days before placing concrete pavement	A	COR	0	5	1
02052-15	Interstate 8 Highway – Section 90-2.01 Cementitious materials	Certificate of compliance for cementitious materials	In conformance with the provisions of Section 6-1.07 "Certificates of Compliance"	I	COR	0	5	1

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						CO	COR	TSC
02052-16	Interstate 8 Highway – Section 95-1. Materials – Epoxy (Drill and Bond)	Certificate of compliance for materials – epoxy (drill and bond)	In conformance with the provisions of Section 6-1.07 "Certificates of Compliance"	I	COR	0	5	1
02242-1	Removal of Water	Removal of water plan for Coachella Canal modification	At least 28 days before beginning removal of water operations for Coachella Canal modification	A	86-68312	0	3	2
02242-2	Removal of Water	Removal of water plan for steel pipe and outlet canal construction	At least 28 days before beginning removal of water operations for steel pipe and outlet canal construction	A	86-68312	0	3	2
02242-3	Removal of Water	Installation data	Within 2 days after installation	I	COR	0	5	1
02242-4	Removal of Water	Records	Daily	I	COR	0	5	0
02261-1	Diversion and Care of Coachella Canal During Construction	Coachella Canal water control plan	At least 28 days before beginning diversion and care of Coachella Canal	A	COR	0	5	1
02261-2	Diversion and Care of Coachella Canal During Construction	Concrete plug plan	At least 28 days before beginning abandoning and plugging of existing concrete pipe	A	COR	0	5	2
02316-1	Steel Pipe Earthwork	Steel pipe earthwork and pipeline construction sequence plan	At least 35 days before beginning steel pipe trench earthwork	A	COR	0	5	1
02321-1	Excavation from Borrow	Borrow area use plan	At least 35 days before beginning excavation from borrow	A	COR	0	5	1
02322-1	Excavation of Existing Earth Plug	Excavation of existing earth plug plan	At least 28 days before beginning excavation of existing earth plug	A	COR	0	5	1

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02323-1	Controlled Low Strength Material (CLSM)	Approval data	AT least 28 days before furnishing controlled low strength material	A	COR	0	5	1
02344-1	Geomem-brane	Geomembrane installer qualifications and installation plan	At least 42 days before delivery to jobsite	A	86-68180	0	3	1
02344-2	Geomem-brane	Qualifications of manufacturer and fabricator	At least 42 days before delivery to jobsite	A	86-68180	0	3	1
02344-3	Geomem-brane	Notice of start of production	At least 21 days before start of production	I	86-68180	0	3	1
02344-4	Geomem-brane	Certifications	At least 42 days before delivery to jobsite	A	86-68180	0	3	1
02344-5	Geomem-brane	Samples	At least 42 days before delivery to jobsite	A	86-68180	0	0	1
02344-6	Geomem-brane	Warranty	At least 42 days before delivery to jobsite	I	86-68180	0	3	1
02344-7	Geomem-brane	Surveyed as-built drawings	Within 14 days of completion of installation	I	86-68180	0	3	1
02346-1	Geotextile and Geonet Composite	Manufacturer's certification	At least 42 days before delivery to jobsite	A	86-68180	0	3	1
02346-2	Geotextile and Geonet Composite	Geotextile samples	At least 42 days before delivery to jobsite	A	86-68180	0	0	1
02346-3	Geotextile and Geonet Composite	Geonet composite samples	At least 42 days before delivery to jobsite	A	86-68180	0	3	1
02346-4	Geotextile and Geonet Composite	Protection method	At least 42 days before delivery to jobsite	A	86-68180	0	3	1
02346-5	Geotextile and Geonet Composite	Sewn geotextile seams, if used	At least 42 days before delivery to jobsite	A	86-68180	0	3	1
02376-1	Soil-Cement Test Section	Soil-Cement test section placement plan	At least 35 days before beginning soil-cement test section	A	86-68180	0	3	1

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02376-2	Soil-Cement Test Section	Test section placement report	Within 2 days of completing test section	I	86-68180	0	3	3
02377-1	Soil-Cement	Samples	At least 35 days before beginning soil-cement placement	A	86-68180	0	3	1
02377-2	Soil-Cement	Material certifications and supplier data	At least 35 days before beginning soil-cement placement	A	86-68180	0	3	1
02377-3	Soil-Cement	Soil-cement placement schedule	At least 35 days before beginning soil-cement placement	A	86-68180	0	3	1
02377-4	Soil-Cement	Equipment plan	At least 35 days before beginning soil-cement placement	A	86-68180	0	3	1
02460-1	Sheet Pile Wall	Plan for constructing sheet pile wall	At least 28 days before beginning sheet pile wall construction	A	86-68312	0	3	2
02460-2	Sheet Pile Wall	Quality control, construction records, and operation records	Daily	I	COR	0	5	0
02514-1	Steel Pipe	Shop drawings	At least 56 days before fabricating pipe	A	86-68140	0	3	2
02514-2	Steel Pipe	Purchase orders	Within 2 days of submitting purchase	I	COR	0	5	0
02514-3	Steel Pipe	Pipelaying diagrams	At least 35 days before shipment of pipe	A	86-68140	0	3	2
02514-4	Steel Pipe	Pipe embedment plans	At least 35 days before beginning pipe embedment	A	86-68140	0	3	2
02514-5	Steel Pipe	Welder qualifications	At least 35 days before shipment of pipe	A	COR	0	5	0
02514-6	Steel Pipe	Test reports for hydrostatic testing	Immediately after completing each test	A	COR	0	5	0
02514-7	Steel Pipe	Test reports of field welds	Immediately after completing each test	I	COR	0	5	0
02722-1	Aggregate Base Course	Certification	At least 28 days before furnishing aggregate base course	I	COR	0	5	1

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02732-1	Gravel Surfacing	Certification	At least 28 days before furnishing gravel surfacing	I	COR	0	5	1
02743-1	Asphaltic Concrete Pavement	Mix design data	At least 28 days before placing asphaltic concrete pavement	A	COR	0	5	1
02743-2	Asphaltic Concrete Pavement	Certifications	At least 28 days before furnishing asphaltic concrete pavement	I	COR	0	5	1
02763-1	Painted Traffic Lines and Markings	Certification	At least 28 days before furnishing paint	I	COR	0	5	1
02763-2	Painted Traffic Lines and Markings	Instructions	At least 28 days before furnishing paint	A	COR	0	5	1
02846-1	Metal Beam Guard Railing and Chain Link Railing	Certifications	At least 28 days before furnishing metal beam guard railing or chain link railing	I	COR	0	5	1
03152-1	Sponge Rubber Joint Filler	Certification	At least 28 days before furnishing sponge rubber joint filler	I	COR	0	5	1
03152-2	Sponge Rubber Joint Filler	Instructions	At least 28 days before beginning installation	I	COR	0	5	1
03156-1	PVC Waterstop	Purchase orders	At least 28 days before furnishing PVC waterstop	I	COR	0	5	0
03156-2	PVC Waterstop	Approval samples	At least 28 days before furnishing PVC waterstop	A	86-68180	0	0	1
03156-3	PVC Waterstop	Certifications	At least 28 days before furnishing PVC waterstop	I	COR	0	5	1
03156-4	PVC Waterstop	Instructions	At least 28 days before furnishing PVC waterstop	I	COR	0	5	1

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03157-1	PVC Retro-Fit Waterstop	Approval data and instructions	At least 28 days before furnishing PVC retro-fit waterstop	A	COR	0	5	1
03158-1	PVC Strip Waterstop for Concrete Canal Lining	Purchase orders	At least 28 days before furnishing PVC strip waterstop	I	COR	0	5	0
03158-2	PVC Strip Waterstop for Concrete Canal Lining	Approval samples	At least 28 days before furnishing PVC strip waterstop	A	86-68180	0	0	1
03158-3	PVC Strip Waterstop for Concrete Canal Lining	Certifications	At least 28 days before furnishing PVC strip waterstop	I	COR	0	5	1
03158-4	PVC Strip Waterstop for Concrete Canal Lining	Instructions	At least 28 days before furnishing PVC strip waterstop	I	COR	0	5	1
03200-1	Concrete Reinforce-ment	Reinforcement diagrams and lists	At least 35 days before concrete placement	A	COR	0	5	1
03200-2	Concrete Reinforce-ment	Shop drawings	At least 35 days before concrete placement	A	86-68140	0	3	2
03200-3	Concrete Reinforce-ment	Mill certifications	At least 35 days before concrete placement	I	86-68180	0	3	1
03300-1	Cast-in-Place Concrete	Material approval data	At least 35 days before cast-in-place concrete placement	A	COR	0	5	1
03300-2	Cast-in-Place Concrete	Concrete placement drawings	At least 35 days before cast-in-place concrete placement	A	COR	0	5	1
03300-3	Cast-in-Place Concrete	Concrete placement schedule	At least 35 days before cast-in-place concrete placement	A	COR	0	5	1
03300-4	Cast-in-Place Concrete	Concrete check out cards	At least 35 days before cast-in-place concrete placement	A	COR	0	5	1

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03305-1	Concrete Removal	Concrete removal plan	At least 28 days before beginning removal of concrete	A	COR	0	5	1
03306-1	Removing Existing Coachella Canal Concrete Lining	Concrete canal lining removal plan	At least 28 days before beginning removal of concrete canal lining	A	COR	0	5	1
03306-2	Removing Existing Coachella Canal Concrete Lining	Concrete canal lining repair plan	At least 28 days before beginning removal of concrete canal lining	A	COR	0	5	1
03309-1	Concrete in Canal Lining	Concrete material approval data	At least 35 days before placement of concrete in canal lining	A	COR	0	5	1
03309-2	Concrete in Canal Lining	Elastomeric sealant certification	At least 35 days before placement of concrete in canal lining	I	COR	0	5	1
03309-3	Concrete in Canal Lining	Lining placement procedures	At least 35 days before placement of concrete in canal lining	A	COR	0	5	1
03362-1	Concrete Floor Hardener	Manufacturer's instructions	At least 28 days before applying	A	COR	0	5	1
03622-1	Grouting Mortar for Equipment and Metalwork	Packaged nonshrink grout data	At least 28 days before placing	A	COR	0	5	1
04822-1	Reinforced Concrete Unit Masonry Assemblies	Approval data	At least 56 days before beginning installation	A	86-68120	0	3	1
04822-2	Reinforced Concrete Unit Masonry Assemblies	Certifications and instructions	At least 28 days before beginning installation	I	COR	0	5	1

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04822-3	Reinforced Concrete Unit Masonry Assemblies	Mix designs	At least 28 days before beginning installation	A	86-68120	0	3	1
05315-1	Metal Roof Deck	Approval data	At least 56 days before fabrication or procurement	A	86-68120	0	3	5
05315-2	Metal Roof Deck	Approval drawings	At least 56 days before fabrication or procurement	A	86-68120	0	3	1
05315-3	Metal Roof Deck	Welder qualifications	At least 56 days before fabrication or procurement	A	86-68120	0	3	1
05425-1	Pre-Engineered, Pre-Fabricated Cold Formed Steel Roof Trusses	Approval data	At least 56 days before fabrication or procurement	A	86-68120	0	3	5
05425-2	Pre-Engineered, Pre-Fabricated Cold Formed Steel Roof Trusses	Approval drawings	At least 56 days before fabrication or procurement	A	86-68120	0	3	1
05635-1	Metal Piping	Shop drawings	At least 35 days before fabrication or procurement	A	86-68420	0	3	5
05635-2	Metal Piping	Drawings of vent tee fittings	At least 35 days before fabricating pipe and fittings	A	86-68420	0	3	5
05635-3	Metal Piping	Final drawings	Within 28 days after installation	I	86-68420	0	3	7
07192-1	Silane Water Repellent	Approval data	At least 28 days before applying	A	86-68180	0	3	1
07192-2	Silane Water Repellent	Instructions and documentation	At least 28 days before applying	I	COR	0	5	1

Table 01330A. - List of Submittals

* Submittal types: A – Approval, I – Information
** CO indicates Contracting Officer, COR indicates Contracting Officer's Representative, and TSC indicates Technical Service Center.

RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No. of sets to be sent to: **		
						CO	COR	TSC
07213-1	Batt and Blanket Insulation	Approval data	At least 56 days before fabrication or procurement	A	86-68120	0	3	5
07213-2	Batt and Blanket Insulation	Instructions	At least 56 days before fabrication or procurement	I	86-68120	0	3	5
07430-1	Pre-Insulated Metal Roof and Wall Panels	Approval drawings, data, and sample kit	At least 56 days before fabrication or procurement	A	86-68120	0	3	5
07430-2	Pre-Insulated Metal Roof and Wall Panels	Documentation	At least 56 days before fabrication or procurement	I	COR	0	5	5
07612-1	Metal Soffit Panels	Approval drawings, data, and sample kit	At least 56 days before fabrication or procurement	A	86-68120	0	3	5
07612-2	Metal Soffit Panels	Instructions	At least 56 days before fabrication or procurement	I	86-68120	0	3	5
07612-3	Metal Soffit Panels	Documentation	At least 56 days before fabrication or procurement	I	COR	0	5	5
07612-4	Metal Soffit Panels	Warranties	At least 56 days before fabrication or procurement	I	COR	0	5	5
07840-1	Firestopping	Approval data	At least 56 days before fabrication or procurement	A	86-68120	0	3	5
07840-2	Firestopping	Instructions	At least 56 days before fabrication or procurement	I	COR	0	5	5
07920-1	Joint Sealants	Approval data	At least 56 days before procurement	A	86-68120	0	3	5
07920-2	Joint Sealants	Color sample kit	At least 56 days before procurement	A	86-68120	0	3	5
07920-3	Joint Sealants	Certification and instructions	At least 56 days before procurement	I	COR	0	5	5

Table 01330A. - List of Submittals

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						CO	COR	TSC
08115-1	Bullet-Resistant Steel Doors and Frames	Approval drawings and data	At least 56 days before fabrication or procurement	A	86-68120	0	3	5
08115-2	Bullet-Resistant Steel Doors and Frames	Instructions	At least 56 days before fabrication or procurement	I	COR	0	5	5
08710-1	Door Hardware	Hardware schedule	At least 56 days before fabrication or procurement	A	86-68120	0	3	5
08710-2	Door Hardware	Approval data	At least 56 days before fabrication or procurement	A	86-68120	0	3	5
08710-3	Door Hardware	Instructions	At least 56 days before fabrication or procurement	I	86-68120	0	3	5
09260-1	Gypsum Board Wall Assembly	Approval data	At least 56 days before fabrication or procurement	A	86-68120	0	3	5
09902-1	Coatings	Approval data	At least 28 days before application	A	86-68180	0	3	1
09902-2	Coatings	Documentation	At least 28 days before application	I	86-68180	0	3	1
09902-3	Coatings	Certifications	At least 28 days before application	I	86-68180	0	3	1
09902-4	Coatings	Contractor quality control data	At least 28 days before application	A	86-68180	0	3	1
09980-1	Coatings for Concrete and Masonry	Approval data	At least 28 days before application	A	86-68180	0	3	1
09980-2	Coatings for Concrete and Masonry	Documentation	At least 28 days before application	I	86-68180	0	3	1
10522-1	Fire Extinguishers	Approval data	At least 28 days before fabrication or procurement	A	86-68420	0	3	5
11288-1	Slide Gates	Approval drawings and data	At least 42 days before fabrication or procurement	A	86-68420	0	3	5

Table 01330A. - List of Submittals

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RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No. of sets to be sent to: **		
						CO	COR	TSC
11288-2	Slide Gates	Purchase orders	Within 2 days of submitting purchase	I	COR	0	5	0
11288-3	Slide Gates	Installation procedures	At least 42 days before beginning installation	A	86-68420	0	3	5
11288-4	Slide Gates	Final data	Within 28 days after installation	I	86-68420	0	3	5
11851-1	Safety Cable with Floats	Shop Drawings and Manufacturer's Recommendations	At least 42 days before fabrication or procurement	A	COR	0	5	1
11851-2	Safety Cable with Floats	Approval data	At least 42 days before fabrication or procurement	A	COR	0	5	1
13110-1	Buried Impressed Current Cathodic Protection System	Manufacturers data and preconstruction drawings	At least 28 days before beginning installation	A	COR	0	5	2
13110-2	Buried Impressed Current Cathodic Protection System	As-built drawings	Within 14 days after completing installation	I	COR	0	5	2
13111-1	Galvanic Anode Cathodic Protection Systems for Gates and Poles	Manufacturers data and preconstruction drawings	At least 28 days before beginning installation	A	COR	0	5	2
13111-2	Galvanic Anode Cathodic Protection Systems for Gates and Poles	As-built drawings	Within 14 days after completing installation	I	COR	0	5	2

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RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No. of sets to be sent to: **		
						CO	COR	TSC
13112-1	Submerged Galvanic Anode Cathodic Protection System – Pipes	Manufacturers data and preconstruction drawings	At least 28 days before beginning installation	A	COR	0	5	2
13112-2	Submerged Galvanic Anode Cathodic Protection System - Pipes	As-built drawings	Within 14 days after completing installation	I	COR	0	5	2
13113-1	Submerged Impressed Current Cathodic Protection System – Trashracks	Manufacturer's data and preconstruction drawings	At least 28 days before beginning installation	A	COR	0	5	2
13113-2	Submerged Impressed Current Cathodic Protection System - Trashracks	As-built drawings	Within 14 days after completing installation	I	COR	0	5	2
13423-1	Water Level Measuring Devices	Approval data	At least 42 days before procurement	A	86-68410	0	3	5
13423-2	Water Level Measuring Devices	Final data	Before shipment to jobsite	I	86-68410	0	3	5
13424-1	Ultrasonic Flowmeters	Approval data	At least 56 days before procurement	A	86-68410	0	3	5
13424-2	Ultrasonic Flowmeters	Final data	Before shipment to jobsite	I	86-68410	0	3	5
13425-1	Canal Measuring Device	Approval data	At least 42 days before procurement	A	86-68410	0	3	5

Table 01330A. - List of Submittals

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RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No. of sets to be sent to: **		
						CO	COR	TSC
13425-2	Canal Measuring Device	Final data	Before shipment to jobsite	I	86-68410	0	3	5
13455-1	Control and Monitoring System	Approval drawings and data	Within 91 days after notice to proceed	A	86-68430	0	3	1
13455-2	Control and Monitoring System	Test report	Within 35 days after testing	A	86-68430	0	3	1
13455-3	Control and Monitoring System	Operation and maintenance manual	Within 42 days after testing	I	86-68430	0	3	1
14510-1	Hydraulic Trash Rake	Approval drawings and data	At least 42 days before procurement	A	86-68410	0	3	5
14510-2	Hydraulic Trash Rake	Purchase order	Within 2 days of submitting purchase	I	COR	0	5	0
14510-3	Hydraulic Trash Rake	Final drawings and data	Before shipment to jobsite	I	86-68410	0	3	5
14520-1	Trash Rake Conveyors	Approval drawings and data	At least 42 days before procurement	A	86-68410	0	3	5
14520-2	Trash Rake Conveyors	Purchase orders	Within 2 days of submitting purchases	I	COR	0	5	0
14520-3	Trash Rake Conveyors	Final drawings and data	Before shipment to jobsite	I	86-68410	0	3	8
15810-1	Ducts	Approval data	At least 56 days before fabrication	A	86-68410	0	3	5
15810-2	Ducts	Final data	Within 28 days after final installation	A	86-68410	0	3	8
15820-1	Duct Accessories	Approval data	At least 56 days before fabrication	A	86-68410	0	3	5
15820-2	Duct Accessories	Final data	Before shipment to jobsite	A	86-68410	0	3	8
15830-1	Fan	Approval data	At least 56 days before procurement	A	86-68410	0	3	5
15830-2	Fan	Final data	Before shipment to jobsite	A	86-68410	0	3	8
15850-1	Air Outlets and Inlets	Approval data	At least 56 days before fabrication	A	86-68410	0	3	5

Table 01330A. - List of Submittals

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RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No. of sets to be sent to: **		
						CO	COR	TSC
15850-2	Air Outlets and Inlets	Final data	Before shipment to jobsite	A	86-68410	0	3	8
15950-1	Testing, Adjusting, and Balancing – HVAC	Approval data	Not later than 28 days before commencement of testing	A	86-68410	0	3	5
15950-2	Testing, Adjusting, and Balancing - HVAC	Final data	Within 28 days after completion of testing	A	86-68410	0	3	8
16060-1	Grounding and Bonding	Test reports	Within 35 days after testing	A	86-68430	0	3	3
16080-1	Wiring Checkout and Tests	Wiring checkout test plan	Within 56 days after notice to proceed	I	86-68430	0	3	3
16120-1	Conductors and Cables	Shop drawings and manufacturer's data	Within 56 days after notice to proceed	A	86-68430	0	3	3
16120-2	Conductors and Cables	Test reports	Within 35 days after tests are completed	I	86-68430	0	3	3
16130-1	Electrical Conduit	Shop drawings and manufacturer's data	Within 56 days after notice to proceed	A	86-68430	0	3	3
16130-2	Electrical Conduit	As-built drawings	Within 28 days after installation	I	86-68430	0	3	1
16132-1	Automatic Transfer Switch	Approval drawings and data	At least 42 days before procurement	A	86-68410	0	3	3
16132-2	Automatic Transfer Switch	Final drawings and data	Before shipment to jobsite	I	86-68410	0	3	5
16140-1	Wiring Devices	Shop drawings and manufacturer's data	Within 56 days after notice to proceed	A	86-68430	0	3	3
16212-1	Meter Socket and Service Disconnect	Shop drawings and manufacturer's data	Within 56 days after notice to proceed	A	86-68430	0	3	3
16232-1	Engine-Generator Set	Approval drawings and data	At least 42 days before procurement	A	86-68410	0	3	3
16232-2	Engine-Generator Set	Final drawings and data	Before shipment to jobsite	I	86-68410	0	3	5

Table 01330A. - List of Submittals

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RSN	Clause or Section Title	Submittals required	Due date or delivery time	Type *	Respon-sible code	No. of sets to be sent to: **		
						CO	COR	TSC
16441-1	Distribution Panelboards	Shop drawings and manufacturer's data	Within 56 days after notice to proceed	A	86-68430	0	3	3
16460-1	Lighting and Distribution Transformer	Shop drawings and manufacturer's data	Within 56 days after notice to proceed	A	86-68430	0	3	3
16510-1	Interior Luminaires	Shop drawings and manufacturer's data	Within 56 days after notice to proceed	A	86-68430	0	3	3
16520-1	Exterior Luminaires	Shop drawings and manufacturer's data	Within 56 days after notice to proceed	A	86-68430	0	3	3

END OF SECTION

SECTION 01335 - MATERIAL SAFETY DATA SHEETS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.02 DEFINITIONS

A. LHM: List of Hazardous Materials

B. MSDS: Material Safety Data Sheet.

1.03 APPLICATION

A. For the purposes of this contract, the definition of “materials delivered under this contract” in the clause at FAR 52.223-3 “Hazardous Material Identification and Material Safety Data” Alternate 1 includes materials delivered to the Government and all materials expected to be used during contract performance at the jobsite.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 01335-1, Complete LHM and MSDS.

C. RSN 01335-2, Updated LHM and MSDS:

1. Comply with paragraph (e) of clause at FAR 52.223-3 “Hazardous Material Identification and Material Safety Data” Alternate 1.

1.05 DELIVERY

A. Do not deliver hazardous materials to jobsite which are not included on the original or previously updated LHM and MSDS before receipt of updated LHM and MSDS by COR.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01420 - REFERENCES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.02 REFERENCES

A. Referenced editions of standard specifications, codes, and manuals form a part of this specification to the extent referenced.

B. These specifications take precedence when conflicting requirements occur between specifications and referenced standard.

1.03 JOBSITE REFERENCES

A. Maintain at fabrication site, a copy of referenced standard specifications, codes, and manuals required for work in progress at fabrication site. Make available for use by the Government.

B. Maintain onsite, a copy of referenced standard specifications, codes, and manuals required for onsite work in progress. Make available for use by the Government.

1.04 AVAILABILITY

A. Code of Federal Regulation (CFR):

1. Available online, authorized by the National Archives and Records Administration (NARA) and the Government Printing Office (GPO), at www.gpoaccess.gov/cfr/index.html.

B. Federal Specifications, Standards, and Commercial Item Descriptions; and Military Specifications:

1. Copies of Federal Specifications, Standards, and Commercial Item Descriptions may be obtained from GSA Federal Supply Service, see the provision at FAR 52.211-1, "Availability of Specifications Listed in the GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29."

2. Copies of Military Specifications may be obtained from Department of Defense, see the provision at FAR 52.211-2, “Availability of Specifications, Standards, and Data Item Descriptions Listed in the Acquisition Streamlining and Standardization Information System (ASSIST)”.

C. Bureau of Reclamation Documents:

1. Printed copies of Reclamation Safety and Health Standards (RSHS), stock number 024-003-00190-2, may be purchased from the Superintendent of Documents at the U.S. Government Printing Office, phone number (202) 512-1800. RSHS may be downloaded at http://www.usbr.gov/ssle/safety/RSHS/rshs.html

   a. Printed copies of RSHS are dated 2001. Electronic versions of the RSHS are dated 2002. These documents are identical. These specifications use the 2001 date.

2. Bureau of Reclamation Standard Specifications are designated with an M-series number. Copies of these documents may be obtained from Bureau of Reclamation, Attn 86-68170, PO Box 25007, Denver CO 80225-0007.

3. Bureau of Reclamation manuals and other publications including significant scientific, technical, and engineering works are available from the National Technical Information Service (NTIS). Information regarding availability and pricing may be obtained by contacting NTIS at the following address:

   United States Department of Commerce
   National Technical Information Service
   5285 Port Royal Road
   Springfield, Virginia 22161
   Telephone: (703)487-4650 or 1-800-553-6847

4. Bureau of Reclamation was officially named Water and Power Resources Service for a short period. References to Water and Power Resources Service or any derivative form are synonymous with Bureau of Reclamation.

D. Industrial and Governmental Documents

1. When a reference has a joint designation (e.g. ANSI/IEEE) these specifications generally cite the proponent organization (e.g. IEEE).

2. Addresses for obtaining industrial and governmental (other than Federal and Bureau of Reclamation specifications and standards) specifications, standards, and codes are listed in table 01420A - Addresses for Specifications, Standards, and Codes.

Table 01420A – Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
AAMA	American Architectural Manufacturers Association 1827 Walden Office Square, Suite 550 Schaumburg, IL 60173-4268 www.aamanet.org	(847) 303-5664

Table 01420A – Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol St., NW, Suite 249 Washington, DC 20001 www.aashto.org	(202) 624-5800 (800) 231-3475
ABMA	American Bearing Manufacturers Association 1200 19th St., NW, Suite 300 Washington, DC 20036-2422 www.abma-dc.org	(202) 429-5155
ACI	American Concrete Institute P.O. Box 9094 Farmington Hills, MI 48333 www.aci-int.org	(248) 848-3700
ADC	Air Diffusion Council 104 South Michigan Ave., Suite 1500 Chicago, IL 60603	(312) 201-0101
AGC	Associated General Contractors of America 333 John Carlyle Street, Suite 200 Alexandria VA 22314 www.agc.org	(703) 548-3118
AISC	American Institute of Steel Construction One East Wacker Dr., Suite 3100 Chicago, IL 60601-2001 www.aisc.org	(312) 670-2400
AISI	American Iron and Steel Institute 1101 17th St., NW, Suite 1300 Washington, DC 20036 www.steel.org	(202) 452-7100 (800) 277-3850
AMCA	Air Movement and Control Association International, Inc. 30 W. University Dr. Arlington Heights, IL 60004-1893 www.amca.org	(847) 394-0150
ANSI	American National Standards Institute 1819 L. Street, N.W. Washington, DC 20036 www.ansi.org	(202) 293-8020

Table 01420A – Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
APA/EWA	APA-The Engineered Wood Association P.O. Box 11700 Tacoma, WA 98411-0700 www.apawood.org	(253) 565-6600
ARI	Air-Conditioning and Refrigeration Institute 4301 Fairfax Dr., Suite 425 Arlington, VA 22203 www.ari.org	(301) 459-3200
ASCE	American Society of Civil Engineers World Headquarters 1801 Alexander Graham Bell Dr. Reston, VA 20191-4400 www.asce.org	(800) 548-2723 (703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers 1791 Tullie Circle, NE Atlanta, GA 30329 www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	American Society of Mechanical Engineers 3 Park Ave. New York, NY 10016-5990 www.asme.org	(800) 843-2763
ASTM	ASTM International 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959 www.astm.org	(601) 832-9585
AWS	American Welding Society 550 NW LeJeune Rd. Miami, FL 33126 www.amweld.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association 6666 W. Quincy Ave. Denver, CO 80235 www.awwa.org	(303) 794-7711

Table 01420A – Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
BHMA	Builders Hardware Manufacturers Association 355 Lexington Ave., 17th Floor New York, NY 10017 www.buildershardware.com	(212) 297-2122 Fax (212) 320-9047
CALTRANS	State of California Department of Transportation Standard Plans and Specifications online: www.dot.ca.gov/hq/esc/oe/specs_html/index.html	
CEQA	California Environmental Quality Act www.ceres.ca.gov	
CLFMI	Chain Link Fence Manufacturers Institute 9891 Broken Land Pkwy, Suite 300 Columbia, MD 21046 www.chainlinkinfo.org	(301) 596-2583
COE	USACE Publications Depot Attn: CEIM-SP-D 2803 52nd Avenue Hyattsville, MD 20781-1102 www.usace.army.mil/publications or www.hnd.usace.army.mil/techinfo/indes.htm	(301) 394-0081 Fax (301) 394-0084
EIA	Electronic Industries Alliance 2500 Wilson Boulevard Arlington, Virginia 22201	(703) 907-7500
FM	FM Global Corporate Headquarters P.O. Box 7500 Johnston, RI 02919 www.fmglobal.com	(401) 275-3000
FS	Federal Specification Unit General Services Administration Federal Supply Service FSS Acquisition Management Center Environmental Programs and Engineering Policy Division Washington, DC 20406 http://pub.fss.gsa.gov	(703) 305-5682

Table 01420A – Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
GA	Gypsum Association 810 First St., NE, Suite 510 Washington, DC 20002 www.usg.com www.gypsum.org	(202) 289-5440
GRI	Geosynthetic Research Institute Drexel University West Wing – Rush Building #10 Philadelphia, PA 19104	(215) 895-2343
GSI	Geosynthetic Institute 475 Kedron Avenue Folsom, PA 19033 www.geosynthetic-institute.org	(610) 522-8440 Fax (610) 522-8441
ICAPCD	Imperial County Air Pollution Control District 150 South Ninth Street El Centro, CA 92243 imperialcounty.net/ag/departments/air%20pollution	
ICC	International Code Council 5203 Leesburg Pike, Suite 600 Falls Church, VA 22041 www.intlcode.org	(703) 931-4533
ICEA	Insulated Cable Engineers Association PO Box 440 South Yarmouth, MA 02664 www.icea.net	(508) 394-4424 Fax (508) 394-1194
IEC	International Electrotechnical Commission IEC Regional Centre for North America (IEC-ReCNA) 446 Main Street, 16th Floor Worcester, MA 01608 www.iec.ch	(508) 755-5663 Fax (508) 755-5669
IEEE	Institute of Electrical and Electronics Engineers 3 Park Ave.,17th Floor New York, NY 10016-5997 www.ieee.org	(212) 419-7900

Table 01420A – Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
LGSEA	Light Gauge Steel Engineers Association 1202 15th Street NW Suite 320 Washington, DC 20005 www.lgsea.com	(202) 263-4488 Fax (202) 785-3856
MBMA	Metal Building Manufacturers Association 1300 Sumner Ave. Cleveland, OH 44115-2851 www.mbma.com	(216) 241-7333
MIC	Masonry Industry Council Mason Contractors Association of America 1910 South Highland Avenue, Suite 101 Lombard, IL 60148	(630) 705-4200
MIL	Military Standardization Documents Defense Automated Printing Service 700 Robbins Ave., Building 4D Philadelphia, PA 19111-5094 www.dodssp.daps.mil	(125) 697-2179
NAAMM	National Association of Architectural Metal Manufacturers 8 South Michigan Ave., Suite 1000 Chicago, IL 60603 www.naamm.org	(312) 332-0405
NACE	NACE International 1440 South Creek Drive Houston, TX 77084 www.nace.org	(281) 228-6200
NAPF	National Association of Pipe Fabricators Oklahoma City, OK www.napf.com	
NCMA	National Concrete Masonry Association 2302 Horse Pen Road Herndon, VA 20171-3499 www.nema.org	(703) 713-1900

Table 01420A – Addresses for Specifications, Standards, and Codes

Acronym	Name and Address	Telephone
NEBB	National Environmental Balancing Bureau 8575 Grovemont Circle Gaithersburg, MD 20877 www.nebb.org	(301) 977-3698
NEMA	National Electrical Manufacturers Association 1300 N 17th St., Suite 1847 Rosslyn, VA 22209 www.nema.org	(703) 841-3200
NFPA	National Fire Protection Association One Batterymarch Park P.O. Box 9101 Quincy, MA 02269-9101 www.nfpa.org	(800) 344-3555 (617) 770-3000
SDI	Steel Deck Institute P.O. Box 25 Fox River Grove, IL 60021 www.sdi.org	(847) 462-1930
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association 4201 Lafayette Center Dr. Chantilly, VA 20151-1209 www.smacna.org	(703) 803-2980
SSPC	SSPC: The Society for Protective Coatings 40 24th St., 6th Floor Pittsburgh, PA 15222-4656 www.sspc.org	(800) 837-8303 (412) 281-2331
UL	Underwriters Laboratories Inc. 333 Pfingsten Rd. Northbrook, IL 60062-2096 www.ul.com	(847) 272-8800
WWPA	Western Wood Products Association 522 SW 5th Ave., Suite 500 Portland, OR 97204-2122 www.wwpa.org	(503) 224-3930

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01453 – CONTRACTOR QUALITY TESTING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM C 1077-07	Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
2.	ASTM C 1093-07	Accreditation of Testing Agencies for Unit Masonry
3.	ASTM D 3666-07a	Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
4.	ASTM D 3740-04a	Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
5.	ASTM E 329-07a	Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
6.	ASTM E 543-08	Agencies Performing Nondestructive Testing

1.03 DEFINITIONS

A. Contractor Quality Testing: Specified tests to be performed by the Contractor.

1. The Contractor may use the tests as part of the Contractor Quality Control program.
    a. They do not relieve the Contractor of complying with the Quality Control clause at FAR 52.246-12 “Inspection of Construction”.
2. The Government may use the test results for Quality Assurance.

B. Quality Control: Activities performed by Contractor to assure work conforms to contractual requirements.

C. Quality Assurance: Testing and inspection performed by Government to determine whether Contractor has fulfilled contract requirements.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 01453-1, Resume:

1. Person responsible for managing Contractor's quality control program.

C. RSN 01453-2, Contractor Quality Testing Plan:

1. Prepared by Quality Control Manager.
2. Address methods, procedures, sequences, and scheduling for performing quality testing in the following sections:
    a. Section 02302 – Compacting Earth Materials.
    b. Section 02344 – Geomembrane.
    c. Section 02377 – Soil-Cement.
    d. Section 02514 – Steel Pipe.
    e. Section 03300 – Cast-In-Place Cocnrete.
    f. Section 03309 – Concrete in Canal Lining.
3. If independent laboratories will be retained for performing testing, list each laboratory with their accreditations.
4. If Contractor employees will be performing the testing, list each employee with their qualifications or certifications.

1.05 QUALIFICATIONS

A. Quality Control Manager: Experienced licensed professional engineer with minimum of 5 years experience in charge of managing quality control for construction similar in nature to that required by this contract.

1. If quality control performance does not meet specifications requirements as determined by the CO, the Contractor shall replace the responsible person in charge of quality control.

B. Testing Laboratories or Personnel:

1. Testing laboratories shall be accredited by laboratory agencies such as AMRL (AASHTO Reference Material Laboratory), CALTRANS (State of California Department of Transportation), CCRL (Cement and Concrete Reference Laboratory), or USACE (US Army Corps of Engineers) or shall meet the requirements of the qualification standards below.
2. Contractor personnel shall be qualified to perform testing in accordance with the qualification standards below.

C. Laboratory equipment shall be provided and calibrated in accordance with the qualifications standards below.

D. Qualification standards:

1. Construction materials testing: Meet requirements of ASTM E 329.
2. Concrete and concrete aggregates testing: Meet requirements of ASTM C 1077.
3. Concrete masonry units testing: Meet requirements of ASTM C 1093.
4. Soil and rock testing: Meet requirements of ASTM D 3740.
5. Bituminous paving materials: Meet requirements of ASTM D 3666.
6. Nondestructive testing: Meet requirements of ASTM E 543.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CONTRACTOR QUALITY TESTING

A. An independent testing laboratory retained by the Contractor or Contractor personnel shall perform Contractor quality testing as required in specification sections.

END OF SECTION

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SECTION 01510 - TEMPORARY UTILITIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.02 REFERENCES

A. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2-2007 National Electrical Safety Code (NESC)®

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals.

B. RSN 01510-1, Construction Water Diversion Facility Information

1. Location and capacity of diversion facility.
2. Points of withdrawal for construction water.

1.04 TEMPORARY ELECTRICITY

A. Electric service will be available up to a maximum of approximately 1,000 kilovolt amperes from the Government at the southwest corner of the Drop 2 Storage Reservoir site. This power will be available as three-phase, 60 hertz, alternating current at 480 volts. Transformers for this power may not be available until December, 2008. Contractor may need to provide generators until power is available from this source.

B. Pay all fees for electric power including Government furnished electric power to Imperial Irrigation District.

C. Provide generators, transmission lines, distribution circuits, transformers, and other electrical equipment and facilities required for obtaining power and distributing power to points of use.

D. Comply with IEEE C2 clearances and spacing for temporary communications and supply lines.

E. Remove temporary equipment and facilities upon completion of work under this contract.

1.05 TEMPORARY WATER

A. Water for construction may be obtained from All-American Canal.

1. Contact Imperial Irrigation District for rates and to arrange for use.

B. Contact and obtain approval from Imperial Irrigation District before use of any water from All-American Canal.

C. Pay all fees to Imperial Irrigation District for use of water from All American Canal.

D. Use water which meets specified requirements for water used in concrete, soil-cement, masonry, grouting, and other permanent work.

E. Provide means of conveying water to points of use.

F. Remove temporary equipment and facilities upon completion of work under this contract.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01512 - TEMPORARY UTILITIES AND SERVICES FOR GOVERNMENT FIELD OFFICES AND LABORATORY

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.02 REFERENCES

A. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2-2007 National Electrical Safety Code (NESC)

1.03 PROJECT CONDITIONS

A. Government Field Offices and Government Field Laboratory will exist on site at time of award of this contract and will be located in the area shown on drawings.

1.04 TEMPORARY ELECTRICITY

A. Provide electrical service to Government Field Offices and to Government Field Laboratory.

1. Electrical service shall consist of conductors and equipment for delivering electrical energy from the serving utility to the wiring systems of the Government Field Offices and Government Field Laboratory.

B. Electric power for Field Offices:

1. 100 ampere, single-phase, 120/240 volt, three-wire, grounded service.

C. Electric power for Field Laboratory:

1. 200 ampere, single-phase, 120/240 volt, three-wire, grounded service.

D. Obtain power from source in accordance with Section 01510 – Temporary Utilities.

E. Provide transmission lines, distribution circuits, transformers, and other electrical equipment and facilities required for obtaining power and distributing power to Government Field Offices and Government Field Laboratory.

F. Comply with IEEE C2 clearances and spacing for temporary supply lines.

G. Remove temporary equipment and facilities upon completion of work under this contract.

1.05 TEMPORARY WATER

A. Provide water to Government Field Offices suitable for restroom use including toilet flushing and hand washing to accommodate up to 350 gallons per day.

B. Provide water to Government Field Laboratory suitable for material testing to accommodate up to 200 gallons per day.

C. Install temporary equipment and facilities necessary to provide water for use.

D. Provide means of conveying water to points of use.

E. Remove temporary equipment and facilities upon completion of work under this contract.

1.06 DRINKING WATER AND ICE

A. Provide drinking water for Government Field Offices and Government Field Laboratory.

B. Provide drinking water in 5 gallon plastic containers up to 50 gallons per day.

C. Provide three hot/cold water coolers for drinking water use.

D. Provide 250 pounds of ice per day for Government personnel use in addition to ice for use by Contractor personnel.

1.07 SEWAGE FACILITIES

A. Install temporary equipment and facilities necessary for sewage collection and disposal.

B. Provide waste water pumping services for Government Field Offices and Government Field Laboratory.

C. Remove temporary equipment and facilities upon completion of work under this contract.

1.08 SERVICES

A. Provide daily janitorial services during normal working hours for Government Field Offices and Government Field Laboratory.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01527 - SAFETY AND HEALTH

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.02 REFERENCES

A. Bureau of Reclamation (USBR)

1. USBR RSHS-2001 Reclamation Safety and Health Standards

a. Available on the Internet at:
http://www.usbr.gov/ssle/safety/RSHS/rshs.html.

b. Hard copies available from:

The Government Printing Office
Superintendent of Documents
North Capitol and H St. N. W.
MS-SSMC - Room 566
Washington, D.C. 20401
(202) 512-1800
(Stock item GPO-024-003-00190-2)

c. Printed copies of RSHS are dated 2001. Electronic versions of the RSHS are dated 2002. These documents are identical. These specifications use the 2001 date.

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 01527-1, Safety program:

1. Written safety program in accordance with Section 3 of USBR RSHS.

C. RSN 01527-2, Monthly accident summary report:

1. Form 7-2218 or other acceptable form in accordance with paragraph 3.8 of USBR RSHS.

D. RSN 01527-3, Job hazard analysis.

1. In accordance with Section 4 of USBR RSHS.

2. Form in accordance with Appendix A of USBR RSHS.

1.04 PROJECT CONDITIONS

A. Comply with USBR RSHS.

B. Provide and maintain a work environment and procedures that will:

1. Safeguard the public and Government's personnel exposed to Contractor operations and activities.
2. Avoid interruptions of site operations and delays in project completion dates.
3. Control costs in contract performance.

C. Do not require persons employed in performance of this contract, including subcontracts, to work under conditions which are unsanitary, hazardous, or dangerous to the employee’s health or safety.

D. Provide appropriate safety barricades, signs, and signal lights.

E. Maintain accurate record of and report to the CO the following occurrences during performance of this contract:

1. Death.
2. Occupational disease.
3. Traumatic injury to employees or the public.
4. Property damage in excess of $2,500.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01528 - CONTRACTOR'S ONSITE SAFETY PERSONNEL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 01528-1, Resumes:

1. Contractor's Onsite Safety Representative.

C. RSN 01528-2, Safety Inspection Reports:

1. Include a list of noted deficiencies, their abatement dates, and follow-up action for all jobsite activities.
2. Base inspection report on findings of jobsite walk-through with Government personnel.

1.03 QUALIFICATIONS

A. Contractor's Onsite Safety Representative:

1. Competent supervisory employee with minimum three years appropriate level of safety related training and experience.
2. Capable of identifying existing and predictable hazards in the surrounding or working conditions which are unsanitary, hazardous, or dangerous to employees.
3. Fully qualified by possession of a recognized degree, certificate, or professional standing; or by extensive knowledge, training, and experience has successfully demonstrated ability to solve or resolve problems relating to safety.
4. Safety representative requirements can be met by engaging full-time services of a safety consultant.

1.04 APPLICATION

A. Contractor's Onsite Safety Representative authorities, duties, and responsibilities:

1. Review and approve the Contractor's Safety Program prior to submittal.
2. Full-time job shall be safety and accident prevention. The safety representative shall not supervise or perform other work.

3. Empowered with sufficient line authority to effectively implement Contractor's Safety Program.

4. Before start of construction: Identify existing and predictable unsanitary, hazardous, or dangerous conditions.

5. Full authorization to correct unsafe acts on the spot.

6. Prepare and submit Job Hazard Analysis (JHA) in accordance with Section 01527 – Safety and Health.

   a. Consult with a safety or health professional if necessary, and assess the workplace and work activities to determine if hazards are present or are likely to be present. Develop a written JHA if warranted by identified or potential hazards.

7. Oversee monitoring of excavated materials. Implement additional controls as required.

8. At least once each week:

   a. Conduct safety inspection of worksites, materials, and equipment.

   b. Prepare detailed safety inspection report listing noted deficiencies, their abatement dates, and follow up action.

9. Onsite during any and all construction activities.

1.05 QUALITY ASSURANCE

A. Contractor's Onsite Safety Representative:

1. The effectiveness of the Contractor's Onsite Safety Representative in prosecuting the safety program will be subject to continued review and approval by the COR.

B. Safety Program:

1. The effectiveness of the Contractor's Safety Program will be subject to continued review and approval by the COR.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01529 - FIRST AID

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.02 REFERENCE

A. Bureau of Reclamation (USBR)

1. USBR RSHS-2001 Reclamation Safety and Health Standards

1.03 SERVICE

A. First-aid and medical facilities: In accordance with section 5 of USBR RSHS.

B. If there is a difference between the provisions of this section and the safety and health regulations promulgated by the U.S. Department of Labor in Title 29 CFR, Parts 1910 and 1926, Occupational Safety and Health Act of 1970, or approved State plans, the more stringent provision shall prevail.

C. Do not perform onsite work until first aid plans have been submitted, approved by the COR, and implemented on site.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 01529-1, Medical Facilities Plan:

1. Describe facilities for providing medical attention for injured or disabled employees.

2. Include onsite emergency facilities and ambulance service.

1.05 AMBULANCE SERVICE

A. Arrange for dependable ambulance service in accordance with USBR RSHS, paragraph 5.4.

1.06 AVAILABILITY

A. Make facilities and services available for providing emergency aid to employees, subcontractor employees, and Government employees.

B. Provide services free of charge to Government employees injured on job.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01550 - VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work, except as specified.

1.02 REGULATORY REQUIREMENTS

A. Meet requirements established by jurisdictional authority for use of existing roadways and haul routes; including seasonal or other limitations or restrictions, payment of excess size and weight fees, and posting of bonds conditioned upon repair of damage.

B. Comply with applicable regulations for haul routes over public highways, roads, or bridges.

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals.

B. RSN 01550-1, Access Roads and Haul Routes Plan. Include, as a minimum, the following:

1. Plan for use of access and haul routes.
2. Provide haul patterns for earthwork and concrete lining activities.
3. Ingress and egress procedures for haul trucks.
4. Road conditions inspections and repairs.
5. Truck size limitations per jurisdictional authority.
6. Layout and details of all temporary roads, including earthwork.
7. On-site and off-site parking.

C. RSN 01550-2, Preconstruction Video.

1. Video of preconstruction conditions of Evan Hewes Highway and County Road.

D. RSN 01550-3, Post Construction Video.

1. Video of post construction conditions of Evan Hewes Highway and County Road.

1.04 SITE CONDITIONS

A. Rights-of-way for access to work from existing roads will be established by the Government.

1. In accordance with the clause at FAR 52.236-10 "Operations and Storage Areas," use only established roadways, parking areas, and haul routes; or temporary roadways, parking areas, or haul routes constructed by the Contractor when and as authorized by the COR.

2. Subject to the clause at FAR 52.249-10 "Default (Fixed-Price Construction)," unavailability of transportation facilities or limitations thereon shall not become a basis for claims for damages or extension of time for completion of work.

B. Access roads include roadways to the site and within the work site area.

C. Evan Hewes Highway will be closed from south west corner of the reservoir site to the within 150 feet west of the south west corner of section 36 for the duration of this contract.

D. County Road will be closed from Evan Hewes Highway for the duration of this contract.

E. Brock Farm Road will be closed for the duration of this contract.

F. Refer to Section 01141 – Use of Site for land use and landscape rehabilitation plan to be submitted.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials to maintain and repair existing roadways, parking areas, and haul routes: In accordance with requirements of jurisdictional authority.

B. Materials to construct, maintain, and repair temporary roadways, parking areas, and haul routes: As approved by the COR.

C. Materials to maintain roadways and parking areas constructed under this contract and used by the Contractor for construction work: In accordance with specified requirements for construction of those roadways and parking areas.

PART 3 EXECUTION

3.01 EXAMINATION

A. Investigate condition of available public or private roads for clearances, restrictions, bridge-load limits, bond requirements, and other limitations that affect or may affect access and transportation operations to and from the jobsite.

3.02 RECORDS

A. Make preconstruction video of surface conditions of Evan Hewes Highway and of County Road.

1. DVD format.
2. Label:
    a. Contract number and title.
    b. Contractor’s name.
    c. Date the video is made.
    d. Preface video with this information.

B. Make post construction video of surface conditions of Evan Hewes Highway and of County Road.

1. DVD format.
2. Label:
    a. Contract number and title.
    b. Contractor’s name.
    c. Date the video is made.
    d. Preface video with this information.

C. Make camera movement speed for videos such that areas can be readily identified and located as approved by COR.

D. COR will be present during preconstruction videoing and post construction videoing.

3.03 ESTABLISHED ROADWAYS

A. Established roadways are available for the Contractor's use subject to existing restrictions and approval of the COR.

B. Designated existing onsite roadways and driveways may be used for construction traffic. Tracked vehicles are not allowed.

C. Coordinate with Imperial County for use of and closure of Evan Hewes Highway.

D. Coordinate with Imperial County for use of county roads.

E. Coordinate with Imperial Irrigation District for use of Drop 2 Power Plant access road.

F. Access for Coachella Valley Water District to Coachella Canal west operating road and at the Coachella Canal turnout structure must be maintained at all times.

3.04 TEMPORARY ROADWAYS AND PARKING AREAS

A. Roadways:

1. Construct temporary all-weather surfaced roadways for access from public thoroughfares to serve construction area, of a width and load-bearing capacity to provide unimpeded traffic for construction purposes.
2. Construct temporary bridges or culverts at stream crossings or cross-drainage channels to allow for unimpeded surface drainage.

B. Construction Parking Areas:

1. Arrange for temporary parking areas at approved staging areas to accommodate use of construction personnel.
2. Provide additional offsite parking when site space is not adequate.
3. Locate as approved by the COR.

3.05 ROADWAYS CONSTRUCTED UNDER THE CONTRACT

A. Roadways constructed under these specifications will be available for the Contractor's use in accordance with requirements of this section.

B. Prior to acceptance, permanent roads may be used for construction traffic.

1. Avoid traffic loading beyond design capacity.
2. Steel tracked vehicles not allowed.
3. Rubber tracked vehicles are acceptable.
4. Contractor is responsible for damage caused by construction operations.

C. After completion, roadways constructed under the contract will be accepted by the COR and will be available for use by the public and by the Contractor in the Contractor's construction operations for the remaining work under the contract.

D. Acceptance of roadways as provided above will not require a release of the percentages withheld from progress payments under the clause at FAR 52.232-5 "Payment Under Fixed-Price Construction Contracts."

3.06 HAUL ROUTES

A. Perform work on rights-of-way established by the Government as necessary to construct and maintain any roads, bridges, or drainage structures required for establishment and use of haul routes for construction operations.

B. Use existing available public highways, roads, or bridges as haul routes subject to applicable local regulations.

C. Use established haul patterns in accordance with approved plan. Discuss any proposed changes in haul patterns with COR before making any changes.

D. Minimize interference with or congestion of local traffic.

E. Provide barricades, flaggers, and other necessary precautions for safety of the public as required by RSHS where haul routes cross or parallel public highways or roads.

3.07 MAINTENANCE

A. Maintain roadways and haul routes in a sound, smooth condition.

B. Maintain roadbed, side slopes, structures, and surfacing of roads until completion and acceptance of all work under this contract. As approved by the COR, defer until latest practicable date within specified completion period, placement of surfacing on roads subject to heavy and deteriorating use by the Contractor's construction operations or equipment.

C. Maintain surfacing of gravel-surfaced roads in a smooth condition until completion and acceptance of all work under this contract.

3.08 REPAIR

A. Promptly repair ruts, broken pavement, potholes, low areas with standing water, and other deficiencies to maintain road surfacing and drainage in original or specified condition.

B. Return closed roads to original condition before reopening.

3.09 REMOVAL

A. Remove materials used to construct temporary roadways, parking areas, and haul routes prior to contract completion. Recycle salvageable materials as approved by the COR.

B. Remove temporary underground work and compacted materials to a depth of 2 feet, fill and regrade site as specified.

END OF SECTION

SECTION 01555 - TRAFFIC CONTROL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Traffic Control:

1. Payment: Lump sum price offered in the schedule.

   a. Includes traffic control for access road to Drop 2 Powerplant, Coachella Canal turnout structure, Evan Hewes Highway, and County Road.

   b. Does not include traffic control for Interstate 8 Highway work and temporary traffic detour. Refer to Section 02052 – Interstate 8 Highway Work.

   c. Does not include watering for dust abatement. Refer to Section 02202 – Water for Dust Abatement.

   d. Equal monthly progress payments as a percentage of the lump-sum price for traffic control will be made over the duration of the contract.

1.02 REFERENCES

A. Federal Highway Administration, Department of Transportation

1. MUTCD, Part 6 — Part 6, Temporary Traffic Control, MUTCD 2000, Manual on Uniform Traffic Control Devices, 2003 Edition, with Revision No. 1, July 21, 2004 (http://mutcd.fhwa.dot.gov/)

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 01555-1, Traffic control plan.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 TRAFFIC CONTROL

A. Meet requirements of MUTCD, Part 6.

B. Provide cones, delineators, concrete safety barriers, barricades, flasher lights, danger signals, signs, and other temporary traffic control devices as required to protect work and public safety.

C. Provide flaggers and guards as required to prevent accidents and damage or injury to passing traffic.

D. Do not begin work along public or private roads until proper traffic control devices for warning, channeling, and protecting motorists are in place in accordance with approved traffic control plan.

E. Maintain traffic flow and conduct construction operations to minimize obstruction and inconvenience to public traffic.

F. Provide unobstructed, smooth, and dustless passageway for two lanes of traffic through construction operations.

G. Construct temporary access roads with two lanes of traffic between existing roadway and staging areas.

H. Maintain convenient access to roadways along line of work.

I. Protect roads closed to traffic with effective barricades and warning signs. Illuminate barricades and obstructions from sunset to sunrise.

J. Remove traffic control devices when no longer needed.

END OF SECTION

SECTION 01562 - ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in the prices offered in the schedule for other items of work, except as specified.
2. Costs for damages and work stoppage are the Contractor's responsibility.

B. See Section 02202 - Water for Construction, for measurement and payment for applying water used for dust abatement within the rights-of-way.

1.02 REFERENCES

A. Bureau of Reclamation (USBR)

1. USBR RSHS Reclamation Safety and Health Standards, 2001 Edition

1.03 DEFINITIONS

A. CARB (ARB): California Air Resources Board.

B. CAAQS: California Ambient Air Quality Air Standards

C. NOx: Nitrous Oxide.

D. PM: Particulate Matter.

E. PM_{10}: Particulate Matter with diameters less than 10 micrometers.

F. ICAPCD: Imperial County Air Pollution Control District.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 01562-1, Air Quality Dust Control Plan:

1. Approved plan from ICAPCD.

C. RSN 01562-2, Authority to Construct (ATC)/Permit to Operate (PTO):

1. For fixed or portable plant equipment operations for site produced concrete and soil cement.
2. Approved permit from ICAPCD.

D. RSN 01562-3, Equipment Inventory:

1. All off-road equipment greater than 50 horsepower used for more than an aggregate of 40 hours or more during any portion of this project.
2. Include horsepower rating, engine production year, emission factors, and projected hours of use and fuel throughput for each piece of equipment.
3. Updated monthly and also submitted to the ICAPCD.

E. RSN 01562-4, Air Quality Conformance:

1. Calculations summing total emissions, tracked by ICAPCD, showing daily, monthly, and annual totals.
2. Updated monthly and also submitted to the ICAPCD.

1.05 REGULATORY REQUIREMENTS

A. Comply with Federal, State, and local laws and regulations.

B. Comply with USBR RSHS.

C. Comply with the guidelines of the California Environmental Quality Act (CEQA) Air Quality Handbook where appropriate

D. Comply with all applicable standards outlined in ICAPCD Regulation VIII (minimization of fugitive dust emissions), as outlined in the following rules:

1. Rule 800 – General Requirements for Control of Fine Particulate Matter
2. Rule 801 – Construction and Earthmoving Activities
3. Rule 802 – Bulk Materials
4. Rule 804 – Open Areas
5. Rule 805 – Paved and Unpaved Roads
6. Rule 806 – Conservation Management Practices

E. Comply with all applicable standards outlined in ICAPCD Regulation II – Permits with special focus on the following rules:

1. Rule 201 – Permits Required
2. Rule 207 – New and Modified Stationary Sources

F. Conform to most stringent requirement in cases of conflict between specifications, regulatory requirements, and USBR RSHS.

G. Contractor shall be responsible for damages resulting from emissions originating from Contractor operations in accordance with clause at FAR 52.236-7 "Permits and Responsibilities."

H. The CO may stop any construction activity in violation of Federal, State, or local laws and additional expenses resulting from work stoppage will be responsibility of Contractor.

1.06 DUST CONTROL

A. Provide dust control and abatement during construction in compliance with ICAPCD approved Dust Control Plan.

B. Prevent, control, and abate dust pollution within construction limits and on rights-of-way provided by Government or elsewhere during performance of work.

C. Provide labor, equipment, and materials, and use efficient methods wherever and whenever required to prevent dust nuisance or damage to persons, property, or activities, including, but not limited to, wildlife habitats, dwellings and residences, agricultural activities, recreational activities, traffic, and similar conditions.

D. Provide means for eliminating atmospheric discharges of dust during mixing, handling, and storing of cement, pozzolan, and concrete aggregate.

E. Implement the feasible compensation measures identified in Section 7.1 of the ICAPCD CEQA Air Quality Handbook that are not part of the Regulation VIII requirements.

1.07 AIR POLLUTION CONTROL

A. Use methods and devices to prevent, control, and otherwise minimize atmospheric emissions or discharges of air contaminants.

B. Do not operate equipment and vehicles that show excessive exhaust gas emissions until corrective repairs or adjustments reduce such emissions to acceptable levels.

1.08 NOISE CONTROL

A. Do not exceed noise levels of 90 decibels of maximum noise level with no noise reduction measures in place and assuming a background noise level of 45 decibels.

B. Noise barriers and equipment mufflers required.

1.09 LIGHT CONTROL

A. All site facilities shall be color treated with non-reflective materials to avoid off-site glare, except where safety is an issue.

B. Night lighting shall be directed downward and inward through use of standard light shields or hoods toward the area to be illuminated, in accordance with USBR RSHS, in order to minimize nighttime light and glare.

1.10 TEMPORARY POWER

A. When line power is available in accordance with Section 01510 – Temporary Utilities, the Contractor shall utilize this line power in lieu of generator power for fixed or portable plant equipment operations for site produced concrete and soil cement.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01563 - WATER POLLUTION CONTROL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.02 REFERENCES

A. Bureau of Reclamation (USBR)

1. USBR RSHS-2001 Reclamation Safety and Health Standards

B. Code of Federal Regulations (CFR)

1. 40 CFR, Part 112 Oil Pollution Prevention

C. Public Law

1. Sections 311, 402, and 404 Clean Water Act (Public Law 92-500, as amended)

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 01563-1, Pollution Prevention Plan:

1. As required by the stormwater permit for discharges from construction sites.

C. RSN 01563-2, Spill Prevention, Control, and Countermeasure (SPCC) Plan:

1. Submit when SPCC Plan is required in accordance with 40 CFR, Part 112.
    a. Generally, SPCC Plan required where location of construction site is such that oil and oil products from accidental spillage could reasonably be expected to enter into or upon navigable waters of the United States or adjoining shorelines, and aggregate on site oil storage capacity is over 1,320 gallons. Only containers with capacity of 55 gallons and greater are included in determining on site aggregate storage capacity.
2. Reviewed and certified by a registered professional engineer in accordance with 40 CFR, Part 112, as required by section 311 of the Clean Water Act (Public Law 92-500 as amended).

1.04 REGULATORY REQUIREMENTS

A. Construction Safety Standards:

1. Comply with sanitation and potable water requirements of section 7 of USBR RSHS.

B. Laws, Regulations, and Permits:

1. Perform construction operations to comply, and ensure subcontractors comply, with:

a. Applicable Federal, State, and local laws, orders, regulations, and Water Quality Standards concerning control and abatement of water pollution; and terms and conditions of applicable permits issued by permit issuing authority.

b. If conflict occurs between Federal, State, and local laws, regulations, and requirements, the most stringent shall apply.

C. Contractor Violations:

1. If noncompliance should occur, immediately (verbally) report noncompliance to the COR. Submit specific information within 2 days.

2. Violation of applicable Federal, State, or local laws, orders, regulations, or Water Quality Standards may result in the CO stopping site activity until compliance is ensured.

3. The Contractor shall not be entitled to extension of time, claim for damage, or additional compensation by reason of such a work stoppage.

4. Corrective measures required to bring activities into compliance shall be at the Contractor's expense.

1.05 REQUIRED PERMITS

A. Wastewater Discharge Permit:

1. Permit:

a. Prior to discharging wastewater or other pollutants, secure a permit to discharge pollutants as required under section 402 of the Clean Water Act (Public Law 92-500 as amended).

2. Terms and Conditions: Comply with terms and conditions as stated in the permit.

3. Monitoring and Treatment:

a. Provide monitoring and water treatment, if necessary, to achieve compliance with permit conditions

b. Provide recordkeeping required of the section 402 permittee, as stated in the section 402 permit.

4. Sampling: Include sampling in monitoring required of the Contractor to meet section 402 requirements, as well as required laboratory tests to determine effluent characteristics.

5. Monitoring Results:

   a. Provide monitoring results to the COR 2 weeks prior to submittal deadline to appropriate State and/or Environmental Protection Agency (EPA) Regional Administrator.

   b. Send copies of all information transmitted to EPA and/or the State to the COR.

B. Stormwater Discharge Permit Associated With a Construction Site:

1. Notice of Intent (NOI):

   a. Both the Bureau of Reclamation and the Contractor shall sign the NOI to obtain coverage under a stormwater general permit to control stormwater discharges from the construction site as required under section 402 of the Clean Water Act (Public Law 92-500, as amended).

2. Pollution Prevention Plan:

   a. The Contractor shall prepare a Pollution Prevention Plan as required by the permit.

   b. Comply with terms and conditions to obtain and maintain this stormwater discharge permit.

3. Monitoring and Water Treatment:

   a. Provide monitoring and water treatment, if necessary, to achieve compliance with applicable Water Quality Standards.

   b. Provide the recordkeeping required by the stormwater discharge permit associated with construction activity.

C. Stormwater Discharge Permit Associated With Industrial Activity:

1. Stormwater Discharge Permit:

   a. If construction activities will entail the use of a mobile concrete plant, mobile asphalt plant, or nonmetallic borrow areas, a stormwater discharge permit associated with industrial activity may be required.

2. Notice of Intent (NOI):

   a. Sign the NOI to obtain coverage under a stormwater general permit to control stormwater discharges from industrial activity at the construction site as required under section 402 of the Clean Water Act (Public Law 92-500, as amended).

3. Terms and Conditions:

   a. Comply with terms and conditions to obtain and maintain the industrial stormwater discharge permit, including the preparation of a Pollution Prevention Plan.

4. Monitoring and Water Treatment:

   a. Provide monitoring and water treatment, if necessary, to achieve compliance with applicable Water Quality Standards.

   b. Provide recordkeeping required by the stormwater discharge permit associated with industrial activity.

1.06 CONTRACTOR RESPONSIBILITIES

A. Permits:

1. Obtain necessary licenses and permits.

B. Monitoring:

1. Conduct monitoring in order to meet the requirements of the permits which may include:

   a. Sampling,

   b. Site inspections, and

   c. Required laboratory tests to determine effluent characteristics.

C. Reporting Results:

1. The Contractor shall report required monitoring results to appropriate agencies. The section 402 wastewater discharge permit has specific reporting requirements for the permittee for noncompliance when effluent limitations are exceeded.

D. Recordkeeping:

1. Retain records and data required by permits.

PART 2 PRODUCTS

2.01 STRAW BALES

A. Straw bales, if used: Certified weed free.

PART 3 EXECUTION

3.01 POLLUTION CONTROLS

A. Control pollutants by use of sediment and erosion controls, wastewater and stormwater management controls, construction site management practices, and other controls including State and local control requirements.

B. Sediment and Erosion Controls:

1. Establish methods for controlling sediment and erosion which address vegetative practices, structural control, silt fences, straw dikes, sediment controls, and operator controls as appropriate.

2. Institute stormwater management measures as required, including velocity dissipators, and solid waste controls which address controls for building materials and offsite tracking of sediment.

C. Wastewater and Stormwater Management Controls:

1. Pollution prevention measures:

a. Use methods of dewatering, unwatering, excavating, or stockpiling earth and rock materials which include prevention measures to control silting and erosion, and which will intercept and settle any runoff of sediment-ladened waters.

b. Prevent wastewater from general construction activities such as drainwater collection, aggregate processing, concrete batching, drilling, grouting, or other construction operations, from entering flowing or dry watercourses without the use of approved turbidity control methods.

c. Divert stormwater runoff from upslope areas away from disturbed areas.

2. Turbidity prevention measures:

a. Use methods for prevention of excess turbidity which include, but are not restricted to, intercepting ditches, settling ponds, gravel filter entrapment dikes, flocculating processes, recirculation, combinations thereof, or other approved methods that are not harmful to aquatic life.

b. Wastewaters discharged into surface waters shall meet conditions of section 402, the National Pollutant Discharge Elimination System (NPDES) permit.

c. Do not operate mechanized equipment in waterbodies without having first obtained a section 404 permit, and then only as necessary to construct crossings or perform the required construction.

D. Construction Site Management:

1. Contractor construction operations:

a. Perform construction activities by methods that will prevent entrance, or accidental spillage, of solid matter, contaminants, debris, or other pollutants or wastes into streams, flowing or dry watercourses, lakes, wetlands, reservoirs, or underground water sources.

1) Pollutants and wastes include, but are not restricted to: refuse, garbage, cement, sanitary waste, industrial waste, hazardous materials, radioactive substances, oil and other petroleum products, aggregate processing tailings, mineral salts, and thermal pollution.

2. Stockpiled or deposited materials:

    a. Do not stockpile or deposit excavated materials or other construction materials, near or on, stream banks, lake shorelines, or other watercourse perimeters where they can be washed away by high water or storm runoff, or can in any way encroach upon the watercourse.

3. Petroleum product storage tanks management:

    a. Place oil or other petroleum product storage tanks at least 20 feet from streams, flowing or dry watercourses, lakes, wetlands, reservoirs, and any other water source.

    b. Do not use underground storage tanks.

    c. Construct storage area dikes at least 12 inches high or graded and sloped to permit safe containment of leaks and spills equal to storage tank capacity located in the area plus sufficient freeboard to contain the 25-year rainstorm.

        1) Line diked areas with an impermeable barrier at least 50 mils thick.

    d. Areas for refueling operations: Lined with impermeable barrier at least 10 mils thick covered with 2 to 4 inches of soil.

END OF SECTION

SECTION 01568 - SITE SECURITY

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Site Security:

1. Payment: Lump sum price offered in the schedule.

1.02 REFERENCES

A. Section I – Contract Clauses

1. Security Requirement – I.17 1452.237-80 Information Technology/Compulsory Protection of Sensitive Information and Security Access Requirements – BOR

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals.

B. RSN 01568-1, Security Plan

1. Project security plan to include details on efforts that will be undertaken to comply with the requirements of this Section. Plan shall include:
    a. Contractor's detail plan for construction site security.
    b. Areas to be secured and protected during non-work hours.
    c. Means for identification of all employees, subcontractors, supplier and visitors on-site.
    d. Delivery schedules for materials and equipment.
    e. Means for communication and coordination of all security action with COR.
2. Security services for the project including their staffing schedule.
    a. Resume of each security guard including experience and training.
    b. Identify security level for all areas of the project to be provided with responsibilities and actions to be taken by guards.
    c. Security schedule for working and non-working period of time.
3. A sample of the photo identification badge that will be used on this project.

C. RSN 01568-2, Information Security Plan

1. Submit plan for release of information that is Project related by contractor to media, public, or interested parties requiring COR review.

1.04 RESPONSIBILITIES

A. Protect work and existing facilities from unauthorized entry, theft, and vandalism. Afford unrestricted access to work

B. Allow surveillance and inspection by Government personnel as authorized by the COR.

C. Maintain security, and avoid compromise of any sensitive information caused by unauthorized disclosures or improper handling.

D. Protect work and existing facilities from unauthorized entry, theft, and vandalism.

E. Initiate an approved security program at job mobilization.

F. Maintain security throughout construction period until acceptance of work by the CO or directed by the CO to terminate security program.

G. Coordinate security program with U.S. Border Patrol, Imperial County Sheriff, and other law enforcement agencies having jurisdiction in the Project vicinity

H. Report all incidents and suspicious activity to the COR.

1.05 INFORMATION SECURITY

A. Project Information Handling: Any For Official Use Only (FOUO) documents related to this project indentified by the COR shall be controlled in accordance with guidance furnished by the COR.

B. Limit dissemination of FOUO information on a need-to-know basis. Assume responsibility for FOUO information as received, including drawings, sketches, photographs/exposed negatives, written descriptions of work requirements, electronic media, and similar information. Upon request, return such information, including copies, promptly to the COR.

1.06 CONSTRUCTION YARD AND SITE ENTRY CONTROL

A. Restrict entrance of personnel and vehicles into construction yard area.

B. Restrict entry to Project areas to authorized persons with proper identification.

C. Maintain a continuous log of subcontractors, suppliers, technical support, workmen and visitors and make available to Government on request.

D. Coordinate access of Government's personnel, equipment, and materials to jobsite and secured areas with COR.

E. Vehicle access to the Project Site will be restricted to employees and authorized visitor's personal vehicles, tractors, cranes, and similar implements used directly in the performance of work, for delivery of materials/supplies, and for removal of waste and surplus material, and Law Enforcement vehicles as requested.

F. No employees or visitors except Law Enforcement vehicles shall be permitted access to the Project Site after normal working hours without prior written authorization from the Contractor's Responsible Manager. Notification of work during non-scheduled work hours shall be provided to COR. All persons seeking access to the site after normal working hours shall be required to sign in and out in a Visitor's Log maintained by the Security Guard.

1.07 BADGING AND IDENTIFICATION MARKINGS

A. Issue a project specific photo identification badge that includes employer data, an employee ID number, and an expiration date.

1. The Contractor will provide the required photo and badge producing equipment for production of Identification Badges and will issue the badges to each Project worker.
2. Identification badges must be continuously displayed in a manner that others can easily confirm the employees association with the project. Badges can be temporarily removed as a safety precaution when operating or near equipment that could cause injury if the ID badge accidently comes in contact.
3. Lost badges must be immediately reported to the Contractor's Responsible Manager.
4. The Contractor's Responsible Manager must immediately report to Law Enforcement if it is suspected that a lost ID badge may occurred..
5. Employees are required to surrender I.D. badges when access to the Project Site is no longer authorized or needed.
6. The Contractor must maintain a current register of badge holders and provide a copy to the COR.

B. Issue unique alpha and/or numeric markings for hard hats for authorized workmen and visitors to be onsite.

C. Provide unique alpha and/or numeric markings for all construction equipment and vehicles authorized to be onsite

1.08 GUARD SERVICES

A. Employ a Security Guard service to patrol all areas of the site and to respond to emergency or unusual events that may occur within the geographic boundaries of the project.

1. The Security Guard service company must be licensed in the State of California and individual Security Officers assigned to the Project must have appropriate documentation to confirm that they have met all regulatory requirements and have current firearms proficiency.
2. The Security Guards must be armed and have uniforms that clearly identify them as security personnel.
3. The Security Guards must be present on the site twenty-four hours per day, seven days per week.
4. Provide four wheel drive transportation that will permit Security Guard travel and emergency response throughout the site.
5. Provide communications equipment to Security Guards for both on-site use and to contact off-site emergency response providers.
6. The Security Guards must maintain logs to record daily activity and visitor information. The logs must be available for inspection by the Government.

1.09 COORDINATION

A. Coordinate with U.S. Border Patrol, Imperial County Sheriff, and other law enforcement agencies having jurisdiction in the Project vicinity regarding notification and disposition of security issues throughout construction.

B. Coordination may be in the form of participation at weekly security coordination meetings, or other types of activities.

C. Maintain daily contact with the U.S. Border Patrol, Imperial County Sheriff, and other law enforcement agencies having jurisdiction in the Project vicinity. This includes coordination of road closures or traffic disruptions, reporting incidents and suspicious activity, and seeking advisories on conditions and possible criminal or illegal activity in the area that could affect the project or the safety of the workers.

1.10 INSPECTIONS BY THE GOVERNMENT

A. The Government reserves unqualified and unlimited right at any time to conduct security-related inspections of the Contractor’s work, material, equipment, personnel, and facilities at the Project Site.

PART 2 PRODUCTS

2.01 CHAIN LINK FENCING

A. In accordance with standard drawings.

B. Security lock system

PART 3 EXECUTION

3.01 FENCING

A. Erect chain link fencing around staging areas including Government facilities. Access gates into the storage area shall remain locked when the area is unattended and during off-hours periods.

B. Remove chain link fencing when no longer required as determined by COR.

3.02 CONTROL OF KEYS AND LOCK COMBINATIONS

A. Key and lock combination control is essential for Project security. Do not allow keys to be duplicated or allow lock combinations to be divulged.

3.03 SIGNAGE

A. Post signs approved by COR around site area to indicate: AUTHORIZED PERSONNEL ONLY.

END OF SECTION

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SECTION 01566 - TEMPORARY SAFETY FENCE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in schedule for other items of work.

1.02 REFERENCES

A. Bureau of Reclamation (USBR)

1. USBR RSHS-2001 Reclamation Safety and Health Standards

PART 2 PRODUCTS

2.01 SAFETY FENCE

A. Fence:

1. High-density polyethylene grid.
2. Minimum height: 48-inch.
3. Color: Safety orange.

B. Posts: Steel fence posts.

PART 3 EXECUTION

3.01 INSTALLATION

A. Erect fence around work areas at locations in accordance with the Contractor's approved safety plan and as directed by the COR.

B. Space posts 10 feet, maximum, on center.

C. Secure grid to posts.

D. Comply with USBR RSHS.

3.02 MAINTENANCE AND REMOVAL

A. Maintain fence until work in area is complete and accepted by the COR.

B. Remove fence when no longer required.

END OF SECTION

SECTION 01568 - SITE SECURITY

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Site Security:

1. Payment: Lump sum price offered in the schedule.

1.02 REFERENCES

A. Section I – Contract Clauses

1. Security Requirement – I.17 1452.237-80 Information Technology/Compulsory Protection of Sensitive Information and Security Access Requirements – BOR

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals.

B. RSN 01568-1, Security Plan.

1. Project security plan to include details on efforts that will be undertaken to comply with the requirements of this Section. Plan shall include:
   a. Contractor's detail plan for construction site security.
   b. Areas to be secured and protected during non-work hours.
   c. Means for identification of all employees, subcontractors, supplier and visitors on-site.
   d. Delivery schedules for materials and equipment.
   e. Means for communication and coordination of all security action with COR.
2. Security services for the project including their staffing schedule.
   a. Resume of each security guard including experience and training.
   b. Identify security level for all areas of the project to be provided with responsibilities and actions to be taken by guards.
   c. Security schedule for working and non-working period of time.
3. A sample of the photo identification badge that will be used on this project.

C. RSN 01568-2, Information Security Plan.

1. Submit plan for release of information that is Project related by Contractor to media, public, or interested parties requiring COR review.

1.04 RESPONSIBILITIES

A. Protect work and existing facilities from unauthorized entry, theft, and vandalism. Afford unrestricted access to work

B. Allow surveillance and inspection by Government personnel as authorized by the COR.

C. Maintain security, and avoid compromise of any sensitive information caused by unauthorized disclosures or improper handling.

D. Protect work and existing facilities from unauthorized entry, theft, and vandalism.

E. Initiate an approved security program at job mobilization.

F. Maintain security throughout construction period until acceptance of work by the CO or directed by the CO to terminate security program.

G. Coordinate security program with U.S. Border Patrol, Imperial County Sheriff, and other law enforcement agencies having jurisdiction in the Project vicinity

H. Report all incidents and suspicious activity to the COR.

1.05 INFORMATION SECURITY

A. Project Information Handling: Any For Official Use Only (FOUO) documents related to this project indentified by the COR shall be controlled in accordance with guidance furnished by the COR.

B. Limit dissemination of FOUO information on a need-to-know basis. Assume responsibility for FOUO information as received, including drawings, sketches, photographs/exposed negatives, written descriptions of work requirements, electronic media, and similar information. Upon request, return such information, including copies, promptly to the COR.

1.06 CONSTRUCTION YARD AND SITE ENTRY CONTROL

A. Restrict entrance of personnel and vehicles into construction yard area.

B. Restrict entry to Project areas to authorized persons with proper identification.

C. Maintain a continuous log of subcontractors, suppliers, technical support, workmen and visitors and make available to Government on request.

D. Coordinate access of Government's personnel, equipment, and materials to jobsite and secured areas with COR.

E. Vehicle access to the Project Site will be restricted to employees and authorized visitor's personal vehicles, tractors, cranes, and similar implements used directly in the performance of work, for delivery of materials/supplies, and for removal of waste and surplus material, and Law Enforcement vehicles as requested.

F. No employees or visitors except Law Enforcement vehicles shall be permitted access to the Project Site after normal working hours without prior written authorization from the Contractor's Responsible Manager. Notification of work during non-scheduled work hours shall be provided to COR. All persons seeking access to the site after normal working hours shall be required to sign in and out in a Visitor's Log maintained by the Security Guard.

1.07 BADGING AND IDENTIFICATION MARKINGS

A. Issue a project specific photo identification badge that includes employer data, an employee ID number, and an expiration date.

1. The Contractor shall provide the required photo and badge producing equipment for production of Identification Badges and will issue the badges to each Project worker.
2. Identification badges shall be continuously displayed in a manner that others can easily confirm the employees association with the project. Badges can be temporarily removed as a safety precaution when operating or near equipment that could cause injury if the ID badge accidently comes in contact.
3. Lost badges shall be immediately reported to the Contractor's Responsible Manager.
4. The Contractor's Responsible Manager shall immediately report to Law Enforcement if it is suspected that a lost ID badge may have occurred.
5. Employees are required to surrender ID badges when access to the Project Site is no longer authorized or needed.
6. The Contractor shall maintain a current register of badge holders and provide a copy to the COR.

B. Issue unique alpha and/or numeric markings for hard hats for authorized workmen and visitors to be onsite.

C. Provide unique alpha and/or numeric markings for all construction equipment and vehicles authorized to be onsite

1.08 GUARD SERVICES

A. Employ a Security Guard service to patrol all areas of the site and to respond to emergency or unusual events that may occur within the geographic boundaries of the project.

1. The Security Guard service company shall be licensed in the State of California and individual Security Officers assigned to the Project shall have appropriate documentation to confirm that they have met all regulatory requirements and have current firearms proficiency.
2. The Security Guards shall be armed and have uniforms that clearly identify them as security personnel.
3. The Security Guards shall be present on the site twenty-four hours per day, seven days per week.
4. Provide four wheel drive transportation that will permit Security Guard travel and emergency response throughout the site.
5. Provide communications equipment to Security Guards for both on-site use and to contact off-site emergency response providers.
6. The Security Guards shall maintain logs to record daily activity and visitor information. The logs shall be available for inspection by the Government.

1.09 COORDINATION

A. Coordinate with U.S. Border Patrol, Imperial County Sheriff, and other law enforcement agencies having jurisdiction in the Project vicinity regarding notification and disposition of security issues throughout construction.

B. Coordination may be in the form of participation at weekly security coordination meetings, or other types of activities.

C. Maintain daily contact with the U.S. Border Patrol, Imperial County Sheriff, and other law enforcement agencies having jurisdiction in the Project vicinity. This includes coordination of road closures or traffic disruptions, reporting incidents and suspicious activity, and seeking advisories on conditions and possible criminal or illegal activity in the area that could affect the project or the safety of the workers.

1.10 INSPECTIONS BY THE GOVERNMENT

A. The Government reserves unqualified and unlimited right at any time to conduct security-related inspections of the Contractor’s work, material, equipment, personnel, and facilities at the Project Site.

PART 2 PRODUCTS

2.01 CHAIN LINK FENCING

A. In accordance with standard drawings.

B. Security lock system

PART 3 EXECUTION

3.01 FENCING

A. Erect chain link fencing around staging areas including Government facilities. Access gates into the storage area shall remain locked when the area is unattended and during off-hours periods.

B. Remove chain link fencing when no longer required as determined by COR.

3.02 CONTROL OF KEYS AND LOCK COMBINATIONS

A. Key and lock combination control is essential for Project security. Do not allow keys to be duplicated or allow lock combinations to be divulged.

3.03 SIGNAGE

A. Post signs approved by COR around site area to indicate: AUTHORIZED PERSONNEL ONLY.

END OF SECTION

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SECTION 01569 - TREE AND PLANT PROTECTION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work, except as specified.
2. Costs for repair or treatment of injured vegetation and replacement of trees or shrubs are the Contractor's responsibility.

1.02 SITE CONDITIONS

A. Trees to be preserved are located along the north side and west side of the project area and will be designated by the Government before onsite work commences.

B. Creosote bushes are located between construction right-of-way and permanent right-of-way. Loss of creosote bushes is to be minimized by the Contractor.

PART 2 PRODUCTS

2.01 REPLACEMENT TREES AND SHRUBS

A. Species: Same as removed tree or shrub or other species approved by the COR.

B. Size: Same size as removed tree or shrub, or maximum practicable size that can be planted and sustained in the particular environment as approved by the COR.

PART 3 EXECUTION

3.01 PRESERVATION AND PROTECTION

A. Preserve natural landscape and preserve and protect existing vegetation not required or otherwise authorized to be removed.

1. Submit requests to remove vegetation not specifically required to be removed to the COR.

B. Conduct operations to prevent unnecessary destruction, scarring, or defacing of natural surroundings in the vicinity of the work.

C. Move crews and equipment within the designated rights-of-way and over routes provided for access to the work in a manner to prevent damage to existing undeveloped land or property.

D. Protect vegetation from damage or injury caused by construction operations, personnel, or equipment by the use of protective barriers or other methods approved by the COR.

E. Minimize, to the greatest extent practicable, clearings and cuts through vegetation. Irregularly shape authorized clearings and cuts to soften undesirable aesthetic impacts.

F. Do not use trees for anchorages except in emergency cases or as approved by the COR.

1. For such use, wrap the trunk with a sufficient thickness of approved protective material before any rope, cable, or wire is placed.

2. Submit requests to use trees for anchorage, except for emergencies. Include description of protective material.

G. Use safety ropes where tree climbing is necessary; do not use climbing spurs.

3.02 REPAIR, TREATMENT, OR REPLACEMENT

A. The Contractor is responsible for injuries to vegetation caused by Contractor operations, personnel, or equipment.

B. Employ the services of an experienced arborist or licensed tree surgeon to direct repair, treatment, and replacement of injured vegetation. Submit qualifications of experienced arborist or licensed tree surgeon to COR prior to employment.

C. Repair or treat injured vegetation without delay and as recommended by and under direction of an experienced arborist or licensed tree surgeon.

D. Remove and dispose of trees or shrubs not required or otherwise authorized to be removed that, in the opinion of the COR, are injured beyond saving.

E. Replace removed tree or shrub with tree or shrub approved by the COR.

END OF SECTION

SECTION 01600 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. When a separate item which includes furnishing of a material is provided in the schedule, include cost of furnishing, hauling, storing, and handling in the price offered in the schedule for the item.

2. When a separate item is not provided in the schedule for furnishing a material, include cost of furnishing, hauling, storing, and handling in the price offered in the schedule for work for which the material is required.

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME)

1.	ASME B1.1-2003	Unified Inch Screw Threads, UN and UNR Thread Form
2.	ASME B1.20.1-1983(2006)	Pipe Threads, General Purpose, Inch

B. Bureau of Reclamation (USBR)

1.	USBR RSHS-2001	Reclamation Safety and Health Standards

1.03 DEFINITIONS

A. Essential Characteristics: As used in these specifications, the term "essential characteristics" is synonymous with the term "salient characteristics."

B. Salient Characteristics: Those qualities of an item that are essential to ensure that the intended use of the item can be satisfactorily realized.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Transport and handle manufactured products in accordance with manufacturer's instructions.

B. Store and protect manufactured products in accordance with manufacturer's instructions and USBR RSHS. Obtain instructions from the manufacturer before delivery of materials to jobsite. Maintain a copy of instructions at jobsite.

C. Remove and replace damaged items with new items.

D. Protect materials subject to adverse effects from moisture, sunlight, ultraviolet light, or weather during storage at jobsite.

E. Store curing compounds, sealants, adhesives, paints, coatings, sealers, joint compounds, grouts, and similar products at the temperature and environmental conditions recommended by manufacturer.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide materials required for completion of work except Government-furnished materials specified in Section 01640 – Government-Furnished Materials.

B. Provide type and quality described in these specifications.

C. Furnish new materials conforming to referenced standards unless otherwise specified.

D. For materials not covered by these or referenced specifications, furnish materials of standard commercial quality.

E. If materials to be used deviate from or are not covered by recognized specifications and standards, submit, for approval, justification for and exact nature of the deviation, and complete specifications for materials proposed for use.

F. Make parts accurately to standard gauge where possible.

1. Use unified screw threads conforming to ASME B1.1 or B1.20.1 for threads, including but not limited to those of bolts, nuts, screws, taps, pipes, and pipefittings.

2. For internal connections only, the Contractor may deviate from ASME standards, provided a complete set of taps and dies are furnished as required to facilitate repair or replacement.

G. Permanently mark fasteners with a symbol identifying the manufacturer and with symbol(s) indicating grade, class, type, and other identifying marks in accordance with reference or applicable standard.

2.02 SUBSTITUTIONS

A. If materials required by these specifications become unavailable, because of Government priorities or other causes, substitute materials may be used.

B. Obtain written approval to use substitute materials from the CO. State in the request for approval the amount of the adjustment, if any, to be made in favor of the Government.

C. The Government's determination as to whether substitution will be permitted and as to what substitute materials may be used, shall be final and conclusive.

D. If approved substitute materials are of less value to the Government or involve less cost to the Contractor than specified material, a contract adjustment will be made in favor of the Government. Where the amount involved or the importance of substitution warrants, a deductive modification to the contract will be issued.

E. No payments in excess of prices offered in the schedule will be made because of substitution of one material for another or because of use of one alternate material in place of another.

2.03 WORKMANSHIP

A. Accurately manufacture and fabricate materials in accordance with best modern practice and requirements of these specifications, notwithstanding minor errors or omissions therein.

B. Use liberal factors of safety and adequate shock-absorbing features in designs, especially for parts subjected to variable stress or shock, including alternating or vibrating stress or shock.

C. Include provisions which prevent components from loosening for shock-absorbing features and parts subject to vibration.

2.04 SOURCE QUALITY ASSURANCE

A. Materials will be subject to inspection in accordance with clause 52.246-12 "Inspection of Construction" at any one or more of the following locations, as determined by the COR:

1. At place of production or manufacture.
2. At shipping point.
3. At jobsite.

B. To allow sufficient time to provide for inspection, submit at time of issuance, three copies of purchase orders, including drawings and other pertinent information, covering material on which inspection will be made as advised by the COR, or submit other evidence if such purchase orders are issued verbally or by letter.

C. Inspection of materials at any location specified above or waiving of inspection shall not be construed as being conclusive as to whether materials and equipment conform to contract requirements under the clause at FAR 52.246-12 "Inspection of Construction," nor shall the Contractor be relieved thereby of the responsibility for furnishing materials meeting the requirements of these specifications.

D. Acceptance of materials will be made only at the jobsite.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's recommendations unless otherwise specified.

3.02 FIELD QUALITY ASSURANCE

A. Final inspection and acceptance of materials will be made only at the jobsite after installation and testing.

END OF SECTION

SECTION 01640 - GOVERNMENT-FURNISHED PRODUCTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of loading, hauling, processing, inspecting, storing, protecting, handling, and caring for products furnished by the Government in prices offered in the schedule for work in which products are to be used.

1.02 DELIVERY, STORAGE, AND HANDLING

A. Rockfill is stockpiled on the west side of the reservoir site.

B. Recycled concrete is stockpiled on the reservoir site as shown on drawings.

C. Wood chips are stockpiled at two locations on the reservoir site as shown on drawings.

D. Load and haul products from stockpiles to placement locations.

E. Minimize handling to reduce breakdown of rockfill.

1.03 PROJECT CONDITIONS

A. The quantity of rockfill stockpiled on site is greater than that required for completion of work. Material in excess of the required volume for construction shown on the drawings shall remain in stockpile.

B. Rockfill in stockpile may not meet gradation requirements of Section 02332 – Rockfill. Processing of rockfill in stockpile may be required.

PART 2 PRODUCTS

2.01 PRODUCTS

A. The Government will furnish products listed in Table 01640A - Government-Furnished Products.

Table 01640A – Government-Furnished Products

Item No.	Description	Estimated quantity required	Estimated quantity available
1	Rockfill for reservoir	7,300 yd^3	10,000 yd^{3*}
2	Rock for Coachella Canal temporary bypass channel	550 yd^3	10,000 yd^{3*}
3	Recycled Concrete	2,600 yd^3	2,600 yd^3
4	Wood Chips	3,150 yd^3	3,150 yd^3

*Total estimated quantity available for rockfill for reservoir and rock for Coachella Canal temporary bypass channel.

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01721 - SURVEYING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for items of work requiring surveying.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 01721-1, Surveying plan:

1. Describe work layout and survey methods.
2. Include surveying schedule.

C. RSN 01721-2, Resume:

1. Engineer or licensed surveyor responsible for supervising and directing survey work for approval.

D. RSN 01721-3, Accuracy check results:

1. Accuracy check of Government-established primary control.
2. Accuracy check of Government-established topographic information.

E. RSN 01721-4, Completed and reduced survey notes:

1. Copy of completed and reduced survey notes for a survey or portion of survey.

F. RSN 01721-5, Original field survey books.

G. RSN 01721-6, Quantity survey notes and computations:

1. Copies required for progress payment. Include itemized statement for work covered by notes and computations.

H. RSN 01721-7, Workday's survey notes:

1. Copies when requested by Government.

1.03 PRIMARY CONTROL

A. The Government has established primary control to be used for establishing work lines and grades.

B. Primary control consists of bench marks and horizontal control points in work vicinity as indicated on drawings.

C. Survey data is based on the following datums:

1. Horizontal: NAD83, California State Plane, Zone VI, U.S. Survey Feet.
2. Vertical: NGVD29, U.S. Survey Feet.

D. All-American Canal Confluence Structure is based on hybrid NGVD29 datum.

E. Verify all datums included on informational drawings.

F. Check and verify primary control and resolve discrepancies with Government before beginning work.

G. Government has provided topographic survey. Check and verify topographic survey and resolve discrepancies with Government before beginning work.

H. Preserve and maintain primary control points until otherwise authorized. Government may reestablish damaged or destroyed primary control points and backcharge reestablishment cost to the Contractor.

1.04 QUALITY ASSURANCE

A. The Government reserves the right to perform own surveys to check and verify the Contractor's surveys.

1.05 QUALIFICATIONS

A. Provide experienced construction surveyors under supervision and direction of a licensed engineer or surveyor with minimum of 2 years experience in charge of construction surveys for construction similar in nature to that required by this contract.

B. If survey performance does not meet specifications requirements, the CO has the authority to order Contractor to replace responsible person in charge of surveys.

PART 2 PRODUCTS

2.01 SURVEYING MATERIALS AND EQUIPMENT

A. Provide materials and equipment required for surveying work, including, but not limited to, instruments, stakes, spikes, steel pins, templates, platforms, and tools.

B. Except as required to be incorporated in work or left in place, surveying materials and equipment will remain property of Contractor.

PART 3 EXECUTION

3.01 LAYOUT OF WORK SURVEYS

A. Establish lines and grades for work layout from Government- established primary control points.

B. Establish measurements required for work execution to specified tolerances.

C. Provide stakes, markers, and other survey controls necessary to control, check, and guide construction.

3.02 QUANTITY SURVEYS

A. Perform surveys and computations to determine quantities of work performed or placed during each progress payment period.

B. Perform surveys necessary for the Government to determine final quantities of work in place. Final payment quantities will be based on the Government's original terrain data and submitted survey notes and computations.

C. Perform quantity surveys in presence of an authorized Government representative, unless specifically waived. Notify the Government at least 24 hours before performing a quantity survey.

3.03 SURVEY REQUIREMENTS

A. Alignment Staking: Each 50 feet on tangent and each 25 feet on curves.

B. Slope Staking: Each 50 feet on tangent and each 25 feet on curves, restake every 10 feet in elevation.

C. Structures: Stake out of structures and checkouts before and during construction.

D. Roads: Blue tops each 50 feet on tangent and each 25 feet on curves.

E. Cross-sections: Original, final, and intermediate as required, for structure sites and other locations as necessary for quantity surveys.

F. As-builts: As required for structures and other features of work.

3.04 ACCURACY

A. Degree of Accuracy

1. Alignment of Tangents and Curves: Within 0.1 foot.
2. Structure Points: Set within 0.01 foot, except where installation or operation considerations require tighter tolerances.

3. Blue Tops: Set within 0.01 foot for paved roads and 0.1 foot for gravel surfaced roads.

4. Cross-Section Points: Locate within 0.10 foot, horizontally and vertically.

5. Vertical Elevation Surveys: Close within 0.05 foot times the square root of the circuit length in miles.

3.05 FIELD RECORDS

A. Record original field notes, computations, and other surveying data in fieldbooks.

B. Record survey data in accordance with recognized professional surveying standards.

1. Notes or data not in accordance with standard formats will be rejected.

2. Illegible notes or data or erasures on any page of a fieldbook will be sufficient cause for rejection of part or all of fieldbook.

3. Corrections by ruling or lining out errors will be permitted.

4. Copied notes or data will not be permitted.

5. Rejection of part or all of a fieldbook may necessitate resurveying.

C. Notes may be collected on an electronic data collection device with prior approval of the COR.

1. Submit electronic files of notes in approved format.

2. Submit paper copies of notes.

END OF SECTION

SECTION 01725 - PROTECTION OF EXISTING INSTALLATIONS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work, except as specified.
2. Costs for repair of installations damaged by the Contractor's operations are the Contractor's responsibility.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals:

B. RSN 01725-1, Plan for protecting existing installations.

1.03 PROJECT CONDITIONS

A. Drawings included in these specifications show items of existing materials and equipment but may not show all equipment and materials existing at the jobsite.

B. Obtain the location of embedded conduit, pipe, cable, ground mat, and other buried items before performing any drilling or cutting of concrete.

C. Contractor is responsible for conducting Contractor’s own investigations of each site prior to performing any work. Notify the COR of any materials or equipment found that has not been previously identified before starting work or during performance of work prior to disturbance.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 REPAIR

A. Repair, at Contractor's expense, damage to existing installations due to Contractor's operations or Contractor's failure to provide proper protection. At the Government's option, damage may be repaired by the Government, and the Contractor will be backcharged repair costs.

3.02 PROTECTION

A. Provide protection for personnel and existing facilities from harm due to the Contractor's operations. Protection shall be subject to approval of the Government.

B. Arrange protective installations to permit operation of existing equipment and facilities by the Government while work is in progress.

3.03 REMOVAL OF PROTECTIVE INSTALLATIONS

A. Remove protective installations after purpose has been served. Materials furnished by the Contractor to provide protection remain property of the Contractor.

END OF SECTION

SECTION 01726 - PROTECTION OF EXISTING UTILITIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.02 REFERENCES

A. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2-2007 National Electrical Safety Code (NESC)

B. Bureau of Reclamation (USBR)

1. USBR RSHS-2001 Reclamation Safety and Health Standards

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 01726-1, Utility owner acknowledgment.

1. Copy of notification acknowledgement to string conductors or overhead ground lines.
2. Include copies of all information of communication and coordination with utility owners.

1.04 PROJECT CONDITIONS

A. Drawings included in these specifications show existing utilities, but may not show all utilities existing at the jobsite.

B. Obtain location of buried conduit, pipe, cable, ground mat, and other buried items before excavating.

C. Consultant report of existing utilities is available for review from the COR.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 INTERFERENCE WITH OPERATION OR MAINTENANCE

A. Do not interfere with operation or maintenance service on utilities, existing on date offers are received.

1. Provide for access to utilities in a manner satisfactory to owners and operators and the Government.

B. Provide required temporary structures; make necessary repairs, replacements, or similar operations; and furnish indemnity or other bonds.

3.02 CLEARANCES

A. Clearances in accordance with IEEE C2 provided by Contractor:

1. Where existing overhead powerline or communication line crosses a feature of work to be constructed, the Contractor shall provide clearance at the crossing site between the line and the higher of (1) original ground; or (2) final elevation of constructed work.

2. Where existing buried powerline or communication line crosses a feature of work to be constructed, the Contractor shall provide clearance at the crossing site between the line and the lower of (1) original ground; or (2) final elevation of constructed work.

B. Additional clearances required for construction operations: The Contractor shall provide in accordance with USBR RSHS.

C. Powerline or communication line poles or other accessories lying within a feature of the work shall be moved by the Contractor.

3.03 STRINGING OF CONDUCTORS OR GROUND LINES

A. Prior to stringing conductors or overhead ground wires which cross over energized electric powerlines:

1. Notify owners and operators of energized electric powerlines when stringing will be done.

2. Obtain written acknowledgment from owners and operators of energized electric powerlines of notification to string conductors or overhead ground lines.

END OF SECTION

SECTION 01727 – RELOCATION OF EXISTING FIBER OPTIC CABLE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.02 PROJECT CONDITIONS

A. Existing fiber optic cable shown on drawings is owned and operated by Level 3 Communications, Inc.

B. Level 3 Communications, Inc. will relocate the existing fiber optic cable.

C. Contact COR for relocation information.

D. Contractor to restrict work in area where fiber optic cable is to be relocated until relocation is complete as approved by COR.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 01740 - CLEANING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work except as specified.
2. Cost of environmental site assessments are the Contractor's responsibility.

1.02 REFERENCES

A. Bureau of Reclamation (USBR)

1. USBR RSHS-2001 Reclamation Safety and Health Standards

B. Code of Federal Regulations (CFR)

1. 40 CFR 261.3 Definition of Hazardous Waste
2. 49 CFR 171-179 Transportation - Hazardous Waste Regulations

1.03 DEFINITION

A. Hazardous waste: Defined as hazardous by 40 CFR 261.3; or by other Federal, State, or local laws or regulations.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 01740-1, Plan for maintaining site.

1. Plans for keeping work areas and storage areas free of waste materials and rubbish.

C. RSN 01740-2, Waste production and disposal records.

D. RSN 01740-3, Hazardous wastes manifest.

E. RSN 01740-4, Environmental consultant resume:

1. Describe experience on similar project.

F. RSN 01740-5, Environmental site assessment.

1.05 QUALIFICATIONS

A. Environmental consultant: Minimum 2 years experience in conducting environmental site assessments for similar construction.

1.06 REGULATORY REQUIREMENTS

A. Comply with Federal, State, and local laws and regulations.

B. Comply with USBR RSHS.

C. Conform to most stringent requirement in cases of conflict between specifications, regulatory requirements, and USBR RSHS.

1.07 PROJECT CONDITIONS

A. Report waste materials discovered at jobsite to COR.

1. Cease work in areas where waste may be hazardous until waste materials are investigated by the Government.
2. If waste is hazardous, the CO may order delays in time of performance or changes in work, or both.
3. If such delays or changes are ordered, an equitable adjustment will be made in the contract in accordance with applicable clauses of the contract.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 PROGRESS CLEANING

A. Keep work and storage areas free from accumulations of waste materials and rubbish.

3.02 FINAL CLEANUP

A. Remove temporary plant facilities, buildings, concrete footings and slabs, rubbish, unused materials, concrete forms, and other similar materials which are not part of permanent work.

3.03 NONHAZARDOUS WASTE DISPOSAL

A. Combustible waste materials: Dispose by removal from jobsite.

B. Noncombustible waste: Dispose by removal from jobsite.

C. Disposal by Removal:

1. Dispose of waste materials at a permitted landfill. Make arrangements with owner for use of landfill and pay required fees.

D. Do not burn waste materials.

E. Do not bury waste materials.

3.04 HAZARDOUS WASTE DISPOSAL

A. Recycle hazardous waste whenever possible.

B. Dispose of hazardous waste materials at permitted treatment or disposal facilities.

C. Transport hazardous waste in accordance with 49 CFR 171-179.

3.05 ENVIRONMENTAL SITE ASSESSMENT

A. Upon completion of work, perform environmental site assessment at following areas for work done under these specifications:

1. Hazardous waste accumulation and storage areas.

2. Hazardous material and petroleum dispensing and storage areas where aggregate storage of hazardous materials or petroleum at jobsite was over 110 gallons.

B. Employ qualified environmental consultant to perform assessments.

C. Demonstrate and document by appropriate analytical sampling that site contamination is less than State action cleanup levels.

3.06 RECORDS

A. Keep records of types and amounts of waste materials produced.

B. Keep records of waste material disposal.

END OF SECTION

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SECTION 01781 - PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.
2. CO reserves right to withhold portion of progress payments until satisfactory acceptance of as-built drawings by the COR.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 01781-1, Progress As-built Drawings:

1. As-built drawings for a particular structure or feature of work.
2. Copies of As-built drawings maintained on site. Colored copies are not required.

C. RSN 01781-2, Final As-built Drawings:

1. Certified marked sets upon completion of each feature of work.

D. RSN 01781-3, Warranties:

1. Additional warranties other than those required by the clause at FAR 52.246-21 "Warranty of Construction - Alternate I".

1.03 RECORD DRAWINGS

A. Maintain 2 sets of full-size prints of contract drawings marked to show accurate and complete records of as-built conditions. Keep drawings at the jobsite and mark as work progresses.

1. Mark and dimension to show variations between actual construction and that indicated or specified in contract documents.
    a. Include buried or concealed construction and utilities.
    b. Include existing items, topographic features, and utility lines revealed during construction which differ from those shown on contract drawings.
2. Mark to define construction actually provided where choice of materials or methods is permitted in specifications, or where variations in scope or character of work from that of the original contract are authorized.

B. Use standard drafting practice to represent changes and include supplementary notes, legends, and details necessary to clearly portray as-built construction.

C. Mark as-built drawings in the following colors:

1. Red - Additions to original drawings.
2. Green - Deletions to original drawings.
3. Blue - Notations necessary for explanation of as-built markings.

D. Allow the Government to review the drawings at all times.

E. Upon completion of work, sign marked prints as certified correct.

1.04 WARRANTIES

A. Provide warranties in accordance with the clause at FAR 52.246-21 "Warranty of Construction [-Alternate I]," the specifications, and this section.

B. Warranty of Construction

1. Submit data concerning warranty of construction, required by the clause at FAR 52.246-21 "Warranty of Construction [-Alternate I]," including the warranty period (dates), and warranty contacts with names, addresses, and telephone numbers. Also, post this data, under glass, at a location as directed by the COR.

C. Other Warranties

1. For other warranties, including those warranties for equipment specified by the COR on a brand name and model basis, provide the following:
2. Warranty List
   a. Bound and indexed notebook containing written warranties obtained, required, or furnished under the contract. Prepare complete list of warranted products, equipment, materials, processes, and other warranted items. Fully execute and deliver this list to the COR prior to final acceptance of contract work. Provide the list in the following format:

Warranty list			
Specification Section	Warranted Item	Warranty Period Dates	Point of Contact

3. Equipment Warranty Tags
   a. At installation, tag each warranted item with a durable, oil- and water-resistant tag approved by the COR.
      1) Attach tag with copper wire and spray with a clear silicone waterproof coating.

2) Leave date of acceptance and inspector's signature blank until project is accepted.

3) Provide tags showing the following information:

WARRANTY TAG	
Type of Item	
Warranty Period	[Period] or [Form ___ To ____]
Contract No.	
Inspector's Signature	
Date Accepted	
Construction Contractor	
Name	
Address	
Telephone	
Warranty Contact	
Name	
Address	
Telephone	

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 02001 – CONTROL BUILDING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Control Building:

1. Payment: Lump-sum price offered in the schedule. Includes:

   a. Splash Blocks. – Refer to Section 02635 – Splash Blocks.

   b. Earthwork for control building. Refer to Section 02318 – Earthwork for Structures.

   c. Concrete reinforcement for cast-in-place concrete foundation, floor slab, and aprons. - Refer to Section 03200 – Concrete Reinforcement.

   d. Cast-in-place concrete foundation, floor slab, and aprons. - Refer to Section 03300 – Cast-In-Place Concrete.

   e. Cementitious materials for cast-in-place concrete foundation, floor slab, and aprons. - Refer to Section 03300 – Cast-In-Place Concrete.

   f. Concrete Floor Hardener. - Refer to Section 03362 – Concrete Floor Hardener.

   g. Reinforced Concrete Unit Masonry Assemblies. - Refer to Section 04822 – Reinforced Concrete Unit Masonry Assemblies.

   h. Metal Roof Deck. – Refer to Section 05315 – Metal Roof Deck.

   i. Pre-Engineered, Pre-Fabricated Cold-Formed Steel Roof Trusses. - Refer to Section 05425 – Pre-Engineered, Pre-Fabricated Cold-Formed Steel Roof Trusses.

   j. Silane Water Repellant. - Refer to Section 07192 – Silane Water Repellent.

   k. Batt and Blanket Insulation. – Refer to Section 07213 – Batt and Blanket Insulation.

   l. Pre-Insulated Metal Roof and Wall Panels. – Refer to Section 07430 – Pre-Insulated Metal Roof and Wall Panels.

   m. Metal Soffit Panels. – Refer to Section 07612 – Metal Soffit Panels.

   n. Firestopping. - Refer to Section 07840 – Firestopping.

   o. Joint Sealants. - Refer to Section 07920 – Joint Sealants.

   p. Bullet-Resistant Steel Doors and Frames. - Refer to Section 08115 – Bullet-Resistant Steel Doors and Frames.

   q. Door Hardware. – Refer to Section 08710 – Door Hardware.

r. Gypsum Board Wall Assembly. - Refer to Section 09260 – Gypsum Board Wall Assembly.

s. Fire Extinguishers. – Refer to Section 10522 – Fire Extinguishers.

t. HVAC System. - Refer to Section 15701 – HVAC System.

u. Interior Luminaires. - Refer to Section 16510 – Interior Luminaires.

v. Exterior Luminaires. - Refer to Section 16520 – Exterior Luminaires.

2. Include cost of miscellaneous metalwork for control building in lump sum price offered in the schedule for miscellaneous metalwork. – Refer to Section 05500 – Metal Fabrications.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CONTROL BUILDING CONSTRUCTION

A. Construct control building in accordance with these specifications and as shown on the drawings.

B. Provide fully functional systems for the control building.

END OF SECTION

SECTION 02052 – INTERSTATE 8 HIGHWAY

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Interstate 8 Highway Detour Preparation, Barricade Evan Hewes Highway, K-Rail:

1. Measurement: Length in feet.
2. Payment: Linear foot price offered in the schedule.

B. Interstate 8 Highway Detour Preparation, Demolish Evan Hewes Highway:

1. Measurement: Volume in cubic yards.
2. Payment: Cubic yard price offered in the schedule.

C. Interstate 8 Highway Detour Preparation, Demolish Interstate 8 Shoulders:

1. Measurement: Volume in cubic yards.
2. Payment: Cubic yard price offered in the schedule.

D. Build Detour for Interstate 8, Excavation:

1. Measurement: Volume in cubic yards.
2. Payment: Cubic yard price offered in the schedule.

E. Build Detour for Interstate 8, Backfill (sub-grade and sub-base):

1. Measurement: Volume in cubic yards.
2. Payment: Cubic yard price offered in the schedule.

F. Build Detour for Interstate 8, Aggregate Base Course for Traveled Way and Shoulder:

1. Measurement: Volume in cubic yards.
2. Payment: Cubic yard price offered in the schedule.

G. Build Detour for Interstate 8, Hot Mix Asphalt, Type A for Traveled Way and Shoulder

1. Measurement: Weight in tons.
2. Payment: Tons price offered in the schedule

H. Build Detour for Interstate 8, Temporary Railing (K-Rail) to Separate Lanes of Traffic

1. Measurement: Length in linear feet.
2. Payment: Linear foot price offered in the schedule.

I. Build Detour for Interstate 8, Crash Barriers:

1. Measurement: Number of crash barriers.
2. Payment: Price each offered in the schedule.

J. Build Detour for Interstate 8, Paint Traffic Stripe (Yellow for Centerline and White for Edge of Lanes):

1. Measurement: Length in linear feet.
2. Payment: Linear foot price offered in the schedule.

K. Stage Construction and Traffic Handling, Temporary Traffic Stripes (Paint):

1. Measurement: Length in linear feet.
2. Payment: Linear foot price offered in the schedule.

L. Stage Construction and Traffic Handling, Traffic Plastic Drum:

1. Measurement: Number of traffic plastic drums.
2. Payment: Price each offered in the schedule.

M. Stage Construction and Traffic Handling, Construction Area Signs:

1. Payment: Lump sum price offered in the schedule

N. Stage Construction and Traffic Handling, Remove Temporary Traffic Stripes (Paint):

1. Measurement: Length in linear feet.
2. Payment: Linear foot price offered in the schedule.

O. Demolish Interstate 8 Detour, Roadway Excavation (Asphalt, Aggregate Base Course, and Earthwork):

1. Measurement: Volume in cubic yards.
2. Payment: Cubic yard price offered in the schedule

P. Prepare Site for Pipe Installation on Interstate 8, Cut and Remove Interstate 8 Pavement and Sub-grade:

1. Payment: Lump sum price offered in the schedule

Q. Re-build Interstate 8, Backfill (sub-grade and sub-base):

1. Measurement: Volume in cubic yards.
2. Payment: Cubic yard price offered in the schedule.

R. Re-build I-8, Aggregate Base Course, Class 2:

1. Measurement: Volume in cubic yards.
2. Payment: Cubic yard price offered in the schedule

S. Re-build Interstate 8, Hot Mix Asphalt, Type A:

1. Measurement: Weight in tons.
2. Payment: Ton price offered in the schedule.

T. Re-build Interstate 8, Joint Plane Concrete Pavement:

1. Measurement: Volume in cubic yards.
2. Payment: Cubic yard price offered in the schedule.

U. Re-build Interstate 8, Paint (Yellow for Centerline & White for Edge of Lanes)

1. Measurement: Length in linear feet.
2. Payment: Linear foot price offered in the schedule

V. Re-build Interstate 8, Rumble Strip:

1. Measurement: Length in linear feet.
2. Payment: Linear foot price offered in the schedule.

W. Miscellaneous, Right-of-Way Fencing:

1. Measurement: Length in linear feet.
2. Payment: Linear foot price offered in the schedule

X. Miscellaneous, Sampling and Testing of Materials:

1. Payment: Lump sum price offered in the schedule

Y. Miscellaneous, Reset Roadside Sign:

1. Payment: Lump sum price offered in the schedule.

1.02 REFERENCES

A. California Department of Transportation (CALTRANS)

1.	CALTRANS SS	Standard Specifications, State of California, Business, Transportation, and Housing Agency, Department of Transportation, May 2006
2.	CALTRANS SP	Standard Plans, State of California, Business, Transportation, and Housing Agency, Department of Transportation, May 2006
3.	CALTRANS SSP	Standard Special Provisions, State of California, Business, Transportation, and Housing Agency, Department of Transportation, May 2006

4.	CALTRANS HDM	Highway Design Manual, State of California, Business, Transportation, and Housing Agency, Department of Transportation, September 2006
5.	CALTRANS DD-60	Department Deputy Directive 60 "Transportation Management Plans", State of California, Business, Transportation, and Housing Agency, Department of Transportation, September 2006
6.	CALTRANS CM	Construction Manual, Chapter 6 "Sampling & Testing", State of California, Department of Transportation, September 2007
7.	CALTRANS MUTCD	Manual on Uniform Traffic Control Devices State of California, Department of Transportation, September 2006

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 02052-1, Certificate of Compliance for Prequalified and Tested Signing and Delineation Material.

1. Certificate of Compliance

C. RSN 02052-2, Written Schedule of Closure Requirements and Conditions based upon Approved Closure Schedule.

1. Written schedule of planned road closures.

D. RSN 02052-3, Contingency Plan for Closure Requirements and Conditions based upon Approved Closure Schedule.

1. Contingency plan for road closure.

E. RSN 02052-4, Certificate of Compliance for Traffic Plastic Drums.

1. Certificate of Compliance.

F. RSN 02052-5, Hot Mix Asphalt Information.

1. Source.
2. Gradation.
3. Proportions of aggregates and materials proposed.

G. RSN 02052-6, Certificate of Compliance for Asphalt Rubber Binder.

1. Certificate of Compliance

H. RSN 02052-7, Certified Weight Slips for Asphalt Rubber Binder.

1. Certified Weight Slips

I. RSN 02052-8 Profilograph.

1. Electronic copy of profile information in Microsoft Excel and an electronic copy of longitudinal pavement profiles in “erd.” Format or other Proval compatible format.

J. RSN 02052-9, Written Quality Control Plan.

1. Written quality control plan.

K. RSN 02052-10, Written Test Results of Quality Control Inspection, Sampling, and Testing.

1. Written test results.

L. RSN 02052-11, Certificate of Compliance for Materials - Silicone Joint Sealant.

1. Certificate of Compliance

M. RSN 02052-12, Certificate of Compliance for Materials – Joint Filler Material.

1. Certificate of Compliance.

N. RSN 02052-13, Certificate of Compliance for Materials – Paint for Stripping.

1. Certificate of Compliance

O. RSN 02052-14, Concrete Pavement Mix Proportions.

1. Proposed concrete pavement mix design proportions with laboratory test reports.

P. RSN 02052-15, Certificate of Compliance for Cementitious Materials.

1. Certificate of Compliance.

Q. RSN 02052-16, Certificate of Compliance for Materials – Epoxy (Drill and Bond).

1. Certificate of Compliance.

1.04 PROSECUTION OF WORK

A. Interstate 8 Highway construction shall be in accordance with the Drawings and CALTRANS SP, and CALTRANS SS as amended by CALTRANS SSP as amended by CALTRANS District 11.

1. CALTRANS SSP as amended by CALTRANS District 11 is included as Appendix 02052-A.

B. The administrative requirements in CALTRAN SS, CALTRANS SP, CALTRANS SSP, and Appendix 02052-A shall not apply.

C. The terms “Engineer,” “Inspector,” “Technician” in CALTRAN SS, CALTRANS SP, CALTRANS SSP, and Appendix 02052-A shall mean COR.

D. The term “Department” in CALTRAN SS, CALTRANS SP, CALTRANS SSP, and Appendix 02052-A shall mean Government.

E. A Stage Construction and Traffic Handling Plan (THP) developed in accordance with CALTRANS District 11 requirements will be provided by the Government within 14 calendar days after notice to proceed. Until such Stage Construction and THP is provided, it shall be assumed that a minimum of ten (10) stages will be required for the execution of Interstate 8 Highway construction. It shall be assumed that all CALTRANS District 11 requirements will be applicable and may include but not be limited to requirements for construction areas, stage areas, direction of traffic control, temporary railing (type K), temporary crash cushion modules, traffic plastic drums, Type III barricades, temporary fence, stage specific construction area signs, stage construction pavement delineation, Class I delineators, channelizers, flashing yellow beacons, temporary striping, temporary pavement markers, and temporary striping and pavement marker removal.

PART 2 PRODUCTS

2.01 GENERAL

A. All products shall be provided in accordance with the Drawings and CALTRANS SP, and CALTRANS SS as amended by CALTRANS SSP as amended by CALTRANS District 11.

1. CALTRANS SSP as amended by CALTRANS District 11 is included as Appendix 02052-A.

PART 3 EXECUTION

3.01 GENERAL

A. All work shall be executed in accordance with the Drawings and CALTRANS SP, and CALTRANS SS as amended by CALTRANS SSP as amended by CALTRANS District 11.

1. CALTRANS SSP as amended by CALTRANS District 11 is included as Appendix 02052-A.

END OF SECTION

APPENDIX 02052-A

SECTION 02052 –
INTERSTATE 8 HIGHWAY

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STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISIONS

SECTION 1. SPECIFICATIONS AND PLANS

The work embraced herein shall conform to the provisions in the State Standard Specifications dated May 2006 and the State Standard Plans dated May 2006 of the Department of Transportation insofar as the same may apply and these special provisions.

AMENDMENTS TO MAY 2006 STATE STANDARD SPECIFICATIONS

UPDATED APRIL 4, 2008

SECTION 0: GLOBAL REVISIONS

Issue Date: July 31, 2007

Global revisions are changes to contract documents not specific to a section of the State Standard Specifications.

- In each contract document at each occurrence:

1. Except where existing asphalt concrete is described, replace "asphalt concrete" with "hot mix asphalt"
2. Except where existing AC is described, replace "AC" with "HMA" where AC means asphalt concrete

SECTION 1: DEFINITIONS AND TERMS

Issue Date: January 18, 2008

Section 1-1.01, "General," of the State Standard Specifications is amended by adding the following:

- The Department is gradually changing the style and language of the specifications. The new style and language includes:

1. Use of:

    1.1. Imperative mood
    1.2. Introductory modifiers
    1.3. Conditional clauses

2. Elimination of:

    2.1. Language variations
    2.2. Definitions for industry-standard terms
    2.3. Redundant specifications
    2.4. Needless cross-references

- The use of this new style does not change the meaning of a specification not yet using this style.
- The specifications are written to the Bidder before award and the Contractor after. Before award, interpret sentences written in the imperative mood as starting with "The Bidder must" and interpret "you" as "the Bidder" and "your" as "the Bidder's." After award, interpret

sentences written in the imperative mood as starting with "The Contractor must" and interpret "you" as "the Contractor" and "your" as "the Contractor's."

- Unless an object or activity is specified to be less than the total, the quantity or amount is all of the object or activity.
- All items in a list apply unless the items are specified as choices.
- Interpret terms as defined in the Contract documents. A term not defined in the Contract documents has the meaning defined in Means Illustrated Construction Dictionary, Condensed Version, Second Edition.

The 1st table in Section 1-1.02, "Abbreviations," of the State Standard Specifications is amended by adding:

SSPC	The Society for Protective Coatings

Section 1, "Definitions and Terms," of the State Standard Specifications is amended by adding the following sections:

1-1.082 BUSINESS DAY

- Day on the calendar except Saturday or holiday.

1-1.084 CALIFORNIA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES

- The California Manual on Uniform Traffic Control Devices for Streets and Highways (California MUTCD) is issued by the Department of Transportation and is the Federal Highway Administration's MUTCD 2003 Edition, as amended for use in California.

1-1.125 DEDUCTION

- Amount of money permanently taken from progress payment and final payment. Deductions are cumulative and are not retentions under Pub Cont Code § 7107.

1-1.205 FEDERAL-AID CONTRACT

- Contract that has a Federal-aid project number on the cover of the Notice to Contractors and Special Provisions.

1-1.245 HOLIDAY

1. Every Sunday
2. January 1st, New Year's Day
3. 3rd Monday in January, Birthday of Martin Luther King, Jr.
4. February 12th, Lincoln's Birthday
5. 3rd Monday in February, Washington's Birthday
6. March 31st, Cesar Chavez Day
7. Last Monday in May, Memorial Day
8. July 4th, Independence Day
9. 1st Monday in September, Labor Day
10. 2nd Monday in October, Columbus Day
11. November 11th, Veterans Day
12. 4th Thursday in November, Thanksgiving Day

13. Day after Thanksgiving Day
14. December 25th, Christmas Day

• If January 1st, February 12th, March 31st, July 4th, November 11th, or December 25th falls on a Sunday, the Monday following is a holiday. If November 11th falls on a Saturday, the preceding Friday is a holiday. Interpret "legal holiday" as "holiday."

1-1.475 WITHHOLD

• Money temporarily or permanently taken from progress payment. Withholds are cumulative and are not retentions under Pub Cont Code § 7107.

Section 1-1.255, "Legal Holidays," of the State Standard Specifications is deleted.

Section 1-1.265, "Manual on Uniform Traffic Control Devices," of the State Standard Specifications is deleted.

Section 1-1.266, "Manual on Uniform Traffic Control Devices California Supplement," of the State Standard Specifications is deleted.

Section 1-1.39 "State," of the State Standard Specifications is amended to read:

1-1.39 STATE

• The State of California, including its agencies, departments, or divisions, whose conduct or action is related to the work.

SECTION 3: AWARD AND EXECUTION OF CONTRACT

Issue Date: August 17, 2007

Section 3-1.025, "Insurance Policies," of the State Standard Specifications is amended to read:

3-1.025 INSURANCE POLICIES

• The successful bidder shall submit:

1. Copy of its commercial general liability policy and its excess policy or binder until such time as a policy is available, including the declarations page, applicable endorsements, riders, and other modifications in effect at the time of contract execution. Standard ISO form No. CG 0001 or similar exclusions are allowed if not inconsistent with Section 7-1.12, "Indemnification and Insurance." Allowance of additional exclusions is at the discretion of the Department.
2. Certificate of insurance showing all other required coverages. Certificates of insurance, as evidence of required insurance for the auto liability and any other required policy, shall set forth deductible amounts applicable to each policy and all exclusions that are added by endorsement to each policy. The evidence of insurance shall provide that no cancellation, lapse, or reduction of coverage will occur without 10 days prior written notice to the Department.

3. A declaration under the penalty of perjury by a certified public accountant certifying the accountant has applied Generally Accepted Accounting Principles (GAAP) guidelines confirming the successful bidder has sufficient funds and resources to cover any self-insured retentions if the self-insured retention is $50,000 or higher.

• If the successful bidder uses any form of self-insurance for workers compensation in lieu of an insurance policy, it shall submit a certificate of consent to self-insure in accordance with the provisions of Section 3700 of the Labor Code.

Section 3-1.03, "Execution of Contract," of the State Standard Specifications is amended to read:

3-1.03 EXECUTION OF CONTRACT

• The contract shall be signed by the successful bidder and returned, together with the contract bonds and the documents identified in Section 3-1.025, "Insurance Policies," within 10 business days of receiving the contract for execution.

Section 3-1.04, "Failure to Execute Contract," of the State Standard Specifications is amended to read:

3-1.04 FAILURE TO EXECUTE CONTRACT

• Failure of the lowest responsible bidder, the second lowest responsible bidder, or the third lowest responsible bidder to execute the contract as required in Section 3-1.03, "Execution of Contract," within 10 business days of receiving the contract for execution shall be just cause for the forfeiture of the proposal guaranty. The successful bidder may file with the Department a written notice, signed by the bidder or the bidder's authorized representative, specifying that the bidder will refuse to execute the contract if it is presented. The filing of this notice shall have the same force and effect as the failure of the bidder to execute the contract and furnish acceptable bonds within the time specified.

Section 3-1.05, "Return of Proposal Guaranties," of the State Standard Specifications is amended to read:

3-1.05 RETURN OF PROPOSAL GUARANTIES

• The Department keeps the proposal guaranties of the 1st, 2nd and 3rd lowest responsible bidders until the contract has been executed. The other bidders' guaranties, other than bidders' bonds, are returned upon determination of the 1st, 2nd, and 3rd apparent lowest bidders, and their bidders' bonds are of no further effect.

SECTION 4: SCOPE OF WORK

Issue Date: August 17, 2007

Section 4-1.01, "Intent of Plans and Specifications," of the State Standard Specifications is amended by adding the following:

• Nothing in the specifications voids the Contractor's public safety responsibilities.

SECTION 5: CONTROL OF WORK

Issue Date: February 1, 2008

Section 5, "Control of Work," of the State Standard Specifications is amended by adding the following sections:

5-1.005 GENERAL

- Failure to comply with any specification part is a breach of the contract and a waiver of your right to time or payment adjustment.
- After contract approval, submit documents and direct questions to the Engineer. Orders, approvals, and requests to the Contractor are by the Engineer.
- The Engineer furnishes the following in writing:

1. Approvals
2. Notifications
3. Orders

- The Contractor must furnish the following in writing:

1. Assignments
2. Notifications
3. Proposals
4. Requests, sequentially numbered
5. Subcontracts
6. Test results

- The Department rejects a form if it has any error or any omission.
- Convert foreign language documents to English.
- Use contract administration forms available at the Department's Web site.
- If the last day for submitting a document falls on a Saturday or holiday, it may be submitted on the next business day with the same effect as if it had been submitted on the day specified.

5-1.015 RECORD RETENTION, INSPECTION, COPYING, AND AUDITING

- Retain project records and make them available for inspection, copying, and auditing by State representatives from bid preparation through:

1. Final payment
2. Resolution of claims, if any

- For at least 3 years after the later of these, retain and make available for inspection, copying, and auditing cost records by State representatives including:

1. Records pertaining to bid preparation

2. Overhead
3. Payroll records and certified payroll
4. Payments to suppliers and subcontractors
5. Cost accounting records
6. Records of subcontractors and suppliers

- Maintain the records in an organized way in the original format, electronic and hard copy, conducive to professional review and audit.
- Before contract acceptance, the State representative notifies the Contractor, subcontractor, or supplier 5 days before inspection, copying, or auditing.
- If an audit is to start more than 30 days after contract acceptance, the State representative notifies the Contractor, subcontractor, or supplier when the audit is to start.

Section 5-1.01, "Authority of Engineer," of the State Standard Specifications is amended by adding:

- Failure to enforce a contract provision does not waive enforcement of any contract provision.

Section 5-1.04, "Coordination and Interpretation of Plans, State Standard Specifications, and Special Provisions," of the State Standard Specifications is amended to read:

5-1.04 CONTRACT COMPONENTS

- A component in one contract part applies as if appearing in each. The parts are complementary and describe and provide for a complete work.
- If a discrepancy exists:

1. The governing ranking of contract parts in descending order is:

    1.1. Special provisions
    1.2. Project plans
    1.3. Revised Standard Plans
    1.4. Standard Plans
    1.5. Amendments to the State Standard Specifications
    1.6. State Standard Specifications
    1.7. Project information

2. Written numbers and notes on a drawing govern over graphics
3. A detail drawing governs over a general drawing
4. A detail specification governs over a general specification
5. A specification in a section governs over a specification referenced by that section

- If a discrepancy is found or confusion arises, request correction or clarification.

Section 5-1.07, "Lines and Grades," of the State Standard Specifications is replaced with the following:

5-1.07 LINES AND GRADES

• The Engineer places stakes and marks under Chapter 12, "Construction Surveys," of the Department's Surveys Manual.
• Submit your request for Department-furnished stakes:

1. On a Request for Construction Stakes form. Ensure:

   1.1. Requested staking area is ready for stakes
   1.2. You use the stakes in a reasonable time

2. A reasonable time before starting an activity using the stakes

• Establish priorities for stakes and note priorities on the request.
• Preserve stakes and marks placed by the Engineer. If the stakes or marks are destroyed, the Engineer replaces them at the Engineer's earliest convenience and deducts the cost.

Section 5-1.116, "Differing Site Conditions," is amended to read:

5-1.116 DIFFERING SITE CONDITIONS (23 CFR 635.109)

5-1.116A Contractor's Notification

• Promptly notify the Engineer if you find either of the following:

1. Physical conditions differing materially from either of the following:

   1.1. Contract documents
   1.2. Job site examination

2. Physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work provided for in the contract

• Include details explaining the information you relied on and the material differences you discovered.
• If you fail to notify the Engineer promptly, you waive the differing site condition claim for the period between your discovery of the differing site condition and your notification to the Engineer.
• If you disturb the site after discovery and before the Engineer's investigation, you waive the differing site condition claim.

5-1.116B Engineer's Investigation and Decision

• Upon your notification, the Engineer investigates job site conditions and:

1. Notifies you whether to resume affected work
2. Decides whether the condition differs materially and is cause for an adjustment of time, payment, or both

5-1.116C Protests

- You may protest the Engineer's decision by:

1. Submitting an Initial Notice of Potential Claim within 5 business days after receipt of the Engineer's notification
2. Complying with claim procedures

- The Initial Notice of Potential Claim must detail the differences in your position from the Engineer's determination and support your position with additional information, including additional geotechnical data. Attach to the Initial Notice of Potential Claim a certification stating that you complied with Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work."
- Promptly submit supplementary information when obtained.

SECTION 6: CONTROL OF MATERIALS

Issue Date: August 17, 2007

Section 6-1.05, "Trade Names and Alternatives," of the State Standard Specifications is amended to read:

6-1.05 Specific Brand or Trade Name and Substitution

- A reference to a specific brand or trade name establishes a quality standard and is not intended to limit competition. You may use a product that is equal to or better than the specified brand or trade name if approved.
- Submit a substitution request within a time period that:

1. Follows Contract award
2. Allows 30 days for review
3. Causes no delay

- Include substantiating data with the substitution request that proves the substitution:

1. Is of equal or better quality and suitability
2. Causes no delay in product delivery and installation

Section 6, "Control of Materials," of the State Standard Specifications is amended by adding the following sections:

6-1.085 BUY AMERICA (23 CFR 635.410)

- For a Federal-aid contract, furnish steel and iron materials to be incorporated into the work that are produced in the United States except:

1. Foreign pig iron and processed, pelletized, and reduced iron ore may be used in the domestic production of the steel and iron materials [60 Fed Reg 15478 (03/24/1995)]

2. If the total combined cost of the materials does not exceed the greater of 0.1 percent of the total bid or $2,500, material produced outside the United States may be used

- Production includes:

1. Processing steel and iron materials, including smelting or other processes that alter the physical form or shape (such as rolling, extruding, machining, bending, grinding, and drilling) or chemical composition
2. Coating application, including epoxy coating, galvanizing, and painting, that protects or enhances the value of steel and iron materials

- For steel and iron materials to be incorporated into the work, submit a Certificate of Compliance under Section 6-1.07, "Certificates of Compliance," of the State Standard Specifications that certifies all production processes occurred in the United States except for the above exceptions.

6-1.087 BUY AMERICA (PUB RES CODE § 42703(d))

- Furnish crumb rubber to be incorporated into the work that is produced in the United States and is derived from waste tires taken from vehicles owned and operated in the United States.
- For crumb rubber to be incorporated into the work, submit a Certificate of Compliance under Section 6-1.07, "Certificates of Compliance," of the State Standard Specifications that certifies only crumb rubber manufactured in the United States and derived from waste tires taken from vehicles owned and operated in the United States is used.

The 7th and 8th paragraph of Section 6-2.01, "General," of the State Standard Specifications are amended to read:

- Upon the Contractor's written request, the Department tests materials from an untested local source. If satisfactory material from that source is used in the work, the Department does not charge the Contractor for the tests; otherwise, the Department deducts the test cost.

The 2nd sentence of the 7th paragraph of Section 6-2.02, "Possible Local Material Sources," of the State Standard Specifications is amended to read:

- The Department deducts the charges for the removed material.

SECTION 7: LEGAL RELATIONS AND RESPONSIBILITIES

Issue Date: February 1, 2008

Section 7-1.01, "Laws To Be Observed," of the State Standard Specifications is amended to read:

7-1.01 LAWS TO BE OBSERVED

- Comply with laws, regulations, orders, decrees, and permits applicable to the project. Indemnify and defend the State against any claim or liability arising from the violation of a law,

regulation, order, decree, or permit by you or your employees. Immediately report to the Engineer in writing a discrepancy or inconsistency between the contract and a law, regulation, order, decree, or permit.

The 3rd listed requirement of the 1st paragraph of Section 7-1.01A(2), "Prevailing Wage," of the State Standard Specifications is amended to read:

3. Upon becoming aware of the subcontractor's failure to pay the specified prevailing rate of wages to the subcontractor's workers, the Contractor must diligently take corrective action to stop or rectify the failure, including withholding sufficient funds due the subcontractor for work performed on the public works project.

The 2nd paragraph of Section 7-1.01A(2), "Prevailing Wage," of the State Standard Specifications is amended to read:

• Pursuant to Section 1775 of the Labor Code, the Division of Labor Standards Enforcement must notify the Contractor on a public works project within 15 days of the receipt by the Division of Labor Standards Enforcement of a complaint of the failure of a subcontractor on that public works project to pay workers the general prevailing rate of per diem wages. If the Division of Labor Standards Enforcement determines that employees of a subcontractor were not paid the general prevailing rate of per diem wages and if the Department did not withhold sufficient money under the contract to pay those employees the balance of wages owed under the general prevailing rate of per diem wages, the Contractor must withhold an amount of moneys due the subcontractor sufficient to pay those employees the general prevailing rate of per diem wages if requested by the Division of Labor Standards Enforcement. The Contractor must pay any money withheld from and owed to a subcontractor upon receipt of notification by the Division of Labor Standards Enforcement that the wage complaint has been resolved. If notice of the resolution of the wage complaint has not been received by the Contractor within 180 days of the filing of a valid notice of completion or acceptance of the public works project, whichever occurs later, the Contractor must pay all moneys withheld from the subcontractor to the Department. The Department withholds these moneys pending the final decision of an enforcement action.

The 2nd paragraph of Section 7-1.01A(3), "Payroll Records," of the State Standard Specifications is amended to read:

• The Department withholds the penalties specified in subdivision (g) of Labor Code § 1776 for noncompliance with the requirements in Section 1776.

The 4th paragraph of Section 7-1.01A(3), "Payroll Records," of the State Standard Specifications is amended to read:

• The Department withholds for delinquent or inadequate payroll records (Labor Code § 1771.5). If the Contractor has not submitted an adequate payroll record by the month's 15th day for the period ending on or before the 1st of that month, the Department withholds 10 percent of the monthly progress estimate, exclusive of mobilization. The Department does not withhold more than $10,000 or less than $1,000.

The 5th paragraph of Section 7-1.01A(3), "Payroll Records," of the State Standard Specifications is deleted.

Section 7-1.01A(6), "Workers' Compensation," of the State Standard Specifications is amended to read:

7-1.01A(6) (Blank)

The fourth sentence of the second paragraph of Section 7-1.02, "Load Limitations," of the State Standard Specifications is amended to read:

• Trucks used to haul treated base, portland cement concrete, or hot mix asphalt shall enter onto the base to dump at the nearest practical entry point ahead of spreading equipment.

The first sentence of the eighth paragraph of Section 7-1.09, "Public Safety," of the State Standard Specifications is amended to read:

• Signs, lights, flags, and other warning and safety devices and their use shall conform to the requirements set forth in Part 6 of the California MUTCD.

The sixteenth paragraph of Section 7-1.09, "Public Safety," of the State Standard Specifications is amended to read:

• When vertical clearance is temporarily reduced to 15.5 feet or less, low clearance warning signs shall be placed in accordance with Part 2 of the California MUTCD and as directed by the Engineer. Signs shall conform to the dimensions, color, and legend requirements of the California MUTCD and these specifications except that the signs shall have black letters and numbers on an orange retroreflective background. W12-2P signs shall be illuminated so that the signs are clearly visible.

The last sentence of the 2nd paragraph of Section 7-1.11, "Preservation of Property," of the State Standard Specifications is amended to read:

• The cost of the repairs must be borne by the Contractor and will be deducted.

Section 7-1.12, "Indemnification and Insurance," of the State Standard Specifications is amended to read:

7-1.12 INDEMNIFICATION AND INSURANCE

• The Contractor's obligations regarding indemnification of the State of California and the requirements for insurance shall conform to the provisions in Section 3-1.025, "Insurance Policies," and Sections 7-1.12A, "Indemnification," and 7-1.12B, "Insurance," of this Section 7-1.12.

7-1.12A Indemnification

• The Contractor shall defend, indemnify, and save harmless the State, including its officers, employees, and agents (excluding agents who are design professionals) from any and all claims, demands, causes of action, damages, costs, expenses, actual attorneys' fees, losses or liabilities, in law or in equity (Section 7-1.12A Claims) arising out of or in connection with the Contractor's performance of this contract for:

1. Bodily injury including, but not limited to, bodily injury, sickness or disease, emotional injury or death to persons, including, but not limited to, the public, any employees or agents of the Contractor, the State, or any other contractor; and
2. Damage to property of anyone including loss of use thereof; caused or alleged to be caused in whole or in part by any negligent or otherwise legally actionable act or omission of the Contractor or anyone directly or indirectly employed by the Contractor or anyone for whose acts the Contractor may be liable.

• Except as otherwise provided by law, these requirements apply regardless of the existence or degree of fault of the State. The Contractor is not obligated to indemnify the State for Claims arising from conduct delineated in Civil Code Section 2782 and to Claims arising from any defective or substandard condition of the highway that existed at or before the start of work, unless this condition has been changed by the work or the scope of the work requires the Contractor to maintain existing highway facilities and the Claim arises from the Contractor's failure to maintain. The Contractor's defense and indemnity obligation shall extend to Claims arising after the work is completed and accepted if the Claims are directly related to alleged acts or omissions by the Contractor that occurred during the course of the work. State inspection is not a waiver of full compliance with these requirements.

• The Contractor's obligation to defend and indemnify shall not be excused because of the Contractor's inability to evaluate liability or because the Contractor evaluates liability and determine that the Contractor is not liable. The Contractor shall respond within 30 days to the tender of any Claim for defense and indemnity by the State, unless this time has been extended by the State. If the Contractor fails to accept or reject a tender of defense and indemnity within 30 days, in addition to any other remedy authorized by law, the Department may withhold such funds the State reasonably considers necessary for its defense and indemnity until disposition has been made of the Claim or until the Contractor accepts or rejects the tender of defense, whichever occurs first.

• With respect to third-party claims against the Contractor, the Contractor waives all rights of any type to express or implied indemnity against the State, its officers, employees, or agents (excluding agents who are design professionals).

• Nothing in the Contract is intended to establish a standard of care owed to any member of the public or to extend to the public the status of a third-party beneficiary for any of these indemnification specifications.

7-1.12B Insurance

7-1.12B(1) General

• Nothing in the contract is intended to establish a standard of care owed to any member of the public or to extend to the public the status of a third-party beneficiary for any of these insurance specifications.

7-1.12B(2) Casualty Insurance

• The Contractor shall procure and maintain insurance on all of its operations with companies acceptable to the State as follows:

1. The Contractor shall keep all insurance in full force and effect from the beginning of the work through contract acceptance.
2. All insurance shall be with an insurance company with a rating from A.M. Best Financial Strength Rating of A- or better and a Financial Size Category of VII or better.
3. The Contractor shall maintain completed operations coverage with a carrier acceptable to the State through the expiration of the patent deficiency in construction statute of repose set forth in Code of Civil Procedure Section 337.1.

7-1.12B(3) Workers' Compensation and Employer's Liability Insurance

• In accordance with Labor Code Section 1860, the Contractor shall secure the payment of worker's compensation in accordance with Labor Code Section 3700.

• In accordance with Labor Code Section 1861, the Contractor shall submit to the Department the following certification before performing the work:

> I am aware of the provisions of Section 3700 of the Labor Code which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this contract.

• Contract execution constitutes certification submittal.

• The Contractor shall provide Employer's Liability Insurance in amounts not less than:

1. $1,000,000 for each accident for bodily injury by accident
2. $1,000,000 policy limit for bodily injury by disease
3. $1,000,000 for each employee for bodily injury by disease

• If there is an exposure of injury to the Contractor's employees under the U.S. Longshoremen's and Harbor Workers' Compensation Act, the Jones Act, or under laws, regulations, or statutes applicable to maritime employees, coverage shall be included for such injuries or claims.

7-1.12B(4) Liability Insurance

7-1.12B(4)(a) General

• The Contractor shall carry General Liability and Umbrella or Excess Liability Insurance covering all operations by or on behalf of the Contractor providing insurance for bodily injury liability and property damage liability for the following limits and including coverage for:

1. Premises, operations, and mobile equipment
2. Products and completed operations
3. Broad form property damage (including completed operations)
4. Explosion, collapse, and underground hazards

5. Personal injury
6. Contractual liability

7-1.12B(4)(b) Liability Limits/Additional Insureds

- The limits of liability shall be at least the amounts shown in the following table:

Total Bid	For Each Occurrence[1]	Aggregate for Products/Completed Operation	General Aggregate[2]	Umbrella or Excess Liability[3]
≤$1,000,000	$1,000,000	$2,000,000	$2,000,000	$5,000,000
>$1,000,000 ≤$5,000,000	$1,000,000	$2,000,000	$2,000,000	$10,000,000
>$5,000,000 ≤$25,000,000	$2,000,000	$2,000,000	$4,000,000	$15,000,000
>$25,000,000	$2,000,000	$2,000,000	$4,000,000	$25,000,000

1. Combined single limit for bodily injury and property damage.
2. This limit shall apply separately to the Contractor's work under this contract.
3. The umbrella or excess policy shall contain a clause stating that it takes effect (drops down) in the event the primary limits are impaired or exhausted.

- The Contractor shall not require certified Small Business subcontractors to carry Liability Insurance that exceeds the limits in the table above. Notwithstanding the limits specified herein, at the option of the Contractor, the liability insurance limits for certified Small Business subcontractors of any tier may be less than those limits specified in the table. For Small Business subcontracts, "Total Bid" shall be interpreted as the amount of subcontracted work to a certified Small Business.
- The State, including its officers, directors, agents (excluding agents who are design professionals), and employees, shall be named as additional insureds under the General Liability and Umbrella Liability Policies with respect to liability arising out of or connected with work or operations performed by or on behalf of the Contractor under this contract. Coverage for such additional insureds does not extend to liability:

1. Arising from any defective or substandard condition of the roadway which existed at or before the time the Contractor started work, unless such condition has been changed by the work or the scope of the work requires the Contractor to maintain existing roadway facilities and the claim arises from the Contractor's failure to maintain;
2. For claims occurring after the work is completed and accepted unless these claims are directly related to alleged acts or omissions of the Contractor that occurred during the course of the work; or
3. To the extent prohibited by Insurance Code Section 11580.04

- Additional insured coverage shall be provided by a policy provision or by an endorsement providing coverage at least as broad as Additional Insured (Form B) endorsement form CG 2010, as published by the Insurance Services Office (ISO), or other form designated by the Department.

7-1.12B(4)(c) Contractor's Insurance Policy is Primary

• The policy shall stipulate that the insurance afforded the additional insureds applies as primary insurance. Any other insurance or self-insurance maintained by the State is excess only and shall not be called upon to contribute with this insurance.

7-1.12B(5) Automobile Liability Insurance

• The Contractor shall carry automobile liability insurance, including coverage for all owned, hired, and nonowned automobiles. The primary limits of liability shall be not less than $1,000,000 combined single limit each accident for bodily injury and property damage. The umbrella or excess liability coverage required under Section 7-1.12B(4)(b) also applies to automobile liability.

7-1.12B(6) Policy Forms, Endorsements, and Certificates

• The Contractor shall provide its General Liability Insurance under Commercial General Liability policy form No. CG0001 as published by the Insurance Services Office (ISO) or under a policy form at least as broad as policy form No. CG0001.

7-1.12B(7) Deductibles

• The State may expressly allow deductible clauses, which it does not consider excessive, overly broad, or harmful to the interests of the State. Regardless of the allowance of exclusions or deductions by the State, the Contractor is responsible for any deductible amount and shall warrant that the coverage provided to the State is in accordance with Section 7-1.12B, "Insurance."

7-1.12B(8) Enforcement

• The Department may assure the Contractor's compliance with its insurance obligations. Ten days before an insurance policy lapses or is canceled during the contract period, the Contractor shall submit to the Department evidence of renewal or replacement of the policy.
• If the Contractor fails to maintain any required insurance coverage, the Department may maintain this coverage and withhold or charge the expense to the Contractor or terminate the Contractor's control of the work in accordance with Section 8-1.08, "Termination of Control."
• The Contractor is not relieved of its duties and responsibilities to indemnify, defend, and hold harmless the State, its officers, agents, and employees by the Department's acceptance of insurance policies and certificates.
• Minimum insurance coverage amounts do not relieve the Contractor for liability in excess of such coverage, nor do they preclude the State from taking other actions available to it, including the withholding of funds under this contract.

7-1.12B(9) Self-Insurance

• Self-insurance programs and self-insured retentions in insurance policies are subject to separate annual review and approval by the State.
• If the Contractor uses a self-insurance program or self-insured retention, the Contractor shall provide the State with the same protection from liability and defense of suits as would be afforded by first-dollar insurance. Execution of the contract is the Contractor's acknowledgement that the Contractor will be bound by all laws as if the Contractor were an

insurer as defined under Insurance Code Section 23 and that the self-insurance program or self-insured retention shall operate as insurance as defined under Insurance Code Section 22.

SECTION 8: PROSECUTION AND PROGRESS

Issue Date: August 17, 2007

The 2nd paragraph of Section 8-1.02, "Assignment," of the State Standard Specifications is amended to read:

• If the Contractor assigns the right to receive contract payments, the Department accepts the assignment upon the Engineer's receipt of a notice. Assigned payments remain subject to deductions and withholds described in the contract. The Department may use withheld payments for work completion whether payments are assigned or not.

SECTION 9: MEASUREMENT AND PAYMENT

Issue Date: August 17, 2007

The last sentence of the 1st paragraph of Section 9-1.02, "Scope of Payment," of the State Standard Specifications is amended to read:

• Neither the payment of any estimate nor of any retained percentage or withhold relieves the Contractor of any obligation to make good any defective work or material.

The 6th paragraph of Section 9-1.03C, "Records," of the State Standard Specifications is deleted.

The 2nd sentence of the 14th paragraph of Section 9-1.04, "Notice of Potential Claim," of the State Standard Specifications is amended to read:

• Administrative disputes are disputes of administrative deductions or withholds, contract item quantities, contract item adjustments, interest payments, protests of contract change orders as provided in Section 4-1.03A, "Procedure and Protest," and protests of the Weekly Statement of Working Days as provided in Section 8-1.06, "Time of Completion."

Section 9-1.05, "Stop Notices," of the State Standard Specifications is amended to read:

9-1.05 STOP NOTICE WITHHOLDS

• The Department may withhold payments to cover claims filed under Civ Code § 3179 et seq.

Section 9, "Measurement and Payment," of the State Standard Specifications is amended by adding the following sections:

9-1.053 PERFORMANCE FAILURE WITHHOLDS

• During each estimate period you fail to comply with a contract part, including submittal of a document as specified, the Department withholds a part of the progress payment. The

documents include quality control plans, schedules, traffic control plans, and water pollution control submittals.

- For 1 performance failure, the Department withholds 25 percent of the progress payment but does not withhold more than 10 percent of the total bid.
- For multiple performance failures, the Department withholds 100 percent of the progress payment but does not withhold more than 10 percent of the total bid.
- The Department returns performance-failure withholds in the progress payment following the correction of noncompliance.

9-1.055 PENALTY WITHHOLDS

- Penalties include fines and damages that are proposed, assessed, or levied against you or the Department by a governmental agency or citizen lawsuit. Penalties are also payments made or costs incurred in settling alleged permit violations of Federal, State, or local laws, regulations, or requirements. The cost incurred may include the amount spent for mitigation or correcting a violation.
- If you or the Department is assessed a penalty, the Department may withhold the penalty amount until the penalty disposition has been resolved. The Department may withhold penalty funds and notify you within 15 days of the withhold. If the penalty amount is less than the amount being withheld from progress payments for retentions, the Department will not withhold the penalty amount.
- If the penalty is resolved for less than the amount withheld, the Department pays interest at a rate of 6 percent per year on the excess withhold. If the penalty is not resolved, the withhold becomes a deduction.
- Instead of the withhold, you may provide a bond payable to the Department of Transportation equal to the highest estimated liability for any disputed penalties proposed.

9-1.057 PROGRESS WITHHOLDS FOR FEDERAL-AID CONTRACTS

- Section 9-1.057, "Progress Withholds for Federal-Aid Contracts," applies to a Federal-aid contract.
- The Department withholds 10 percent of a partial payment for noncompliant progress. Noncompliant progress occurs when:

1. Total days to date exceed 75 percent of the revised contract working days
2. Percent of working days elapsed exceeds the percent of value of work completed by more than 15 percent

- The Engineer determines the percent of working days elapsed by dividing the total days to date by the revised contract working days and converting the quotient to a percentage.
- The Engineer determines the percent of value of work completed by summing payments made to date and the amount due on the current progress estimate, dividing this sum by the current total estimated value of the work, and converting the quotient to a percentage. These amounts are shown on the Progress Payment Voucher.
- When the percent of working days elapsed minus the percent of value of work completed is less than or equal to 15 percent, the Department returns the withhold in the next progress payment.

The 3rd paragraph of Section 9-1.06, "Partial Payments," of the State Standard Specifications is amended to read:

• For a non-Federal-aid project, the Department retains 10 percent of the estimated value of the work done and 10 percent of the value of materials estimated to have been furnished and delivered and unused or furnished and stored as part security for the fulfillment of the contract by the Contractor, except that at any time after 20 percent of the work has been completed, if the Engineer finds that satisfactory progress is being made, the Department may reduce the total amount being retained from payment pursuant to the above requirements to 5 percent of the total estimated value of the work and materials and may also reduce the amount retained from any of the remaining partial payments to 5 percent of the estimated value of the work and materials. In addition, on any partial payment made after 95 percent of the work has been completed, the Department may reduce the amount retained from payment pursuant to the requirements of this Section 9-1.06, to such lesser amount as the Department determines is adequate security for the fulfillment of the balance of the work and other requirements of the contract, but in no event is that amount reduced to less than 125 percent of the estimated value of the work yet to be completed as determined by the Engineer. The reduction is made only upon the request of the Contractor and must be approved in writing by the surety on the performance bond and by the surety on the payment bond. The approval of the surety must be submitted to the Disbursing Officer of the Department; the signature of the person executing the approval for the surety must be properly acknowledged and the power of attorney authorizing the person to give that consent must either accompany the document or be on file with the Department. The retentions specified in this paragraph are those defined in Pub Cont Code § 7107(b).

The 1st sentence of the 4th paragraph of Section 9-1.06, "Partial Payments," of the State Standard Specifications is amended to read:

• The Department shall pay monthly to the Contractor, while carrying on the work, the balance not retained, as aforesaid, after deducting therefrom all previous payments and all sums to be deducted or withheld under the provisions of the contract.

The title and 1st and 2nd paragraphs of Section 9-1.065, "Payment of Withheld Funds," of the State Standard Specifications are amended to read:

9-1.065 RELEASE OF RETAINED FUNDS

• The Department releases retained funds if you:

1. Request release of the retention (Pub Cont Code § 10263) in writing
2. Deposit securities equivalent to the funds you want released into escrow with the State Treasurer or with a bank acceptable to the Department
3. Are the beneficial owner of and receive interest on the deposited securities substituted for the retained funds

The 2nd sentence Section 9-1.07A, "Payment Prior to Proposed Final Estimate," of the State Standard Specifications is amended to read:

• The Department pays the balance due less previous payments, deductions, withholds, and retentions under the provisions of the contract and those further amounts that the Engineer determines to be necessary pending issuance of the proposed final estimate and payment thereon.

The 1st paragraph of Section 9-1.07B, "Final Payment and Claims," of the State Standard Specifications is amended to read:

• After acceptance by the Director, the Engineer makes a proposed final estimate of the total amount payable to the Contractor, including an itemization of the total amount, segregated by contract item quantities, extra work, and other basis for payment, and shows each deduction made or to be made for prior payments and amounts to be deducted, withheld, or retained under the provisions of the contract. Prior estimates and payments are subject to correction in the proposed final estimate. The Contractor must submit written approval of the proposed final estimate or a written statement of claims arising under or by virtue of the contract so that the Engineer receives the written approval or statement of claims no later than close of business of the 30th day after receiving the proposed final estimate. The Contractor's receipt of the proposed final estimate must be evidenced by postal receipt. The Engineer's receipt of the Contractor's written approval or statement of claims must be evidenced by postal receipt or the Engineer's written receipt if delivered by hand.

SECTION 12: CONSTRUCTION AREA TRAFFIC CONTROL DEVICES

Issue Date: October 6, 2006

The first sentence of the second paragraph of Section 12-1.01, "Description," of the State Standard Specifications is amended to read:

• Attention is directed to Part 6 of the California MUTCD.

Section 12-2.01, "Flaggers," of the State Standard Specifications is amended to read:

12-2.01 FLAGGERS

• Flaggers while on duty and assigned to traffic control or to give warning to the public that the highway is under construction and of any dangerous conditions to be encountered as a result thereof, shall perform their duties and shall be provided with the necessary equipment in conformance with Part 6 of the California MUTCD. The equipment shall be furnished and kept clean and in good repair by the Contractor at the Contractor's expense.

The first paragraph of Section 12-3.01, "General," of the State Standard Specifications is amended to read:

• In addition to the requirements in Part 6 of the California MUTCD, all devices used by the Contractor in the performance of the work shall conform to the provisions in this Section 12-3.

The second sentence of the first paragraph of Section 12-3.06, "Construction Area Signs," of the State Standard Specifications is amended to read:

• Construction area signs are shown in or referred to in Part 6 of the California MUTCD.

The first sentence of the fourth paragraph of Section 12-3.06, "Construction Area Signs," of the State Standard Specifications is amended to read:

• All construction area signs shall conform to the dimensions, color and legend requirements of the plans, Part 6 of the California MUTCD and these specifications.

The first sentence of the eighth paragraph of Section 12-3.06, "Construction Area Signs," of the State Standard Specifications is amended to read:

• Used signs with the specified sheeting material will be considered satisfactory if they conform to the requirements for visibility and legibility and the colors conform to the requirements in Part 6 of the California MUTCD.

SECTION 19: EARTHWORK

Issue Date: July 31, 2007

Section 19-1.03, "Grade Tolerance," of the State Standard Specifications is amended to read:

• Immediately prior to placing subsequent layers of material thereon, the grading plane shall conform to one of the following:

A. When hot mix asphalt is to be placed on the grading plane, the grading plane at any point shall not vary more than 0.05-foot above or below the grade established by the Engineer.
B. When subbase or base material to be placed on the grading plane is to be paid for by the ton, the grading plane at any point shall not vary more than 0.10-foot above or below the grade established by the Engineer.
C. When the material to be placed on the grading plane is to be paid for by the cubic yard, the grading plane at any point shall be not more than 0.05-foot above the grade established by the Engineer.

The first paragraph of Section 19-3.025C, "Soil Cement Bedding," of the State Standard Specifications is amended to read:

• Cementitious material used in soil cement bedding shall conform to the provisions in Section 90-2.01, "Cementitious Materials." Supplementary cementitious material will not be required.

The fourth paragraph of Section 19-3.025C, "Soil Cement Bedding," of the State Standard Specifications is amended to read:

• The aggregate, cementitious material, and water shall be proportioned either by weight or by volume. Soil cement bedding shall contain not less than 282 pounds of cementitious material per cubic yard. The water content shall be sufficient to produce a fluid, workable mix that will flow and can be pumped without segregation of the aggregate while being placed.

The first paragraph of Section 19-3.062, "Slurry Cement Backfill," of the State Standard Specifications is amended to read:

• Slurry cement backfill shall consist of a fluid, workable mixture of aggregate, cementitious material, and water.

The fifth paragraph of Section 19-3.062, "Slurry Cement Backfill," of the State Standard Specifications is amended to read:

• Cementitious material shall conform to the provisions in Section 90-2.01, "Cementitious Materials." Supplementary cementitious material will not be required.

The eighth paragraph of Section 19-3.062, "Slurry Cement Backfill," of the State Standard Specifications is amended to read:

• The aggregate, cementitious material, and water shall be proportioned either by weight or by volume. Slurry cement backfill shall contain not less than 188 pounds of cementitious material per cubic yard. The water content shall be sufficient to produce a fluid, workable mix that will flow and can be pumped without segregation of the aggregate while being placed.

SECTION 20: EROSION CONTROL AND HIGHWAY PLANTING

Issue Date: August 17, 2007

Section 20-2.03, "Soil Amendment," of the State Standard Specifications is amended to read:

20-2.03 SOIL AMENDMENT

• Soil amendment shall comply with the requirements in the California Food and Agricultural Code.
• Soil amendment producers shall comply with the following:

1. Be fully permitted to produce compost as specified under the California Integrated Waste Management Board, Local Enforcement Agencies and any other State and Local Agencies that regulate Solid Waste Facilities. If exempt from State permitting requirements, the composting facility must certify that it follows guidelines and procedures for production of compost meeting the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7.
2. Be a participant in United States Composting Council's Seal of Testing Assurance program.

• Soil amendment shall be composted and may be derived from any single, or mixture of any of the following feedstock materials:

1. Green material consisting of chipped, shredded, or ground vegetation; or clean processed recycled wood products
2. Biosolids
3. Manure
4. Mixed food waste

• Soil amendment feedstock materials shall be composted to reduce weed seeds, pathogens and deleterious materials as specified under Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7, Section 17868.3.
• Soil amendment shall not be derived from mixed municipal solid waste and must be reasonably free of visible contaminates. Soil amendment must not contain paint, petroleum products, pesticides or any other chemical residues harmful to animal life or plant growth. Soil amendment must not possess objectionable odors.
• Metal concentrations in soil amendment must not exceed the maximum metal concentrations listed in Title 14, California Code of Regulations, Division 7, Chapter 3.1, Section 17868.2.
• Soil amendment must comply with the following:

Physical/Chemical Requirements

Property	Test Method	Requirement
pH	*TMECC 04.11-A, Elastometric pH 1:5 Slurry Method, pH Units	6.0–8.0
Soluble Salts	TMECC 04.10-A, Electrical Conductivity 1:5 Slurry Method dS/m (mmhos/cm)	0-10.0
Moisture Content	TMECC 03.09-A, Total Solids & Moisture at 70+/- 5 deg C, % Wet Weight Basis	30–60
Organic Matter Content	TMECC 05.07-A, Loss-On-Ignition Organic Matter Method (LOI), % Dry Weight Basis	30–65
Maturity	TMECC 05.05-A, Germination and Vigor Seed Emergence Seedling Vigor % Relative to Positive Control	 80 or Above 80 or Above
Stability	TMECC 05.08-B, Carbon Dioxide Evolution Rate mg CO_2-C/g OM per day	8 or below
Particle Size	TMECC 02.02-B Sample Sieving for Aggregate Size Classification % Dry Weight Basis	95% Passing 5/8 inch 70% Passing 3/8 inch
Pathogen	TMECC 07.01-B, Fecal Coliform Bacteria < 1000 MPN/gram dry wt.	Pass
Pathogen	TMECC 07.01-B, Salmonella < 3 MPN/4 grams dry wt.	Pass
Physical Contaminants	TMECC 02.02-C, Man Made Inert Removal and Classification: Plastic, Glass and Metal, % > 4mm fraction	Combined Total: < 1.0
Physical Contaminants	TMECC 02.02-C, Man Made Inert Removal and Classification: Sharps (Sewing needles, straight pins and hypodermic needles), % > 4mm fraction	None Detected

*TMECC refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC).

• Prior to application, the Contractor shall provide the Engineer with a copy of the soil amendment producer's Compost Technical Data Sheet and a copy of the compost producers STA certification. The Compost Technical Data Sheet shall include laboratory analytical test results, directions for product use, and a list of product ingredients.
• Prior to application, the Contractor shall provide the Engineer with a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the State Standard Specifications.

The last 3 paragraphs of Section 20-2.10, "Seed," of the State Standard Specifications are deleted.

The last paragraph of Section 20-3.04A, "General," of the State Standard Specifications is deleted.

Section 20-4.055, "Pruning," of the State Standard Specifications is amended to read:

20-4.055 PRUNING

• Pruning of plants shall be consistent with American National Standards Institute (ANSI), "Tree, Shrub and Other Woody Plant Maintenance Standard Practices," ANSI 300 (Part 1)-2001 and "Best Management Practices Tree Pruning," 2002 (ISBN 1-881956318), published by the International Society of Arboriculture, P.O. Boc 3129, Champaign, IL 61826.

SECTION 25: AGGREGATE SUBBASES

Issue Date: February 16, 2007

The first paragraph of Section 25-1.02A, "Class 1, Class 2, and Class 3 Aggregate Subbases," of the State Standard Specifications is amended to read:

• Aggregate must be clean and free from organic matter and other deleterious substances. Aggregate must consist of any combination of:

1. Broken stone
2. Crushed gravel
3. Natural rough surfaced gravel
4. Sand
5. Up to 100 percent of any combination of processed:

    5.1. Asphalt concrete
    5.2. Portland cement concrete
    5.3. Lean concrete base
    5.4. Cement treated base

The first paragraph of Section 25-1.02B, "Class 4 Aggregate Subbase," of the State Standard Specifications is amended to read:

• Aggregate must be clean and free from organic matter and other deleterious substances. Aggregate must consist of any combination of:

1. Broken stone
2. Crushed gravel
3. Natural rough surfaced gravel
4. Sand
5. Up to 100 percent of any combination of processed:

    5.1. Asphalt concrete
    5.2. Portland cement concrete
    5.3. Lean concrete base
    5.4. Cement treated base

SECTION 26: AGGREGATE BASE

Issue Date: February 16, 2007

The first paragraph of Section 26-1.02A, "Class 2 Aggregate Base," of the State Standard Specifications is amended to read:

• Aggregate must be clean and free from organic matter and other deleterious substances. Aggregate must consist of any combination of:

1. Broken stone
2. Crushed gravel
3. Natural rough surfaced gravel
4. Sand
5. Up to 100 percent of any combination of processed:

    5.1. Asphalt concrete
    5.2. Portland cement concrete
    5.3. Lean concrete base
    5.4. Cement treated base

The first paragraph of Section 26-1.02B, "Class 3 Aggregate Base," of the State Standard Specifications is amended to read:

• Aggregate must be clean and free from organic matter and other deleterious substances. Aggregate must consist of any combination of:

1. Broken stone
2. Crushed gravel
3. Natural rough surfaced gravel
4. Sand
5. Up to 100 percent of any combination of processed:

5.1. Asphalt concrete
5.2. Portland cement concrete
5.3. Lean concrete base
5.4. Cement treated base

SECTION 27: CEMENT TREATED BASES

Issue Date: July 31, 2007

The first paragraph of Section 27-1.02, "Materials," of the State Standard Specifications is amended to read:

• Cement shall be Type II portland cement conforming to the provisions in Section 90-2.01A, "Cement."

The third paragraph of Section 27-1.02, "Materials," of the State Standard Specifications is amended to read:

• Aggregate for use in Class A cement treated base shall be of such quality that when mixed with cement in an amount not to exceed 5 percent by weight of the dry aggregate and compacted at optimum moisture content, the compressive strength of a sample of the compacted mixture shall not be less than 750 pounds per square inch at 7 days, when tested by California Test 312.

The fourth paragraph of Section 27-1.02, "Materials," of the State Standard Specifications is amended to read:

• Aggregate for use in Class B cement treated base shall have a Resistance (R-value) of not less than 60 before mixing with cement and a Resistance (R-value) of not less than 80 after mixing with cement in an amount not to exceed 2.5 percent by weight of the dry aggregate.

The ninth paragraph of Section 27-1.07, "Compacting," of the State Standard Specifications is amended to read:

• When surfacing material is hot mix asphalt, the low areas shall be filled with hot mix asphalt conforming to the requirements for the lowest layer of hot mix asphalt to be placed as surfacing. This filling shall be done as a separate operation prior to placing the lowest layer of surfacing, and full compensation for this filling will be considered as included in the contract price paid for cement treated base and no additional compensation will be allowed therefor.

SECTION 28: LEAN CONCRETE BASE

Issue Date: July 31, 2007

The first paragraph of Section 28-1.02, "Materials," of the State Standard Specifications is amended to read:

• Cement shall be Type II portland cement conforming to the provisions in Section 90-2.01A, "Cement."

The sixth paragraph of Section 28-1.02, "Materials," of the State Standard Specifications is amended to read:

• Aggregate shall be of such quality that, when mixed with cement in an amount not to exceed 300 pounds per cubic yard, and tested in conformance with the requirements in California Test 548, the compressive strength of a sample will be not less than 700 pounds per square inch at 7 days.

The second paragraph of Section 28-1.06, "Spreading, Compacting and Shaping," of the State Standard Specifications is amended to read:

• In advance of curing operations, lean concrete base to be surfaced with hot mix asphalt shall be textured with a drag strip of burlap, a broom or a spring steel tine device which will produce scoring in the finished surface. The scoring shall be parallel with the centerline or transverse thereto. The operation shall be performed at a time and in a manner to produce the coarsest texture practical for the method used.

The second paragraph of Section 28-1.08, "Surfaces Not Within Tolerance," of the State Standard Specifications is amended to read:

• Hardened lean concrete base with a surface lower than 0.05-foot below the grade established by the Engineer shall be removed and replaced with lean concrete base which complies with these specifications, or if permitted by the Engineer, the low areas shall be filled with pavement material as follows:

1. When pavement material is hot mix asphalt, the low areas shall be filled with hot mix asphalt conforming to the requirements for the lowest layer of hot mix asphalt to be placed as pavement. This shall be done as a separate operation prior to placing the lowest layer of pavement, and full compensation for this filling will be considered as included in the contract price paid per cubic yard for lean concrete base and no additional compensation will be allowed therefor.
2. When pavement material is portland cement concrete, the low areas shall be filled with pavement concrete at the time and in the same operation that the pavement is placed. Full compensation for this filling will be considered as included in the contract price paid per cubic yard for lean concrete base and no additional compensation will be allowed therefor.

SECTION 29: TREATED PERMEABLE BASES

Issue Date: July 31, 2007

The second paragraph of Section 29-1.02B, "Cement Treated Permeable Base," of the State Standard Specifications is amended to read:

• Cement shall be Type II portland cement conforming to the provisions in Section 90-2.01A, "Cement."

The first paragraph of Section 29-1.04A, "Asphalt Treated Permeable Base," of the State Standard Specifications is amended to read:

• Aggregates and asphalt for asphalt treated permeable base shall be stored, proportioned and mixed in the same manner provided for storing, proportioning and mixing aggregates and asphalt for hot mix asphalt in Section 39-1.08, "Production," except as follows:

1. The aggregate need not be separated into sizes.
2. The temperature of the aggregate before adding the asphalt binder shall be not less than 275° F nor more than 325° F.
3. Asphalt treated permeable base stored in excess of 2 hours shall not be used in the work.
4. The aggregate shall be combined with 2.5 percent paving asphalt by weight of the dry aggregate. After testing samples of the Contractor's proposed aggregate supply, the Engineer may order an increase or decrease in the asphalt content. If an increase or decrease is ordered, and the increase or decrease exceeds the specified amount by more than 0.1-percent by weight of the dry aggregate, the compensation payable to the Contractor for the asphalt treated permeable base will be increased or decreased on the basis of the total increase or decrease in asphalt.
5. The asphalt content of the asphalt mixture will be determined, at the option of the Engineer, by extraction tests in conformance with the requirements in California Test 310 or 362, or will be determined in conformance with the requirements in California Test 379. The bitumen ratio pounds of asphalt per 100 pounds of dry aggregate shall not vary by more than 0.5-pound of asphalt above or 0.5-pound of asphalt below the amount designated by the Engineer. Compliance with this requirement will be determined either by taking samples from trucks at the plant or from the mat behind the paver before rolling. If the sample is taken from the mat behind the paver, the bitumen ratio shall be not less than the amount designated by the Engineer, less 0.7-pound of asphalt per 100 pounds of dry aggregate.

The second paragraph of Section 29-1.04B, "Cement Treated Permeable Base," of the State Standard Specifications is amended to read:

• Cement treated permeable base shall contain not less than 287 pounds of cement per cubic yard.

The first paragraph of Section 29-1.05, "Spreading and Compacting Asphalt Treated Permeable Base," of the State Standard Specifications is amended to read:

• Asphalt treated permeable base shall be spread and compacted as specified for hot mix asphalt under the "Method" construction process in Section 39, "Hot Mix Asphalt," and these specifications.

The second paragraph of Section 29-1.07, "Surfaces Not Within Tolerance," of the State Standard Specifications is amended to read:

• Hardened treated permeable base with a surface lower than 0.05-foot below the grade established by the Engineer shall be removed and replaced with treated permeable base which complies with these specifications, or if permitted by the Engineer, the low areas shall be filled with pavement material as follows:

1. When pavement material is hot mix asphalt, the low areas shall be filled with hot mix asphalt conforming to the requirements for the lowest layer of hot mix asphalt to be placed as pavement. This shall be done as a separate operation prior to placing the lowest layer of pavement.
2. When pavement material is portland cement concrete, the low areas shall be filled with pavement concrete at the time and in the same operation in which the pavement is placed.
3. Full compensation for filling low areas will be considered as included in the contract price paid per cubic yard for treated permeable base and no additional compensation will be allowed therefor.

SECTION 37: BITUMINOUS SEALS

Issue Date: August 17, 2007

The fourth through sixth paragraphs in Section 37-1.03, "Maintaining Traffic," of the State Standard Specifications are amended to read:

• On 2-lane two-way roadways, W8-7 "LOOSE GRAVEL" signs and W13-1 (35) speed advisory signs shall be furnished and placed adjacent to both sides of the traveled way where screenings are being spread on a traffic lane. The first W8-7 sign in each direction shall be placed where traffic first encounters loose screenings, regardless of which lane the screenings are being spread on. The W13-1 (35) signs need not be placed in those areas with posted speed limits of less than 40 MPH. The signs shall be placed at maximum 2,000-foot intervals along each side of the traveled way and at public roads or streets entering the seal coat area as directed by the Engineer.

• On multilane roadways (freeways, expressways and multilane conventional highways) where screenings are being spread on a traffic lane, W8-7 "LOOSE GRAVEL" signs and W13-1 (35) speed advisory signs shall be furnished and placed adjacent to the outside edge of the traveled way nearest to the lane being worked on. The first W8-7 sign shall be placed where the screenings begin with respect to the direction of travel on that lane. The W13-1 (35) signs need not be placed in those areas with posted speed limits of less than 40 MPH. The signs shall be placed at maximum 2,000-foot intervals along the edge of traveled way and at on-ramps, public roads or streets entering the seal coat area as directed by the Engineer.

• The W8-7 and W13-1 signs shall be maintained in place at each location until final brooming of the seal coat surface at that location is completed. The W8-7 and W13-1 signs shall conform to the provisions for construction area signs in Section 12, "Construction Area Traffic Control Devices." The signs may be set on temporary portable supports with the W13-1 below the W8-7 or on barricades with the W13-1 sign alternating with the W8-7 sign.

The second paragraph of Section 37-1.07, "Finishing," of the State Standard Specifications is amended to read:

• Rollers shall be oscillating type pneumatic-tired rollers. A minimum of 2 pneumatic-tired rollers conforming to the provisions in Section 39-3.03 "Spreading and Compacting Equipment," shall be furnished.

The second paragraph in Section 37-1.09, "Payment," of the State Standard Specifications is amended to read:

• The above prices and payments shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in applying seal coat, complete in place, including furnishing, placing, maintaining, and removing W8-7 and W13-1 signs, when required, and temporary supports or barricades for the signs, as shown on the plans, and as specified in these specifications and the special provisions, and as directed by the Engineer.

SECTION 39 HOT MIX ASPHALT

Issue Date: March 21, 2008

39-1 GENERAL

39-1.01 DESCRIPTION

• Section 39 includes specifications for producing and placing hot mix asphalt (HMA) by mixing aggregate and asphalt binder at a mixing plant and spreading and compacting the HMA mixture.

• The special provisions specify one or more type of HMA, including:

1. Type A
2. Type B
3. Open graded friction course (OGFC). OGFC includes hot mix asphalt (open graded), rubberized hot mix asphalt (open graded) (RHMA-O) and rubberized hot mix asphalt (open graded high binder) (RHMA-O-HB)
4. Rubberized hot mix asphalt (gap graded) (RHMA-G)

• The special provisions specify the HMA construction process, including:

1. Standard
2. Method
3. Quality Control / Quality Assurance (QC / QA)

39-1.02 MATERIALS

39-1.02A GEOSYNTHETIC PAVEMENT INTERLAYER

• Geosynthetic pavement interlayer must comply with the specifications for pavement reinforcing fabric in Section 88, "Engineering Fabrics."

39-1.02B TACK COAT

• Tack coat must comply with the specifications for asphaltic emulsion in Section 94, "Asphaltic Emulsion," or asphalt binder in Section 92, "Asphalts." Choose the type and grade.

39-1.02C ASPHALT BINDER

• Asphalt binder in HMA must comply with Section 92, "Asphalts," or Section 39-1.02D, "Asphalt Rubber Binder." The special provisions specify the grade.
• Asphalt binder for geosynthetic pavement interlayer must comply with Section 92, "Asphalts." Choose from Grades PG 64-10, PG 64-16, or PG 70-10.

39-1.02D ASPHALT RUBBER BINDER

General

• Use asphalt rubber binder in RHMA-G, RHMA-O, and RHMA-O-HB. Asphalt rubber binder must be a combination of:

1. Asphalt binder
2. Asphalt modifier
3. Crumb rubber modifier (CRM)

• The combined asphalt binder and asphalt modifier must be 80.0 ± 2.0 percent by weight of the asphalt rubber binder.

Asphalt Modifier

• Asphalt modifier must be a resinous, high flash point, and aromatic hydrocarbon, and comply with:

Asphalt Modifier for Asphalt Rubber Binder

Quality Characteristic	ASTM	Specification
Viscosity, m^2/s (x 10^{-6}) at 100 °C	D 445	X ± 3 [a]
Flash Point, CL.O.C., °C	D 92	207 minimum
Molecular Analysis		
Asphaltenes, percent by mass	D 2007	0.1 maximum
Aromatics, percent by mass	D 2007	55 minimum

Note:
[a] The symbol "X" is the proposed asphalt modifier viscosity. "X" must be between 19 and 36. A change in "X" requires a new asphalt rubber binder design.

• Asphalt modifier must be from 2.0 percent to 6.0 percent by weight of the asphalt binder in the asphalt rubber binder.

Crumb Rubber Modifier

• CRM consists of a ground or granulated combination of scrap tire CRM and high natural CRM. CRM must be 75.0 ± 2.0 percent scrap tire CRM and 25.0 ± 2.0 percent high natural

CRM by total weight of CRM. Scrap tire CRM must be from any combination of automobile tires, truck tires, or tire buffings.

- Sample and test scrap tire CRM and high natural CRM separately. CRM must comply with:

Crumb Rubber Modifier for Asphalt Rubber Binder

Quality Characteristic	Test Method	Specification
Scrap tire CRM gradation (% passing No. 8 sieve)	LP-10	100
High natural CRM gradation (% passing No. 10 sieve)	LP-10	100
Wire in CRM (% max.)	LP-10	0.01
Fabric in CRM (% max.)	LP-10	0.05
CRM particle length (inch max.) [a]	--	3/16
CRM specific gravity [a]	CT 208	1.1 – 1.2
Natural rubber content in high natural CRM (%) [a]	ASTM D 297	40.0 – 48.0

Note:
[a] Test at mix design and for Certificate of Compliance.

- Only use CRM ground and granulated at ambient temperature. If steel and fiber are cryogenically separated, it must occur before grinding and granulating. Only use cryogenically produced CRM particles that can be ground or granulated and not pass through the grinder or granulator.
- CRM must be dry, free-flowing particles that do not stick together. CRM must not cause foaming when combined with the asphalt binder and asphalt modifier. You may add calcium carbonate or talc up to 3 percent by weight of CRM.

Asphalt Rubber Binder Design and Profile

- Submit in writing an asphalt rubber binder design and profile. In the design, designate the asphalt, asphalt modifier, and CRM and their proportions. The profile is not a specification and only serves to indicate expected trends in asphalt rubber binder properties during binder production. The profile must include the same component sources for the asphalt rubber binder used.
- Design the asphalt rubber binder from testing you perform for each quality characteristic and for the reaction temperatures expected during production. The 24-hour (1,440-minute) interaction period determines the design profile. At a minimum, mix asphalt rubber binder components, take samples, and perform and record the following tests:

Asphalt Rubber Binder Reaction Design Profile

Test	Minutes of Reaction [a]							Limits
	45	60	90	120	240	360	1440	

Cone penetration @ 77 °F, 0.10-mm (ASTM D 217)	X [b]				X		X	25 - 70
Resilience @ 77 °F, percent rebound (ASTM D 5329)	X				X		X	18 min.
Field softening point, °F (ASTM D 36)	X				X		X	125 - 165
Viscosity, centipoises (LP-11)	X	X	X	X	X	X	X	1,500 - 4,000

Notes:
[a] Six hours (360 minutes) after CRM addition, reduce the oven temperature to 275 °F for a period of 16 hours. After the 16-hour (1320 minutes) cool-down after CRM addition, reheat the binder to the reaction temperature expected during production for sampling and testing at 24 hours (1440 minutes).
[b] "X" denotes required testing

Asphalt Rubber Binder

- After interacting for a minimum of 45 minutes, asphalt rubber binder must comply with:

Asphalt Rubber Binder

Quality Characteristic	Test for Quality Control or Acceptance	Test Method	Specification	
			Minimum	Maximum
Cone penetration @ 77 °F, 0.10-mm	Acceptance	ASTM D 217	25	70
Resilience @ 77 °F, percent rebound	Acceptance	ASTM D 5329	18	--
Field softening point, °F	Acceptance	ASTM D 36	125	165
Viscosity @ 350 °F, centipoises	Quality Control	LP-11	1,500	4,000

39-1.02E AGGREGATE

- Aggregate must be clean and free from deleterious substances. Aggregate:

1. Retained on the No. 4 sieve is coarse
2. Passing the No. 4 sieve is fine
3. Added and passing the No. 30 sieve is supplemental fine, including:

   3.1. Hydrated lime
   3.2. Portland cement
   3.3. Fines from dust collectors

- The special provisions specify the aggregate gradation for each HMA type.
- The specified aggregate gradation is before the addition of asphalt binder and includes supplemental fines. The Engineer tests for aggregate grading under California Test 202, modified by California Test 105 if there is a difference in specific gravity of 0.2 or more between the coarse and fine parts of different aggregate blends.
- Choose a sieve size target value (TV) within each target value limit presented in the aggregate gradation tables.

Aggregate Gradation
(Percentage Passing)
HMA Types A and B

3/4–inch HMA Types A and B

Sieve Sizes	Target Value Limits	Allowable Tolerance
1"	100	—
3/4"	90 - 100	TV ±5
1/2"	70 - 90	TV ±6
No. 4	45 - 55	TV ±7
No. 8	32 - 40	TV ±5
No. 30	12 - 21	TV ±4
No. 200	2 - 7	TV ±2

1/2–inch HMA Types A and B

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/4"	100	—
1/2"	95 - 99	TV ±6
3/8"	75 - 95	TV ±6
No. 4	55 - 66	TV ±7
No. 8	38 - 49	TV ±5
No. 30	15 - 27	TV ±4
No. 200	2 - 8	TV ±2

3/8–inch HMA Types A and B

Sieve Sizes	Target Value Limits	Allowable Tolerance
1/2"	100	—
3/8"	95 - 100	TV ±6
No. 4	58 - 72	TV ±7
No. 8	34 - 48	TV ±6
No. 30	18 - 32	TV ±5
No. 200	2 - 9	TV ±2

No. 4 HMA Types A and B

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/8"	100	—
No. 4	95 - 100	TV ±7
No. 8	72 - 77	TV ±7
No. 30	37 - 43	TV ±7
No. 200	2 - 12	TV ±4

Rubberized Hot Mix Asphalt - Gap Graded (RHMA-G)

3/4–inch RHMA-G

Sieve Sizes	Target Value Limits	Allowable Tolerance
1"	100	—
3/4"	95 - 100	TV ±5
1/2"	83 - 87	TV ±6
3/8"	65 - 70	TV ±6
No. 4	28 - 42	TV ±7
No. 8	14 - 22	TV ±5
No. 200	0 - 6	TV ±2

1/2–inch RHMA-G

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/4"	100	—
1/2"	90 - 100	TV ±6
3/8"	83 - 87	TV ±6
No. 4	28 - 42	TV ±7
No. 8	14 - 22	TV ±5
No. 200	0 - 6	TV ±2

Open Graded Friction Course (OGFC)

1–inch OGFC

Sieve Sizes	Target Value Limits	Allowable Tolerance
1 1/2"	100	—
1"	99 - 100	TV ±5
3/4"	85 - 96	TV ±5
1/2"	55 - 71	TV ±6
No. 4	10 - 25	TV ±7
No. 8	6 - 16	TV ±5
No. 200	1 - 6	TV ±2

1/2–inch OGFC

Sieve Sizes	Target Value Limits	Allowable Tolerance
3/4"	100	—
1/2"	95 - 100	TV ±6
3/8"	78 - 89	TV ±6
No. 4	28 - 37	TV ±7
No. 8	7 - 18	TV ±5
No. 30	0 - 10	TV ±4
No. 200	0 - 3	TV ±2

3/8–inch OGFC

Sieve Sizes	Target Value Limits	Allowable Tolerance
1/2"	100	—
3/8"	90 - 100	TV ±6
No. 4	29 - 36	TV ±7
No. 8	7 - 18	TV ±6
No. 30	0 - 10	TV ±5
No. 200	0 - 3	TV ±2

- Before the addition of asphalt binder and lime treatment, aggregate must comply with:

Aggregate Quality

Quality Characteristic	Test Method	HMA Type			
		A	B	RHMA-G	OGFC
Percent of crushed particles	CT 205				
Coarse aggregate (% min.)					
One fractured face		90	25	--	90
Two fractured faces		75	--	90	75
Fine aggregate (% min) (Passing No. 4 sieve and retained on No. 8 sieve.)					
One fractured face		70	20	70	90
Los Angeles Rattler (% max.)	CT 211				
Loss at 100 Rev.		12	--	12	12
Loss at 500 Rev.		45	50	40	40
Sand equivalent (min.) [a]	CT 217	47	42	47	--
Fine aggregate angularity (% min.) [b]	AASHTO T 304 Method A	45	45	45	--
Flat and elongated particles (% max. by weight @ 5:1)	ASTM D 4791	10	10	10	10
K_c factor (max.)	CT 303	1.7	1.7	1.7	--
K_f factor (max.)	CT 303	1.7	1.7	1.7	--

Notes:
[a] Reported value must be the average of 3 tests from a single sample.
[b] The Engineer waives this specification if HMA contains less than 10 percent of nonmanufactured sand by weight of total aggregate.

39-1.02F RECLAIMED ASPHALT PAVEMENT

• You may produce HMA using reclaimed asphalt pavement (RAP). HMA produced using RAP must comply with the specifications for HMA except aggregate quality specifications do not apply to RAP. You may substitute RAP aggregate for a part of the virgin aggregate in HMA in a quantity not exceeding 15 percent of the aggregate blend. Do not use RAP in OGFC and RHMA-G.

• Assign the substitution rate of RAP aggregate for virgin aggregate with the job mix formula (JMF) submittal. The JMF must include the percent of RAP used. If you change your assigned RAP aggregate substitution rate by more than 5 percent (within the 15 percent limit), submit a new JMF.

• Process RAP from asphalt concrete. You may process and stockpile RAP throughout the project's life. Prevent material contamination and segregation. Store RAP in stockpiles on smooth surfaces free of debris and organic material. Processed RAP stockpiles must consist only of homogeneous RAP.

39-1.03 HOT MIX ASPHALT MIX DESIGN REQUIREMENTS

39-1.03A GENERAL

• A mix design consists of performing California Test 367 and laboratory procedures on combinations of aggregate gradations and asphalt binder contents to determine the optimum binder content (OBC) and HMA mixture qualities. If RAP is used, use Laboratory Procedure LP-9. The result of the mix design becomes the proposed JMF.

- Use Form CEM-3512 to document aggregate quality and mix design data. Use Form CEM-3511 to present the JMF.
- Laboratories testing aggregate qualities and preparing the mix design and JMF must be qualified under the Department's Independent Assurance Program. Take samples under California Test 125.
- The Engineer reviews the aggregate qualities, mix design, and JMF and verifies and accepts the JMF.
- You may change the JMF during production. Do not use the changed JMF until the Engineer accepts it. Except when adjusting the JMF in compliance with Section 39-1.03E, "Job Mix Formula Verification," perform a new mix design and submit in writing a new JMF submittal for changing any of the following:

1. Target asphalt binder percentage
2. Asphalt binder supplier
3. Asphalt rubber binder supplier
4. Component materials used in asphalt rubber binder or percentage of any component materials
5. Combined aggregate gradation
6. Aggregate sources
7. Substitution rate for RAP aggregate of more than 5 percent
8. Any material in the JMF

- For OGFC, submit in writing a complete JMF submittal except asphalt binder content. The Engineer determines the asphalt binder content under California Test 368 within 20 days of your complete JMF submittal and provides you a Form CEM-3513.

39-1.03B HOT MIX ASPHALT FOR JOB MIX FORMULA

- Determine the proposed JMF from a mix design that complies with:

Hot Mix Asphalt for Job Mix Formula

Quality Characteristic	Test Method	HMA Type		
		A	B	RHMA-G
Air voids content (%)	CT 367[a]	4.0	4.0	Special Provisions
Voids in mineral aggregate (% min.)	LP-2			
No. 4 grading		17.0	17.0	--
3/8" grading		15.0	15.0	--
1/2" grading		14.0	14.0	18.0 – 23.0[b]
3/4" grading		13.0	13.0	18.0 – 23.0[b]
Voids filled with asphalt (%)	LP-3			
No. 4 grading		76.0 – 80.0	76.0 – 80.0	Note d
3/8" grading		73.0 – 76.0	73.0 – 76.0	
1/2" grading		65.0 – 75.0	65.0 – 75.0	
3/4" grading		65.0 – 75.0	65.0 – 75.0	
Dust proportion	LP-4			
No. 4 and 3/8" gradings		0.9 – 2.0	0.9 – 2.0	Note d
1/2" and 3/4" gradings		0.6 – 1.3	0.6 – 1.3	
Stabilometer value (min.) [c]	CT 366			
No. 4 and 3/8" gradings		30	30	--
1/2" and 3/4" gradings		37	35	23

Notes:

[a] Calculate the air voids content of each specimen using California Test 309 and Lab Procedure LP-1. Modify California Test 367, Paragraph C5, to use the exact air voids content specified in the selection of OBC.
[b] Voids in mineral aggregate for RHMA-G must be within this range.
[c] Modify California Test 304, Part 2.B.2.c: "After compaction in the compactor, cool to 140 °± 5 °F by allowing the briquettes to cool at room temperature for 0.5-hour, then place the briquettes in the oven at 140 °F for a minimum of 2 hours and not more than 3 hours."
[d] Report this value in the JMF submittal.

- For stability, prepare 3 briquettes separately at the proposed JMF and test for compliance. Report the average of 3 tests. Prepare new briquettes and test if the range of stability for the 3 briquettes is more than 12 points. The average air void content may vary from the specified air void content by ±0.5 percent.
- You may use the briquettes used for stability testing to determine bulk specific gravity under CT 308. If you use the same briquettes and tests using bulk specific gravity fail, you may prepare 3 new briquettes and determine a new bulk specific gravity. If you choose to determine bulk specific gravity with new briquettes and your tests fail, you may not test again using the stability briquettes.

39-1.03C JOB MIX FORMULA SUBMITTAL

- Each JMF submittal must consist of:

1. Proposed JMF on Form CEM-3511
2. Mix design documentation on Form CEM-3512 dated within 12 months of submittal
3. JMF verification on Form CEM-3513 dated within 12 months of production start, if applicable
4. Materials Safety Data Sheets (MSDS) for:

   4.1. Asphalt binder
   4.2. Base asphalt binder used in asphalt rubber binder

4.3. CRM and asphalt modifier used in asphalt rubber binder
4.4. Blended asphalt rubber binder mixture
4.5. Supplemental fine aggregate except fines from dust collectors
4.6. Antistrip additives

• If the JMF must be verified or if the Engineer requests, submit samples of the following materials in labeled containers weighing no more than 50 pounds each (notify the Engineer at least 2 business days before sampling materials):

1. Coarse, fine, and supplemental fine aggregate from stockpiles, cold feed belts, or hot bins. Samples must include at least 120 pounds for each coarse aggregate, 80 pounds for each fine aggregate, and 10 pounds for each type of supplemental fines. The Department combines these aggregate samples to comply with the JMF target values submitted on Form CEM-3511.
2. RAP from stockpiles or RAP system. Samples must be at least 60 pounds.
3. Asphalt binder from the binder supplier. Samples must be in two 1-quart cylindrical shaped cans with open top and friction lids.
4. Asphalt rubber binder with the components blended in the proportions to be used. Samples must be in four 1-quart cylindrical shaped cans with open top and friction lids.

39-1.03D JOB MIX FORMULA REVIEW

• The Engineer reviews each mix design and proposed JMF within 5 business days from the complete JMF submittal. The review consists of reviewing the mix design procedures and comparing the proposed JMF with the specifications.
• The Engineer may verify aggregate qualities during this review period.

39-1.03E JOB MIX FORMULA VERIFICATION

• If you cannot submit a Department-verified JMF on Form CEM-3513 dated within 12 months before HMA production, the Engineer verifies the JMF.
• Based on your testing and production experience, you may submit on Form CEM-3511 an adjusted JMF before the Engineer's verification testing. JMF adjustments may include a change in the:

1. Asphalt binder content target value up to ±0.6 percent from the optimum binder content value submitted on Form CEM-3512 except do not adjust the target value for asphalt rubber binder for RHMA-G below 7.0 percent
2. Aggregate gradation target values within the target value limits specified in the aggregate gradation tables

• Test samples from the HMA plant to be used to determine possible JMF adjustments.
• For HMA Type A, Type B, and RHMA-G, the Engineer verifies the JMF from samples taken from HMA produced by the plant to be used. The Engineer verifies each proposed JMF within 20 days of receiving a complete JMF submittal and verification samples. Verification is testing for compliance with the specifications for:

1. Aggregate quality

2. Aggregate gradation (JMF TV ± tolerance)
3. Asphalt binder content (JMF TV ± tolerance)
4. HMA quality specified in the table Hot Mix Asphalt for Job Mix Formula except:

    4.1. Air voids content (design value ± 2.0 percent)
    4.2. Voids filled with asphalt (report only if an adjustment for asphalt binder content target value is less than ± 0.3 percent from optimum binder content)
    4.3. Dust proportion (report only if an adjustment for asphalt binder content target value is less than ± 0.3 percent from optimum binder content)

• If you request in writing, the Engineer verifies RHMA-G quality requirements within 3 business days of sampling.
• In the Engineer's presence, under California Test 125, and from the same production run, take samples of:

1. Aggregate
2. Asphalt binder
3. RAP
4. HMA

• Sample aggregate from cold feed belts or hot bins. Sample RAP from the RAP system. Sample HMA from any of the following locations:

1. The plant
2. A truck
3. A windrow
4. Behind a paver

• You may sample from a different project including a non-Department project if you make arrangements for the Engineer to be present during sampling.
• For aggregate, RAP, and HMA, split the samples into at least 4 parts and label their containers. Submit 3 split parts to the Engineer and use 1 part for your testing.
• The Engineer prepares 3 briquettes from a single split sample. To verify the JMF for stability, the Engineer tests the 3 briquettes and reports the average of 3 tests. The Engineer prepares new briquettes if the range of stability for the 3 briquettes is more than 12 points.
• The Engineer may use the briquettes used for stability testing to determine bulk specific gravity under CT 308. If the Engineer uses the same briquettes and the tests using bulk specific gravity fail, the Engineer may prepare 3 new briquettes and determine a new bulk specific gravity. If the Engineer chooses to determine bulk specific gravity with new briquettes and the Engineer's tests fail, the Engineer may not test again using the stability briquettes.
• If the Engineer verifies the JMF, the Engineer provides you a Form CEM-3513.
• If the Engineer's tests on plant-produced samples do not verify the JMF, the Engineer notifies you in writing and you must submit a new JMF submittal or submit an adjusted JMF based on your testing. JMF adjustments may include a change in the:

1. Asphalt binder content target value up to ±0.6 percent from the optimum binder content value submitted on Form CEM-3512 except do not adjust the target value for asphalt rubber binder for RHMA-G below 7.0 percent
2. Aggregate gradation target values within the target value limits specified in the aggregate gradation tables

• You may adjust the JMF only once due to a failed verification test. An adjusted JMF requires a new Form CEM-3511 and verification of a plant-produced sample.
• The Engineer reverifies the JMF if HMA production has stopped for longer than 30 days and the verified JMF is older than 12 months.
• For each HMA type and aggregate size specified, the Engineer verifies at the State's expense up to 2 proposed JMF including a JMF adjusted after verification failure. The Engineer deducts $3,000 from payments for each verification exceeding this limit. This deduction does not apply to verifications initiated by the Engineer or if a JMF expires while HMA production is stopped longer than 30 days.

39-1.03F JOB MIX FORMULA ACCEPTANCE

• You may start HMA production if:

1. The Engineer's review of the JMF shows compliance with the specifications.
2. The Department has verified the JMF within 12 months before HMA production.
3. The Engineer accepts the verified JMF.

39-1.04 CONTRACTOR QUALITY CONTROL

39-1.04A GENERAL

• Establish, maintain, and change a quality control system to ensure materials and work comply with the specifications. Submit quality control test results to the Engineer within 3 days of a request except when QC / QA is specified.

39-1.04B PREPAVING CONFERENCE

• Meet with the Engineer at a prepaving conference at a mutually agreed time and place. Discuss methods of performing the production and paving work.

39-1.04C ASPHALT RUBBER BINDER

• Take asphalt rubber binder samples from the feed line connecting the asphalt rubber binder tank to the HMA plant. Sample and test asphalt rubber binder under Laboratory Procedure LP-11.
• Test asphalt rubber binder for compliance with the viscosity specifications in Section 39-1.02, "Materials." During asphalt rubber binder production and HMA production using asphalt rubber binder, measure viscosity every hour with not less than 1 reading for each asphalt rubber binder batch. Log measurements with corresponding time and asphalt rubber binder temperature. Submit the log daily in writing.
• Submit a Certificate of Compliance under Section 6-1.07, "Certificates of Compliance." With the Certificate of Compliance, submit test results in writing for CRM and asphalt modifier with each truckload delivered to the HMA plant. A Certificate of Compliance for asphalt

modifier must not represent more than 5,000 pounds. Use an AASHTO-certified laboratory for testing.

- Sample and test gradation and wire and fabric content of CRM once per 10,000 pounds of scrap tire CRM and once per 3,400 pounds of high natural CRM. Sample and test scrap tire CRM and high natural CRM separately.
- Submit certified weight slips in writing for the CRM and asphalt modifier furnished.

39-1.04D AGGREGATE

- Determine the aggregate moisture content and RAP moisture content in continuous mixing plants at least twice a day during production and adjust the plant controller. Determine the RAP moisture content in batch mixing plants at least twice a day during production and adjust the plant controller.

39-1.04E RECLAIMED ASPHALT PAVEMENT

- Perform RAP quality control testing each day.
- Sample RAP once daily and determine the RAP aggregate gradation under Laboratory Procedure LP-9 and submit the results to the Engineer in writing with the combined aggregate gradation.

39-1.04F CORES

- For Standard and QC / QA projects, take 4-inch or 6-inch diameter cores at least once every 5 business days. Take 1 core for every 250 tons of HMA from random locations the Engineer designates. Take cores in the Engineer's presence and backfill and compact holes with material authorized by the Engineer. Before submitting a core to the Engineer, mark it with the core's location and place it in a protective container.
- If a core is damaged, replace it with a core taken within 1 foot longitudinally from the original core. Relocate any core located within 1 foot of a rumble strip to 1 foot transversely away from the rumble strip.

39-1.04G BRIQUETTES

- Prepare 3 briquettes separately for each stability determination. Report the average of 3 tests. Prepare new briquettes and test if the range of stability for the 3 briquettes is more than 12 points.
- You may use the briquettes used for stability testing to determine bulk specific gravity under CT 308. If you use the same briquettes and tests using bulk specific gravity fail, you may prepare 3 new briquettes and determine a new bulk specific gravity. If you choose to determine bulk specific gravity with new briquettes and your tests fail, you may not test again using the stability briquettes.

39-1.05 ENGINEER'S ACCEPTANCE

- The Engineer's acceptance of HMA is specified in the sections for each HMA construction process.
- The Engineer samples materials for testing under California Test 125 and the applicable test method. Sampling must be statistically-based and random.
- The Engineer takes HMA and aggregate samples during production and splits each sample into 2 parts. The Engineer tests 1 part to verify quality control test results and reserves

and stores the remaining part. If you request, the Engineer splits samples and provides you with a part.

- The Engineer accepts HMA based on:

1. Accepted JMF
2. Accepted QCP for Standard and QC / QA
3. Compliance with the HMA Acceptance tables
4. Acceptance of a lot for QC / QA
5. Visual inspection

- The Engineer prepares 3 briquettes separately for each stability determination. The Engineer reports the average of 3 tests. The Engineer prepares new briquettes and test if the range of stability for the 3 briquettes is more than 12 points.
- The Engineer may use the briquettes used for stability testing to determine bulk specific gravity under CT 308. If the Engineer uses the same briquettes and the tests using bulk specific gravity fail, the Engineer may prepare 3 new briquettes and determine a new bulk specific gravity. If the Engineer chooses to determine bulk specific gravity with new briquettes and the Engineer tests fail, the Engineer may not test again using the stability briquettes.

39-1.06 DISPUTE RESOLUTION

- You and the Engineer must work together to avoid potential conflicts and to resolve disputes regarding test result discrepancies. Notify the Engineer in writing within 5 days of receiving a test result if you dispute the test result.
- If you or the Engineer dispute each other's test results, submit written quality control test results and copies of paperwork including worksheets used to determine the disputed test results to the Engineer. An Independent Third Party (ITP) performs referee testing. Before the ITP participates in a dispute resolution, the ITP must be accredited under the Department's Independent Assurance Program. The ITP must be independent of the project. By mutual agreement, the ITP is chosen from:

1. A Department laboratory
2. A Department laboratory in a district or region not in the district or region the project is located
3. The Transportation Laboratory
4. A laboratory not currently employed by you or your HMA producer

- If split quality control or acceptance samples are not available, the ITP uses any available material representing the disputed HMA for evaluation.

39-1.07 PRODUCTION START-UP EVALUATION

- The Engineer evaluates HMA production and placement at production start-up.
- Within the first 750 tons produced on the first day of HMA production, in the Engineer's presence and from the same production run, take samples of:

1. Aggregate

2. Asphalt binder
3. RAP
4. HMA

• Sample aggregate from cold feed belts or hot bins. Take RAP samples from the RAP system. Sample HMA under California Test 125. For aggregate, RAP, and HMA, split the samples into at least 4 parts and label their containers. Submit 3 split parts to the Engineer and keep 1 part.
• For Standard and QC / QA projects, you and the Engineer must test the split samples for compliance with specifications. You and the Engineer must report test results in writing within 3 business days of sampling.
• For Standard and QC / QA projects, take 4-inch or 6-inch diameter cores within the first 750 tons on the first day of HMA production. For each core, the Engineer reports the bulk specific gravity determined under California Test 308, Method A in addition to the percent of maximum theoretical density. You may test for in-place density at the core locations and include them in your production tests for percent of maximum theoretical density.

39-1.08 PRODUCTION

39-1.08A GENERAL

• Produce HMA in a batch mixing plant or a continuous mixing plant. Proportion aggregate by hot or cold feed control.
  • HMA plants must be Department-qualified. Before production, the HMA plant must have a current qualification under the Department's Materials Plant Quality Program.
• During production, you may adjust:

1. Hot or cold feed proportion controls for virgin aggregate and RAP
2. The set point for asphalt binder content

39-1.08B MIXING

• Mix HMA ingredients into a homogeneous mixture of coated aggregates.
• Asphalt binder must be between 275 °F and 375 °F when mixed with aggregate.
• Asphalt rubber binder must be between 350 °F and 425 °F when mixed with aggregate.
• Aggregate must not be more than 325 °F when mixed with asphalt binder. Aggregate temperature specifications do not apply when you use RAP.
• HMA with or without RAP must not be more than 325 °F.

39-1.08C ASPHALT RUBBER BINDER

• Deliver scrap tire CRM and high natural CRM in separate bags.
• Either proportion and mix asphalt binder, asphalt modifier, and CRM simultaneously or premix the asphalt binder and asphalt modifier before adding CRM. If you premix asphalt binder and asphalt modifier, the asphalt binder must be between 350 °F and 425 °F when you add asphalt modifier. Mix them for at least 20 minutes. When you add CRM, the asphalt binder and asphalt modifier must be between 350 °F and 425 °F.
• Do not use asphalt rubber binder during the first 45 minutes of the reaction period. During this period, the asphalt rubber binder mixture must be between 350 °F and the lower of 425 °F or 10 °F below the asphalt binder's flash point indicated in the MSDS.

• If any asphalt rubber binder is not used within 4 hours after the reaction period, discontinue heating. If the asphalt rubber binder drops below 350 °F, reheat before use. If you add more scrap tire CRM to the reheated asphalt rubber binder, the binder must undergo a 45-minute reaction period. The added scrap tire CRM must not exceed 10 percent of the total asphalt rubber binder weight. Reheated and reacted asphalt rubber binder must comply with the viscosity specifications for asphalt rubber binder in Section 39-1.02, "Materials." Do not reheat asphalt rubber binder more than twice.

39-1.09 SUBGRADE, TACK COAT, AND GEOSYNTHETIC PAVEMENT INTERLAYER

39-1.09A GENERAL

• Prepare subgrade or apply tack coat to surfaces receiving HMA. If specified, place geosynthetic pavement interlayer over a coat of asphalt binder.

39-1.09B SUBGRADE

• Subgrade to receive HMA must comply with the compaction and elevation tolerance specifications in the sections for the material involved. Subgrade must be free of loose and extraneous material. If HMA is paved on existing base or pavement, remove loose paving particles, dirt, and other extraneous material by any means including flushing and sweeping.

39-1.09C TACK COAT

• Apply tack coat:

1. To existing pavement including planed surfaces
2. Between HMA layers
3. To vertical surfaces of:

    3.1. Curbs
    3.2. Gutters
    3.3. Construction joints

• Before placing HMA, apply tack coat in 1 application at the minimum residual rate specified for the condition of the underlying surface:

Tack Coat Application Rates for HMA Type A, Type B, and RHMA-G

HMA Overlay over:	Minimum Residual Rates (gallons per square yard)		
	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h Asphaltic Emulsion	CRS1/CRS2, RS1/RS2 and QS1/CQS1 Asphaltic Emulsion	Asphalt Binder and PMRS2/PMCRS2 and PMRS2h/PMCRS2h Asphaltic Emulsion
New HMA (between layers)	0.02	0.03	0.02
Existing AC and PCC pavement	0.03	0.04	0.03
Planed pavement	0.05	0.06	0.04

Tack Coat Application Rates for OGFC

OGFC over:	Minimum Residual Rates (gallons per square yard)		
	CSS1/CSS1h, SS1/SS1h and QS1h/CQS1h Asphaltic Emulsion	CRS1/CRS2, RS1/RS2 and QS1/CQS1 Asphaltic Emulsion	Asphalt Binder and PMRS2/PMCRS2 and PMRS2h/PMCRS2h Asphaltic Emulsion
New HMA	0.03	0.04	0.03
Existing AC and PCC pavement	0.05	0.06	0.04
Planed pavement	0.06	0.07	0.05

- Apply to vertical surfaces with a residual tack coat rate that will thoroughly coat the vertical face without running off.
- If you request in writing and the Engineer authorizes, you may change tack coat rates.
- Immediately in advance of placing HMA, apply additional tack coat to damaged areas or where loose or extraneous material is removed.
- Close areas receiving tack coat to traffic. Do not track tack coat onto pavement surfaces beyond the job site.
- Asphalt binder tack coat must be between 285 °F and 350 °F when applied.

39-1.09D GEOSYNTHETIC PAVEMENT INTERLAYER

- Before placing the geosynthetic pavement interlayer and asphalt binder:

1. Repair cracks 1/4 inch and wider, spalls, and holes in the pavement. The State pays for this repair work under Section 4-1.03D, "Extra Work."
2. Clean the pavement of loose and extraneous material.

- Immediately before placing the interlayer, apply 0.25 gallon ± 0.03 gallon of asphalt binder per square yard of interlayer or until the fabric is saturated. Apply asphalt binder the width of the geosynthetic pavement interlayer plus 3 inches on each side. At interlayer overlaps, apply asphalt binder on the lower interlayer the same overlap distance as the upper interlayer.
- Align and place the interlayer with no overlapping wrinkles, except a wrinkle that overlaps may remain if it is less than 1/2 inch thick. If the overlapping wrinkle is more than 1/2 inch thick, cut the wrinkle out and overlap the interlayer no more than 2 inches.
- The minimum HMA thickness over the interlayer must be 0.12 foot thick including conform tapers. Do not place the interlayer on a wet or frozen surface.
- Overlap the interlayer borders between 2 inches and 4 inches. In the direction of paving, overlap the following roll with the preceding roll at any break.
- You may use rolling equipment to correct distortions or wrinkles in the interlayer.
- If asphalt binder tracked onto the interlayer or brought to the surface by construction equipment causes interlayer displacement, cover it with a small quantity of HMA.
- Before placing HMA on the interlayer, do not expose the interlayer to:

1. Traffic except for crossings under traffic control and only after you place a small HMA quantity
2. Sharp turns from construction equipment
3. Damaging elements

- Pave HMA on the interlayer during the same work shift.

39-1.10 SPREADING AND COMPACTING EQUIPMENT

- Paving equipment for spreading must be:

1. Self-propelled
2. Mechanical
3. Equipped with a screed or strike-off assembly that can distribute HMA the full width of a traffic lane
4. Equipped with a full-width compacting device
5. Equipped with automatic screed controls and sensing devices that control the thickness, longitudinal grade, and transverse screed slope

- Install and maintain grade and slope references.
- The screed must produce a uniform HMA surface texture without tearing, shoving, or gouging.
- The paver must not leave marks such as ridges and indentations unless you can eliminate them by rolling.
- Rollers must be equipped with a system that prevents HMA from sticking to the wheels. You may use a parting agent that does not damage the HMA or impede the bonding of layers.
- In areas inaccessible to spreading and compacting equipment:

1. Spread the HMA by any means to obtain the specified lines, grades and cross sections.
2. Use a pneumatic tamper, plate compactor, or equivalent to achieve thorough compaction.

39-1.11 TRANSPORTING, SPREADING, AND COMPACTING

- Do not pave HMA on a wet pavement or frozen surface.
- You may deposit HMA in a windrow and load it in the paver if:

1. Paver is equipped with a hopper that automatically feeds the screed
2. Loading equipment can pick up the windrowed material and deposit it in the paver hopper without damaging base material
3. Activities for deposit, pick-up, loading, and paving are continuous
4. HMA temperature in the windrow does not fall below 260 °F

- You may pave HMA in 1 or more layers on areas less than 5 feet wide and outside the traveled way including shoulders. You may use mechanical equipment other than a paver for these areas. The equipment must produce a uniform smoothness and texture.
- HMA handled, spread, or windrowed must not stain the finished surface of any improvement including pavement.
- Do not use petroleum products such as kerosene or diesel fuel to release HMA from trucks, spreaders, or compactors.
- HMA must be free of:

1. Segregation
2. Coarse or fine aggregate pockets

3. Hardened lumps

- Longitudinal joints in the top layer must match specified lane edges. Alternate longitudinal joint offsets in lower layers at least 0.5 foot from each side of the specified lane edges. You may request in writing other longitudinal joint placement patterns.
- Until the adjoining through lane's top layer has been paved, do not pave the top layer of:

1. Shoulders
2. Tapers
3. Transitions
4. Road connections
5. Private drives
6. Curve widenings
7. Chain control lanes
8. Turnouts
9. Left turn pockets

- If the number of lanes change, pave each through lane's top layer before paving a changing lane's top layer. Simultaneous to paving a through lane's top layer, you may pave an adjoining area's top layer including shoulders. Do not operate spreading equipment on any area's top layer until completing final compaction.
- If HMA (leveling) is specified, fill and level irregularities and ruts with HMA before spreading HMA over base, existing surfaces, or bridge decks. You may use mechanical equipment other than a paver for these areas. The equipment must produce a uniform smoothness and texture. HMA used to change an existing surface's cross slope or profile is not HMA (leveling).
- If placing HMA against the edge of existing pavement, sawcut or grind the pavement straight and vertical along the joint and remove extraneous material without damaging the surface remaining in place. If placing HMA against the edge of a longitudinal or transverse construction joint and the joint is damaged or not placed to a neat line, sawcut or grind the pavement straight and vertical along the joint and remove extraneous material without damaging the surface remaining in place. Repair or remove and replace damaged pavement at your expense.
- Rolling must leave the completed surface compacted and smooth without tearing, cracking, or shoving. Complete finish rolling activities before the pavement surface temperature is:

1. Below 150 °F for HMA with unmodified binder
2. Below 140 °F for HMA with modified binder
3. Below 200 °F for RHMA-G

- If a vibratory roller is used as a finish roller, turn the vibrator off.
- Do not use a pneumatic tired roller to compact RHMA-G.
- For Standard and QC/QA, if a 3/4-inch aggregate grading is specified, you may use a 1/2-inch aggregate grading if the total layer thickness is between 0.125 foot and 0.20 foot thick.
- Spread and compact HMA under Section 39-3.03, "Spreading and Compacting Equipment," and Section 39-3.04, "Transporting, Spreading, and Compacting," if either:

1. Total paved thickness is less than 0.15 foot.
2. Total paved thickness is less than 0.20 foot and a 3/4-inch aggregate grading is specified and used.
3. You spread and compact at:

    3.1. Asphalt concrete surfacing replacement areas
    3.2. Leveling courses
    3.3. Detours not included in the final roadway prism
    3.4. Areas the Engineer determines conventional compaction and compaction measurement methods are impeded

• Do not allow traffic on new HMA pavement until its mid-depth temperature is below 160 °F.
• If you request in writing and the Engineer authorizes, you may cool HMA Type A and Type B with water when rolling activities are complete. Apply water under Section 17, "Watering."
• Spread sand at a rate between 1 pound and 2 pounds per square yard on new RHMA-G, RHMA-O, and RHMA-O-HB pavement when finish rolling is complete. Sand must be free of clay or organic matter. Sand must comply with Section 90-3.03, "Fine Aggregate Grading." Keep traffic off the pavement until spreading sand is complete.

39-1.12 SMOOTHNESS

39-1.12A GENERAL

• Determine HMA smoothness with a profilograph and a straightedge.
• Smoothness specifications do not apply to OGFC placed on existing pavement not constructed under the same project.
• If portland cement concrete is placed on HMA:

1. Cold plane the HMA finished surface to within specified tolerances if it is higher than the grade specified by the Engineer.
2. Remove and replace HMA if the finished surface is lower than 0.05 foot below the grade specified by the Engineer.

39-1.12B STRAIGHTEDGE

• The HMA pavement top layer must not vary from the lower edge of a 12-foot long straightedge:

1. More than 0.01 foot when the straight edge is laid parallel with the centerline
2. More than 0.02 foot when the straightedge is laid perpendicular to the centerline and extends from edge to edge of a traffic lane
3. More than 0.02 foot when the straightedge is laid within 24 feet of a pavement conform

39-1.12C PROFILOGRAPH

- Under California Test 526, determine the zero (null) blanking band Profile Index (PI_0) and must-grinds on the top layer of HMA Type A, Type B, and RHMA-G pavement. Take 2 profiles within each traffic lane, 3 feet from and parallel with the edge of each lane.
- A must-grind is a deviation of 0.3 inch or more in a length of 25 feet. You must correct must-grinds.
- For OGFC, only determine must-grinds when placed over HMA constructed under the same project. The top layer of the underlying HMA must comply with the smoothness specifications before placing OGFC.
- Profile pavement in the Engineer's presence. Choose the time of profiling.
- On tangents and horizontal curves with a centerline radius of curvature 2,000 feet or more, the PI_0 must be at most 3 inches per 0.1-mile section.
- On horizontal curves with a centerline radius of curvature between 1,000 feet and 2,000 feet including pavement within the superelevation transitions, the PI_0 must be at most 6 inches per 0.1-mile section.
- Before the Engineer accepts HMA pavement for smoothness, submit written final profilograms.
- Submit 1 electronic copy of profile information in Microsoft Excel and 1 electronic copy of longitudinal pavement profiles in ".erd" format or other ProVAL compatible format to the Engineer and to:

Smoothness@dot.ca.gov

- The following HMA pavement areas do not require a PI_0. You must measure these areas with a 12-foot straightedge and determine must-grinds with a profilograph:

1. New HMA with a total thickness less than or equal to 0.25 foot
2. HMA sections of city or county streets and roads, turn lanes and collector lanes that are less than 1,500 feet in length

- The following HMA pavement areas do not require a PI_0. You must measure these areas with a 12-foot straightedge:

1. Horizontal curves with a centerline radius of curvature less than 1,000 feet including pavement within the superelevation transitions of those curves
2. Within 12 feet of a transverse joint separating the pavement from:

    2.1. Existing pavement not constructed under the same project
    2.2. A bridge deck or approach slab

3. Exit ramp termini, truck weigh stations, and weigh-in-motion areas
4. If steep grades and superelevation rates greater than 6 percent are present on:

    4.1. Ramps
    4.2. Connectors

5. Turn lanes and areas around manholes or drainage transitions

6. Acceleration and deceleration lanes for at-grade intersections
7. Shoulders and miscellaneous areas
8. HMA pavement within 3 feet from and parallel to the construction joints formed between curbs, gutters, or existing pavement

39-1.12D SMOOTHNESS CORRECTION

• If the top layer of HMA Type A, Type B, or RHMA-G pavement does not comply with the smoothness specifications, grind the pavement to within tolerances, remove and replace it, or place an overlay of HMA. The Engineer must authorize your choice of correction before the work begins.

• Remove and replace the areas of OGFC not in compliance with the must-grind and straightedge specifications, except you may grind OGFC for correcting smoothness:

1. At a transverse joint separating the pavement from pavement not constructed under the same project
2. Within 12 feet of a transverse joint separating the pavement from a bridge deck or approach slab

• Corrected HMA pavement areas must be uniform rectangles with edges:

1. Parallel to the nearest HMA pavement edge or lane line
2. Perpendicular to the pavement centerline

• After correcting for smoothness, measure the corrected HMA pavement surface with a profilograph and a 12-foot straightedge until the pavement is within specified tolerances. If a must-grind area or straightedged pavement cannot be corrected to within specified tolerances, remove and replace the pavement.

• On ground areas not overlaid with OGFC, apply fog seal coat under Section 37-1, "Seal Coats."

39-1.13 MISCELLANEOUS AREAS AND DIKES

• Miscellaneous areas are outside the traveled way and include:

1. Median areas not including inside shoulders
2. Island areas
3. Sidewalks
4. Gutters
5. Gutter flares
6. Ditches
7. Overside drains
8. Aprons at the ends of drainage structures

• Spread miscellaneous areas in 1 layer and compact to the specified lines and grades.

• For miscellaneous areas and dikes:

1. Do not submit a JMF.

2. Choose the 3/8-inch or 1/2-inch HMA Type A and Type B aggregate gradations.
3. Minimum asphalt binder content must be 6.8 percent for 3/8-inch aggregate and 6.0 percent for 1/2-inch aggregate. If you request in writing and the Engineer authorizes, you may reduce the minimum asphalt binder content.
4. Choose asphalt binder Grade PG 70-10 or the same grade specified for HMA.

39-1.14 SHOULDER RUMBLE STRIP

- Construct shoulder rumble strips by rolling or grinding indentations in the top layer of new HMA surfacing.
- Select the method and equipment for constructing ground-in indentations.
- Do not construct shoulder rumble strips on structures or approach slabs.
- Construct rumble strips within 2 inches of the specified alignment. Roller or grinding equipment must be equipped with a sighting device enabling the operator to maintain the rumble strip alignment.
- Rolled-in indentations must not vary from the specified dimensions by more than 10 percent.
- Ground-in indentations must comply with the specified dimensions within 0.06 inch in depth or 10 percent in length and width.
- The Engineer orders grinding or removal and replacement of noncompliant rumble strips to bring them within specified tolerances. Ground surface areas must be neat and uniform in appearance.
- The grinding equipment must be equipped with a vacuum attachment to remove residue.
- Dispose of removed material under Section 7-1.13, "Disposal of Material Outside the Highway Right of Way."
- On ground areas, apply fog seal coat under Section 37-1, "Seal Coats."

39-2 STANDARD

39-2.01 DESCRIPTION

- If HMA is specified as Standard, construct it under Section 39-1, "General," this Section 39-2, "Standard," and Section 39-5, "Measurement and Payment."

39-2.02 CONTRACTOR QUALITY CONTROL

39-2.02A QUALITY CONTROL PLAN

- Establish, implement, and maintain a Quality Control Plan (QCP) for HMA. The QCP must describe the organization and procedures you will use to:

1. Control the quality characteristics
2. Determine when corrective actions are needed (action limits)
3. Implement corrective actions

- When you submit the proposed JMF, submit the written QCP. You and the Engineer must discuss the QCP during the prepaving conference.
- The QCP must address the elements affecting HMA quality including:

1. Aggregate
2. Asphalt binder

3. Additives
4. Production
5. Paving

39-2.02B QUALITY CONTROL TESTING

• Perform sampling and testing at the specified frequency for the following quality characteristics:

Minimum Quality Control – Standard

Quality Characteristic	Test Method	Minimum Sampling and Testing Frequency	HMA Type			
			A	B	RHMA-G	OGFC
Aggregate gradation[a]	CT 202	1 per 750 tons and any remaining part	JMF ± Tolerance[b]	JMF ± Tolerance[b]	JMF ± Tolerance[b]	JMF ± Tolerance[b]
Sand equivalent (min.)[c]	CT 217		47	42	47	--
Asphalt binder content (%)	CT 379 or 382		JMF ± 0.45	JMF ± 0.45	JMF ± 0.50	JMF +0.50 -0.70
HMA moisture content (%, max.)	CT 226 or CT 370	1 per 2,500 tons but not less than 1 per paving day	1.0	1.0	1.0	1.0
Percent of maximum theoretical density (%)[d, e]	Quality control plan	2 per business day (min.)	91 - 97	91 - 97	91 - 97	--
Stabilometer value (min.)[c, f]	CT 366	One per 4,000 tons or 2 per 5 bus-iness days, which-ever is more				
No. 4 and 3/8" gradings			30	30	--	--
1/2" and 3/4" gradings			37	35	23	--
Air voids content (%)[c, g]	CT 367		4 ± 2	4 ± 2	Specification ± 2	--
Aggregate moisture content at continuous mixing plants and RAP moisture content at continuous mixing plants and batch mixing plants[h]	CT 226 or CT 370	2 per day during production	--	--	--	--
Percent of crushed particles coarse aggregate (%, min.)	CT 205	As necessary and designat-ed in the QCP. At least once per project				
One fractured face			90	25	--	90
Two fractured faces			75	--	90	75
Fine aggregate (%, min) (Passing No. 4 sieve and retained on No. 8 sieve.)						
One fractured face			70	20	70	90

Los Angeles Rattler (%, max.) Loss at 100 rev. Loss at 500 rev.	CT 211		 12 45	 -- 50	 12 40	 12 40
Flat and elongated particles (%, max. by weight @ 5:1)	ASTM D 4791		Report only	Report only	Report only	Report only
Fine aggregate angularity (%, min.)	AASHTO T 304, Method A		Report only	Report only	Report only	--
Voids filled with asphalt (%) [i] No. 4 grading 3/8" grading 1/2" grading 3/4" grading	LP-3		 76.0 – 80.0 73.0 – 76.0 65.0 – 75.0 65.0 – 75.0	 76.0 – 80.0 73.0 – 76.0 65.0 – 75.0 65.0 – 75.0	 Report only	--
Voids in mineral aggregate (% min.) [i] No. 4 grading 3/8" grading 1/2" grading 3/4" grading	LP-2		 17.0 15.0 14.0 13.0	 17.0 15.0 14.0 13.0	 -- -- 18.0 – 23.0 [j] 18.0 – 23.0 [j]	--
Dust proportion [i] No. 4 and 3/8" gradings 1/2" and 3/4" gradings	LP-4		 0.9 – 2.0 0.6 – 1.3	 0.9 – 2.0 0.6 – 1.3	 Report only	--
Smoothness	Section 39-1.12	--	12-foot straightedge, must-grind, and PI_0	12-foot straightedge, must-grind, and PI_0	12-foot straightedge, must-grind, and PI_0	12-foot straightedge and must-grind
Asphalt rubber binder viscosity @ 350 °F, centipoises	Section 39-1.02D	--	--	--	1,500 – 4,000	1,500 – 4,000
Crumb rubber modifier	Section 39-1.02D	--	--	--	Section 39-1.02D	Section 39-1.02D

Notes:
[a] Determine combined aggregate gradation containing RAP under Laboratory Procedure LP-9.
[b] The tolerances must comply with the allowable tolerances in Section 39-1.02E, "Aggregate."
[c] Report the average of 3 tests from a single split sample.
[d] Required for HMA Type A, Type B, and RHMA-G if the total paved thickness is at least 0.15 foot.
[e] Determine maximum theoretical density (California Test 309) at the frequency specified for Test Maximum Density under California Test 375, Part 5.D.
[f] Modify California Test 304, Part 2.B.2.c: "After compaction in the mechanical compactor, cool to 140 °F ± 5 °F by allowing the briquettes to cool at room temperature for 0.5 hour, then place the briquettes in the oven at 140 °F for a minimum of 2 hours and not more than 3 hours."
[g] Determine the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.
[h] For adjusting the plant controller at the HMA plant.
[i] Report only if the adjustment for asphalt binder content target value is less than ± 0.3 percent from OBC.
[j] Voids in mineral aggregate for RHMA-G must be within this range.

- For any single quality characteristic except smoothness, if 2 consecutive quality control test results do not comply with the action limits or specifications:

1. Stop production.
2. Notify the Engineer in writing.
3. Take corrective action.
4. Demonstrate compliance with the specifications before resuming production and placement on the State highway.

39-2.03 ENGINEER'S ACCEPTANCE

39-2.03A TESTING

- The Engineer samples for acceptance testing and tests for:

HMA Acceptance - Standard

Quality Characteristic	Test Method	HMA Type			
		A	B	RHMA-G	OGFC
Aggregate gradation [a]	CT 202	JMF ± Tolerance [c]	JMF ± Tolerance [c]	JMF ± Tolerance [c]	JMF ± Tolerance [c]
Sieve: 3/4" / 1/2" / 3/8"					
1/2": X [b] / /					
3/8": / X /					
No. 4: / / X					
No. 8: X / X / X					
No. 200: X / X / X					
Sand equivalent (min.) [d]	CT 217	47	42	47	--
Asphalt binder content (%)	CT 379 or 382	JMF ± 0.45	JMF ± 0.45	JMF ± 0.5	JMF +0.50 -0.70
HMA moisture content (%, max.)	CT 226 or CT 370	1.0	1.0	1.0	1.0
Percent of maximum theoretical density (%) [e, f]	CT 375	91 – 97	91 – 97	91 – 97	--
Stabilometer value (min.) [d, g]	CT 366				
No. 4 and 3/8" gradings		30	30	--	--
1/2" and 3/4" gradings		37	35	23	--
Air voids content (%) [d, h]	CT 367	4 ± 2	4 ± 2	Specification ± 2	--
Percent of crushed particles	CT 205				
Coarse aggregate (%, min.)					
One fractured face		90	25	--	90
Two fractured faces		75	--	90	75
Fine aggregate (%, min) (Passing No. 4 sieve and retained on No. 8 sieve.)					
One fractured face		70	20	70	90
Los Angeles Rattler (%, max.)	CT 211				
Loss at 100 rev.		12	--	12	12
Loss at 500 rev.		45	50	40	40
Fine aggregate angularity (%, min.)	AASHTO T 304, Method A	Report only	Report only	Report only	--
Flat and elongated particles (%, max. by weight @ 5:1)	ASTM D 4791	Report only	Report only	Report only	Report only
Voids filled with asphalt (%) [i]	LP-3				--
No. 4 grading		76.0 – 80.0	76.0 – 80.0	Report only	
3/8" grading		73.0 – 76.0	73.0 – 76.0		
1/2" grading		65.0 – 75.0	65.0 – 75.0		
3/4" grading		65.0 – 75.0	65.0 – 75.0		
Voids in mineral aggregate (% min.) [i]	LP-2				--
No. 4 grading		17.0	17.0	--	
3/8" grading		15.0	15.0	--	
1/2" grading		14.0	14.0	18.0 – 23.0 [j]	
3/4" grading		13.0	13.0	18.0 – 23.0 [j]	
Dust proportion [i]	LP-4				--
No. 4 and 3/8" gradings		0.9 – 2.0	0.9 – 2.0	Report only	
1/2" and 3/4" gradings		0.6 – 1.3	0.6 – 1.3		
Smoothness	Section	12-foot	12-foot	12-foot	12-foot

	39-1.12	straightedge, must-grind, and PI_0	straightedge, must-grind, and PI_0	straightedge, must-grind, and PI_0	straightedge and must-grind
Asphalt binder	Various	Section 92	Section 92	Section 92	Section 92
Asphalt rubber binder	Various	--	--	Section 92-1.02(C) and Section 39-1.02D	Section 92-1.02(C) and Section 39-1.02D
Asphalt modifier	Various	--	--	Section 39-1.02D	Section 39-1.02D
Crumb rubber modifier	Various	--	--	Section 39-1.02D	Section 39-1.02D

[a] The Engineer determines combined aggregate gradations containing RAP under Laboratory Procedure LP-9.
[b] "X" denotes the sieves the Engineer considers for the specified aggregate gradation.
[c] The tolerances must comply with the allowable tolerances in Section 39-1.02E, "Aggregate."
[d] The Engineer reports the average of 3 tests from a single split sample.
[e] The Engineer determines percent of maximum theoretical density if the total paved thickness is at least 0.15 foot under California Test 375 except the Engineer uses:

1. California Test 308, Method A, to determine in-place density of each core instead of using the nuclear gauge in Part 4, "Determining In-Place Density By The Nuclear Density Device."
2. California Test 309 to determine maximum theoretical density instead of calculating test maximum density in Part 5, "Determining Test Maximum Density."

[f] The Engineer determines maximum theoretical density (California Test 309) at the frequency specified for Test Maximum Density under California Test 375, Part 5.D.
[g] Modify California Test 304, Part 2.B.2.c: "After compaction in the mechanical compactor, cool to 140 °F ±5 °F by allowing the briquettes to cool at room temperature for 0.5 hour, then place the briquettes in the oven at 140 °F for a minimum of 2 hours and not more than 3 hours."
[h] The Engineer determines the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.
[i] Report only if the adjustment for asphalt binder content target value is less than ± 0.3 percent from OBC.
[j] Voids in mineral aggregate for RHMA-G must be within this range.

- No single test result may represent more than the smaller of 750 tons or 1 day's production.
- For any single quality characteristic except smoothness, if 2 consecutive acceptance test results do not comply with the specifications:

1. Stop production.
2. Take corrective action.
3. In the Engineer's presence, take samples and split each sample into 4 parts. Test 1 part for compliance with the specifications and submit 3 parts to the Engineer. The Engineer tests 1 part for compliance with the specifications and reserves and stores 2 parts.
4. Demonstrate compliance with the specifications before resuming production and placement on the State highway.

- The Engineer tests the core you take from each 250 tons of HMA production. The Engineer determines the percent of maximum theoretical density for each core by determining the core's density and dividing by the maximum theoretical density.
- If the total paved thickness is at least 0.15 foot and any layer is less than 0.15 foot, the Engineer determines the percent of maximum theoretical density from cores taken from the final layer measured the full depth of the total paved HMA thickness.

• For percent of maximum theoretical density, the Engineer determines a deduction for each test result outside the specifications in compliance with:

Reduced Payment Factors for Percent of Maximum Theoretical Density

HMA Type A and B and RHMA-G Percent of Maximum Theoretical Density	Reduced Payment Factor	HMA Type A and B and RHMA-G Percent of Maximum Theoretical Density	Reduced Payment Factor
91.0	0.0000	97.0	0.0000
90.9	0.0125	97.1	0.0125
90.8	0.0250	97.2	0.0250
90.7	0.0375	97.3	0.0375
90.6	0.0500	97.4	0.0500
90.5	0.0625	97.5	0.0625
90.4	0.0750	97.6	0.0750
90.3	0.0875	97.7	0.0875
90.2	0.1000	97.8	0.1000
90.1	0.1125	97.9	0.1125
90.0	0.1250	98.0	0.1250
89.9	0.1375	98.1	0.1375
89.8	0.1500	98.2	0.1500
89.7	0.1625	98.3	0.1625
89.6	0.1750	98.4	0.1750
89.5	0.1875	98.5	0.1875
89.4	0.2000	98.6	0.2000
89.3	0.2125	98.7	0.2125
89.2	0.2250	98.8	0.2250
89.1	0.2375	98.9	0.2375
89.0	0.2500	99.0	0.2500
< 89.0	Remove and Replace	> 99.0	Remove and Replace

39-2.04 TRANSPORTING, SPREADING, AND COMPACTING

• Determine the number of rollers needed to obtain the specified density and surface finish.

39-3 METHOD

39-3.01 DESCRIPTION

• If HMA is specified as Method, construct it under Section 39-1, "General," this Section 39-3, "Method," and Section 39-5, "Measurement and Payment."

39-3.02 ENGINEER'S ACCEPTANCE

39-3.02A TESTING

• The Engineer samples for acceptance testing and tests for:

HMA Acceptance - Method

Quality Characteristic	Test Method	HMA Type			
		A	B	RHMA-G	OGFC
Aggregate gradation [a]	CT 202	JMF ± Tolerance [b]	JMF ± Tolerance [b]	JMF ± Tolerance [b]	JMF ± Tolerance [b]
Sand equivalent (min.) [c]	CT 217	47	42	47	--
Asphalt binder content (%)	CT 379 or 382	JMF ± 0.45	JMF ± 0.45	JMF ± 0.5	JMF +0.50 -0.70
HMA moisture content (%, max.)	CT 226 or CT 370	1.0	1.0	1.0	1.0
Stabilometer value (min.) [c, d]	CT 366				
No. 4 and 3/8" gradings		30	30	--	--
1/2" and 3/4" gradings		37	35	23	--
Percent of crushed particles	CT 205				
Coarse aggregate (% min.)					
One fractured face		90	25	--	90
Two fractured faces		75	--	90	75
Fine aggregate (% min) (Passing No. 4 sieve and retained on No. 8 sieve.)					
One fractured face		70	20	70	90
Los Angeles Rattler (% max.)	CT 211				
Loss at 100 rev.		12	--	12	12
Loss at 500 rev.		45	50	40	40
Air voids content (%) [c, e]	CT 367	4 ± 2	4 ± 2	Specification ± 2	--
Fine aggregate angularity (% min.)	AASHTO T 304, Method A	Report only	Report only	Report only	--
Flat and elongated particles (% max. by weight @ 5:1)	ASTM D 4791	Report only	Report only	Report only	Report only
Voids filled with asphalt (%) [f]	LP-3				--
No. 4 grading		76.0 – 80.0	76.0 – 80.0	Report only	
3/8" grading		73.0 – 76.0	73.0 – 76.0		
1/2" grading		65.0 – 75.0	65.0 – 75.0		
3/4" grading		65.0 – 75.0	65.0 – 75.0		
Voids in mineral aggregate (% min.) [f]	LP-2				--
No. 4 grading		17.0	17.0	--	
3/8" grading		15.0	15.0	--	
1/2" grading		14.0	14.0	18.0 – 23.0 [g]	
3/4" grading		13.0	13.0	18.0 – 23.0 [g]	
Dust proportion [f]	LP-4				--
No. 4 and 3/8" gradings		0.9 – 2.0	0.9 – 2.0	Report only	
1/2" and 3/4" gradings		0.6 – 1.3	0.6 – 1.3		
Smoothness	Section 39-1.12	12-foot straightedge and must-grind	12-foot straightedge and must-grind	12-foot straightedge and must-grind	12-foot straightedge and must-grind
Asphalt binder	Various	Section 92	Section 92	Section 92	Section 92

Asphalt rubber binder	Various	--	--	Section 92-1.02(C) and Section 39-1.02D	Section 92-1.02(C) and Section 39-1.02D
Asphalt modifier	Various	--	--	Section 39-1.02D	Section 39-1.02D
Crumb rubber modifier	Various	--	--	Section 39-1.02D	Section 39-1.02D

[a] The Engineer determines combined aggregate gradations containing RAP under Laboratory Procedure LP-9.
[b] The tolerances must comply with the allowable tolerances in Section 39-1.02E, "Aggregate."
[c] The Engineer reports the average of 3 tests from a single split sample.
[d] Modify California Test 304, Part 2.B.2.c: "After compaction in the mechanical compactor, cool to 140 °F ±5 °F by allowing the briquettes to cool at room temperature for 0.5 hour, then place the briquettes in the oven at 140 °F for a minimum of 2 hours and not more than 3 hours."
[e] The Engineer determines the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.
[f] Report only if the adjustment for asphalt binder content target value is less than ± 0.3 percent from OBC.
[g] Voids in mineral aggregate for RHMA-G must be within this range.

- No single test result may represent more than the smaller of 750 tons or 1 day's production.
- For any single quality characteristic except smoothness, if 2 consecutive acceptance test results do not comply with the specifications:

1. Stop production.
2. Take corrective action.
3. In the Engineer's presence, take samples and split each sample into 4 parts. Test 1 part for compliance with the specifications and submit 3 parts to the Engineer. The Engineer tests 1 part for compliance with the specifications and reserves and stores 2 parts.
4. Demonstrate compliance with the specifications before resuming production and placement on the State highway.

39-3.03 SPREADING AND COMPACTING EQUIPMENT

- Each paver spreading HMA Type A and Type B must be followed by 3 rollers:

1. One vibratory roller specifically designed to compact HMA. The roller must be capable of at least 2,500 vibrations per minute and must be equipped with amplitude and frequency controls. The roller's gross static weight must be at least 7.5 tons.
2. One oscillating type pneumatic-tired roller at least 4 feet wide. Pneumatic tires must be of equal size, diameter, type, and ply. The tires must be inflated to 60 psi minimum and maintained so that the air pressure does not vary more than 5 psi.
3. One steel-tired, 2-axle tandem roller. The roller's gross static weight must be at least 7.5 tons.

- Each roller must have a separate operator. Rollers must be self-propelled and reversible.
- Compact RHMA-G under the specifications for compacting HMA Type A and Type B except do not use pneumatic-tired rollers.
- Compact OGFC with steel-tired, 2-axle tandem rollers. If placing over 300 tons of OGFC per hour, use at least 3 rollers for each paver. If placing less than 300 tons of OGFC per

hour, use at least 2 rollers for each paver. Each roller must weigh between 126 pounds to 172 pounds per linear inch of drum width. Turn the vibrator off.

39-3.04 TRANSPORTING, SPREADING, AND COMPACTING

- Pave HMA in maximum 0.25-foot thick compacted layers.
- If the surface to be paved is both in sunlight and shade, pavement surface temperatures are taken in the shade.
- Spread HMA Type A and Type B only if atmospheric and surface temperatures are:

Minimum Atmospheric and Surface Temperatures

Compacted Layer Thickness, feet	Atmospheric,° F		Surface,° F	
	Unmodified Asphalt Binder	Modified Asphalt Binder[a]	Unmodified Asphalt Binder	Modified Asphalt Binder[a]
< 0.15	55	50	60	55
0.15 – 0.25	45	45	50	50

Note:
[a] Except asphalt rubber binder.

- If the asphalt binder for HMA Type A and Type B is:

1. Unmodified asphalt binder, complete:

1.1. First coverage of breakdown compaction before the surface temperature drops below 250 °F
1.2. Breakdown and intermediate compaction before the surface temperature drops below 200 °F
1.3. Finish compaction before the surface temperature drops below 150 °F

2. Modified asphalt binder, complete:

2.1. First coverage of breakdown compaction before the surface temperature drops below 240 °F
2.2. Breakdown and intermediate compaction before the surface temperature drops below 180 °F
2.3. Finish compaction before the surface temperature drops below 140 °F

- For RHMA-G:

1. Only spread and compact if the atmospheric temperature is at least 55 °F and the surface temperature is at least 60 °F.
2. Complete the first coverage of breakdown compaction before the surface temperature drops below 280 °F.
3. Complete breakdown and intermediate compaction before the surface temperature drops below 250 °F.
4. Complete finish compaction before the surface temperature drops below 200 °F.

5. If the atmospheric temperature is below 70 °F, cover loads in trucks with tarpaulins. The tarpaulins must completely cover the exposed load until you transfer the mixture to the paver's hopper or to the pavement surface.

- For OGFC with unmodified asphalt binder:

1. Only spread and compact if the atmospheric temperature is at least 55 °F and the surface temperature is at least 60 °F.
2. Complete first coverage using 2 rollers before the surface temperature drops below 240 °F.
3. Complete all compaction before the surface temperature drops below 200 °F.
4. If the atmospheric temperature is below 70 °F, cover loads in trucks with tarpaulins. The tarpaulins must completely cover the exposed load until you transfer the mixture to the paver's hopper or to the pavement surface.

- For OGFC with modified asphalt binder except asphalt rubber binder:

1. Only spread and compact if the atmospheric temperature is at least 50 °F and the surface temperature is at least 50 °F.
2. Complete first coverage using 2 rollers before the surface temperature drops below 240 °F.
3. Complete all compaction before the surface temperature drops below 180 °F.
4. If the atmospheric temperature is below 70 °F, cover loads in trucks with tarpaulins. The tarpaulins must completely cover the exposed load until you transfer the mixture to the paver's hopper or to the pavement surface.

- For RHMA-O and RHMA-O-HB:

1. Only spread and compact if the atmospheric temperature is at least 55 °F and surface temperature is at least 60 °F.
2 Complete the 1st coverage using 2 rollers before the surface temperature drops below 280 °F.
3. Complete compaction before the surface temperature drops below 250 °F.
4. If the atmospheric temperature is below 70 °F, cover loads in trucks with tarpaulins. The tarpaulins must completely cover the exposed load until the mixture is transferred to the paver's hopper or to the pavement surface.

- For RHMA-G and OGFC, tarpaulins are not required if the time from discharge to truck until transfer to the paver's hopper or the pavement surface is less than 30 minutes.
- HMA compaction coverage is the number of passes needed to cover the paving width. A pass is 1 roller's movement parallel to the paving in either direction. Overlapping passes are part of the coverage being made and are not a subsequent coverage. Do not start a coverage until completing the prior coverage.
- Start rolling at the lower edge and progress toward the highest part.
- Perform breakdown compaction of each layer of HMA Type A, Type B, and RHMA-G with 3 coverages using a vibratory roller. The speed of the vibratory roller in miles per hour must not exceed the vibrations per minute divided by 1,000. If the HMA layer thickness is less than 0.08 foot, turn the vibrator off. The Engineer may order fewer coverages if the HMA layer thickness is less than 0.15 foot.

- Perform intermediate compaction of each layer of HMA Type A and Type B with 3 coverages using a pneumatic-tired roller at a speed not to exceed 5 mph.
- Perform finish compaction of HMA Type A, Type B, and RHMA-G with 1 coverage using a steel-tired roller.
- Compact OGFC with 2 coverages using steel-tired rollers.

39-4 QUALITY CONTROL / QUALITY ASSURANCE

39-4.01 DESCRIPTION

- If HMA is specified as Quality Control / Quality Assurance, construct it under Section 39-1, "General," this Section 39-4, "Quality Control / Quality Assurance," and Section 39-5, "Measurement and Payment."

39-4.02 GENERAL

- The QC / QA construction process consists of:

1. Establishing, maintaining, and changing if needed a quality control system providing assurance the HMA complies with the specifications
2. Sampling and testing at specified intervals, or sublots, to demonstrate compliance and to control process
3. The Engineer sampling and testing at specified intervals to verify testing process and HMA quality
4. The Engineer using test results, statistical evaluation of verified quality control tests, and inspection to accept HMA for payment

- A lot is a quantity of HMA. The Engineer designates a new lot when:

1. 20 sublots are complete
2. The JMF changes
3. Production stops for more than 30 days

- Each lot consists of no more than 20 sublots. A sublot is 750 tons except HMA paved at day's end greater than 250 tons is a sublot. If HMA paved at day's end is less than 250 tons, you may either make this quantity a sublot or include it in the previous sublot's test results for statistical evaluation.

39-4.03 CONTRACTOR QUALITY CONTROL

39-4.03A GENERAL

- Use a composite quality factor, QF_C, and individual quality factors, QF_{QCi}, to control your process and evaluate quality control program. For quality characteristics without quality factors, use your quality control plan's action limits to control process.
- Control HMA quality including:

1. Materials
2. Proportioning
3. Spreading and compacting
4. Finished roadway surface

- Develop, implement, and maintain a quality control program that includes:

1. Inspection
2. Sampling
3. Testing

39-4.03B QUALITY CONTROL PLAN

- With the JMF submittal, submit a written Quality Control Plan (QCP). The QCP must comply with the Department's Quality Control Manual for Hot Mix Asphalt Production and Placement. Discuss the QCP with the Engineer during the prepaving conference.
- The Engineer reviews each QCP within 5 business days from the submittal. Hold HMA production until the Engineer accepts the QCP in writing. The Engineer's QCP acceptance does not mean your compliance with the QCP will result in acceptable HMA. Section 39-1.05, "Engineer's Acceptance," specifies HMA acceptance.
- The QCP must include the name and qualifications of a Quality Control Manager. The Quality Control Manager administers the QCP and during paving must be at the job site within 3 hours of receiving notice. The Quality Control Manager must not be any of the following on the project:

1. Foreman
2. Production or paving crewmember
3. Inspector
4. Tester

- The QCP must include action limits and details of corrective action you will take if a test result for any quality characteristic falls outside an action limit.
- As work progresses, you must submit a written QCP supplement to change quality control procedures, personnel, tester qualification status, or laboratory accreditation status.

39-4.03C QUALITY CONTROL INSPECTION, SAMPLING, AND TESTING

- Sample, test, inspect, and manage HMA quality control.
- Provide a roadway inspector while HMA paving activities are in progress. Provide a plant inspector during HMA production.
- Inspectors must comply with the Department's Quality Control Manual for Hot Mix Asphalt Production and Placement.
- Provide a testing laboratory and personnel for quality control testing. Provide the Engineer unrestricted access to the quality control activities. Before providing services for the project, the Engineer reviews, accredits, and qualifies the testing laboratory and personnel under the Department's Independent Assurance Program.
- The minimum random sampling and testing for quality control is:

Minimum Quality Control – QC / QA

Quality Characteristic	Test Method	Min-imum Sampl-ing and Testing Frequen-cy	HMA Type			Location of Sampling	Max. Report-ing Time Allow-ance
			A	B	RHMA-G		
Aggregate gradation [a]	CT 202	1 per 750 tons	JMF ± Tolerance [b]	JMF ± Tolerance [b]	JMF ± Tolerance [b]	CT 125	24 hours
Asphalt binder content (%)	CT 379 or 382		JMF ±0.45	JMF ±0.45	JMF ±0.5	Loose Mix Behind Paver See CT 125	
Percent of maximum theoretical density (%) [c, d]	QC Plan		92 - 96	92 - 96	91 - 96	QC Plan	
Aggregate moisture content at continuous mixing plants and RAP moisture content at continuous mixing plants and batch mixing plants [e]	CT 226 or CT 370	2 per day during produc-tion	--	--	--	Stock-piles or cold feed belts	--
Sand equivalent (min.) [f]	CT 217	1 per 750 tons	47	42	47	CT 125	24 hours
HMA moisture content (%,max.)	CT 226 or CT 370	1 per 2,500 tons but not less than 1 per paving day	1.0	1.0	1.0	Loose Mix Behind Paver See CT 125	24 hours
Stabilometer Value (min.) [f, h] No. 4 and 3/8" gradings 1/2" and 3/4" gradings	CT 366	1 per 4,000 tons or 2 per 5 bus-iness days, which-ever is more	30 37	30 35	-- 23		48 hours
Air voids content (%) [f, h]	CT 367		4 ± 2	4 ± 2	Specifica-tion ± 2		

Percent of crushed particles coarse aggregate (% min.) One fractured face Two fractured faces Fine aggregate (% min) (Passing No. 4 sieve and retained on No. 8 sieve.) One fractured face	CT 205	As necessary and designated in QCP. At least once per project.	90 75 70	25 -- 20	-- 90 70	CT 125	48 hours
Los Angeles Rattler (% max.) Loss at 100 rev. Loss at 500 rev.	CT 211		12 45	-- 50	12 40	CT 125	
Fine aggregate angularity (% min.)	AASHTO T 304, Method A		Report only	Report only	Report only	CT 125	
Flat and elongated particle (% max. by mass @ 5:1)	ASTM D 4791					CT 125	
Voids filled with asphalt (%) [i] No. 4 grading 3/8" grading 1/2" grading 3/4" grading	LP-2		76.0 – 80.0 73.0 – 76.0 65.0 – 75.0 65.0 – 75.0	76.0 – 80.0 73.0 – 76.0 65.0 – 75.0 65.0 – 75.0	Report only	LP-2	
Voids in mineral aggregate (% min.) [i] No. 4 grading 3/8" grading 1/2" grading 3/4" grading	LP-3		17.0 15.0 14.0 13.0	17.0 15.0 14.0 13.0	-- -- 18.0 – 23.0 [j] 18.0 – 23.0 [j]	LP-3	
Dust proportion [i] No. 4 and 3/8" gradings 1/2" and 3/4" gradings	LP-4		0.9 – 2.0 0.6 – 1.3	0.9 – 2.0 0.6 – 1.3	Report only	LP-4	
Smoothness	Section 39-1.12	--	12-foot straight-edge, must-grind, and PI_0	12-foot straight-edge, must-grind, and PI_0	12-foot straight-edge, must-grind, and PI_0	--	
Asphalt rubber binder viscosity @ 350 °F, centipoises	Section 39-1.02D	--	--	--	1,500 – 4,000	Section 39-1.02D	24 hours
Crumb rubber modifier	Section 39-1.02D	--	--	--	Section 39-1.02D	Section 39-1.02D	48 hours

Notes:
[a] Determine combined aggregate gradation containing RAP under Laboratory Procedure LP-9.
[b] The tolerances must comply with the allowable tolerances in Section 39-1.02E, "Aggregate."

[c] Required for HMA Type A, Type B, and RHMA-G if the total paved thickness is at least 0.15 foot.
[d] Determine maximum theoretical density (California Test 309) at the frequency specified for test maximum density under California Test 375, Part 5 D.
[e] For adjusting the plant controller at the HMA plant.
[f] Report the average of 3 tests from a single split sample.
[g] Modify California Test 304, Part 2.B.2.c: "After compaction in the mechanical compactor, cool to 140 °F ± 5 °F by allowing the briquettes to cool at room temperature for 0.5 hour, then place the briquettes in the oven at 140 °F for a minimum of 2 hours and not more than 3 hours."
[h] Determine the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.
[i] Report only if the adjustment for asphalt binder content target value is less than ± 0.3 percent from OBC.
[j] Voids in mineral aggregate for RHMA-G must be within this range.

- Within the specified reporting time, submit written test results including:

1. Sampling location, quantity, and time
2. Testing results
3. Supporting data and calculations

- If test results for any quality characteristic are beyond the action limits in the QCP, take corrective actions. Document the corrective actions taken in the inspection records under Section 39-4.03E, "Records of Inspection and Testing."
- Stop production, notify the Engineer in writing, take corrective action, and demonstrate compliance with the specifications before resuming production and placement on the State highway if:

1. A lot's composite quality factor, Q_{FC}, or an individual quality factor, QF_{QCi} for i = 3, 4, or 5, is below 0.90 determined under Section 39-4.03F, "Statistical Evaluation"
2. An individual quality factor, QF_{QCi} for i = 1 or 2, is below 0.75
3. Quality characteristics for which a quality factor, QF_{QCi}, is not determined has 2 consecutive acceptance or quality control tests not in compliance with the specifications

39-4.03D CHARTS AND RECORDS

- Record sampling and testing results for quality control on forms provided in the "Quality Control Manual for Hot Mix Asphalt Production and Placement," or on forms you submit with the QCP. The QCP must also include form posting locations and submittal times.
- Submit quality control test results using the Department's statistical evaluation program, HMAPay, available at

www.dot.ca.gov/hq/construc/hma/index.htm

39-4.03E RECORDS OF INSPECTION AND TESTING

- During HMA production, submit in writing a daily:

1. HMA Construction Daily Record of Inspection. Also make this record available at the HMA plant and job site each day.
2. HMA Inspection and Testing Summary. Include in the summary:

2.1. Test forms with the testers' signatures and Quality Control Manager's initials.
2.2. Inspection forms with the inspectors' signatures and Quality Control Manager's initials.
2.3. A list and explanation of deviations from the specifications or regular practices.
2.4. A signed statement by the Quality Control Manager that says:

"It is hereby certified that the information contained in this record is accurate, and that information, tests, or calculations documented herein comply with the specifications of the contract and the standards set forth in the testing procedures. Exceptions to this certification are documented as part of this record."

• Retain for inspection the records generated as part of quality control including inspection, sampling, and testing for at least 3 years after final acceptance.

39-4.03F STATISTICAL EVALUATION

General

• Determine a lot's composite quality factor, QF_C, and the individual quality factors, QF_{QCi}. Perform statistical evaluation calculations to determine these quality factors based on quality control test results for:

1. Aggregate gradation
2. Asphalt binder content
3. Percent of maximum theoretical density

• The Engineer grants a waiver and you must use 1.0 as the individual quality factor for percent of maximum theoretical density, QF_{QC5}, for HMA paved in:

1. Areas where the total paved thickness is less than 0.15 foot
2. Areas where the total paved thickness is less than 0.20 foot and a 3/4-inch grading is specified and used
3. Dig outs
4. Leveling courses
5. Detours not part of the finished roadway prism
6. Areas where, in the opinion of the Engineer, compaction or compaction measurement by conventional methods is impeded

Statistical Evaluation Calculations

• Use the Variability-Unknown / Standard Deviation Method to determine the percentage of a lot not in compliance with the specifications. The number of significant figures used in the calculations must comply with AASHTO R-11, Absolute Method.
• Determine the percentage of work not in compliance with the specification limits for each quality characteristic as follows:

1. Calculate the arithmetic mean ($\bar{X}$) of the test values

$$\overline{X} = \frac{\Sigma x}{n}$$

where:

x = individual test values
n = number of test values

2. Calculate the standard deviation

$$s = \sqrt{\frac{n\,(\Sigma x^2)-(\Sigma x)^2}{n(n-1)}}$$

where:

$\sum(x^2)$ = sum of the squares of individual test values
$(\sum x)^2$ = sum of the individual test values squared
n = number of test values

3. Calculate the upper quality index (Qu)

$$Q_u = \frac{USL - \overline{X}}{s}$$

where:

USL = target value plus the production tolerance or upper specification limit
s = standard deviation
$\overline{X}$ = arithmetic mean

4. Calculate the lower quality index (QL);

$$Q_L = \frac{\overline{X} - LSL}{s}$$

where:

LSL = target value minus production tolerance or lower specification limit
s = standard deviation
$\overline{X}$ = arithmetic mean

5. From the table, Upper Quality Index Q_U or Lower Quality Index Q_L, of this Section 39-4.03F, "Statistical Evaluation", determine P_U ;

where:

P_U = the estimated percentage of work outside the USL.
P_U = 0, when USL is not specified.

6. From the table, Upper Quality Index Q_U or Lower Quality Index Q_L, of this Section 39-4.03F, "Statistical Evaluation," determine P_L;

where:

P_L = the estimated percentage of work outside the LSL.

$P_L = 0$, when LSL is not specified.

7. Calculate the total estimated percentage of work outside the USL and LSL, percent defective

   Percent defective = $P_U + P_L$

- P_U and P_L are determined from:

P_U or P_L	**Upper Quality Index Q_U or Lower Quality Index Q_L** Sample Size (n)												
	5	6	7	8	9	10-11	12-14	15-17	18-22	23-29	30-42	43-66	>66
0	1.72	1.88	1.99	2.07	2.13	2.20	2.28	2.34	2.39	2.44	2.48	2.51	2.56
1	1.64	1.75	1.82	1.88	1.91	1.96	2.01	2.04	2.07	2.09	2.12	2.14	2.16
2	1.58	1.66	1.72	1.75	1.78	1.81	1.84	1.87	1.89	1.91	1.93	1.94	1.95
3	1.52	1.59	1.63	1.66	1.68	1.71	1.73	1.75	1.76	1.78	1.79	1.80	1.81
4	1.47	1.52	1.56	1.58	1.60	1.62	1.64	1.65	1.66	1.67	1.68	1.69	1.70
5	1.42	1.47	1.49	1.51	1.52	1.54	1.55	1.56	1.57	1.58	1.59	1.59	1.60
6	1.38	1.41	1.43	1.45	1.46	1.47	1.48	1.49	1.50	1.50	1.51	1.51	1.52
7	1.33	1.36	1.38	1.39	1.40	1.41	1.41	1.42	1.43	1.43	1.44	1.44	1.44
8	1.29	1.31	1.33	1.33	1.34	1.35	1.35	1.36	1.36	1.37	1.37	1.37	1.38
9	1.25	1.27	1.28	1.28	1.29	1.29	1.30	1.30	1.30	1.31	1.31	1.31	1.31
10	1.21	1.23	1.23	1.24	1.24	1.24	1.25	1.25	1.25	1.25	1.25	1.26	1.26
11	1.18	1.18	1.19	1.19	1.19	1.19	1.20	1.20	1.20	1.20	1.20	1.20	1.20
12	1.14	1.14	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
13	1.10	1.10	1.10	1.10	1.10	1.10	1.11	1.11	1.11	1.11	1.11	1.11	1.11
14	1.07	1.07	1.07	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
15	1.03	1.03	1.03	1.03	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
16	1.00	0.99	0.99	0.99	0.99	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
17	0.97	0.96	0.95	0.95	0.95	0.95	0.94	0.94	0.94	0.94	0.94	0.94	0.94
18	0.93	0.92	0.92	0.92	0.91	0.91	0.91	0.91	0.90	0.90	0.90	0.90	0.90
19	0.90	0.89	0.88	0.88	0.88	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
20	0.87	0.86	0.85	0.85	0.84	0.84	0.84	0.83	0.83	0.83	0.83	0.83	0.83
21	0.84	0.82	0.82	0.81	0.81	0.81	0.80	0.80	0.80	0.80	0.80	0.80	0.79
22	0.81	0.79	0.79	0.78	0.78	0.77	0.77	0.77	0.76	0.76	0.76	0.76	0.76
23	0.77	0.76	0.75	0.75	0.74	0.74	0.74	0.73	0.73	0.73	0.73	0.73	0.73
24	0.74	0.73	0.72	0.72	0.71	0.71	0.70	0.70	0.70	0.70	0.70	0.70	0.70
25	0.71	0.70	0.69	0.69	0.68	0.68	0.67	0.67	0.67	0.67	0.67	0.67	0.66
26	0.68	0.67	0.67	0.65	0.65	0.65	0.64	0.64	0.64	0.64	0.64	0.64	0.63
27	0.65	0.64	0.63	0.62	0.62	0.62	0.61	0.61	0.61	0.61	0.61	0.61	0.60
28	0.62	0.61	0.60	0.59	0.59	0.59	0.58	0.58	0.58	0.58	0.58	0.58	0.57
29	0.59	0.58	0.57	0.57	0.56	0.56	0.55	0.55	0.55	0.55	0.55	0.55	0.54
30	0.56	0.55	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.52	0.52	0.52	0.52
31	0.53	0.52	0.51	0.51	0.50	0.50	0.50	0.49	0.49	0.49	0.49	0.49	0.49
32	0.50	0.49	0.48	0.48	0.48	0.47	0.47	0.47	0.46	0.46	0.46	0.46	0.46
33	0.47	0.48	0.45	0.45	0.45	0.44	0.44	0.44	0.44	0.43	0.43	0.43	0.43
34	0.45	0.43	0.43	0.42	0.42	0.42	0.41	0.41	0.41	0.41	0.41	0.41	0.40
35	0.42	0.40	0.40	0.39	0.39	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38
36	0.39	0.38	0.37	0.37	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
37	0.36	0.35	0.34	0.34	0.34	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.32
38	0.33	0.32	0.32	0.31	0.31	0.31	0.30	0.30	0.30	0.30	0.30	0.30	0.30
39	0.30	0.30	0.29	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
40	0.28	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
41	0.25	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
42	0.23	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
43	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
44	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
45	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
46	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
47	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
48	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
49	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1. If the value of Q_U or Q_L does not correspond to a value in the table, use the next lower value.
2. If Q_U or Q_L are negative values, P_U or P_L is equal to 100 minus the table value for P_U or P_L.

Quality Factor Determination

- Determine individual quality factors, QF_{QCi}, using percent defective = $P_U + P_L$ and:

Quality Factors

Quality Factor	Maximum Allowable Percent Defective ($P_U + P_L$) Sample Size (n)												
	5	6	7	8	9	10-11	12-14	15-17	18-22	23-29	30-42	43-66	>66
1.05				0	0	0	0	0	0	0	0	0	0
1.04			0	1	3	5	4	4	4	3	3	3	3
1.03		0	2	4	6	8	7	7	6	5	5	4	4
1.02		1	3	6	9	11	10	9	8	7	7	6	6
1.01	0	2	5	8	11	13	12	11	10	9	8	8	7
1.00	22	20	18	17	16	15	14	13	12	11	10	9	8
0.99	24	22	20	19	18	17	16	15	14	13	11	10	9
0.98	26	24	22	21	20	19	18	16	15	14	13	12	10
0.97	28	26	24	23	22	21	19	18	17	16	14	13	12
0.96	30	28	26	25	24	22	21	19	18	17	16	14	13
0.95	32	29	28	26	25	24	22	21	20	18	17	16	14
0.94	33	31	29	28	27	25	24	22	21	20	18	17	15
0.93	35	33	31	29	28	27	25	24	22	21	20	18	16
0.92	37	34	32	31	30	28	27	25	24	22	21	19	18
0.91	38	36	34	32	31	30	28	26	25	24	22	21	19
0.90	39	37	35	34	33	31	29	28	26	25	23	22	20
0.89	41	38	37	35	34	32	31	29	28	26	25	23	21
0.88	42	40	38	36	35	34	32	30	29	27	26	24	22
0.87	43	41	39	38	37	35	33	32	30	29	27	25	23
0.86	45	42	41	39	38	36	34	33	31	30	28	26	24
0.85	46	44	42	40	39	38	36	34	33	31	29	28	25
0.84	47	45	43	42	40	39	37	35	34	32	30	29	27
0.83	49	46	44	43	42	40	38	36	35	33	31	30	28
0.82	50	47	46	44	43	41	39	38	36	34	33	31	29
0.81	51	49	47	45	44	42	41	39	37	36	34	32	30
0.80	52	50	48	46	45	44	42	40	38	37	35	33	31
0.79	54	51	49	48	46	45	43	41	39	38	36	34	32
0.78	55	52	50	49	48	46	44	42	41	39	37	35	33
0.77	56	54	52	50	49	47	45	43	42	40	38	36	34
0.76	57	55	53	51	50	48	46	44	43	41	39	37	35
0.75	58	56	54	52	51	49	47	46	44	42	40	38	36
	60	57	55	53	52	51	48	47	45	43	41	40	37
	61	58	56	55	53	52	50	48	46	44	43	41	38
Reject	62	59	57	56	54	53	51	49	47	45	44	42	39
	63	61	58	57	55	54	52	50	48	47	45	43	40
	64	62	60	58	57	55	53	51	49	48	46	44	41
Reject Values Greater Than Those Shown Above													

Notes:

1. To obtain a quality factor when the estimated percent outside specification limits from table, "Upper Quality Index Q_U or Lower Quality Index Q_L," does not correspond to a value in the table, use the next larger value.

Compute the composite of single quality factors, QF_C, for a lot using:

$$QF_C = \sum_{i=1}^{5} w_i \, QF_{QC_i}$$

where:

QF_C = the composite quality factor for the lot rounded to 2 decimal places.
QF_{QCi} = the quality factor for the individual quality characteristic.
w = the weighting factor listed in the table HMA Acceptance – QC / QA.
i = the quality characteristic index number in the table HMA Acceptance – QC / QA.

39-4.04 ENGINEER'S QUALITY ASSURANCE

39-4.04A GENERAL

- The Engineer assures quality by:

1. Reviewing mix designs and proposed JMF
2. Inspecting procedures
3. Conducting oversight of quality control inspection and records
4. Verification sampling and testing during production and paving

39-4.04B VERIFICATION SAMPLING AND TESTING

General

- The Engineer samples:

1. Aggregate to verify gradation
2. HMA to verify asphalt binder content

Verification

- For aggregate gradation and asphalt binder content, the ratio of verification testing frequency to the minimum quality control testing frequency is 1:5. The Engineer performs at least 3 verification tests per lot.
- Using the t-test, the Engineer compares quality control tests results for aggregate gradation and asphalt binder content with corresponding verification test results. The Engineer uses the average and standard deviation of up to 20 sequential sublots for the comparison. When there are less than 20 sequential sublots, the Engineer uses the maximum number of sequential sublots available. The 21st sublot becomes the 1st sublot (n = 1) in the next lot.
- The t-value for a group of test data is computed as follows:

$$t = \frac{|\overline{X}_c - \overline{X}_v|}{S_p\sqrt{\frac{1}{n_c} + \frac{1}{n_v}}} \qquad \text{and} \qquad S_p^2 = \frac{S_c^2(n_c - 1) + S_v^2(n_v - 1)}{n_c + n_v - 2}$$

where:

n_c = Number of quality control tests (2 minimum, 20 maximum).
n_v = Number of verification tests (minimum of 1 required).
$\overline{X}_c$ = Mean of quality control tests.
$\overline{X}_v$ = Mean of verification tests.
S_p = Pooled standard deviation (When $n_v = 1$, $S_p = S_c$).
S_c = Standard deviation of quality control tests.
S_v = Standard deviation of verification tests (when $n_v > 1$).

- The comparison of quality control test results and the verification test results is at a level of significance of $\alpha = 0.025$. The Engineer computes t and compares it to the critical t-value, t_{crit}, from:

Critical T-Value

Degrees of freedom (n_c+n_v-2)	t_{crit} (for $\alpha = 0.025$)	Degrees of freedom (n_c+n_v-2)	t_{crit} (for $\alpha = 0.025$)
1	24.452	18	2.445
2	6.205	19	2.433
3	4.177	20	2.423
4	3.495	21	2.414
5	3.163	22	2.405
6	2.969	23	2.398
7	2.841	24	2.391
8	2.752	25	2.385
9	2.685	26	2.379
10	2.634	27	2.373
11	2.593	28	2.368
12	2.560	29	2.364
13	2.533	30	2.360
14	2.510	40	2.329
15	2.490	60	2.299
16	2.473	120	2.270
17	2.458	∞	2.241

- If the t-value computed is less than or equal to t_{crit}, quality control test results are verified.
- If the t-value computed is greater than t_{crit} and both $\overline{X}_v$ and $\overline{X}_c$ comply with acceptance specifications, the quality control tests are verified. You may continue to produce and place HMA with the following allowable differences:

1. $\left|\overline{X}_v - \overline{X}_c\right| \leq 1.0$ percent for any grading
2. $\left|\overline{X}_v - \overline{X}_c\right| \leq 0.1$ percent for asphalt binder content

- If the t-value computed is greater than t_{crit} and the $\left|\overline{X}_v - \overline{X}_c\right|$ for grading and asphalt binder content are greater than the allowable differences, quality control test results are not verified and:

1. The Engineer notifies you in writing.
2. You and the Engineer must investigate why the difference exist.

3. If the reason for the difference cannot be found and corrected, the Engineer's test results are used for acceptance and pay.

39-4.05 ENGINEER'S ACCEPTANCE

39-4.05A TESTING

- The Engineer samples for acceptance testing and tests for:

HMA Acceptance – QC / QA

Index (i)	Quality Characteristic				Weight-ing Factor (w)	Test Method	HMA Type		
							A	B	RHMA-G
		Aggregate gradation [a]							
	Sieve	3/4"	1/2"	3/8"					
1	1/2"	X [b]	--	--	0.05	CT 202	JMF ± Tolerance [c]		
1	3/8"	--	X	--	0.05				
1	No. 4	--	--	X	0.05				
2	No. 8	X	X	X	0.10				
3	No. 200	X	X	X	0.15				
4	Asphalt binder content (%)				0.30	CT 379 or 382	JMF ± 0.45	JMF ± 0.45	JMF ± 0.5
5	Percent of maximum theoretical density (%) [d, e]				0.40	CT 375	92 – 96	92 – 96	91 – 96
	Sand equivalent (min.) [f]					CT 217	47	42	47
	Stabilometer value (min.) [f, g]					CT 366			
	No. 4 and 3/8" gradings						30	30	--
	1/2" and 3/4" gradings						37	35	23
	Air voids content (%) [f, h]					CT 367	4 ± 2	4 ± 2	Specification ± 2
	Percent of crushed particles coarse aggregate (% min.)					CT 205			
	One fractured face						90	25	--
	Two fractured faces						70	--	90
	Fine aggregate (% min)								
	(Passing No. 4 sieve and retained on No. 8 sieve.)								
	One fractured face						70	20	70
	HMA moisture content (%, max.)					CT 226 or CT 370	1.0	1.0	1.0
	Los Angeles Rattler (% max.)					CT 211			
	Loss at 100 rev.						12	--	12
	Loss at 500 rev.						45	50	45
	Fine aggregate angularity (% min.)					AASHTO T 304, Method A	Report only	Report only	Report only
	Flat and elongated particle (% max. by mass @ 5:1)					ASTM D 4791	Report only	Report only	Report only
	Voids in mineral aggregate (% min.) [i]								(Note j)
	No. 4 grading						17.0	17.0	--
	3/8" grading					LP-2	15.0	15.0	--
	1/2" grading						14.0	14.0	18.0 - 23.0
	3/4" grading						13.0	13.0	18.0 - 23.0
	Voids filled with asphalt (%) [i]								
	No. 4 grading					LP-3	76.0 - 80.0	76.0 - 80.0	Report only
	3/8" grading						73.0 - 76.0	73.0 - 76.0	
	1/2" grading						65.0 - 75.0	65.0 - 75.0	
	3/4" grading						65.0 - 75.0	65.0 - 75.0	
	Dust proportion [i]					LP-4			
	No. 4 and 3/8" gradings						0.9 - 2.0	0.9 – 2.0	Report only
	1/2" and 3/4" gradings						0.6 - 1.3	0.6 – 1.3	

	Smoothness		Section 39-1.12	12-foot straight-edge, must-grind, and PI_0	12-foot straight-edge, must-grind, and PI_0	12-foot straight-edge, must-grind, and PI_0
	Asphalt binder		Various	Section 92	Section 92	Section 92
	Asphalt rubber binder		Various	--	--	Section 92-1.02(C) and Section 39-1.02D
	Asphalt modifier		Various	--	--	Section 39-1.02D
	Crumb rubber modifier		Various	--	--	Section 39-1.02D

Notes:
[a] The Engineer determines combined aggregate gradations containing RAP under Laboratory Procedure LP-9.
[b] "X" denotes the sieves the Engineer considers for the specified aggregate gradation.
[c] The tolerances must comply with the allowable tolerances in Section 39-1.02E, "Aggregate."
[d] The Engineer determines percent of maximum theoretical density if the total paved thickness is at least 0.15 foot under California Test 375 except the Engineer uses:

1. California Test 308, Method A, to determine in-place density of each core instead of using the nuclear gauge in Part 4, "Determining In-Place Density By The Nuclear Density Device."
2. California Test 309 to determine maximum theoretical density instead of calculating test maximum density in Part 5, "Determining Test Maximum Density."

[e] The Engineer determines maximum theoretical density (California Test 309) at the frequency specified for Test Maximum Density under California Test 375, Part 5.D.
[f] The Engineer reports the average of 3 tests from a single split sample.
[g] Modify California Test 304, Part 2.B.2.c: "After compaction in the mechanical compactor, cool to 140 °F ± 5 °F by allowing the briquettes to cool at room temperature for 0.5 hour, then place the briquettes in the oven at 140 °F for a minimum of 2 hours and not more than 3 hours."
[h] The Engineer determines the bulk specific gravity of each lab-compacted briquette under California Test 308, Method A, and theoretical maximum specific gravity under California Test 309.
[i] Report only if the adjustment for asphalt binder content target value is less than ± 0.3 percent from OBC.
[j] Voids in mineral aggregate for RHMA-G must be within this range.

- The Engineer determines the percent of maximum theoretical density from the average density of 3 cores you take from every 750 tons of production or part thereof divided by the maximum theoretical density.
- If the total paved thickness is at least 0.15 foot and any layer is less than 0.15 foot, the Engineer determines the percent of maximum theoretical density from cores taken from the final layer measured the full depth of the total paved HMA thickness.
- The Engineer stops production and terminates a lot if:

1. The lot's composite quality factor, Q_{FC}, or an individual quality factor, QF_{QCi} for i = 3, 4, or 5, is below 0.90 determined under Section 39-4.03F, "Statistical Evaluation"
2. An individual quality factor, QF_{QCi} for i = 1 or 2, is below 0.75
3. Quality characteristics for which a quality factor, QF_{QCi}, is not determined has 2 consecutive acceptance or quality control tests not in compliance with the specifications

• For any single quality characteristic for which a quality factor, QF_{QCi}, is not determined, except smoothness, if 2 consecutive acceptance test results do not comply with specifications:

1. Stop production.
2. Take corrective action.
3. In the Engineer's presence, take samples and split each sample into 4 parts. Test 1 part for compliance with the specifications and submit 3 parts to the Engineer. The Engineer tests 1 part for compliance with the specifications and reserves and stores 2 parts.
4. Demonstrate compliance with the specifications before resuming production and placement on the State highway.

39-4.05B STATISTICAL EVALUATION, DETERMINATION OF QUALITY FACTORS AND ACCEPTANCE

Statistical Evaluation and Determination of Quality Factors

• To determine the individual quality factor, $QF_{QCi,}$ for any quality factor i = 1 through 5 or a lot's composite quality factor, QF_C, for acceptance and payment adjustment, the Engineer uses the evaluation specifications under Section 39-4.03F, "Statistical Evaluation," and:

1. Verified quality control test results for aggregate gradation
2. Verified quality control test results for asphalt binder content
3. The Engineer's test results for percent of maximum theoretical density

Lot Acceptance Based on Quality Factors

• The Engineer accepts a lot based on the quality factors determined for aggregate gradation and asphalt binder content, QF_{QCi} for i = 1 through 4, using the total number of verified quality control test result values and the total percent defective ($P_U + P_L$).
• The Engineer accepts a lot based on the quality factor determined for maximum theoretical density, QF_{QC5}, using the total number of test result values from cores and the total percent defective ($P_U + P_L$).
• The Engineer calculates the quality factor for the lot, QF_C, which is a composite of weighted individual quality factors, QF_{QCi}, determined for each quality characteristic in the table "HMA Acceptance – QC / QA" in Section 39-4.05A, "Testing."
• The Engineer accepts a lot based on quality factors if:

1. The current composite quality factor, QF_C, is 0.90 or greater
2. Each individual quality factor, QF_{QCi} for i = 3, 4, and 5, is 0.90 or greater
3. Each individual quality factor, QF_{QCi} for i = 1 and 2, is 0.75 or greater

• No single quality characteristic test may represent more than the smaller of 750 tons or 1 day's production.

Payment Adjustment

• If a lot is accepted, the Engineer adjusts payment with the following formula:

$$PA = \sum_{i=1}^{n} HMACP * wi * \left[QFQCi * (HMATT - WHMATTi) + WHMATTi\right] - (HMACP * HMATT)$$

where:

PA =	Payment adjustment rounded to 2 decimal places.
HMACP =	HMA contract price.
HMATT =	HMA total tons represented in the lot.
$WHMATT_i$ =	Total tons of waived quality characteristic HMA.
QF_{QCi} =	Running quality factor for the individual quality characteristic. QF_{QCi} for i = 1 through 4 must be from verified Contractor's QC results. QF_{QC5} must be determined from the Engineer's results on cores taken for percent of maximum theoretical density determination.
w =	Weighting factor listed in the HMA acceptance table.
i =	Quality characteristic index number in the HMA acceptance table.

- If the payment adjustment is a negative value, the Engineer deducts this amount from payment. If the payment adjustment is a positive value, the Engineer adds this amount to payment.
- The 21st sublot becomes the 1st sublot (n = 1) in the next lot. When the 21st sequential sublot becomes the 1st sublot, the previous 20 sequential sublots become a lot for which the Engineer determines a quality factor. The Engineer uses this quality factor to pay for the HMA in the lot. If the next lot consists of less than 8 sublots, these sublots must be added to the previous lot for quality factor determination using 21 to 27 sublots.

39-4.05C DISPUTE RESOLUTION

- For a lot, if you or the Engineer dispute any quality factor, QF_{QCi}, or verification test result, every sublot in that lot must be retested.
- Referee tests must be performed under the specifications for acceptance testing.
- Any quality factor, QF_{QCi}, must be determined using the referee tests.
- For any quality factor, QF_{QCi}, for i = 1 through 5, dispute resolution:

1. If the difference between the quality factors for QF_{QCi} using the referee test result and the disputed test result is less than or equal to 0.01, the original test result is correct.
2. If the difference between the quality factor for QF_{QCi} using the referee test result and the disputed test result is more than 0.01, the quality factor determined from the referee tests supersedes the previously determined quality factor.

39-5 MEASUREMENT AND PAYMENT

39-5.01 MEASUREMENT

- The contract item for HMA is measured by weight. The weight of each HMA mixture designated in the Engineer's Estimate must be the combined mixture weight.
- If tack coat, asphalt binder, and asphaltic emulsion are paid with separate contract items, their contract items are measured under Section 92, "Asphalts," or Section 94, "Asphaltic Emulsions," as the case may be.

• If recorded batch weights are printed automatically, the contract item for HMA is measured by using the printed batch weights, provided:

1. Total aggregate and supplemental fine aggregate weight per batch is printed. If supplemental fine aggregate is weighed cumulatively with the aggregate, the total aggregate batch weight must include the supplemental fine aggregate weight.
2. Total asphalt binder weight per batch is printed.
3. Each truckload's zero tolerance weight is printed before weighing the first batch and after weighing the last batch.
4. Time, date, mix number, load number and truck identification is correlated with a load slip.
5. A copy of the recorded batch weights is certified by a licensed weighmaster and submitted to the Engineer.

• The contract item for placing HMA dike is measured by the linear foot along the completed length. The contract item for placing HMA in miscellaneous areas is measured as the in-place compacted area in square yards. In addition to the quantities measured on a linear foot or square yard basis, the HMA for dike and miscellaneous areas are measured by weight.
• The contract item for shoulder rumble strips is measured by the station along each shoulder on which the rumble strips are constructed without deductions for gaps between indentations.
• The contract item for geosynthetic pavement interlayer is measured by the square yard for the actual pavement area covered.

39-5.02 PAYMENT

• The contract prices paid per ton for hot mix asphalt as designated in the Engineer's Estimate include full compensation for furnishing all labor, materials, tools, equipment, and incidentals for doing all the work involved in constructing hot mix asphalt, complete in place, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.
• If HMA is specified to comply with Section 39-4, "Quality Control / Quality Assurance," the Engineer adjusts payment under that section.
• Full compensation for the Quality Control Plan and prepaving conference is included in the contract prices paid per ton for hot mix asphalt as designated in the Engineer's Estimate and no additional compensation will be allowed therefor.
• Full compensation for performing and submitting mix designs and for Contractor sampling, testing, inspection, testing facilities, and preparation and submittal of results is included in the contract prices paid per ton for HMA as designated in the Engineer's Estimate and no additional compensation will be allowed therefor.
• Full compensation for reclaimed asphalt pavement is included in the contract prices paid per ton for HMA as designated in the Engineer's Estimate and no additional compensation will be allowed therefor.
• The contract price paid per ton for hot mix asphalt (leveling) includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals for doing all the work involved in hot mix asphalt (leveling), complete in place, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.
• The contract prices paid per station for rumble strips as designated in the Engineer's Estimate include full compensation for furnishing all labor, materials, tools, equipment, and

incidentals for doing all the work involved in constructing rumble strips, including fog seal coat, complete in place, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

- The State will pay for HMA dike at the contract price per linear foot for place HMA dike and by the ton for HMA. The contract prices paid per linear foot for place hot mix asphalt dike as designated in the Engineer's Estimate include full compensation for furnishing all labor, tools, equipment, and incidentals, and for doing all the work involved in placing HMA dike, complete in place, including excavation, backfill, and preparation of the area to receive the dike, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.
- The State pays for HMA specified to be a miscellaneous area at the contract price per square yard for place hot mix asphalt (miscellaneous area) and per ton for hot mix asphalt. The contract price paid per square yard for place hot mix asphalt (miscellaneous area) includes full compensation for furnishing all labor, tools, equipment, and incidentals, and for doing all the work involved in placing HMA (miscellaneous area) complete in place, including excavation, backfill, and preparation of the area to receive HMA (miscellaneous area), as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.
- If the Quality Control / Quality Assurance construction process is specified, HMA placed in dikes and miscellaneous areas is paid for at the contract price per ton for hot mix asphalt under Section 39-4, "Quality Control / Quality Assurance." Section 39-4.05B, "Statistical Evaluation, Determination of Quality Factors and Acceptance," does not apply to HMA placed in dikes and miscellaneous areas.
- If there are no contract items for place hot mix asphalt dike and place hot mix asphalt (miscellaneous area) and the work is specified, full compensation for constructing HMA dikes and HMA (miscellaneous areas) including excavation, backfill, and preparation of the area to receive HMA dike or HMA (miscellaneous area) is included in the contract price paid per ton for the hot mix asphalt designated in the Engineer's Estimate and no separate payment will be made therefor.
- The contract price paid per square yard for geosynthetic pavement interlayer includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in placing geosynthetic pavement interlayer, complete in place, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.
- The contract price paid per ton for paving asphalt (binder, geosynthetic pavement interlayer) includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in applying paving asphalt (binder, geosynthetic pavement interlayer), complete in place, including spreading sand to cover exposed binder material, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.
- Full compensation for small quantities of HMA placed on geosynthetic pavement interlayer to prevent displacement during construction is included in the contract price paid per ton for the HMA being paved over the interlayer and no separate payment will be made therefor.
- The contract price paid per ton for tack coat includes full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in applying tack coat, complete in place, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

- If there is no item for tack coat and the work is specified, full compensation for tack coat is included in the contract price paid per ton for hot mix asphalt as designated in the Engineer's Estimate and no separate payment will be made therefor.
- The Engineer does not adjust payment for increases or decreases in the quantities for tack coat, regardless of the reason for the increase or decrease. Section 4-1.03B, "Increased or Decreased Quantities," does not apply to the items for tack coat.
- Full compensation for performing smoothness testing, submitting written and electronic copies of tests, and performing corrective work including applying fog seal coat is included in the contract price paid per ton for the HMA designated in the Engineer's Estimate and no separate payment will be made therefor.
- Full compensation for spreading sand on RHMA-G, RHMA-O, and RHMA-O-HB surfaces and for sweeping and removing excess sand is included in the contract price paid per ton for rubberized hot mix asphalt as designated in the Engineer's Estimate and no separate payment will be made therefor.
- If the Engineer fails to comply with a specification within a specified time, and if, in the opinion of the Engineer, work completion is delayed because of the failure, the Engineer adjusts payment and contract time under Section 8-1.09, "Right of Way Delays."
- If the dispute resolution ITP determines the Engineer's test results are correct, the Engineer deducts the ITP's testing costs from payments. If the ITP determines your test results are correct, the State pays the ITP's testing costs. If, in the Engineer's opinion, work completion is delayed because of incorrect Engineer test results, the Engineer adjusts payment and contract time under Section 8-1.09, "Right of Way Delays."

SECTION 40: PORTLAND CEMENT CONCRETE PAVEMENT

Issue Date: January 5, 2007

Section 40-1.015, "Cement Content," is deleted.

Section 40-1.05, "Proportioning," of the State Standard Specifications is amended to read:

- Aggregate and cementitious material proportioning shall conform to the provisions in Section 90-5, "Proportioning."

The first paragraph in Section 40-1.105, "Exit Ramp Termini," of the State Standard Specifications is amended to read:

- Concrete pavement shall be constructed at the ends of exit ramps when required by the plans or the special provisions. Texturing for exit ramp termini shall be by means of heavy brooming in a direction normal to ramp centerline. The hardened surface shall have a coefficient of friction not less than 0.35 as determined by California Test 342. Minimum cementitious material content of concrete in pavement for exit ramp termini shall be 590 pounds per cubic yard.

The first paragraph in Section 40-1.14, "Payment," of the State Standard Specifications is amended to read:

• The contract price paid per cubic yard for concrete pavement shall include full compensation for furnishing all labor, materials (including cementitious material in the amount specified), tools, equipment, and incidentals, and for doing all the work involved in constructing the portland cement concrete pavement, complete in place, as shown on the plans, and as specified in these specifications and the special provisions, and as directed by the Engineer.

SECTION 41: PAVEMENT SUBSEALING AND JACKING

Issue Date: January 5, 2007

The second paragraph of Section 41-1.02, "Materials," of the State Standard Specifications is amended to read:

• Cement for grout shall be Type II portland cement conforming to the provisions in Section 90-2.01A, "Cement."

The third paragraph of Section 41-1.02, "Materials," of the State Standard Specifications is amended to read:

• Fly ash shall conform to the requirements in AASHTO Designation: M 295 for either Class C or for Class F. The brand of fly ash used in the work shall conform to the provisions for approval of admixture brands in Section 90-4.03, "Admixture Approval."

The fifth paragraph of Section 41-1.02, "Materials," of the State Standard Specifications is amended to read:

• Chemical admixtures and calcium chloride may be used. Chemical admixtures in the grout mix shall conform to the provisions in Section 90-4, "Admixtures." Calcium chloride shall conform to ASTM Designation: D 98.

SECTION 49: PILING

Issue Date: January 5, 2007

The first sentence of the sixth paragraph of Section 49-1.03, "Determination of Length," of the State Standard Specifications is amended to read:

• Indicator compression pile load testing shall conform to the requirements in ASTM Designation: D 1143-81.

The first sentence of the seventh paragraph of Section 49-1.03, "Determination of Length," of the State Standard Specifications is amended to read:

• Indicator tension pile load testing shall conform to the requirements in ASTM Designation: D 3689-90.

The sixth paragraph in Section 49-1.04, "Load Test Piles," of the State Standard Specifications is amended to read:

• The Contractor may use additional cementitious material in the concrete for the load test and anchor piles.

SECTION 50: PRESTRESSING CONCRETE

Issue Date: April 4, 2008

The 2nd paragraph in Section 50-1.07, "Ducts," of the State Standard Specifications is amended to read:

• Ducts shall be fabricated with either welded or interlocked seams. Galvanizing of the welded seam will not be required. Ducts shall have sufficient strength to maintain their correct alignment during placing of concrete. Joints between sections of duct shall be positive metallic connections which do not result in angle changes at the joints. Waterproof tape shall be used at the connections. Ducts shall be bent without crimping or flattening. Transition couplings connecting the ducts to anchoring devices shall be either ferrous metal or polyolefin. Ferrous metal transition couplings need not be galvanized.

The 3rd paragraph in Section 50-1.05, "Prestressing Steel," of the State Standard Specifications is amended by deleting item A.

The seventh paragraph in Section 50-1.07, "Ducts," of the State Standard Specifications is amended to read:

• All ducts with a total length of 400 feet or more shall be vented. Vents shall be placed at intervals of not more than 400 feet and shall be located within 6 feet of every high point in the duct profile. Vents shall be 1/2 inch minimum diameter standard pipe or suitable plastic pipe. Connections to ducts shall be made with metallic or plastic structural fasteners. Plastic components, if selected, shall not react with the concrete or enhance corrosion of the prestressing steel and shall be free of water soluble chlorides. The vents shall be mortar tight, taped as necessary, and shall provide means for injection of grout through the vents and for sealing the vents. Ends of vents shall be removed one inch below the roadway surface after grouting has been completed.

Item B of the eleventh paragraph in Section 50-1.08, "Prestressing," of the State Standard Specifications is amended to read:

B. When the concrete is designated by class or cementitious material content, either the concrete compressive strength shall have reached the strength shown on the plans at the time of stressing or at least 28 days shall have elapsed since the last concrete to be prestressed has been placed, whichever occurs first.

The second and third paragraphs in Section 50-1.09, "Bonding and Grouting," of the State Standard Specifications are amended to read:

- Grout shall consist of cement and water and may contain an admixture if approved by the Engineer.
- Cement shall conform to the provisions in Section 90-2.01A, "Cement."

The first paragraph in Section 50-1.11, "Payment," of the State Standard Specifications is amended to read:

- No separate payment will be made for pretensioning precast concrete members. Payment for pretensioning precast concrete members shall be considered as included in the contract price paid for furnish precast members as provided for in Section 51, "Concrete Structures."

SECTION 51: CONCRETE STRUCTURES

Issue Date: October 5, 2007

The first sentence of the eleventh paragraph of Section 51-1.05, "Forms," of the State Standard Specifications is amended to read:

- Form panels for exposed surfaces shall be furnished and placed in uniform widths of not less than 3 feet and in uniform lengths of not less than 6 feet, except at the end of continuously formed surfaces where the final panel length required is less than 6 feet.

The first sentence of the eleventh paragraph of Section 51-1.06C, "Removing Falsework," of the State Standard Specifications is amended to read:

- Falsework for box culverts and other structures with decks lower than the roadway pavement and with span lengths of 14 feet or less shall not be released until the last placed concrete has attained a compressive strength of 1,600 psi, provided that curing of the concrete is not interrupted.

The fourth paragraph in Section 51-1.12D, "Sheet Packing, Preformed Pads, and Board Fillers," of the State Standard Specifications is amended to read:

- Expanded polystyrene shall be a commercially available polystyrene board. Expanded polystyrene shall have a minimum flexural strength of 35 psi determined in conformance with the requirements in ASTM Designation: C 203 and a compressive yield strength of between 16 and 40 psi at 5 percent compression. Surfaces of expanded polystyrene against which concrete is placed shall be faced with hardboard. Hardboard shall be 1/8 inch minimum thickness, conforming to ANSI A135.4, any class. Other facing materials may be used provided they furnish equivalent protection. Boards shall be held in place by nails, waterproof adhesive, or other means approved by the Engineer.

The 3rd paragraph of Section 51-1.12F, "Sealed Joints," of the State Standard Specifications is amended to read:

• Type A and AL joint seals shall consist of a groove in the concrete that is filled with field-mixed silicone sealant.

The table in the 6th paragraph of Section 51-1.12F, "Sealed Joints," of the State Standard Specifications is amended to read:

Movement Rating (MR)	Seal Type
MR ≤ 1 inch	Type A or Type B
1 inch < MR ≤ 2 inches	Type B
2 inches < MR ≤ 4 inches	Joint Seal Assembly (Strip Seal)
MR > 4 inches	Joint Seal Assembly (Modular Unit) or Seismic Joint

The 1st paragraph of Section 51-1.12F(3)(a), "Type A and AL Seal, " of the State Standard Specifications is amended to read:

• The sealant must consist of a 2-component silicone sealant that will withstand up to ±50 percent movement.

The 2nd paragraph of Section 51-1.12F(3)(a), "Type A and AL Seal," of the State Standard Specifications is amended to read:

• Silicone sealants must be tested under California Test 435 and must comply with the following:

Specification	Requirement
Modulus at 150 percent elongation	8–75 psi
Recovery	21/32 inch max.
Notch Test	Notched or loss of bond 1/4 inch, max.
Water Resistance	Notched or loss of bond 1/4 inch, max.
Ultraviolet Exposure ASTM Designation: G 154, Table X2.1,Cycle 2.	No more than slight checking or cracking.
Cone Penetration	4.5-12.0 mm

The 3rd paragraph of Section 51-1.12F(3)(a), "Type A and AL Seal," of the State Standard Specifications is deleted.

The 8th paragraph of Section 51-1.12F(3)(a), "Type A and AL Seal," of the State Standard Specifications is deleted.

The 10th paragraph of Section 51-1.12F(3)(a), "Type A and AL Seal," of the State Standard Specifications is amended to read:

• A Certificate of Compliance accompanied by a certified test report must be furnished for each batch of silicone sealant in conformance with the provisions in Section 6-1.07, "Certificates of Compliance."

The 2nd paragraph of Section 51-1.12F(3)(b), "Type B Seal," of the State Standard Specifications is amended to read:

• The preformed elastomeric joint seal must conform to the requirements in ASTM D 2628 and the following:

1. The seal must consist of a multichannel, nonporous, homogeneous material furnished in a finished extruded form.
2. The minimum depth of the seal measured at the contact surface must be at least 95 percent of the minimum uncompressed width of the seal as designated by the manufacturer.
3. When tested in conformance with the requirements in California Test 673 for Type B seals, joint seals must provide a movement rating (MR) of not less than that shown on the plans.
4. The top and bottom edges of the joint seal must maintain continuous contact with the sides of the groove over the entire range of joint movement.
5. The seal must be furnished full length for each joint with no more than 1 shop splice in any 60-foot length of seal.
6. The Contractor must demonstrate the adequacy of the procedures to be used in the work before installing seals in the joints.
7. One field splice per joint may be made at locations and by methods approved by the Engineer. The seals are to be manufactured full length for the intended joint, then cut at the approved splice section and rematched before splicing. The Contractor must submit splicing details prepared by the joint seal manufacturer for approval before beginning splicing work.
8. Shop splices and field splices must have no visible offset of exterior surfaces and must show no evidence of bond failure.
9. At all open ends of the seal that would admit water or debris, each cell must be filled to a depth of 3 inches with commercial quality open cell polyurethane foam or closed by other means subject to approval by the Engineer.

The 7th paragraph of Section 51-1.12F(3)(b), "Type B Seal," of the State Standard Specifications is amended to read:

• The joint seal must be installed full length for each joint with equipment that does not twist or distort the seal, elongate the seal longitudinally, or otherwise cause damage to the seal or to the concrete forming the groove.

The first sentence of the eleventh paragraph of Section 51-1.12F(3)(b), "Type B Seal," of the State Standard Specifications is amended to read:

• Samples of the prefabricated joint seals, not less than 3 feet in length, will be taken by the Engineer from each lot of material.

The fourth and fifth sentences of the sixth paragraph of Section 51-1.12H(1), "Plain and Fabric Reinforced Elastomeric Bearing Pads," of the State Standard Specifications are amended to read:

• Each ply of fabric shall have a breaking strength of not less than 800 pounds per inch of width in each thread direction when 3" x 36" samples are tested on split drum grips. The bond between double plies shall have a minimum peel strength of 20 pounds per inch.

The hardness (Type A) requirement in the table in the eighth paragraph of Section 51-1.12H(1), "Plain and Fabric Reinforced Elastomeric Bearing Pads," of the State Standard Specifications is amended to read:

Hardness (Type A)	D 2240 with 2kg mass.	55 ±5

The first sentence of subparagraph A of the first paragraph of Section 51-1.12H(2), "Steel Reinforced Elastomeric Bearings," of the State Standard Specifications is amended to read:

• The bearings shall consist of alternating steel laminates and internal elastomer laminates with top and bottom elastomer covers. Steel laminates shall have a nominal thickness of 0.075 inch (14 gage).

The first paragraph in Section 51-1.135, "Mortar," of the State Standard Specifications is amended to read:

• Mortar shall be composed of cementitious material, sand, and water proportioned and mixed as specified in this Section 51-1.135.

The third paragraph in Section 51-1.135, "Mortar," of the State Standard Specifications is amended to read:

• The proportion of cementitious material to sand, measured by volume, shall be one to 2 unless otherwise specified.

The third sentence of the fourth paragraph of Section 51-1.17, "Finishing Bridge Decks," of the State Standard Specifications is amended to read:

• The surfaces shall have a profile trace showing no high points in excess of 0.25 inch, and the portions of the surfaces within the traveled way shall have a profile count of 5 or less in any 100-foot section.

Section 51-1.17, "Finishing Bridge Decks," of the State Standard Specifications is amended by adding the following subsection:

51-1.17A DECK CRACK TREATMENT

• The Contractor shall use all means necessary to minimize the development of shrinkage cracks.

• The Contractor shall remove all equipment and materials from the deck and clean the surface as necessary for the Engineer to measure the surface crack intensity. Surface crack intensity will be determined by the Engineer after completion of concrete cure, before prestressing, and before the release of falsework. In any 500 square foot portion of deck within

the limits of the new concrete deck, should the intensity of cracking be such that there are more than 16 feet of cracks whose width at any location exceeds 0.02 inch, the deck shall be treated with methacrylate resin. The area of deck to be treated shall have a width that extends for the entire width of new deck inside the concrete barriers and a length that extends at least 5 feet beyond the furthest single continuous crack outside the 500 square foot portion, measured from where that crack exceeds 0.02 inch in width, as determined by the Engineer.

- Deck crack treatment shall include furnishing, testing, and application of methacrylate resin and sand. If grinding is required, deck treatment shall take place before grinding.

51-1.17A(1) Submittals

- Before starting deck treatment, the Contractor shall submit plans in conformance with Section 5-1.02, "Plans and Working Drawings," for the following:

1. Public safety plan for the use of methacrylate resin
2. Placement plan for the construction operation

- The plans shall identify materials, equipment, and methods to be used.
- The public safety plan for the use of methacrylate resin shall include details for the following:

1. Shipping
2. Storage
3. Handling
4. Disposal of residual methacrylate resin and the containers

- The placement plan for construction shall include the following:

1. Schedule of deck treatment for each bridge. The schedule shall be consistent with "Maintaining Traffic" of the special provisions and shall include time for the Engineer to perform California Test 342.
2. Methods and materials to be used, including the following:

    2.1. Description of equipment for applying the resin
    2.2. Description of equipment for applying the sand
    2.3. Gel time range and final cure time for the resin

- If the measures proposed in the safety plan are inadequate to provide for public safety associated with the use of methacrylate resin, the Engineer will reject the plan and direct the Contractor to revise the plan. Directions for revisions will be in writing and include detailed comments. The Engineer will notify the Contractor of the approval or rejection of a submitted or revised plan within 15 days of receipt of that plan.
- In the event the Engineer fails to complete the review within the time allowed, and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the review, the Contractor will be compensated for any resulting loss, and an extension of time will be granted, in the same manner as provided for in Section 8-1.09, "Right of Way Delays."

51-1.17A(2) Materials

• Before using methacrylate resin, a Material Safety Data Sheet shall be submitted for each shipment of resin.

• Methacrylate resin shall be low odor and have a high molecular weight. Before adding initiator, the resin shall have a maximum volatile content of 30 percent when tested in conformance with the requirements in ASTM Designation: D 2369, and shall conform to the following:

PROPERTY	REQUIREMENT	TEST METHOD
* Viscosity	25 cP, maximum, (Brookfield RVT with UL adaptor, 50 RPM at 77°F	ASTM D 2196
* Specific Gravity	0.90 minimum, at 77°F	ASTM D 1475
* Flash Point	180°F, minimum	ASTM D 3278
* Vapor Pressure	1.0 mm Hg, maximum, at 77°F	ASTM D 323
Tack-free Time	400 minutes, maximum at 25°C	Specimen prepared per California Test 551
PCC Saturated Surface-Dry Bond Strength	3.5 MPa, minimum at 24 hours and 21±1°C	California Test 551
* Test shall be performed before adding initiator.		

51-1.17A(3) Testing

• The Contractor shall allow 20 days for sampling and testing by the Engineer of the methacrylate resin before proposed use. If bulk resin is to be used, the Contractor shall notify the Engineer in writing at least 15 days before the delivery of the bulk resin to the job site. Bulk resin is any resin stored in containers in excess of 55 gallons.

• Before starting production treatment, the Contractor shall treat a test area of approximately 500 square feet that is within the project limits and at a location approved by the Engineer. When available the test area shall be outside of the traveled way. Weather and pavement conditions during the test treatment shall be similar to those expected on the deck. Equipment used for testing shall be similar to those used for deck treating operations.

• During test and production deck treatment, test tiles shall be used to evaluate the resin cure time. The Contractor shall coat at least one 4" x 4" commercial quality smooth glazed tile for each batch of methacrylate resin. The coated tile shall be placed adjacent to the corresponding treated area. Sand shall not be applied to the test tiles.

• The acceptance criteria for a treated area is as follows:

1. The test tiles are dry to the touch.
2. The treated deck surface is tack free (non-oily).
3. The sand cover adheres and resists brushing by hand.
4. Excess sand has been removed by vacuuming or sweeping.
5. The coefficient of friction is at least 0.35 when tested in conformance with California Test 342.

- Deck treatment on the test area shall demonstrate that the methods and materials meet the acceptance criteria and that the production work will be completed within the specified time for maintaining traffic.
- If a test or production area fails to meet the acceptance criteria, as determined by the Engineer, the treatment will be rejected, and the treatment shall be removed and replaced until the area complies with the acceptance criteria.

51-1.17A(4) Construction

- Equipment shall be fitted with suitable traps, filters, drip pans, or other devices as necessary to prevent oil or other deleterious material from being deposited on the deck.
- Before deck treatment with methacrylate resin, the bridge deck surface shall be cleaned by abrasive blasting, and all loose material shall be blown from visible cracks using high-pressure air. Concrete curing seals shall be cleaned from the deck surface to be treated, and the deck shall be dry when blast cleaning is performed. If the deck surface becomes contaminated at any time before placing the resin, the deck surface shall be cleaned by abrasive blasting.
- Where abrasive blasting is being performed within 10 feet of a lane occupied by public traffic, the residue including dust shall be removed immediately after contact between the abrasive and the surface being treated. The removal shall be by a vacuum attachment operating concurrently with the abrasive blasting operation.
- A compatible promoter/initiator system shall be capable of providing the resin gel time range shown on the placement plan. Gel time shall be adjusted to compensate for the changes in temperature throughout treatment application.
- Resin shall be applied by machine and by using a two-part resin system with a promoted resin for one part and an initiated resin for the other part. This two-part resin system shall be combined at equal volumes to the spray bars through separate positive displacement pumps. Combining of the 2 components shall be by either static in-line mixers or by external intersecting spray fans. The pump pressure at the spray bars shall not be great enough to cause appreciable atomization of the resin. Compressed air shall not be used to produce the spray. A shroud shall be used to enclose the spray bar apparatus.
- At the Contractor's option, manual application may be used. For manual application, (1) the quantity of resin mixed with promoter and initiator shall be limited to 5 gallons at a time, and (2) the resin shall be distributed by squeegees and brooms within 10 minutes after application.
- The Contractor shall apply methacrylate resin only to the specified area. Barriers, railing, joints, and drainage facilities shall be adequately protected to prevent contamination by the treatment material. Contaminated items shall be repaired at the Contractor's expense.
- The relative humidity shall be less than 90 percent at the time of treatment. The prepared area shall be dry and the surface temperature shall be at least 50°F and not more than 100°F when the resin is applied. The rate of application of promoted/initiated resin shall be approximately 90 square feet per gallon; the exact rate shall be determined by the Engineer.
- The deck surfaces to be treated shall be completely covered with resin so the resin penetrates and fills all cracks. The resin shall be applied within 5 minutes after complete mixing. A significant increase in viscosity shall be cause for rejection. Excess material shall be redistributed by squeegees or brooms within 10 minutes after application. For textured deck surfaces, including grooved surfaces, excess material shall be removed from the texture indentations.

• After the resin has been applied, at least 20 minutes shall elapse before applying sand. The sand shall be commercial quality dry blast sand. At least 95 percent of the sand shall pass the No. 8 sieve and at least 95 percent shall be retained on the No. 20 sieve. The sand shall be applied at a rate of approximately 2 pounds per square yard or until refusal as determined by the Engineer.

• Traffic will not be allowed on treated areas until the acceptance criteria has been met as determined by the Engineer.

The second paragraph in Section 51-1.18C, "Class 2 Surface Finish (Gun Finish)," of the State Standard Specifications is amended to read:

• When Class 2 surface finish (gun finish) is specified, ordinary surface finish shall first be completed. The concrete surfaces shall then be abrasive blasted to a rough texture and thoroughly washed down with water. While the washed surfaces are damp, but not wet, a finish coating of machine applied mortar, approximately 1/4 inch thick, shall be applied in not less than 2 passes. The coating shall be pneumatically applied and shall consist of either (1) sand, cementitious material, and water mechanically mixed prior to its introduction to the nozzle, or (2) premixed sand and cementitious material to which water is added prior to its expulsion from the nozzle. The use of admixtures shall be subject to the approval of the Engineer as provided in Section 90, "Portland Cement Concrete." Unless otherwise specified, supplementary cementitious materials will not be required. The proportion of cementitious material to sand shall be not less than one to 4, unless otherwise directed by the Engineer. Sand shall be of a grading suitable for the purpose intended. The machines shall be operated and the coating shall be applied in conformance with standard practice. The coating shall be firmly bonded to the concrete surfaces on which it is applied.

The fifth paragraph in Section 51-1.18C, "Class 2 Surface Finish (Gun Finish)," of the State Standard Specifications is amended to read:

• When surfaces to be finished are in pedestrian undercrossings, the sand shall be silica sand and the cementitious material shall be standard white portland cement.

Section 51-1.23, "Payment," of the State Standard Specifications is amended by adding the following:

• Full compensation for deck crack treatment, including execution of the public safety plan, shall be considered as included in the contract price paid per cubic yard for structural concrete, bridge, and no additional compensation will be allowed therefor.

SECTION 52: REINFORCEMENT

Issue Date: December 7, 2007

The table in the eleventh paragraph of Section 52-1.07, "Placing," of the State Standard Specifications is amended to read:

Height Zone (H) (Feet above ground)	Wind Pressure Value (psf)
$H \leq 30$	20
$30 < H \leq 50$	25
$50 < H \leq 100$	30
$H > 100$	35

The table in the second paragraph of Section 52-1.08B(1), "Mechanical Splices," of the State Standard Specifications is amended to read:

Reinforcing Bar Number	Total Slip
4	0.010-inch
5	0.010-inch
6	0.010-inch
7	0.014-inch
8	0.014-inch
9	0.014-inch
10	0.018-inch
11	0.018-inch
14	0.024-inch
18	0.030-inch

The subparagraph under the sixth paragraph of Section 52-1.08B(2), "Butt Welded Splices," of the State Standard Specifications is amended to read:

• The minimum preheat and interpass temperatures shall be 400º F for Grade 40 bars and 600º F for Grade 60 bars. Immediately after completing the welding, at least 6 inches of the bar on each side of the splice shall be covered by an insulated wrapping to control the rate of cooling. The insulated wrapping shall remain in place until the bar has cooled below 200º F.

Item A of the 3rd paragraph of Section 52-1.08C, "Service Splice and Ultimate Butt Splice Testing Requirements," of the State Standard Specifications is amended to read:

A. Proper facilities, including a calibrated tensile testing machine capable of breaking the largest size of reinforcing bar to be tested.

The 5th paragraph of Section 52-1.08C, "Service Splice and Ultimate Butt Splice Testing Requirements," of the State Standard Specifications is amended to read:

• Prequalification and production sample splices and testing shall conform to California Test 670 and these specifications.

The 6th paragraph of Section 52-1.08C, "Service Splice and Ultimate Butt Splice Testing Requirements," of the State Standard Specifications is deleted.

The 5th paragraph of Section 52-1.08C(2)(a), "Production Test Requirements for Service Splices," of the State Standard Specifications is amended to read:

• If 3 or more sample splices from a production test conform to the provisions in this Section 52-1.08C(2), "Service Splice Test Criteria," all splices in the lot represented by this production test will be considered acceptable.

The 2nd paragraph of Section 52-1.08C(3), "Ultimate Butt Splice Test Criteria," of the State Standard Specifications is amended to read:

• A minimum of 1 control bar shall be removed from the same bar as, and adjacent to, all ultimate prequalification, production, and quality assurance sample splices. The lengths of control bars shall conform to the lengths specified for sample splices in California Test 670. The portion of adjacent bar remaining in the work shall also be identified with weatherproof markings that correspond to its adjacent control bar.

The 2nd sentence of the 6th paragraph of Section 52-1.08C(3), "Ultimate Butt Splice Test Criteria," of the State Standard Specifications is amended to read:

• In addition, necking of the bar, as defined in California Test 670, shall occur at rupture regardless of whether the bar breaks inside or outside the affected zone.

SECTION 53: SHOTCRETE

Issue Date: November 2, 2007

The third paragraph in Section 53-1.01, "Description," of the State Standard Specifications is amended to read:

• The dry-mix process shall consist of delivering dry mixed aggregate and cementitious material pneumatically or mechanically to the nozzle body and adding water and mixing the materials in the nozzle body. The wet-mix process shall consist of delivering mixed aggregate, cement, and water pneumatically to the nozzle and adding any admixture at the nozzle.

The first through fourth paragraphs in Section 53-1.02, "Materials," of the State Standard Specifications is amended to read:

• Cementitious material, fine aggregate, and mixing water shall conform to the provisions in Section 90, "Portland Cement Concrete."
• Shotcrete to be mixed and applied by the dry-mix process shall consist of one part cementitious material to not more than 4.5 parts fine aggregate, thoroughly mixed in a dry state before being charged into the machine. Measurement may be either by volume or by weight. The fine aggregate shall contain not more than 6 percent moisture by weight.
• Shotcrete to be mixed and applied by the wet-mix process shall consist of cementitious material, fine aggregate, and water and shall contain not less than 632 pounds of cementitious material per cubic yard. A maximum of 30 percent pea gravel may be substituted for fine aggregate. The maximum size of pea gravel shall be such that 100 percent passes the 1/2 inch screen and at least 90 percent passes the 3/8 inch screen.
• Admixtures may be added to shotcrete and shall conform to the provisions in Section 90-4, "Admixtures."

Item C of the third paragraph in Section 53-1.04, "Placing Shotcrete," of the State Standard Specifications is amended to read:

C. Aggregate and cementitious material that have been mixed for more than 45 minutes shall not be used unless otherwise permitted by the Engineer.

Section 53-1.07, "Measurement," of the State Standard Specifications is amended to read:

• Quantities of shotcrete will be measured by the cubic yard computed from measurements, along the slope, of actual areas placed and the theoretical thickness shown on the plans. The Department does not pay for shotcrete placed outside the dimensions shown on the plans or to fill low foundation.

Section 53-1.08, "Payment," of the State Standard Specifications is amended to read:

• The contract price paid per cubic yard for shotcrete shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in placing shotcrete, including preparing the foundation, wire reinforcement, structure backfill, joint filling material, and if required by the plans, drains with sacked pervious backfill material, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

SECTION 55: STEEL STRUCTURES

Issue Date: January 5, 2007

The CVN impact value for Grade HPS 50W in the table in the fifth paragraph of Section 55-2.01, "Description," of the State Standard Specifications is amended to read:

Grade HPS 50W* (4 inches and under in thickness)	20 at 10° F

The first paragraph in Section 55-3.05, "Flatness of Faying and Bearing Surfaces," of the State Standard Specifications is amended to read:

• Surfaces of bearing and base plates and other metal surfaces that are to come in contact with each other or with ground concrete surfaces or with asbestos sheet packing shall be flat to within 1/32-inch tolerance in 12 inches and to within 1/16-inch tolerance overall. Surfaces of bearing and base plates and other metal bearing surfaces that are to come in contact with preformed fabric pads, elastomeric bearing pads, or mortar shall be flat to within 1/8-inch tolerance in 12 inches and to within 3/16-inch tolerance overall.

Item B of the first paragraph of Section 55-3.10, "Fastener Threads," of the State Standard Specifications is amended to read:

B. Internal threads shall conform to the requirements in ASTM Designation: A 563.

The third paragraph in Section 55-3.19, "Bearings and Anchorages," of the State Standard Specifications is amended to read:

• Immediately before setting bearing assemblies or masonry plates directly on ground concrete surfaces, the Contractor shall thoroughly clean the surfaces of the concrete and the metal to be in contact and shall apply a coating of nonsag polysulfide or polyurethane caulking conforming to the requirements in ASTM Designation: C 920 to contact areas to provide full bedding.

The fifth paragraph in Section 55-3.19, "Bearings and Anchorages," of the State Standard Specifications is amended to read:

• Mortar to be placed below masonry plates or bearing plates of the bearing assemblies and in anchor bolt sleeves or canisters shall conform to the provisions in Section 51-1.135, "Mortar," except that the proportion of cementitious material to sand shall be 1:3.

Item D of the first paragraph of Section 55-4.01, "Measurement," of the State Standard Specifications is amended to read:

D. To determine the pay quantities of galvanized metal, the weight to be added to the calculated weight of the base metal for the galvanizing will be determined from the table of weights of zinc coatings specified in ASTM Designation: A 153/A 153M.

SECTION 56: SIGNS

Issue Date: March 16, 2007

The fifth paragraph in Section 56-1.03, "Fabrication," of the State Standard Specifications is amended to read:

• Clips, eyes, or removable brackets shall be affixed to all signs and all posts and shall be used to secure the sign during shipping and for lifting and moving during erection as necessary to prevent damage to the finished galvanized or painted surfaces. Brackets on tubular sign structures shall be removed after erection. Details of the devices shall be shown on the working drawings.

The fourth paragraph of Section 56-1.10, "Payment," of the State Standard Specifications is amended to read:

• The contract price paid per pound for install sign structure of the type or types designated in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in installing sign structures, complete in place, including installing anchor bolt assemblies, removable sign panel frames, and sign panels and performing any welding, painting or galvanizing required during installation, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

The fourth paragraph in Section 56-2.03, "Construction," of the State Standard Specifications is amended to read:

• Backfill material for metal posts shall consist of minor concrete conforming to the provisions in Section 90-10, "Minor Concrete," and shall contain not less than 463 pounds of cementitious material per cubic yard.

SECTION 59: PAINTING

Issue Date: May 1, 2006

The third paragraph of Section 59-2.12, "Painting," of the State Standard Specifications is amended to read:

• Contact surfaces of stiffeners, railings, built up members or open seam exceeding 6 mils in width that would retain moisture, shall be caulked with polysulfide or polyurethane sealing compound conforming to the requirements in ASTM Designation: C 920, Type S, Grade NS, Class 25, Use O, or other approved material.

The fourth paragraph of Section 59-2.12, "Painting," of the State Standard Specifications is amended to read:

• The dry film thickness of the paint will be measured in place with a calibrated Type 2 magnetic film thickness gage in conformance with the requirements in SSPC-PA 2, "Measurement of Dry Coating Thickness with Magnetic Gages," of the "SSPC: The Society for Protective Coatings," except that there shall be no limit to the number or location of spot measurements to verify compliance with specified thickness requirements.

SECTION 64: PLASTIC PIPE

Issue Date: July 31, 2007

The first paragraph of Section 64-1.06, "Concrete Backfill," of the State Standard Specifications is amended to read:

• At locations where pipe is to be backfilled with concrete as shown on the plans, the concrete backfill shall be constructed of minor concrete or Class 4 concrete conforming to the provisions in Section 90, "Portland Cement Concrete." Minor concrete shall contain not less than 380 pounds of cementitious material per cubic yard. The concrete to be used will be designated in the contract item or shown on the plans.

The third paragraph of Section 64-1.06, "Concrete Backfill," of the State Standard Specifications is amended to read:

• The surface of the concrete backfill shall be broomed with a heavy broom to produce a uniform rough surface if hot mix asphalt is to be placed directly thereon.

SECTION 65: REINFORCED CONCRETE PIPE

Issue Date: July 31, 2007

The first paragraph of Section 65-1.02, "Materials," of the State Standard Specifications is amended to read:

• Cementitious material and aggregate shall conform to the provisions in Section 90-2, "Materials" except that mortar strengths relative to Ottawa sand and grading requirements shall not apply to the aggregate. Use of supplemental cementitious material shall conform to AASHTO Designation: M 170.

Subparagraph "c" of the eleventh paragraph of Section 65-1.02A(1) "Circular Reinforced Concrete Pipe (Designated or Selected by Class)," of the State Standard Specifications is amended to read:

c. Cementitious material and aggregate for non-reinforced concrete pipe shall conform to the provisions in Section 65-1.02, "Materials."

The first paragraph of Section 65-1.035, "Concrete Backfill," of the State Standard Specifications is amended to read:

• At locations where pipe is to be backfilled with concrete as shown on the plans, the concrete backfill shall be constructed of minor concrete or Class 4 concrete in conformance with the provisions in Section 90, "Portland Cement Concrete." Minor concrete shall contain not less than 380 pounds of cementitious material per cubic yard. The concrete to be used will be designated in the contract item.

The third paragraph of Section 65-1.035, "Concrete Backfill," of the State Standard Specifications is amended to read:

• The surface of the concrete backfill shall be broomed with a heavy broom to produce a uniform rough surface if hot mix asphalt is to be placed directly thereon.

The first subparagraph of the second paragraph of Section 65-1.06, "Joints," of the State Standard Specifications is amended to read:

• Cement Mortar.- Mortar shall be composed of one part cementitious material and 2 parts sand by volume. Supplementary cementitious material will not be required.

SECTION 66: CORRUGATED METAL PIPE

Issue Date: July 31, 2007

The first paragraph of Section 66-1.045, "Concrete Backfill," of the State Standard Specifications is amended to read:

• At locations where pipe is to be backfilled with concrete as shown on the plans, the concrete backfill shall be constructed of minor concrete or Class 4 concrete conforming to the provisions in Section 90, "Portland Cement Concrete." Minor concrete shall contain not less than 380 pounds of cementitious material per cubic yard. The concrete to be used will be designated in the contract item or shown on the plans.

The third paragraph of Section 66-1.045, "Concrete Backfill," of the State Standard Specifications is amended to read:

• The surface of the concrete backfill shall be broomed with a heavy broom to produce a uniform rough surface if hot mix asphalt is to be placed directly thereon.

SECTION 68: SUBSURFACE DRAINS

Issue Date: July 31, 2007

The first and second paragraphs of Section 68-3.02D, "Miscellaneous," of the State Standard Specifications are amended to read:

• Concrete for splash pads shall be produced from minor concrete conforming to the provisions in Section 90-10, "Minor Concrete." Minor concrete shall contain not less than 470 pounds of cementitious material per cubic yard.
• Mortar placed where edge drain outlets and vents connect to drainage pipe and existing drainage inlets shall conform to the provisions in Section 51-1.135, "Mortar."

The thirteenth paragraph of Section 68-3.03, "Installation," of the State Standard Specifications is amended to read:

• Cement treated permeable material, which is not covered with hot mix asphalt within 12 hours after compaction of the permeable material, shall be cured by either sprinkling the material with a fine spray of water every 4 hours during daylight hours or covering the material with a white polyethylene sheet, not less than 6 mils thick. The above curing requirements shall begin at 7:00 a.m. on the morning following compaction of the cement treated permeable material and continue for the next 72 hours or until the material is covered with hot mix asphalt, whichever is less. The cement treated permeable material shall not be sprayed with water during the first 12 hours after compacting, but may be covered with the polyethylene sheet during the first 12 hours or prior to the beginning of the cure period.

The seventeenth and eighteenth paragraphs of Section 68-3.03, "Installation," of the State Standard Specifications are amended to read:

• Hot mix asphalt for backfilling trenches in existing paved areas shall be produced from commercial quality aggregates and asphalt and mixed at a central mixing plant. The aggregate

shall conform to the 3/4 inch grading, or the 1/2 inch grading for Type A and Type B hot mix asphalt specified in Section 39-1.02E, "Aggregate." The amount of asphalt binder to be mixed with the aggregate shall be between 4 percent and 7 percent by weight of the dry aggregate, as determined by the Engineer.

• Hot mix asphalt backfill shall be spread and compacted in approximately 2 equal layers by methods that will produce a hot mix asphalt surfacing of uniform smoothness, texture and density. Each layer shall be compacted before the temperature of the mixture drops below 250º F. Prior to placing the hot mix asphalt backfill, a tack coat of asphaltic emulsion conforming to the provisions in Section 94, "Asphaltic Emulsions," shall be applied to the vertical edges of existing pavement at an approximate rate of 0.05-gallon per square yard.

The twentieth paragraph of Section 68-3.03, "Installation," of the State Standard Specifications is amended to read:

• Type A pavement markers conforming to the details shown on the plans and the provisions in Section 85, "Pavement Markers," shall be placed on paved shoulders or dikes at outlet, vent and cleanout locations as directed by the Engineer. The waiting period for placing pavement markers on new hot mix asphalt surfacing will not apply.

Section 68-3.05, "Payment," of the State Standard Specifications is amended to read:

• The contract price paid per linear foot for plastic pipe (edge drain) of the size or sizes shown in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in installing edge drains complete in place, including excavation (and removal of any concrete deposits that may occur along the lower edge of the concrete pavement in Type 1 installations) and hot mix asphalt backfill for Type 1 edge drain installation, tack coat, filter fabric, and treated permeable material, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

• The contract price paid per linear foot for plastic pipe (edge drain outlet) of the size or sizes shown in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in installing edge drain outlets, vents and cleanouts complete in place, including outlet and vent covers, expansion plugs, pavement markers, concrete splash pads, connecting outlets and vents to drainage facilities, and excavation and backfill [aggregate base, hot mix asphalt, tack coat, and native material] for outlets, vents, and cleanouts to be installed in embankments and existing shoulders, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

SECTION 69: OVERSIDE DRAINS

Issue Date: July 31, 2007

The first paragraph of Section 69-1.01, "Description," of the State Standard Specifications is amended to read:

• This work shall consist of furnishing and installing entrance tapers, pipe downdrains, tapered inlets, flume downdrains, anchor assemblies, reducers, slip joints and hot mix asphalt overside drains to collect and carry surface drainage down the roadway slopes as shown on the plans or as directed by the Engineer and as specified in these specifications and the special provisions.

Section 69-1.02D, "Asphalt Concrete," of the State Standard Specifications is amended to read:

69-1.02D Hot Mix Asphalt

• Hot mix asphalt for overside drains shall conform to the provisions in Section 39-1.13, "Miscellaneous Areas."

Section 69-1.04, "Asphalt Concrete Overside Drains," is amended to read:

69-1.04 HOT MIX ASPHALT OVERSIDE DRAINS

• Hot mix asphalt overside drains shall be constructed as shown on the plans or as directed by the Engineer. The hot mix asphalt shall be placed in conformance with the provisions in Section 39-1.13, "Miscellaneous Areas."

The second paragraph of Section 69-1.06, "Payment," of the State Standard Specifications is amended to read:

• Quantities of hot mix asphalt placed for overside drains will be paid for as provided in Section 39-5, "Measurement and Payment," for hot mix asphalt placed in miscellaneous areas.

SECTION 70: MISCELLANEOUS FACILITIES

Issue Date: January 5, 2007

The second paragraph of Section 70-1.02C, "Flared End Sections," of the State Standard Specifications is amended to read:

• Precast concrete flared end sections shall conform to the requirements for Class III Reinforced Concrete Pipe in AASHTO Designation: M 170M. Cementitious materials and aggregate shall conform to the provisions in Section 90-2, "Materials," except that mortar strengths relative to Ottawa sand and grading requirements shall not apply to the aggregate. Use of supplementary cementitious material shall conform to the requirements in AASHTO Designation: M 170. The area of steel reinforcement per meter of flared end section shall be at least equal to the minimum steel requirements for circular reinforcement in circular pipe for the internal diameter of the circular portion of the flared end section. The basis of acceptance of the precast concrete flared end section shall conform to the requirements of Section 5.1.2 of AASHTO Designation: M 170.

The first paragraph of Section 70-1.02H, "Precast Concrete Structures," of the State Standard Specifications is amended to read:

• Precast concrete pipe risers and pipe reducers, and precast concrete pipe sections, adjustment rings and tapered sections for pipe energy dissipators, pipe inlets and pipe manholes shall conform to the requirements in AASHTO Designation: M 199M/M 199, except that the cementitious material and aggregate shall conform to the provisions in Section 90-2, "Materials," except that mortar strengths relative to Ottawa sand and grading requirements shall not apply to the aggregate. Use of supplementary cementitious material shall conform to the requirements in AASHTO Designation: M 170.

The second paragraph of Section 70-1.03, "Installation," of the State Standard Specifications is amended to read:

• Cutoff walls for precast concrete flared end sections shall be constructed of minor concrete conforming to the provisions in Section 90-10, "Minor Concrete." Minor concrete shall contain not less than 470 pounds of cementitious material per cubic yard.

SECTION 73: CONCRETE CURBS AND SIDEWALKS

Issue Date: July 31, 2007

The second subparagraph of the second paragraph of Section 73-1.01, "Description," of the State Standard Specifications is amended to read:

2. Minor concrete shall contain not less than 463 pounds of cementitious material per cubic yard except that when extruded or slip-formed curbs are constructed using 3/8-inch maximum size aggregate, minor concrete shall contain not less than 548 pounds of cementitious material per cubic yard.

The fifteenth paragraph of Section 73-1.06, "Sidewalk, Gutter Depression, Island Paving, Curb Ramp (Wheelchair Ramp) and Driveway Construction," of the State Standard Specifications is amended to read:

• Where hot mix asphalt or portland cement concrete pavements are to be placed around or adjacent to manholes, pipe inlets or other miscellaneous structures in sidewalk, gutter depression, island paving, curb ramps or driveway areas, the structures shall not be constructed to final grade until after the pavements have been constructed for a reasonable distance on each side of the structures.

SECTION 75: MISCELLANEOUS METAL

Issue Date: January 18, 2008

The 13th paragraph of Section 75-1.03, "Miscellaneous Bridge Metal," of the State Standard Specifications is amended to read:

• Concrete anchorage devices shall be mechanical expansion or resin capsule types installed in drilled holes or cast-in-place insert types. The anchorage devices shall be selected from the Department's Pre-Qualified Products List at:

http://www.dot.ca.gov/hq/esc/approved_products_list

• The anchorage devices shall be a complete system, including threaded studs, hex nuts, and cut washers. Thread dimensions for externally threaded concrete anchorage devices prior to zinc coating, shall conform to the requirements in ANSI Standard: B1.1 having Class 2A tolerances or ANSI Standard: B1.13M having Grade 6g tolerances. Thread dimensions for internally threaded concrete anchorage devices shall conform to the requirements in ASTM A 563.

The 18th paragraph of Section 75-1.03, "Miscellaneous Bridge Metal," of the State Standard Specifications is amended to read:

• Mechanical expansion anchors shall, when installed in accordance with the manufacturer's instructions and these specifications and tested in conformance with the requirements in California Test 681, withstand the application of a sustained tension test load of at least the following values for at least 48 hours with a movement not greater than 0.035 inch:

Stud Diameter (inches)	Sustained Tension Test Load (pounds)
*3/4	5,000
5/8	4,100
1/2	3,200
3/8	2,100
1/4	1,000

• Resin capsule anchors shall, when installed in accordance with the manufacturer's instructions and these specifications and tested in conformance with the requirements in California Test 681, withstand the application of a sustained tension test load of at least the following values for at least 48 hours with a movement not greater than 0.010 inch:

Stud Diameter (inches)	Sustained Tension Test Load (pounds)
1-1/4	31,000
1	17,900
7/8	14,400
3/4	5,000
5/8	4,100
1/2	3,200
3/8	2,100
1/4	1,000

• At least 25 days before use, the Contractor shall submit one sample of each resin capsule anchor per lot to the Transportation Laboratory for testing. A lot of resin capsule anchors is 100 units, or fraction thereof, of the same brand and product name.

The 20th paragraph of Section 75-1.03, "Miscellaneous Bridge Metal," of the State Standard Specifications is amended to read:

• The Pre-Qualified Products List for concrete anchorage devices has been developed from data previously furnished by suppliers or manufacturers for each type and size. Approval of additional anchorage device types and sizes is contingent upon the Contractor submitting to the Engineer one sample of each type of concrete anchorage device, manufacturer's installation instructions, and certified results of tests, either by a private testing laboratory or the manufacturer, indicating compliance with the above requirements.

The twenty-fourth paragraph of Section 75-1.03, "Miscellaneous Bridge Metal," of the State Standard Specifications is amended to read:

• Sealing compound, for caulking and adhesive sealing, shall be a polysulfide or polyurethane material conforming to the requirements in ASTM Designation: C 920, Type S, Grade NS, Class 25, Use O.

The 1st sentence of the 3rd paragraph of Section 75-1.035, "Bridge Joint Restrainer Units." of the State Standard Specifications is amended to read:

Cables shall be 3/4 inch preformed, 6 x 19, wire strand core or independent wire rope core (IWRC), galvanized in conformance with the requirements in Federal Specification RR-W-410, right regular lay, manufactured of improved plow steel with a minimum breaking strength of 23 tons.

Item C of the fourth paragraph of Section 75-1.035, "Bridge Joint Restrainer Units," of the State Standard Specifications is amended to read:

C. Nuts shall conform to the requirements in ASTM Designation: A 563 including Appendix X1, except lubrication is not required.

The twelfth paragraph in Section 75-1.035, "Bridge Joint Restrainer Units," of the State Standard Specifications is amended to read:

• Concrete for filling cable drum units shall conform to the provisions in Section 90-10, "Minor Concrete," or at the option of the Contractor, may be a mix with 3/8-inch maximum size aggregate and not less than 675 pounds of cementitious material per cubic yard.

The sixth paragraph of Section 75-1.05, "Galvanizing," of the State Standard Specifications is amended to read:

• Galvanizing of iron and steel hardware and nuts and bolts, when specified or shown on the plans, shall conform to the requirements in ASTM Designation: A 153/A 153M, except

whenever threaded studs, bolts, nuts, and washers are specified to conform to the requirements in ASTM Designation: A 307, A 325, A 449, A 563, or F 436 and zinc coating is required, they shall be hot-dip zinc coated or mechanically zinc coated in conformance with the requirements in the ASTM Designations. Unless otherwise specified, galvanizing shall be performed after fabrication.

The eighth paragraph of Section 75-1.05, "Galvanizing," of the State Standard Specifications is amended to read:

• Tapping of nuts or other internally threaded parts to be used with zinc coated bolts, anchor bars or studs shall be done after galvanizing and shall conform to the requirements for thread dimensions and overtapping allowances in ASTM Designation: A 563.

SECTION 80: FENCES

Issue Date: January 5, 2007

The fourth paragraph of Section 80-3.01F, "Miscellaneous," of the State Standard Specifications is amended to read:

• Portland cement concrete for metal post and brace footings and for deadmen shall be minor concrete conforming to the provisions in Section 90-10, "Minor Concrete." Minor concrete shall contain not less than 470 pounds of cementitious material per cubic yard.

The fourth paragraph of Section 80-4.01C, "Miscellaneous," of the State Standard Specifications is amended to read:

• Portland cement concrete for metal post and for deadmen shall be produced from minor concrete conforming to the provisions in Section 90-10, "Minor Concrete." Minor concrete shall contain not less than 470 pounds of cementitious material per cubic yard.

SECTION 83: RAILINGS AND BARRIERS

Issue Date: August 17, 2007

The seventh paragraph in Section 83-1.02, "Materials and Construction," of the State Standard Specifications is amended to read:

• Mortar shall conform to the provisions in Section 51-1.135, "Mortar," and shall consist of one part by volume of cementitious material and 3 parts of clean sand.

The 1st sentence of the 8th subparagraph of the 24th paragraph of Section 83-1.02B, "Metal Beam Guard Railing," of the State Standard Specifications is amended to read:

Anchor cable shall be 3/4 inch preformed, 6 x 19, wire strand core or independent wire rope core (IWRC), galvanized in conformance with the requirements in Federal Specification RR-W-410,

right regular lay, manufactured of improved plow steel with a minimum breaking strength of 23 tons.

The 2nd sentence of the 6th paragraph of Section 83-1.02E, "Cable Railing," of the State Standard Specifications is amended to read:

Cable shall be galvanized in conformance with the requirements in Federal Specification RR-W-410.

The 5th paragraph of Section 83-1.02I, "Chain Link Railing," of the State Standard Specifications is amended to read:

Where shown on the plans, cables used in the frame shall be 5/16 inch in diameter, wire rope, with a minimum breaking strength of 5,000 pounds and shall be galvanized in conformance with the requirements in Federal Specification RR-W-410.

The 14th paragraph of Section 83-1.02I, "Chain Link Railing," of the State Standard Specifications is amended to read:

Chain link fabric shall be either 11-gage Type I zinc-coated fabric conforming to the requirements in AASHTO M 181 or 11-gage Type IV polyvinyl chloride (PVC) coated fabric conforming to the requirements in Federal Specification RR-F-191/1.

Item b of the first paragraph in Section 83-2.02D(2), "Materials," of the State Standard Specifications is amended to read:

b. If the 3/8-inch maximum size aggregate grading is used to construct extruded or slip-formed concrete barriers, the cementitious material content of the minor concrete shall be not less than 675 pounds per cubic yard.

The third paragraph in Section 83-2.02D(2), "Materials," of the State Standard Specifications is amended to read:

• The concrete paving between the tops of the 2 walls of concrete barrier (Types 50E, 60E, 60GE, and 60SE) and the optional concrete slab at the base between the 2 walls of concrete barrier (Types 50E, 60E, 60GE, and 60SE) shall be constructed of minor concrete conforming to the provisions of Section 90-10, "Minor Concrete," except that the minor concrete shall contain not less than 505 pounds of cementitious material per cubic yard.

SECTION 85: PAVEMENT MARKERS

Issue Date: July 31, 2007

The sixth paragraph in Section 85-1.06, "Placement," of the State Standard Specifications is amended to read:

• Pavement markers shall not be placed on new hot mix asphalt surfacing or seal coat until the surfacing or seal coat has been opened to public traffic for a period of not less than 7 days when hot melt bituminous adhesive is used, and not less than 14 days when epoxy adhesive is used.

The second sentence of the fourteenth paragraph in Section 85-1.06, "Placement," of the State Standard Specifications is amended to read:

• Cleaning shall be done by blast cleaning on all surfaces regardless of age or type, except that blast cleaning of clean, new hot mix asphalt and clean, new seal coat surfaces will not be required when hot melt bituminous adhesive is used.

SECTION 86: SIGNALS, LIGHTING AND ELECTRICAL SYSTEMS

Issue Date: July 31, 2007

The first sentence of the first paragraph of Section 86-2.02, "Removing and Replacing Improvements," of the State Standard Specifications is amended to read:

• Improvements such as sidewalks, curbs, gutters, portland cement concrete and hot mix asphalt pavement, underlying material, lawns and plants and any other improvements removed, broken or damaged by the Contractor's operations, shall be replaced or reconstructed with the same kind of material as found on the work or with materials of equal quality.

The fourth paragraph in Section 86-2.03, "Foundations," of the State Standard Specifications is amended to read:

• After each post, standard, and pedestal on structures is in proper position, mortar shall be placed under the base plate as shown on the plans. The exposed portions shall be formed to present a neat appearance. Mortar shall conform to Section 51-1.135, "Mortar," except the mortar shall consist of one part by volume of cementitious material and 3 parts of clean sand and shall contain only sufficient moisture to permit packing. Mortar shall be cured by keeping it damp for 3 days.

Item D of the eighteenth paragraph in Section 86-2.05C, "Installation," of the State Standard Specifications is amended to read:

D. The conduit shall be placed in the bottom of the trench, and the trench shall be backfilled with minor concrete conforming to the provisions in Section 90-10, "Minor Concrete." Minor concrete shall contain not less than 590 pounds of cementitious material per cubic yard. Concrete backfill shall be placed to the pavement surface except, when the trench is in hot mix asphalt pavement and additional pavement is not being placed, the top 0.10 foot of the trench shall be backfilled with hot mix asphalt produced from commercial quality paving asphalt and aggregates.

Item E of the eighteenth paragraph in Section 86-2.05C, "Installation," of the State Standard Specifications is amended to read:

E. Prior to spreading hot mix asphalt, tack coat shall be applied in conformance with the provisions in Section 39, "Hot Mix Asphalt." Spreading and compacting of hot mix asphalt shall be performed by any method which will produce a hot mix asphalt surfacing of uniform smoothness, texture and density.

Item C of the twenty-third paragraph in Section 86-2.05C, "Installation," of the State Standard Specifications is amended to read:

C. Precast concrete conduit cradles shall conform to the dimensions shown on the plans and shall be constructed of minor concrete and commercial quality welded wire fabric. Minor concrete shall conform to the provisions in Section 90-10, "Minor Concrete," and shall contain not less than 590 pounds of cementitious material per cubic yard. The cradles shall be moist cured for not less than 3 days.

Item G of the twenty-third paragraph in Section 86-2.05C, "Installation," of the State Standard Specifications is amended to read:

G. The space around conduits through bridge abutment walls shall be filled with mortar conforming to the provisions in Section 51-1.135, "Mortar," except that the proportion of cementitious material to sand shall be one to 3.

The fifth paragraph in Section 86-2.07, "Traffic Pull Boxes," of the State Standard Specifications is amended to read:

• Concrete placed around and under traffic pull boxes as shown on the plans shall be minor concrete conforming to the provisions in Section 90-10, "Minor Concrete."

The traffic signal controller cabinet requirement in the table in Section 86-2.08A, "Conductor Identification," of the State Standard Specifications is amended to read:

Traffic Signal Controller Cabinet	Ungrounded Circuit Conductor	Blk	None	CON-1	6
	Grounded Circuit Conductor	Wht	None	CON-2	6

The first sentence of the first paragraph of Section 86-4.06, "Pedestrian Signal Faces," of the State Standard Specifications is amended to read:

• Message symbols for pedestrian signal faces shall be white WALKING PERSON and Portland orange UPRAISED HAND conforming to the requirements in the Institute of Transportation Engineers Standards: "Pedestrian Traffic Control Signal Indications" and the "California MUTCD."

The second sentence of the tenth paragraph of Section 86-4.07, "Light Emitting Diode Pedestrian Signal Face 'Upraised Hand' Module," of the State Standard Specifications is amended to read:

• The color of "UPRAISED HAND" shall be Portland orange conforming to the requirements of the Institute of Transportation Engineers Standards: "Pedestrian Traffic Control Signal Indications" and the "California MUTCD."

The second sentence of the first paragraph of subsection, "Elastomeric Sealant," of Section 86-5.01A(5), "Installation Details," of the State Standard Specifications is amended to read:

• Sealant shall be suitable for use in both hot mix asphalt and portland cement concrete.

The first sentence of the first paragraph of subsection, "Asphatic Emulsion Sealant," of Section 86-5.01A(5), "Installation Details," of the State Standard Specifications is amended to read:

• Asphaltic emulsion sealant shall conform to the requirements in State Specification 8040-41A-15 and shall be used only for filling slots in hot mix asphalt pavement.

The third sentence of the first paragraph of subsection, "Hot-Melt Rubberized Asphalt Sealant," of Section 86-5.01A(5), "Installation Details," of the State Standard Specifications is amended to read:

• Sealant shall be suitable for use in both hot mix asphalt and portland cement concrete.

The tenth paragraph of subsection, "Hot-Melt Rubberized Asphalt Sealant," of Section 86-5.01A(5), "Installation Details," of the State Standard Specifications is amended to read:

• If hot mix asphalt surfacing is to be placed, the loop conductors shall be installed prior to placing the uppermost layer of hot mix asphalt. The conductors shall be installed, as shown on the plans, in the compacted layer of hot mix asphalt immediately below the uppermost layer. Installation details shall be as shown on the plans, except the sealant shall fill the slot flush to the surface.

The first paragraph in Section 86-5.01D, "Removing or Abandoning Existing Pressure-Sensitive Detectors," of the State Standard Specifications is amended to read:

• When a foundation for a pressure-sensitive vehicle detector is to be removed, the hole left by removing the detector frame and foundation shall be filled with minor concrete, except the roadway surface shall be reconstructed with material to match existing surfacing. Minor concrete shall conform to the provisions in Section 90-10, "Minor Concrete," except that the concrete shall contain not less than 420 pounds of cementitious material per cubic yard for hot mix asphalt surfaced roadways and not less than 590 pounds of cementitious material per cubic yard for portland cement concrete surfaced roadways.

The first paragraph of Section 86-8.01, "Payment," of the State Standard Specifications is amended to read:

• The contract lump sum price or prices paid for signal, ramp metering, flashing beacon, lighting, sign illumination, traffic monitoring station, highway advisory radio systems, closed circuit television systems, or combinations thereof; for modifying or removing those systems; for temporary systems; or the lump sum or unit prices paid for various units of those systems; or the lump sum or per foot price paid for conduit of the various sizes, types and installation methods listed in the Engineer's Estimate shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in furnishing and installing, modifying, or removing the systems, combinations or units thereof, as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer, including any necessary pull boxes (except when the type required is shown as a separate contract item); excavation and backfill; concrete foundations (except when shown as a separate contract item); pedestrian barricades; furnishing and installing illuminated street name signs; installing sign panels on pedestrian barricades, on flashing beacon standards, and on traffic signal mast arms; restoring sidewalk, pavement and appurtenances damaged or destroyed during construction; salvaging existing materials; and making all required tests.

SECTION 90: PORTLAND CEMENT CONCRETE

Issue Date: January 5, 2007

Section 90, "Portland Cement Concrete," of the State Standard Specifications is amended to read:

SECTION 90: PORTLAND CEMENT CONCRETE

90-1 GENERAL

90-1.01 DESCRIPTION

• Portland cement concrete shall be composed of cementitious material, fine aggregate, coarse aggregate, admixtures if used, and water, proportioned and mixed as specified in these specifications.

• The Contractor shall determine the mix proportions for concrete in conformance with these specifications.

• Class 1 concrete shall contain not less than 675 pounds of cementitious material per cubic yard.

• Class 2 concrete shall contain not less than 590 pounds of cementitious material per cubic yard.

• Class 3 concrete shall contain not less than 505 pounds of cementitious material per cubic yard.

• Class 4 concrete shall contain not less than 420 pounds of cementitious material per cubic yard.

• Minor concrete shall contain not less than 550 pounds of cementitious material per cubic yard unless otherwise specified in these specifications or the special provisions.

• Unless otherwise designated on the plans or specified in these specifications or the special provisions, the amount of cementitious material used per cubic yard of concrete in structures or portions of structures shall conform to the following:

Use	Cementitious Material Content (Pounds/CY)
Concrete designated by compressive strength:	
Deck slabs and slab spans of bridges	675 min., 800 max.
Roof sections of exposed top box culverts	675 min., 800 max.
Other portions of structures	590 min., 800 max.
Concrete not designated by compressive strength:	
Deck slabs and slab spans of bridges	675 min.
Roof sections of exposed top box culverts	675 min.
Prestressed members	675 min.
Seal courses	675 min.
Other portions of structures	590 min.
Concrete for precast members	590 min., 925 max.

- Whenever the 28-day compressive strength shown on the plans is greater than 3,600 pounds per square inch, the concrete shall be designated by compressive strength. If the plans show a 28-day compressive strength that is 4,000 pounds per square inch or greater, an additional 14 days will be allowed to obtain the specified strength. The 28-day compressive strengths shown on the plans that are 3,600 pounds per square inch or less are shown for design information only and are not a requirement for acceptance of the concrete.
- Concrete designated by compressive strength shall be proportioned such that the concrete will attain the strength shown on the plans or specified in the special provisions.
- Before using concrete for which the mix proportions have been determined by the Contractor, or in advance of revising those mix proportions, the Contractor shall submit in writing to the Engineer a copy of the mix design.
- Compliance with cementitious material content requirements will be verified in conformance with procedures described in California Test 518 for cement content. For testing purposes, supplementary cementitious material shall be considered to be cement. Batch proportions shall be adjusted as necessary to produce concrete having the specified cementitious material content.
- If any concrete has a cementitious material, portland cement, or supplementary cementitious material content that is less than the minimum required, the concrete shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place and the Contractor shall pay to the State $0.25 for each pound of cementitious material, portland cement, or supplementary cementitious material that is less than the minimum required. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract. The deductions will not be made unless the difference between the contents required and those actually provided exceeds the batching tolerances permitted by Section 90-5, "Proportioning." No deductions will be made based on the results of California Test 518.
- The requirements of the preceding paragraph shall not apply to minor concrete or commercial quality concrete.

90-2 MATERIALS

90-2.01 CEMENTITIOUS MATERIALS

- Unless otherwise specified, cementitious material shall be either a combination of Type II or Type V portland cement and a supplementary cementitious material, or a blended cement.

• Cementitious materials used in cast-in-place concrete for exposed surfaces of like elements of a structure shall be from the same sources and of the same proportions.
• Cementitious materials shall be protected from moisture until used. Sacked cementitious materials shall be piled to permit access for tallying, inspecting, and identifying each shipment.
• Facilities shall be provided to ensure that cementitious materials meeting this Section 90-2.01 are kept separate from other cementitious materials. Sampling cementitious materials shall be in conformance with California Test 125.
• The Contractor shall furnish a Certificate of Compliance for cementious materials in conformance with the provisions in Section 6-1.07, "Certificates of Compliance." The Certificate of Compliance shall indicate the source by name and location (including country, state, and city). If cementitious material is delivered directly to the job site, the Certificate of Compliance shall be signed by the cementitious material supplier. If the cementitious material is used in ready-mixed concrete or in precast concrete products purchased as such by the Contractor, the Certificate of Compliance shall be signed by the manufacturer of the concrete or product.

90-2.01A CEMENT

• Portland cement shall conform to the requirements in ASTM Designation: C 150 except, using a 10-sample moving average, limestone shall not exceed 2.5 percent. The C_3S content of Type II cement shall not exceed 65 percent.
• Blended cement shall conform to the requirements for Portland Blast-Furnace Slag, Cement Type IS (MS) or Portland-Pozzolan Cement, Type IP (MS) in AASHTO Designation: M 240 and shall be comprised of an intimate and uniform blend of Type II or Type V cement and supplementary cementitious material in an amount conforming to the requirements in Section 90-2.01C, "Required Use of Supplementary Cementitious Materials."
• In addition, blended cement, Type II portland cement, and Type V portland cement shall conform to the following requirements:

A. The cement shall not contain more than 0.60-percent by mass of alkalies, calculated as the percentage of Na_2O plus 0.658 times the percentage of K_2O, when determined by methods as required in AASHTO Designation: T 105;
B. The autoclave expansion shall not exceed 0.50-percent; and
C. Mortar, containing the cement to be used and Ottawa sand, when tested in conformance with California Test 527, shall not expand in water more than 0.010-percent and shall not contract in air more than 0.048-percent, except that when cement is to be used for precast prestressed concrete piling, precast prestressed concrete members, or steam cured concrete products, the mortar shall not contract in air more than 0.053-percent.

• Type III portland cement shall be used only as specified in the special provisions or with the approval of the Engineer. Type III portland cement shall conform to the additional requirements listed above for Type II portland cement, except when tested in conformance with California Test 527, mortar containing Type III portland cement shall not contract in air more than 0.075-percent.

90-2.01B SUPPLEMENTARY CEMENTITIOUS MATERIALS (SCM)

• Fly ash shall conform to the requirements in AASHTO Designation: M 295, Class F, and the following:

A. Calcium oxide content shall not exceed 10 percent.
B. The available alkali, as sodium oxide equivalent, shall not exceed 1.5 percent when determined in conformance with the requirements in ASTM Designation: C 311 or the total alkali, as sodium oxide equivalent, shall not exceed 5.0 percent when determined in conformance with the requirements in AASHTO Designation: T 105.
C. Commingling of fly ash from different sources at uncontrolled ratios is permissible only if the following criteria are satisfied:

1. Sources of fly ash to be commingled shall be on the approved list of materials for use in concrete.
2. Testing of the commingled product is the responsibility of the fly ash supplier.
3. Each fly ash's running average of density shall not differ from any other by more than 0.01-pound per cubic inch at the time of commingling.
4. Each fly ash's running average of loss on ignition shall not differ from any other by more than one percent at the time of commingling.
5. The final product of commingled fly ash shall conform to the requirement in AASHTO Designation: M 295.

• Raw or calcined natural pozzolans shall conform to the requirements in AASHTO Designation: M 295, Class N and the following requirements:

A. Calcium oxide content shall not exceed 10 percent.
B. The available alkali, as sodium oxide equivalent, shall not exceed 1.5 percent when determined in conformance with the requirements in ASTM Designation: C 311 or the total alkali, as sodium oxide equivalent, shall not exceed 5.0 percent when determined in conformance with the requirements in AASHTO Designation: T 105.

• Ground Granulated Blast Furnace Slag (GGBFS) shall conform to the requirements in AASHTO Designation: M 302, Grade 100 or Grade 120.
• Silica Fume shall conform to the requirements of AASHTO Designation: M 307, with reduction in mortar expansion of 80 percent, minimum, using the cement from the proposed mix design.

90-2.01C REQUIRED USE OF SUPPLEMENTARY CEMENTITIOUS MATERIALS

• The amount of portland cement and SCM used in portland cement concrete shall conform to the minimum cementitious material content provisions in Section 90-1.01, "Description," or Section 90-4.05, "Optional Use of Chemical Admixtures," and the following:

A. If a blended cement conforming to the provisions in Section 90-2.01A, "Cement," is used, the minimum amount of SCM incorporated into the cement shall conform to the provisions in this Section 90-2.01C.

B. Fly ash or natural pozzolan, silica fume, or GGBFS shall not be used with Type IP or Type IS cements.

• Use of SCMs shall conform to the following:

A. If fly ash or natural pozzolan is used:

1. The minimum amount of portland cement shall not be less than 75 percent by weight of the specified minimum cementitious material content.
2. The minimum amount of fly ash or natural pozzolan shall be:
   a. Fifteen percent by weight of the total amount of cementitious material if the calcium oxide content of fly ash or natural pozzolan is equal to or less than 2 percent by weight;
   b. Twenty-five percent by weight of the total amount of cementitious material if the calcium oxide content of fly ash or natural pozzolan is greater than 2 percent by weight.

3. The total amount of fly ash or natural pozzolan shall not exceed 35 percent by weight of the total amount of cementitious material to be used in the mix. If Section 90-1.01, "Description," specifies a maximum cementitious material content in pounds per cubic yard, the total weight of portland cement and fly ash or natural pozzolan per cubic yard shall not exceed the specified maximum cementitious material content.

B. If silica fume is used:

1. The amount of silica fume shall not be less than 10 percent by weight of the total amount of cementitious material.
2. The amount of portland cement shall not be less than 75 percent by weight of the specified minimum cementitious material content.
3. If Section 90-1.01, "Description," specifies a maximum cementitious material content in pounds per cubic yard, the total weight of portland cement and silica fume per cubic yard shall not exceed the specified maximum cementitious material content.

C. If GGBFS is used:

1. The minimum amount of GGBFS shall be either:
   a. Forty percent of the total cementitious material to be used, if the aggregates used in the concrete are on the Department's list of "Approved Aggregates For Use in Concrete with Reduced Fly Ash."
   b. No less than 50 percent.

2. The amount of GGBFS shall not exceed 60 percent by weight of the total amount of cementitious materials to be used.

90-2.02 AGGREGATES

• Aggregates shall be free from deleterious coatings, clay balls, roots, bark, sticks, rags, and other extraneous material.

- The Contractor shall provide safe and suitable facilities, including necessary splitting devices for obtaining samples of aggregates, in conformance with California Test 125.
- Aggregates shall be of such character that it will be possible to produce workable concrete within the limits of water content provided in Section 90-6.06, "Amount of Water and Penetration."
- Aggregates shall have not more than 10 percent loss when tested for soundness in conformance with the requirements in California Test 214. The soundness requirement for fine aggregate will be waived, provided that the durability index, D_f, of the fine aggregate is 60 or greater when tested for durability in conformance with California Test 229.
- If the results of any one or more of the Cleanness Value, Sand Equivalent, or aggregate grading tests do not meet the requirements specified for "Operating Range" but all meet the "Contract Compliance" requirements, the placement of concrete shall be suspended at the completion of the current pour until tests or other information indicate that the next material to be used in the work will comply with the requirements specified for "Operating Range."
- If the results of either or both the Cleanness Value and coarse aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete that is represented by the tests shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place, and the Contractor shall pay to the State $3.50 per cubic yard for paving concrete and $5.50 per cubic yard for all other concrete for the concrete represented by these tests and left in place. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract.
- If the results of either or both the Sand Equivalent and fine aggregate grading tests do not meet the requirements specified for "Contract Compliance," the concrete which is represented by the tests shall be removed. However, if the Engineer determines that the concrete is structurally adequate, the concrete may remain in place, and the Contractor shall pay to the State $3.50 per cubic yard for paving concrete and $5.50 per cubic yard for all other concrete for the concrete represented by these tests and left in place. The Department may deduct the amount from any moneys due, or that may become due, the Contractor under the contract.
- The 2 preceding paragraphs apply individually to the "Contract Compliance" requirements for coarse aggregate and fine aggregate. When both coarse aggregate and fine aggregate do not conform to the "Contract Compliance" requirements, both paragraphs shall apply. The payments specified in those paragraphs are in addition to any payments made in conformance with the provisions in Section 90-1.01, "Description."
- No single Cleanness Value, Sand Equivalent, or aggregate grading test shall represent more than 300 cubic yards of concrete or one day's pour, whichever is smaller.
- When the source of an aggregate is changed, the Contractor shall adjust the mix proportions and submit in writing to the Engineer a copy of the mix design before using the aggregates.

90-2.02A COARSE AGGREGATE

- Coarse aggregate shall consist of gravel, crushed gravel, crushed rock, reclaimed aggregate, crushed air-cooled iron blast furnace slag or combinations thereof. Crushed air-cooled blast furnace slag shall not be used in reinforced or prestressed concrete.
- Reclaimed aggregate is aggregate that has been recovered from plastic concrete by washing away the cementitious material. Reclaimed aggregate shall conform to all aggregate requirements.
- Coarse aggregate shall conform to the following quality requirements:

Tests	California Test	Requirements
Loss in Los Angeles Rattler (after 500 revolutions)	211	45% max.
Cleanness Value		
Operating Range	227	75 min.
Contract Compliance	227	71 min.

• In lieu of the above Cleanness Value requirements, a Cleanness Value "Operating Range" limit of 71, minimum, and a Cleanness Value "Contract Compliance" limit of 68, minimum, will be used to determine the acceptability of the coarse aggregate if the Contractor furnishes a Certificate of Compliance, as provided in Section 6-1.07, "Certificates of Compliance," certifying that:

A. Coarse aggregate sampled at the completion of processing at the aggregate production plant had a Cleanness Value of not less than 82 when tested in conformance with the requirements in California Test 227; and
B. Prequalification tests performed in conformance with the requirements in California Test 549 indicated that the aggregate would develop a relative strength of not less than 95 percent and would have a relative shrinkage not greater than 105 percent, based on concrete.

90-2.02B FINE AGGREGATE

• Fine aggregate shall consist of natural sand, manufactured sand produced from larger aggregate or a combination thereof. Manufactured sand shall be well graded.
• Fine aggregate shall conform to the following quality requirements:

Test	California Test	Requirements
Organic Impurities	213	Satisfactory[a]
Mortar Strengths Relative to Ottawa Sand	515	95%, min.
Sand Equivalent:		
Operating Range	217	75, min.
Contract Compliance	217	71, min.

a Fine aggregate developing a color darker than the reference standard color solution may be accepted if it is determined by the Engineer, from mortar strength tests, that a darker color is acceptable.

• In lieu of the above Sand Equivalent requirements, a Sand Equivalent "Operating Range" limit of 71, minimum, and a Sand Equivalent "Contract Compliance" limit of 68, minimum, will be used to determine the acceptability of the fine aggregate if the Contractor furnishes a Certificate of Compliance, as provided in Section 6-1.07, "Certificates of Compliance," certifying that:

A. Fine aggregate sampled at the completion of processing at the aggregate production plant had a Sand Equivalent value of not less than 82 when tested by California Test 217; and
B. Prequalification tests performed in conformance with California Test 549 indicated that the aggregate would develop a relative strength of not less than 95 percent and would have a relative shrinkage not greater than 105 percent, based on concrete.

90-2.03 WATER

• In conventionally reinforced concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 1,000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1,300 parts per million of sulfates as SO_4, when tested in conformance with California Test 417. In prestressed concrete work, the water for curing, for washing aggregates, and for mixing shall be free from oil and shall not contain more than 650 parts per million of chlorides as Cl, when tested in conformance with California Test 422, nor more than 1,300 parts per million of sulfates as SO_4, when tested in conformance with California Test 417. In no case shall the water contain an amount of impurities that will cause either: 1) a change in the setting time of cement of more than 25 percent when tested in conformance with the requirements in ASTM Designation: C 191 or ASTM Designation: C 266 or 2) a reduction in the compressive strength of mortar at 14 days of more than 5 percent, when tested in conformance with the requirements in ASTM Designation: C 109, when compared to the results obtained with distilled water or deionized water, tested in conformance with the requirements in ASTM Designation: C 109.

• In nonreinforced concrete work, the water for curing, for washing aggregates and for mixing shall be free from oil and shall not contain more than 2,000 parts per million of chlorides as Cl, when tested in conformance with California Test 422, or more than 1,500 parts per million of sulfates as SO_4, when tested in conformance with California Test 417.

• In addition to the above provisions, water for curing concrete shall not contain impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.

• Water reclaimed from mixer wash-out operations may be used in mixing concrete. The water shall not contain coloring agents or more than 300 parts per million of alkalis ($Na_2O + 0.658\ K_2O$) as determined on the filtrate. The specific gravity of the water shall not exceed 1.03 and shall not vary more than ±0.010 during a day's operations.

90-2.04 ADMIXTURE MATERIALS

• Admixture materials shall conform to the requirements in the following ASTM Designations:

A. Chemical Admixtures—ASTM Designation: C 494.
B. Air-entraining Admixtures—ASTM Designation: C 260.

90-3 AGGREGATE GRADINGS

90-3.01 GENERAL

• Before beginning concrete work, the Contractor shall submit in writing to the Engineer the gradation of the primary aggregate nominal sizes that the Contractor proposes to furnish. If a primary coarse aggregate or the fine aggregate is separated into 2 or more sizes, the proposed gradation shall consist of the gradation for each individual size, and the proposed proportions of each individual size, combined mathematically to indicate one proposed gradation. The proposed gradation shall meet the grading requirements shown in the table in this section, and shall show the percentage passing each of the sieve sizes used in determining the end result.

• The Engineer may waive, in writing, the gradation requirements in this Section 90-3.01 and in Sections 90-3.02, "Coarse Aggregate Grading," 90-3.03, "Fine Aggregate Grading," and

90-3.04, "Combined Aggregate Gradings," if, in the Engineer's opinion, furnishing the gradation is not necessary for the type or amount of concrete work to be constructed.

• Gradations proposed by the Contractor shall be within the following percentage passing limits:

Primary Aggregate Nominal Size	Sieve Size	Limits of Proposed Gradation
1 1/2" x 3/4"	1"	19 - 41
1" x No. 4	3/4"	52 - 85
1" x No. 4	3/8"	15 - 38
1/2" x No. 4	3/8"	40 - 78
3/8" x No. 8	3/8"	50 - 85
Fine Aggregate	No. 16	55 - 75
Fine Aggregate	No. 30	34 - 46
Fine Aggregate	No. 50	16 - 29

• Should the Contractor change the source of supply, the Contractor shall submit in writing to the Engineer the new gradations before their intended use.

90-3.02 COARSE AGGREGATE GRADING

• The grading requirements for coarse aggregates are shown in the following table for each size of coarse aggregate:

	Percentage Passing Primary Aggregate Nominal Sizes							
	1 1/2" x 3/4"		1" x No. 4		1/2" x No. 4		3/8" x No. 8	
Sieve Sizes	Operating Range	Contract Compliance	Operating Range	Contract Compliance	Operating Range	Contract Compliance	Operating Range	Contract Compliance
2"	100	100	—	—	—	—	—	—
1 1/2"	88 - 100	85 - 100	100	100	—	—	—	—
1"	X ±18	X ±25	88 - 100	86 - 100	—	—	—	—
3/4"	0 - 17	0 - 20	X ±15	X ±22	100	100	—	—
1/2"	—	—	—	—	82 - 100	80 - 100	100	100
3/8"	0 - 7	0 - 9	X ±15	X ±22	X ±15	X ±22	X ±15	X ±20
No. 4	—	—	0 - 16	0 - 18	0 - 15	0 - 18	0 - 25	0 - 28
No. 8	—	—	0 - 6	0 - 7	0 - 6	0 - 7	0 - 6	0 - 7

• In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."

• Coarse aggregate for the 1 1/2 inch, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," shall be furnished in 2 or more primary aggregate nominal sizes. Each primary aggregate nominal size may be separated into 2 sizes and stored separately, provided that the combined material conforms to the grading requirements for that particular primary aggregate nominal size.

• When the one inch, maximum, combined aggregate grading as provided in Section 90-3.04, "Combined Aggregate Gradings," is to be used, the coarse aggregate may be separated into 2 sizes and stored separately, provided that the combined material shall conform to the grading requirements for the 1" x No. 4 primary aggregate nominal size.

90-3.03 FINE AGGREGATE GRADING

• Fine aggregate shall be graded within the following limits:

Sieve Sizes	Percentage Passing	
	Operating Range	Contract Compliance
3/8"	100	100
No. 4	95 - 100	93 - 100
No. 8	65 - 95	61 - 99
No. 16	X ±10	X ±13
No. 30	X ±9	X ±12
No. 50	X ±6	X ±9
No. 100	2 - 12	1 - 15
No. 200	0 - 8	0 - 10

• In the above table, the symbol X is the gradation that the Contractor proposes to furnish for the specific sieve size as provided in Section 90-3.01, "General."

• In addition to the above required grading analysis, the distribution of the fine aggregate sizes shall be such that the difference between the total percentage passing the No. 16 sieve and the total percentage passing the No. 30 sieve shall be between 10 and 40, and the difference between the percentage passing the No. 30 and No. 50 sieves shall be between 10 and 40.

• Fine aggregate may be separated into 2 or more sizes and stored separately, provided that the combined material conforms to the grading requirements specified in this Section 90-3.03.

90-3.04 COMBINED AGGREGATE GRADINGS

• Combined aggregate grading limits shall be used only for the design of concrete mixes. Concrete mixes shall be designed so that aggregates are combined in proportions that shall produce a mixture within the grading limits for combined aggregates as specified herein.

• The combined aggregate grading, except when otherwise specified in these specifications or the special provisions, shall be either the 1 1/2 inch, maximum grading, or the 1 inch, maximum grading, at the option of the Contractor.

Grading Limits of Combined Aggregates

Sieve Sizes	Percentage Passing			
	1 1/2" Max.	1" Max.	1/2" Max.	3/8" Max.
2"	100	—	—	—
1 1/2"	90 - 100	100	—	—
1"	50 - 86	90 - 100	—	—
3/4"	45 - 75	55 - 100	100	—
1/2"	—	—	90 - 100	100
3/8"	38 - 55	45 - 75	55 - 86	50 - 100
No. 4	30 - 45	35 - 60	45 - 63	45 - 63
No. 8	23 - 38	27 - 45	35 - 49	35 - 49
No. 16	17 - 33	20 - 35	25 - 37	25 - 37
No. 30	10 - 22	12 - 25	15 - 25	15 - 25
No. 50	4 - 10	5 - 15	5 - 15	5 - 15
No. 100	1 - 6	1 - 8	1 - 8	1 - 8
No. 200	0 - 3	0 - 4	0 - 4	0 - 4

• Changes from one grading to another shall not be made during the progress of the work unless permitted by the Engineer.

90-4 ADMIXTURES

90-4.01 GENERAL

• Admixtures used in portland cement concrete shall conform to and be used in conformance with the provisions in this Section 90-4 and the special provisions. Admixtures shall be used when specified or ordered by the Engineer and may be used at the Contractor's option as provided herein.

• Chemical admixtures and air-entraining admixtures containing chlorides as Cl in excess of one percent by weight of admixture, as determined by California Test 415, shall not be used.

• Admixtures shall be uniform in properties throughout their use in the work. Should it be found that an admixture as furnished is not uniform in properties, its use shall be discontinued.

• If more than one admixture is used, the admixtures shall be compatible with each other so that the desirable effects of all admixtures used will be realized.

• Chemical admixtures shall be used in conformance with the manufacturer's written recommendations.

90-4.02 MATERIALS

• Admixture materials shall conform to the provisions in Section 90–2.04, "Admixture Materials."

90-4.03 ADMIXTURE APPROVAL

• No admixture brand shall be used in the work unless it is on the Department's current list of approved brands for the type of admixture involved.

• Admixture brands will be considered for addition to the approved list if the manufacturer of the admixture submits to the Transportation Laboratory a sample of the admixture accompanied by certified test results demonstrating that the admixture complies with the requirements in the appropriate ASTM Designation and these specifications. The sample shall be sufficient to permit performance of all required tests. Approval of admixture brands will be dependent upon a determination as to compliance with the requirements, based on the certified test results submitted, together with tests the Department may elect to perform.

• If the Contractor proposes to use an admixture of a brand and type on the current list of approved admixture brands, the Contractor shall furnish a Certificate of Compliance from the manufacturer, as provided in Section 6-1.07, "Certificates of Compliance," certifying that the admixture furnished is the same as that previously approved. If a previously approved admixture is not accompanied by a Certificate of Compliance, the admixture shall not be used in the work until the Engineer has had sufficient time to make the appropriate tests and has approved the admixture for use. The Engineer may take samples for testing at any time, whether or not the admixture has been accompanied by a Certificate of Compliance.

90-4.04 REQUIRED USE OF CHEMICAL ADMIXTURES

• If the use of a chemical admixture is specified, the admixture shall be used at the dosage specified, except that if no dosage is specified, the admixture shall be used at the dosage normally recommended by the manufacturer of the admixture.

90-4.05 OPTIONAL USE OF CHEMICAL ADMIXTURES

• The Contractor may use Type A or F, water-reducing; Type B, retarding; or Type D or G, water-reducing and retarding admixtures as described in ASTM Designation: C 494 to conserve cementitious material or to facilitate any concrete construction application subject to the following conditions:

A. If a water-reducing admixture or a water-reducing and retarding admixture is used, the cementitious material content specified or ordered may be reduced by a maximum of 5 percent by weight, except that the resultant cementitious material content shall be not less than 505 pounds per cubic yard; and
B. When a reduction in cementitious material content is made, the dosage of admixture used shall be the dosage used in determining approval of the admixture.

• Unless otherwise specified, a Type C accelerating chemical admixture conforming to the requirements in ASTM Designation: C 494, may be used in portland cement concrete. Inclusion in the mix design submitted for approval will not be required provided that the admixture is added to counteract changing conditions that contribute to delayed setting of the portland cement concrete, and the use or change in dosage of the admixture is approved in writing by the Engineer.

90-4.06 REQUIRED USE OF AIR-ENTRAINING ADMIXTURES

• When air-entrainment is specified or ordered by the Engineer, the air-entraining admixture shall be used in amounts to produce a concrete having the specified air content as determined by California Test 504.

90-4.07 OPTIONAL USE OF AIR-ENTRAINING ADMIXTURES

• When air-entrainment has not been specified or ordered by the Engineer, the Contractor will be permitted to use an air-entraining admixture to facilitate the use of any construction procedure or equipment provided that the average air content, as determined by California Test 504, of 3 successive tests does not exceed 4 percent, and no single test value exceeds 5.5 percent. If the Contractor elects to use an air-entraining admixture in concrete for pavement, the Contractor shall so indicate at the time the Contractor designates the source of aggregate.

90-4.08 BLANK

90-4.09 BLANK

90-4.10 PROPORTIONING AND DISPENSING LIQUID ADMIXTURES

• Chemical admixtures and air-entraining admixtures shall be dispensed in liquid form. Dispensers for liquid admixtures shall have sufficient capacity to measure at one time the prescribed quantity required for each batch of concrete. Each dispenser shall include a graduated measuring unit into which liquid admixtures are measured to within ±5 percent of the prescribed quantity for each batch. Dispensers shall be located and maintained so that the graduations can be accurately read from the point at which proportioning operations are controlled to permit a

visual check of batching accuracy prior to discharge. Each measuring unit shall be clearly marked for the type and quantity of admixture.

• Each liquid admixture dispensing system shall be equipped with a sampling device consisting of a valve located in a safe and readily accessible position such that a sample of the admixture may be withdrawn slowly by the Engineer.

• If more than one liquid admixture is used in the concrete mix, each liquid admixture shall have a separate measuring unit and shall be dispensed by injecting equipment located in such a manner that the admixtures are not mixed at high concentrations and do not interfere with the effectiveness of each other. When air-entraining admixtures are used in conjunction with other liquid admixtures, the air-entraining admixture shall be the first to be incorporated into the mix, unless it is demonstrated that a different sequence improves performance.

• When automatic proportioning devices are required for concrete pavement, dispensers for liquid admixtures shall operate automatically with the batching control equipment. The dispensers shall be equipped with an automatic warning system in good operating condition that will provide a visible or audible signal at the point at which proportioning operations are controlled when the quantity of admixture measured for each batch of concrete varies from the preselected dosage by more than 5 percent, or when the entire contents of the measuring unit are not emptied from the dispenser into each batch of concrete.

• Unless liquid admixtures are added to premeasured water for the batch, their discharge into the batch shall be arranged to flow into the stream of water so that the admixtures are well dispersed throughout the batch, except that air-entraining admixtures may be dispensed directly into moist sand in the batching bins provided that adequate control of the air content of the concrete can be maintained.

• Liquid admixtures requiring dosages greater than one-half gallon per cubic yard shall be considered to be water when determining the total amount of free water as specified in Section 90-6.06, "Amount of Water and Penetration."

90-4.11 BLANK

90-5 PROPORTIONING

90-5.01 STORAGE OF AGGREGATES

• Aggregates shall be stored or stockpiled in such a manner that separation of coarse and fine particles of each size shall be avoided and the various sizes shall not become intermixed before proportioning.

• Aggregates shall be stored or stockpiled and handled in a manner that prevent contamination by foreign materials. In addition, storage of aggregates at batching or mixing facilities that are erected subsequent to the award of the contract and that furnish concrete to the project shall conform to the following:

A. Intermingling of the different sizes of aggregates shall be positively prevented. The Contractor shall take the necessary measures to prevent intermingling. The preventive measures may include, but are not necessarily limited to, physical separation of stockpiles or construction of bulkheads of adequate length and height; and
B. Contamination of aggregates by contact with the ground shall be positively prevented. The Contractor shall take the necessary measures to prevent contamination. The preventive measures shall include, but are not necessarily limited to, placing aggregates on wooden

platforms or on hardened surfaces consisting of portland cement concrete, asphalt concrete, or cement treated material.

• In placing aggregates in storage or in moving the aggregates from storage to the weigh hopper of the batching plant, any method that may cause segregation, degradation, or the combining of materials of different gradings that will result in any size of aggregate at the weigh hopper failing to meet the grading requirements, shall be discontinued. Any method of handling aggregates that results in excessive breakage of particles shall be discontinued. The use of suitable devices to reduce impact of falling aggregates may be required by the Engineer.

90-5.02 PROPORTIONING DEVICES

• Weighing, measuring, or metering devices used for proportioning materials shall conform to the requirements in Section 9-1.01, "Measurement of Quantities," and this Section 90-5.02. In addition, automatic weighing systems shall comply with the requirements for automatic proportioning devices in Section 90-5.03A, "Proportioning for Pavement." Automatic devices shall be automatic to the extent that the only manual operation required for proportioning the aggregates, cement, and supplementary cementitious material for one batch of concrete is a single operation of a switch or starter.

• Proportioning devices shall be tested as frequently as the Engineer may deem necessary to ensure their accuracy.

• Weighing equipment shall be insulated against vibration or movement of other operating equipment in the plant. When the plant is in operation, the weight of each batch of material shall not vary from the weight designated by the Engineer by more than the tolerances specified herein.

• Equipment for cumulative weighing of aggregate shall have a zero tolerance of ±0.5 percent of the designated total batch weight of the aggregate. For systems with individual weigh hoppers for the various sizes of aggregate, the zero tolerance shall be ±0.5 percent of the individual batch weight designated for each size of aggregate. Equipment for cumulative weighing of cement and supplementary cementitious material shall have a zero tolerance of ±0.5 percent of the designated total batch weight of the cement and supplementary cementitious material. Equipment for weighing cement or supplementary cementitious material separately shall have a zero tolerance of ±0.5 percent of their designated individual batch weights. Equipment for measuring water shall have a zero tolerance of ±0.5 percent of its designated weight or volume.

• The weight indicated for any batch of material shall not vary from the preselected scale setting by more than the following:

A. Aggregate weighed cumulatively shall be within 1.0 percent of the designated total batch weight of the aggregate. Aggregates weighed individually shall be within 1.5 percent of their respective designated batch weights; and
B. Cement shall be 99 to 102 percent of its designated batch weight. When weighed individually, supplementary cementitious material shall be 99 to 102 percent of its designated batch weight. When supplementary cementitious material and cement are permitted to be weighed cumulatively, cement shall be weighed first to 99 to 102 percent of its designated batch weight, and the total for cement and supplementary cementitious material shall be 99 to 102 percent of the sum of their designated batch weights; and
C. Water shall be within 1.5 percent of its designated weight or volume.

• Each scale graduation shall be approximately 0.001 of the total capacity of the scale. The capacity of scales for weighing cement, supplementary cementitious material, or cement plus supplementary cementitious material and aggregates shall not exceed that of commercially available scales having single graduations indicating a weight not exceeding the maximum permissible weight variation above, except that no scale shall be required having a capacity of less than 1,000 pounds, with one pound graduations.

90-5.03 PROPORTIONING

• Proportioning shall consist of dividing the aggregates into the specified sizes, each stored in a separate bin, and combining them with cementitious material and water as provided in these specifications. Aggregates shall be proportioned by weight.

• At the time of batching, aggregates shall have been dried or drained sufficiently to result in a stable moisture content such that no visible separation of water from aggregate will take place during transportation from the proportioning plant to the point of mixing. In no event shall the free moisture content of the fine aggregate at the time of batching exceed 8 percent of its saturated, surface-dry weight.

• Should separate supplies of aggregate material of the same size group, but of different moisture content or specific gravity or surface characteristics affecting workability, be available at the proportioning plant, withdrawals shall be made from one supply exclusively and the materials therein completely exhausted before starting upon another.

• Bulk Type IP (MS) cement shall be weighed in an individual hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer.

• Bulk cement and supplementary cementitious material may be weighed in separate, individual weigh hoppers or may be weighed in the same weigh hopper and shall be kept separate from the aggregates until the ingredients are released for discharge into the mixer. If the cement and supplementary cementitious material are weighed cumulatively, the cement shall be weighed first.

• If cement and supplementary cementitious material are weighed in separate weigh hoppers, the weigh systems for the proportioning of the aggregate, the cement, and the supplementary cementitious material shall be individual and distinct from all other weigh systems. Each weigh system shall be equipped with a hopper, a lever system, and an indicator to constitute an individual and independent material-weighing device. The cement and the supplementary cementitious material shall be discharged into the mixer simultaneously with the aggregate.

• The scales and weigh hoppers for bulk weighing cement, supplementary cementitious material, or cement plus supplementary cementitious material shall be separate and distinct from the aggregate weighing equipment.

• For batches of one cubic yard or more, the batching equipment shall conform to one of the following combinations:

A. Separate boxes and separate scale and indicator for weighing each size of aggregate.
B. Single box and scale indicator for all aggregates.
C. Single box or separate boxes and automatic weighing mechanism for all aggregates.

• In order to check the accuracy of batch weights, the gross weight and tare weight of batch trucks, truck mixers, truck agitators, and non-agitating hauling equipment shall be determined

when ordered by the Engineer. The equipment shall be weighed on scales designated by the Engineer.

90-5.03A PROPORTIONING FOR PAVEMENT

- Aggregates and bulk supplementary cementitious material for use in pavement shall be proportioned by weight by means of automatic proportioning devices of approved type conforming to these specifications.
- The Contractor shall install and maintain in operating condition an electronically actuated moisture meter that will indicate, on a readily visible scale, changes in the moisture content of the fine aggregate as it is batched within a sensitivity of 0.5 percent by weight of the fine aggregate.
- The batching of cement, supplementary cementitious material, or cement plus supplementary cementitious material and aggregate shall be interlocked so that a new batch cannot be started until all weigh hoppers are empty, the proportioning devices are within zero tolerance, and the discharge gates are closed. The interlock shall permit no part of the batch to be discharged until all aggregate hoppers and the cement and supplementary cementitious material hoppers or the cement plus supplementary cementitious material hopper are charged with weights that are within the tolerances specified in Section 90-5.02, "Proportioning Devices."
- If interlocks are required for cement and supplementary cementitious material charging mechanisms and cement and supplementary cementitious material are weighed cumulatively, their charging mechanisms shall be interlocked to prevent the introduction of mineral admixture until the weight of cement in the cement weigh hopper is within the tolerances specified in Section 90-5.02, "Proportioning Devices."
- If concrete is completely mixed in stationary paving mixers, the supplementary cementitious materials shall be weighed in a separate weigh hopper and the supplementary cementitious material and cement shall be introduced simultaneously into the mixer proportionately with the aggregate. If the Contractor provides certification that the stationary mixer is capable of mixing the cement, supplementary cementitious material, aggregates, and water uniformly before discharge, weighing the supplementary cementitious material cumulatively with the cement is permitted. Certification shall contain the following:

A. Test results for 2 compressive strength test cylinders of concrete taken within the first one-third and 2 compressive strength test cylinders of concrete taken within the last one-third of the concrete discharged from a single batch from the stationary paving mixer. Strength tests and cylinder preparation will be in conformance with the provisions of Section 90-9, "Compressive Strength";
B. Calculations demonstrating that the difference in the averages of 2 compressive strengths taken in the first one-third is no greater than 7.5 percent different than the averages of 2 compressive strengths taken in the last one-third of the concrete discharged from a single batch from the stationary paving mixer. Strength tests and cylinder preparation will be in conformance with the provisions of Section 90-9, "Compressive Strength;" and
C. The mixer rotation speed and time of mixing before discharge that are required to produce a mix that meets the requirements above.

• The discharge gate on the cement and supplementary cementitious material hoppers or the cement plus supplementary cementitious material hopper shall be designed to permit regulating the flow of cement, supplementary cementitious material, or cement plus supplementary cementitious material into the aggregate as directed by the Engineer.
• If separate weigh boxes are used for each size of aggregate, the discharge gates shall permit regulating the flow of each size of aggregate as directed by the Engineer.
• Material discharged from the several bins shall be controlled by gates or by mechanical conveyors. The means of withdrawal from the several bins, and of discharge from the weigh box, shall be interlocked so that not more than one bin can discharge at a time, and so that the weigh box cannot be tripped until the required quantity from each of the several bins has been deposited therein. Should a separate weigh box be used for each size of aggregate, all may be operated and discharged simultaneously.
• If the discharge from the several bins is controlled by gates, each gate shall be actuated automatically so that the required mass is discharged into the weigh box, after which the gate shall automatically close and lock.
• The automatic weighing system shall be designed so that all proportions required may be set on the weighing controller at the same time.

90-6 MIXING AND TRANSPORTING

90-6.01 GENERAL

• Concrete shall be mixed in mechanically operated mixers, except that when permitted by the Engineer, batches not exceeding 1/3 cubic yard may be mixed by hand methods in conformance with the provisions in Section 90-6.05, "Hand-Mixing."
• Equipment having components made of aluminum or magnesium alloys that would have contact with plastic concrete during mixing, transporting, or pumping of portland cement concrete shall not be used.
• Concrete shall be homogeneous and thoroughly mixed, and there shall be no lumps or evidence of undispersed cementitious material.
• Uniformity of concrete mixtures will be determined by differences in penetration as determined by California Test 533, or slump as determined by ASTM Designation: C 143, and by variations in the proportion of coarse aggregate as determined by California Test 529.
• When the mix design specifies a penetration value, the difference in penetration, determined by comparing penetration tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed 1/2-inch. When the mix design specifies a slump value, the difference in slump, determined by comparing slump tests on 2 samples of mixed concrete from the same batch or truck mixer load, shall not exceed the values given in the table below. Variation in the proportion of coarse aggregate will be determined by comparing the results of tests of 2 samples of mixed concrete from the same batch or truck mixer load and the difference between the 2 results shall not exceed 170 pounds per cubic yard of concrete.

Average Slump	Maximum Permissible Difference
Less than 4"	1"
4" to 6"	1 1/2"
Greater than 6" to 9"	2"

• The Contractor shall furnish samples of the freshly mixed concrete and provide satisfactory facilities for obtaining the samples.

90-6.02 MACHINE MIXING

• Concrete mixers may be of the revolving drum or the revolving blade type, and the mixing drum or blades shall be operated uniformly at the mixing speed recommended by the manufacturer. Mixers and agitators that have an accumulation of hard concrete or mortar shall not be used.

• The temperature of mixed concrete, immediately before placing, shall be not less than 50° F or more than 90° F. Aggregates and water shall be heated or cooled as necessary to produce concrete within these temperature limits. Neither aggregates nor mixing water shall be heated to exceed 150° F. If ice is used to cool the concrete, discharge of the mixer will not be permitted until all ice is melted.

• The batch shall be so charged into the mixer that some water will enter in advance of cementitious materials and aggregates. All water shall be in the drum by the end of the first one-fourth of the specified mixing time.

• Cementitious materials shall be batched and charged into the mixer by means that will not result either in loss of cementitious materials due to the effect of wind, in accumulation of cementitious materials on surfaces of conveyors or hoppers, or in other conditions that reduce or vary the required quantity of cementitious material in the concrete mixture.

• Paving and stationary mixers shall be operated with an automatic timing device. The timing device and discharge mechanism shall be interlocked so that during normal operation no part of the batch will be discharged until the specified mixing time has elapsed.

• The total elapsed time between the intermingling of damp aggregates and all cementitious materials and the start of mixing shall not exceed 30 minutes.

• The size of batch shall not exceed the manufacturer's guaranteed capacity.

• When producing concrete for pavement or base, suitable batch counters shall be installed and maintained in good operating condition at job site batching plants and stationary mixers. The batch counters shall indicate the exact number of batches proportioned and mixed.

• Concrete shall be mixed and delivered to the job site by means of one of the following combinations of operations:

A. Mixed completely in a stationary mixer and the mixed concrete transported to the point of delivery in truck agitators or in nonagitating hauling equipment (central-mixed concrete).
B. Mixed partially in a stationary mixer, and the mixing completed in a truck mixer (shrink-mixed concrete).
C. Mixed completely in a truck mixer (transit-mixed concrete).
D. Mixed completely in a paving mixer.

• Agitators may be truck mixers operating at agitating speed or truck agitators. Each mixer and agitator shall have attached thereto in a prominent place a metal plate or plates on which is plainly marked the various uses for which the equipment is designed, the manufacturer's guaranteed capacity of the drum or container in terms of the volume of mixed concrete and the speed of rotation of the mixing drum or blades.

• Truck mixers shall be equipped with electrically or mechanically actuated revolution counters by which the number of revolutions of the drum or blades may readily be verified.

• When shrink-mixed concrete is furnished, concrete that has been partially mixed at a central plant shall be transferred to a truck mixer and all requirements for transit-mixed concrete

shall apply. No credit in the number of revolutions at mixing speed will be allowed for partial mixing in a central plant.

90-6.03 TRANSPORTING MIXED CONCRETE

- Mixed concrete may be transported to the delivery point in truck agitators or truck mixers operating at the speed designated by the manufacturer of the equipment as agitating speed, or in non-agitating hauling equipment, provided the consistency and workability of the mixed concrete upon discharge at the delivery point is suitable for adequate placement and consolidation in place, and provided the mixed concrete after hauling to the delivery point conforms to the provisions in Section 90-6.01, "General."
- Truck agitators shall be loaded not to exceed the manufacturer's guaranteed capacity and shall maintain the mixed concrete in a thoroughly mixed and uniform mass during hauling.
- Bodies of nonagitating hauling equipment shall be constructed so that leakage of the concrete mix, or any part thereof, will not occur at any time.
- Concrete hauled in open-top vehicles shall be protected during hauling against rain or against exposure to the sun for more than 20 minutes when the ambient temperature exceeds 75° F.
- No additional mixing water shall be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer. If the Engineer authorizes additional water to be incorporated into the concrete, the drum shall be revolved not less than 30 revolutions at mixing speed after the water is added and before discharge is commenced.
- The rate of discharge of mixed concrete from truck mixer-agitators shall be controlled by the speed of rotation of the drum in the discharge direction with the discharge gate fully open.
- If a truck mixer or agitator is used for transporting concrete to the delivery point, discharge shall be completed within 1.5 hours or before 250 revolutions of the drum or blades, whichever occurs first, after the introduction of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or if the temperature of the concrete is 85° F or above, the time allowed may be less than 1.5 hours. If an admixture is used to retard the set time, the temperature of the concrete shall not exceed 85° F, the time limit shall be 2 hours, and the revolution limitation shall be 300.
- If nonagitating hauling equipment is used for transporting concrete to the delivery point, discharge shall be completed within one hour after the addition of the cement to the aggregates. Under conditions contributing to quick stiffening of the concrete, or when the temperature of the concrete is 85° F or above, the time between the introduction of cement to the aggregates and discharge shall not exceed 45 minutes.
- Each load of concrete delivered at the job site shall be accompanied by a weighmaster certificate showing the mix identification number, nonrepeating load number, date and time at which the materials were batched, the total amount of water added to the load, and for transit-mixed concrete, the reading of the revolution counter at the time the truck mixer is charged with cement. This weighmaster certificate shall also show the actual scale weights (pounds) for the ingredients batched. Theoretical or target batch weights shall not be used as a substitute for actual scale weights.
- Weighmaster certificates shall be provided in printed form, or if approved by the Engineer, the data may be submitted in electronic media. Electronic media shall be presented in a tab-delimited format on a 3 1/2-inch diskette with a capacity of at least 1.4 megabytes. Captured data, for the ingredients represented by each batch shall be "line feed, carriage return"

(LFCR) and "one line, separate record" with allowances for sufficient fields to satisfy the amount of data required by these specifications.

• The Contractor may furnish a weighmaster certificate accompanied by a separate certificate that lists the actual batch weights or measurements for a load of concrete provided that both certificates are imprinted with the same nonrepeating load number that is unique to the contract and delivered to the jobsite with the load.

• Weighmaster certificates furnished by the Contractor shall conform to the provisions in Section 9-1.01, "Measurement of Quantities."

90-6.04 TIME OR AMOUNT OF MIXING

• Mixing of concrete in paving or stationary mixers shall continue for the required mixing time after all ingredients, except water and admixture, if added with the water, are in the mixing compartment of the mixer before any part of the batch is released. Transfer time in multiple drum mixers shall not be counted as part of the required mixing time.

• The required mixing time, in paving or stationary mixers, of concrete used for concrete structures, except minor structures, shall be not less than 90 seconds or more than 5 minutes, except that when directed by the Engineer in writing, the requirements of the following paragraph shall apply.

• The required mixing time, in paving or stationary mixers, except as provided in the preceding paragraph, shall be not less than 50 seconds or more than 5 minutes.

• The minimum required revolutions at the mixing speed for transit-mixed concrete shall not be less than that recommended by the mixer manufacturer, but in no case shall the number of revolutions be less than that required to consistently produce concrete conforming to the provisions for uniformity in Section 90-6.01, "General."

• When a high range water-reducing admixture is added to the concrete at the job site, the total number of revolutions shall not exceed 300.

90-6.05 HAND-MIXING

• Hand-mixed concrete shall be made in batches of not more than 1/3 cubic yard and shall be mixed on a watertight, level platform. The proper amount of coarse aggregate shall be measured in measuring boxes and spread on the platform and the fine aggregate shall be spread on this layer, the 2 layers being not more than one foot in total depth. On this mixture shall be spread the dry cementitious materials and the whole mass turned no fewer than 2 times dry; then sufficient clean water shall be added, evenly distributed, and the whole mass again turned no fewer than 3 times, not including placing in the carriers or forms.

90-6.06 AMOUNT OF WATER AND PENETRATION

• The amount of water used in concrete mixes shall be regulated so that the penetration of the concrete as determined by California Test 533 or the slump of the concrete as determined by ASTM Designation: C 143 is within the nominal values shown in the following table. When the penetration or slump of the concrete is found to exceed the nominal values listed, the mixture of subsequent batches shall be adjusted to reduce the penetration or slump to a value within the nominal range shown. Batches of concrete with a penetration or slump exceeding the maximum values listed shall not be used in the work. If Type F or Type G chemical admixtures are added to the mix, the penetration requirements shall not apply and the slump shall not exceed 9 inches after the chemical admixtures are added.

Type of Work	Nominal		Maximum	
	Penetration (inches)	Slump (inches)	Penetration (inches)	Slump (inches)
Concrete Pavement	0 - 1	—	1 1/2	—
Non-reinforced concrete facilities	0 - 1 1/2	—	2	—
Reinforced concrete structures				
Sections over 12 inches thick	0 - 1 1/2	—	2 1/2	—
Sections 12 inches thick or less	0 - 2	—	3	—
Concrete placed under water	—	6 - 8	—	9
Cast-in-place concrete piles	2 1/2 - 3 1/2	5 - 7	4	8

• The amount of free water used in concrete shall not exceed 310 pounds per cubic yard, plus 20 pounds for each required 100 pounds of cementitious material in excess of 550 pounds per cubic yard.

• The term free water is defined as the total water in the mixture minus the water absorbed by the aggregates in reaching a saturated surface-dry condition.

• If there are adverse or difficult conditions that affect the placing of concrete, the above specified penetration and free water content limitations may be exceeded providing the Contractor is granted permission by the Engineer in writing to increase the cementitious material content per cubic yard of concrete. The increase in water and cementitious material shall be at a ratio not to exceed 30 pounds of water per added 100 pounds of cementitious material per cubic yard. Full compensation for additional cementitious material and water added under these conditions shall be considered as included in the contract price paid for the concrete work involved and no additional compensation will be allowed therefor.

• The equipment for supplying water to the mixer shall be constructed and arranged so that the amount of water added can be measured accurately. Any method of discharging water into the mixer for a batch shall be accurate within 1.5 percent of the quantity of water required to be added to the mix for any position of the mixer. Tanks used to measure water shall be designed so that water cannot enter while water is being discharged into the mixer and discharge into the mixer shall be made rapidly in one operation without dribbling. All equipment shall be arranged so as to permit checking the amount of water delivered by discharging into measured containers.

90-7 CURING CONCRETE

90-7.01 METHODS OF CURING

• Newly placed concrete shall be cured by the methods specified in this Section 90-7.01 and the special provisions.

90-7.01A WATER METHOD

• The concrete shall be kept continuously wet by the application of water for a minimum curing period of 7 days after the concrete has been placed.

• Cotton mats, rugs, carpets, or earth or sand blankets may be used as a curing medium to retain the moisture during the curing period.

• If a curing medium consisting of cotton mats, rugs, carpets, polyethylene sheeting, polyethylene sheeting on burlap, or earth or sand blankets is to be used to retain the moisture, the entire surface of the concrete shall be kept damp by applying water with a nozzle that so atomizes the flow that a mist and not a spray is formed, until the surface of the concrete is

covered with the curing medium. The moisture from the nozzle shall not be applied under pressure directly upon the concrete and shall not be allowed to accumulate on the concrete in a quantity sufficient to cause a flow or wash the surface. At the expiration of the curing period, the concrete surfaces shall be cleared of all curing media.

- At the option of the Contractor, a curing medium consisting of white opaque polyethylene sheeting extruded onto burlap may be used to cure concrete structures. The polyethylene sheeting shall have a minimum thickness of 4-mil, and shall be extruded onto 10-ounce burlap.
- At the option of the Contractor, a curing medium consisting of polyethylene sheeting may be used to cure concrete columns. The polyethylene sheeting shall have a minimum thickness of 10-mil achieved in a single layer of material.
- If the Contractor chooses to use polyethylene sheeting or polyethylene sheeting on burlap as a curing medium, these media and any joints therein shall be secured as necessary to provide moisture retention and shall be within 3 inches of the concrete at all points along the surface being cured. When these media are used, the temperature of the concrete shall be monitored during curing. If the temperature of the concrete cannot be maintained below 140° F, use of these curing media shall be disallowed.
- When concrete bridge decks and flat slabs are to be cured without the use of a curing medium, the entire surface of the bridge deck or slab shall be kept damp by the application of water with an atomizing nozzle as specified above, until the concrete has set, after which the entire surface of the concrete shall be sprinkled continuously with water for a period of not less than 7 days.

90-7.01B CURING COMPOUND METHOD

- Surfaces of the concrete that are exposed to the air shall be sprayed uniformly with a curing compound.

- Curing compounds to be used shall be as follows:
  1. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class B, except the resin type shall be poly-alpha-methylstyrene.
  2. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class B.
  3. Pigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 2, Class A.
  4. Nonpigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 1, Class B.
  5. Nonpigmented curing compound conforming to the requirements in ASTM Designation: C 309, Type 1, Class A.
  6. Nonpigmented curing compound with fugitive dye conforming to the requirements in ASTM Designation: C 309, Type 1-D, Class A.

- The infrared scan for the dried vehicle from curing compound (1) shall match the infrared scan on file at the Transportation Laboratory.
- The loss of water for each type of curing compound, when tested in conformance with the requirements in California Test 534, shall not be more than 0.28-pounds per square yard in 24 hours.

- The curing compound to be used will be specified elsewhere in these specifications or in the special provisions.
- If the use of curing compound is required or permitted elsewhere in these specifications or in the special provisions and no specific kind is specified, any of the curing compounds listed above may be used.
- Curing compound shall be applied at a nominal rate of one gallon per 150 square feet, unless otherwise specified.
- At any point, the application rate shall be within ±50 square feet per gallon of the nominal rate specified, and the average application rate shall be within ±25 square feet per gallon of the nominal rate specified when tested in conformance with the requirements in California Test 535. Runs, sags, thin areas, skips, or holidays in the applied curing compound shall be evidence that the application is not satisfactory.
- Curing compounds shall be applied using power operated spray equipment. The power operated spraying equipment shall be equipped with an operational pressure gage and a means of controlling the pressure. Hand spraying of small and irregular areas that are not reasonably accessible to mechanical spraying equipment, in the opinion of the Engineer, may be permitted.
- The curing compound shall be applied to the concrete following the surface finishing operation, immediately before the moisture sheen disappears from the surface, but before any drying shrinkage or craze cracks begin to appear. In the event of any drying or cracking of the surface, application of water with an atomizing nozzle as specified in Section 90-7.01A, "Water Method," shall be started immediately and shall be continued until application of the compound is resumed or started; however, the compound shall not be applied over any resulting freestanding water. Should the film of compound be damaged from any cause before the expiration of 7 days after the concrete is placed in the case of structures and 72 hours in the case of pavement, the damaged portion shall be repaired immediately with additional compound.
- At the time of use, compounds containing pigments shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. A paddle shall be used to loosen all settled pigment from the bottom of the container, and a power driven agitator shall be used to disperse the pigment uniformly throughout the vehicle.
- Agitation shall not introduce air or other foreign substance into the curing compound.
- The manufacturer shall include in the curing compound the necessary additives for control of sagging, pigment settling, leveling, de-emulsification, or other requisite qualities of a satisfactory working material. Pigmented curing compounds shall be manufactured so that the pigment does not settle badly, does not cake or thicken in the container, and does not become granular or curdled. Settlement of pigment shall be a thoroughly wetted, soft, mushy mass permitting the complete and easy vertical penetration of a paddle. Settled pigment shall be easily redispersed, with minimum resistance to the sideways manual motion of the paddle across the bottom of the container, to form a smooth uniform product of the proper consistency.
- Curing compounds shall remain sprayable at temperatures above 40° F and shall not be diluted or altered after manufacture.
- The curing compound shall be packaged in clean 274-gallon totes, 55-gallon barrels or 5-gallon pails shall be supplied from a suitable storage tank located at the jobsite. The containers shall comply with "Title 49, Code of Federal Regulations, Hazardous Materials Regulations." The 274-gallon totes and the 55-gallon barrels shall have removable lids and airtight fasteners. The 5-gallon pails shall be round and have standard full open head and bail. Lids with bungholes will not be permitted. Settling or separation of solids in containers, except tanks, must be completely redispersed with low speed mixing prior to use, in conformance with

these specifications and the manufacturer's recommendations. Mixing shall be accomplished either manually by use of a paddle or by use of a mixing blade driven by a drill motor, at low speed. Mixing blades shall be the type used for mixing paint. On-site storage tanks shall be kept clean and free of contaminants. Each tank shall have a permanent system designed to completely redisperse settled material without introducing air or other foreign substances.

- Steel containers and lids shall be lined with a coating that will prevent destructive action by the compound or chemical agents in the air space above the compound. The coating shall not come off the container or lid as skins. Containers shall be filled in a manner that will prevent skinning. Plastic containers shall not react with the compound.
- Each container shall be labeled with the manufacturer's name, kind of curing compound, batch number, volume, date of manufacture, and volatile organic compound (VOC) content. The label shall also warn that the curing compound containing pigment shall be well stirred before use. Precautions concerning the handling and the application of curing compound shall be shown on the label of the curing compound containers in conformance with the Construction Safety Orders and General Industry Safety Orders of the State.
- Containers of curing compound shall be labeled to indicate that the contents fully comply with the rules and regulations concerning air pollution control in the State.
- When the curing compound is shipped in tanks or tank trucks, a shipping invoice shall accompany each load. The invoice shall contain the same information as that required herein for container labels.
- Curing compound will be sampled by the Engineer at the source of supply, at the job site, or at both locations.
- Curing compound shall be formulated so as to maintain the specified properties for a minimum of one year. The Engineer may require additional testing before use to determine compliance with these specifications if the compound has not been used within one year or whenever the Engineer has reason to believe the compound is no longer satisfactory.
- Tests will be conducted in conformance with the latest ASTM test methods and methods in use by the Transportation Laboratory.

90-7.01C WATERPROOF MEMBRANE METHOD

- The exposed finished surfaces of concrete shall be sprayed with water, using a nozzle that so atomizes the flow that a mist and not a spray is formed, until the concrete has set, after which the curing membrane, shall be placed. The curing membrane shall remain in place for a period of not less than 72 hours.
- Sheeting material for curing concrete shall conform to the requirements in AASHTO Designation: M 171 for white reflective materials.
- The sheeting material shall be fabricated into sheets of such width as to provide a complete cover for the entire concrete surface. Joints in the sheets shall be securely cemented together in such a manner as to provide a waterproof joint. The joint seams shall have a minimum lap of 0.33-foot.
- The sheets shall be securely weighted down by placing a bank of earth on the edges of the sheets or by other means satisfactory to the Engineer.
- Should any portion of the sheets be broken or damaged before the expiration of 72 hours after being placed, the broken or damaged portions shall be immediately repaired with new sheets properly cemented into place.
- Sections of membrane that have lost their waterproof qualities or have been damaged to such an extent as to render them unfit for curing the concrete shall not be used.

90-7.01D FORMS-IN-PLACE METHOD

• Formed surfaces of concrete may be cured by retaining the forms in place. The forms shall remain in place for a minimum period of 7 days after the concrete has been placed, except that for members over 20 inches in least dimension the forms shall remain in place for a minimum period of 5 days.

• Joints in the forms and the joints between the end of forms and concrete shall be kept moisture tight during the curing period. Cracks in the forms and cracks between the forms and the concrete shall be resealed by methods subject to the approval of the Engineer.

90-7.02 CURING PAVEMENT

• The entire exposed area of the pavement, including edges, shall be cured by the waterproof membrane method, or curing compound method using curing compound (1) or (2) as the Contractor may elect. Should the side forms be removed before the expiration of 72 hours following the start of curing, the exposed pavement edges shall also be cured. If the pavement is cured by means of the curing compound method, the sawcut and all portions of the curing compound that have been disturbed by sawing operations shall be restored by spraying with additional curing compound.

• Curing shall commence as soon as the finishing process provided in Section 40-1.10, "Final Finishing," has been completed. The method selected shall conform to the provisions in Section 90-7.01, "Methods of Curing."

• When the curing compound method is used, the compound shall be applied to the entire pavement surface by mechanical sprayers. Spraying equipment shall be of the fully atomizing type equipped with a tank agitator that provides for continual agitation of the curing compound during the time of application. The spray shall be adequately protected against wind, and the nozzles shall be so oriented or moved mechanically transversely as to result in the minimum specified rate of coverage being applied uniformly on exposed faces. Hand spraying of small and irregular areas, and areas inaccessible to mechanical spraying equipment, in the opinion of the Engineer, will be permitted. When the ambient air temperature is above 60° F, the Contractor shall fog the surface of the concrete with a fine spray of water as specified in Section 90-7.01A, "Water Method." The surface of the pavement shall be kept moist between the hours of 10:00 a.m. and 4:30 p.m. on the day the concrete is placed. However, the fogging done after the curing compound has been applied shall not begin until the compound has set sufficiently to prevent displacement. Fogging shall be discontinued if ordered in writing by the Engineer.

90-7.03 CURING STRUCTURES

• Newly placed concrete for cast-in-place structures, other than highway bridge decks, shall be cured by the water method, the forms-in-place method, or, as permitted herein, by the curing compound method, in conformance with the provisions in Section 90-7.01, "Methods of Curing."

• The curing compound method using a pigmented curing compound may be used on concrete surfaces of construction joints, surfaces that are to be buried underground, and surfaces where only ordinary surface finish is to be applied and on which a uniform color is not required and that will not be visible from a public traveled way. If the Contractor elects to use the curing

compound method on the bottom slab of box girder spans, the curing compound shall be curing compound (1).

• The top surface of highway bridge decks shall be cured by both the curing compound method and the water method. The curing compound shall be curing compound (1).

• Concrete surfaces of minor structures, as defined in Section 51-1.02, "Minor Structures," shall be cured by the water method, the forms-in-place method or the curing compound method.

• When deemed necessary by the Engineer during periods of hot weather, water shall be applied to concrete surfaces being cured by the curing compound method or by the forms-in-place method, until the Engineer determines that a cooling effect is no longer required. Application of water for this purpose will be paid for as extra work as provided in Section 4-1.03D, "Extra Work."

90-7.04 CURING PRECAST CONCRETE MEMBERS

• Precast concrete members shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing." Curing shall be provided for the minimum time specified for each method or until the concrete reaches its design strength, whichever is less. Steam curing may also be used for precast members and shall conform to the following provisions:

A. After placement of the concrete, members shall be held for a minimum 4-hour presteaming period. If the ambient air temperature is below 50° F, steam shall be applied during the presteaming period to hold the air surrounding the member at a temperature between 50° F and 90° F.
B. To prevent moisture loss on exposed surfaces during the presteaming period, members shall be covered as soon as possible after casting or the exposed surfaces shall be kept wet by fog spray or wet blankets.
C. Enclosures for steam curing shall allow free circulation of steam about the member and shall be constructed to contain the live steam with a minimum moisture loss. The use of tarpaulins or similar flexible covers will be permitted, provided they are kept in good repair and secured in such a manner as to prevent the loss of steam and moisture.
D. Steam at the jets shall be at low pressure and in a saturated condition. Steam jets shall not impinge directly on the concrete, test cylinders, or forms. During application of the steam, the temperature rise within the enclosure shall not exceed 40° F per hour. The curing temperature throughout the enclosure shall not exceed 150° F and shall be maintained at a constant level for a sufficient time necessary to develop the required transfer strength. Control cylinders shall be covered to prevent moisture loss and shall be placed in a location where temperature is representative of the average temperature of the enclosure.
E. Temperature recording devices that will provide an accurate, continuous, permanent record of the curing temperature shall be provided. A minimum of one temperature recording device per 200 feet of continuous bed length will be required for checking temperature.
F. Members in pretension beds shall be detensioned immediately after the termination of steam curing while the concrete and forms are still warm, or the temperature under the enclosure shall be maintained above 60° F until the stress is transferred to the concrete.
G. Curing of precast concrete will be considered completed after termination of the steam curing cycle.

90-7.05 CURING PRECAST PRESTRESSED CONCRETE PILES

• Newly placed concrete for precast prestressed concrete piles shall be cured in conformance with the provisions in Section 90-7.04, "Curing Precast Concrete Members," except that piles in a corrosive environment shall be cured as follows:

A. Piles shall be either steam cured or water cured. If water curing is used, the piles shall be kept continuously wet by the application of water in conformance with the provisions in Section 90-7.01A, "Water Method."
B. If steam curing is used, the steam curing provisions in Section 90-7.04, "Curing Precast Concrete Members," shall apply except that the piles shall be kept continuously wet for their entire length for a period of not less than 3 days, including the holding and steam curing periods.

90-7.06 CURING SLOPE PROTECTION

• Concrete slope protection shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing."
• Concreted-rock slope protection shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing," with a blanket of earth kept wet for 72 hours, or by sprinkling with a fine spray of water every 2 hours during the daytime for a period of 3 days.

90-7.07 CURING MISCELLANEOUS CONCRETE WORK

• Exposed surfaces of curbs shall be cured by pigmented curing compounds as specified in Section 90-7.01B, "Curing Compound Method."
• Concrete sidewalks, gutter depressions, island paving, curb ramps, driveways, and other miscellaneous concrete areas shall be cured in conformance with any of the methods specified in Section 90-7.01, "Methods of Curing."
• Shotcrete shall be cured for at least 72 hours by spraying with water, by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."
• Mortar and grout shall be cured by keeping the surface damp for 3 days.
• After placing, the exposed surfaces of sign structure foundations, including pedestal portions, if constructed, shall be cured for at least 72 hours by spraying with water, by a moist earth blanket, or by any of the methods provided in Section 90-7.01, "Methods of Curing."

90-8 PROTECTING CONCRETE

90-8.01 GENERAL

• In addition to the provisions in Section 7-1.16, "Contractor's Responsibility for the Work and Materials," the Contractor shall protect concrete as provided in this Section 90-8. If required by the Engineer, the Contractor shall submit a written outline of the proposed methods for protecting the concrete.
• The Contractor shall protect concrete from damage from any cause, which shall include, but not be limited to: rain, heat, cold, wind, Contractor's actions, and actions of others.
• Concrete shall not be placed on frozen or ice-coated ground or subgrade nor on ice-coated forms, reinforcing steel, structural steel, conduits, precast members, or construction joints.

• Under rainy conditions, placing of concrete shall be stopped before the quantity of surface water is sufficient to damage surface mortar or cause a flow or wash of the concrete surface, unless the Contractor provides adequate protection against damage.
• Concrete that has been frozen or damaged by other causes, as determined by the Engineer, shall be removed and replaced by the Contractor at the Contractor's expense.

90-8.02 PROTECTING CONCRETE STRUCTURES

• Structure concrete and shotcrete used as structure concrete shall be maintained at a temperature of not less than 45° F for 72 hours after placing and at not less than 40° F for an additional 4 days.

90-8.03 PROTECTING CONCRETE PAVEMENT

• Pavement concrete shall be maintained at a temperature of not less than 40° F for 72 hours.
• Except as provided in Section 7-1.08, "Public Convenience," the Contractor shall protect concrete pavement against construction and other activities that abrade, scar, discolor, reduce texture depth, lower coefficient of friction, or otherwise damage the surface. Stockpiling, drifting, or excessive spillage of soil, gravel, petroleum products, and concrete or asphalt mixes on the surface of concrete pavement is prohibited unless otherwise specified in these specifications, the special provisions or permitted by the Engineer.
• If ordered by the Engineer or shown on the plans or specified in the special provisions, pavement crossings shall be constructed for the convenience of public traffic. The material and work necessary for the construction of the crossings, and their subsequent removal and disposal, will be paid for at the contract unit prices for the items of work involved and if there are no contract items for the work involved, payment for pavement crossings will be made by extra work as provided in Section 4-1.03D, "Extra Work.". Where public traffic will be required to cross over the new pavement, Type III portland cement may be used in concrete, if permitted in writing by the Engineer. The pavement may be opened to traffic as soon as the concrete has developed a modulus of rupture of 550 pounds per square inch. The modulus of rupture will be determined by California Test 523.
• No traffic or Contractor's equipment, except as hereinafter provided, will be permitted on the pavement before a period of 10 days has elapsed after the concrete has been placed, nor before the concrete has developed a modulus of rupture of at least 550 pounds per square inch. Concrete that fails to attain a modulus of rupture of 550 pounds per square inch within 10 days shall not be opened to traffic until directed by the Engineer.
• Equipment for sawing weakened plane joints will be permitted on the pavement as specified in Section 40-1.08B, "Weakened Plane Joints."
• When requested in writing by the Contractor, the tracks on one side of paving equipment will be permitted on the pavement after a modulus of rupture of 350 pounds per square inch has been attained, provided that:

A. Unit pressure exerted on the pavement by the paver shall not exceed 20 pounds per square inch;
B. Tracks with cleats, grousers, or similar protuberances shall be modified or shall travel on planks or equivalent protective material, so that the pavement is not damaged; and
C. No part of the track shall be closer than one foot from the edge of pavement.

• In case of visible cracking of, or other damage to the pavement, operation of the paving equipment on the pavement shall be immediately discontinued.
• Damage to the pavement resulting from early use of pavement by the Contractor's equipment as provided above shall be repaired by the Contractor.
• The State will furnish the molds and machines for testing the concrete for modulus of rupture, and the Contractor, at the Contractor's expense, shall furnish the material and whatever labor the Engineer may require.

90-9 COMPRESSIVE STRENGTH

90-9.01 GENERAL

• Concrete compressive strength requirements consist of a minimum strength that shall be attained before various loads or stresses are applied to the concrete and, for concrete designated by strength, a minimum strength at the age of 28 days or at the age otherwise allowed in Section 90-1.01, "Description." The various strengths required are specified in these specifications or the special provisions or are shown on the plans.
• The compressive strength of concrete will be determined from test cylinders that have been fabricated from concrete sampled in conformance with the requirements of California Test 539. Test cylinders will be molded and initially field cured in conformance with California Test 540. Test cylinders will be cured and tested after receipt at the testing laboratory in conformance with the requirements of California Test 521. A strength test shall consist of the average strength of 2 cylinders fabricated from material taken from a single load of concrete, except that, if any cylinder should show evidence of improper sampling, molding, or testing, that cylinder shall be discarded and the strength test shall consist of the strength of the remaining cylinder.
• When concrete compressive strength is specified as a prerequisite to applying loads or stresses to a concrete structure or member, test cylinders for other than steam cured concrete will be cured in conformance with Method 1 of California Test 540. The compressive strength of concrete determined for these purposes will be evaluated on the basis of individual tests.
• When concrete is designated by 28-day compressive strength rather than by cementitious material content, the concrete strength to be used as a basis for acceptance of other than steam cured concrete will be determined from cylinders cured in conformance with Method 1 of California Test 540. If the result of a single compressive strength test at the maximum age specified or allowed is below the specified strength but is 95 percent or more of the specified strength, the Contractor shall make corrective changes, subject to approval of the Engineer, in the mix proportions or in the concrete fabrication procedures, before placing additional concrete, and shall pay to the State $10 for each in-place cubic yard of concrete represented by the deficient test. If the result of a single compressive strength test at the maximum age specified or allowed is below 95 percent of the specified strength, but is 85 percent or more of the specified strength, the Contractor shall make the corrective changes specified above, and shall pay to the State $15 for each in-place cubic yard of concrete represented by the deficient test. In addition, such corrective changes shall be made when the compressive strength of concrete tested at 7 days indicates, in the judgment of the Engineer, that the concrete will not attain the required compressive strength at the maximum age specified or allowed. Concrete represented by a single test that indicates a compressive strength of less than 85 percent of the specified 28-day

compressive strength will be rejected in conformance with the provisions in Section 6-1.04, "Defective Materials."

- If the test result indicates that the compressive strength at the maximum curing age specified or allowed is below the specified strength, but is 85 percent or more of the specified strength, payments to the State as required above shall be made, unless the Contractor, at the Contractor's expense, obtains and submits evidence acceptable to the Engineer that the strength of the concrete placed in the work meets or exceeds the specified 28-day compressive strength. If the test result indicates a compressive strength at the maximum curing age specified or allowed below 85 percent, the concrete represented by that test will be rejected, unless the Contractor, at the Contractor's expense, obtains and submits evidence acceptable to the Engineer that the strength and quality of the concrete placed in the work are acceptable. If the evidence consists of tests made on cores taken from the work, the cores shall be obtained and tested in conformance with the requirements in ASTM Designation: C 42.
- No single compressive strength test shall represent more than 320 cubic yards.
- If a precast concrete member is steam cured, the compressive strength of the concrete will be determined from test cylinders that have been handled and stored in conformance with Method 3 of California Test 540. The compressive strength of steam cured concrete will be evaluated on the basis of individual tests representing specific portions of production. If the concrete is designated by 28-day compressive strength rather than by cementitious material content, the concrete shall be considered to be acceptable whenever its compressive strength reaches the specified 28-day compressive strength provided that strength is reached in not more than the maximum number of days specified or allowed after the member is cast.
- When concrete is specified by compressive strength, prequalification of materials, mix proportions, mixing equipment, and procedures proposed for use will be required prior to placement of the concrete. Prequalification shall be accomplished by the submission of acceptable certified test data or trial batch reports by the Contractor. Prequalification data shall be based on the use of materials, mix proportions, mixing equipment, procedures, and size of batch proposed for use in the work.
- Certified test data, in order to be acceptable, shall indicate that not less than 90 percent of at least 20 consecutive tests exceed the specified strength at the maximum number of cure days specified or allowed, and none of those tests are less than 95 percent of specified strength. Strength tests included in the data shall be the most recent tests made on concrete of the proposed mix design and all shall have been made within one year of the proposed use of the concrete.
- Trial batch test reports, in order to be acceptable, shall indicate that the average compressive strength of 5 consecutive concrete cylinders, taken from a single batch, at not more than 28 days (or the maximum age allowed) after molding shall be at least 580 pounds per square inch greater than the specified 28-day compressive strength, and no individual cylinder shall have a strength less than the specified strength at the maximum age specified or allowed. Data contained in the report shall be from trial batches that were produced within one year of the proposed use of specified strength concrete in the project. Whenever air-entrainment is required, the air content of trial batches shall be equal to or greater than the air content specified for the concrete without reduction due to tolerances.
- Tests shall be performed in conformance with either the appropriate California Test methods or the comparable ASTM test methods. Equipment employed in testing shall be in good condition and shall be properly calibrated. If the tests are performed during the life of the

contract, the Engineer shall be notified sufficiently in advance of performing the tests in order to witness the test procedures.

- The certified test data and trial batch test reports shall include the following information:
  A. Date of mixing.
  B. Mixing equipment and procedures used.
  C. The size of batch in cubic yards and the weight, type, and source of all ingredients used.
  D. Penetration or slump (if the concrete will be placed under water or placed in cast-in-place concrete piles) of the concrete.
  E. The air content of the concrete if an air-entraining admixture is used.
  F. The age at time of testing and strength of all concrete cylinders tested.

- Certified test data and trial batch test reports shall be signed by an official of the firm that performed the tests.
- When approved by the Engineer, concrete from trial batches may be used in the work at locations where concrete of a lower quality is required and the concrete will be paid for as the type or class of concrete required at that location.
- After materials, mix proportions, mixing equipment, and procedures for concrete have been prequalified for use, additional prequalification by testing of trial batches will be required prior to making changes that, in the judgment of the Engineer, could result in a strength of concrete below that specified.
- The Contractor's attention is directed to the time required to test trial batches and the Contractor shall be responsible for production of trial batches at a sufficiently early date so that the progress of the work is not delayed.
- When precast concrete members are manufactured at the plant of an established manufacturer of precast concrete members, the mix proportions of the concrete shall be determined by the Contractor, and a trial batch and prequalification of the materials, mix proportions, mixing equipment, and procedures will not be required.

90-10 MINOR CONCRETE

90-10.01 GENERAL

- Concrete for minor structures, slope paving, curbs, sidewalks and other concrete work, when designated as minor concrete on the plans, in the specifications, or in the contract item, shall conform to the provisions specified herein.
- The Engineer, at the Engineer's discretion, will inspect and test the facilities, materials and methods for producing the concrete to ensure that minor concrete of the quality suitable for use in the work is obtained.

90-10.02 MATERIALS

- Minor concrete shall conform to the following requirements:

90-10.02A CEMENTITIOUS MATERIAL

- Cementitious material shall conform to the provisions in Section 90-1.01, "Description."

90-10.02B AGGREGATE

- Aggregate shall be clean and free from deleterious coatings, clay balls, roots, and other extraneous materials.
- Use of crushed concrete or reclaimed aggregate is acceptable only if the aggregate satisfies all aggregate requirements.
- The Contractor shall submit to the Engineer for approval, a grading of the combined aggregate proposed for use in the minor concrete. After acceptance of the grading, aggregate furnished for minor concrete shall conform to that grading, unless a change is authorized in writing by the Engineer.
- The Engineer may require the Contractor to furnish periodic test reports of the aggregate grading furnished. The maximum size of aggregate used shall be at the option of the Contractor, but in no case shall the maximum size be larger than 1 1/2-inch or smaller than 3/4-inch.
- The Engineer may waive, in writing, the gradation requirements in this Section 90-10.02B, if, in the Engineer's opinion, the furnishing of the gradation is not necessary for the type or amount of concrete work to be constructed.

90-10.02C WATER

- Water used for washing, mixing, and curing shall be free from oil, salts, and other impurities that would discolor or etch the surface or have an adverse affect on the quality of the concrete.

90-10.02D ADMIXTURES

- The use of admixtures shall conform to the provisions in Section 90-4, "Admixtures."

90-10.03 PRODUCTION

- Cementitious material, water, aggregate, and admixtures shall be stored, proportioned, mixed, transported, and discharged in conformance with recognized standards of good practice that will result in concrete that is thoroughly and uniformly mixed, that is suitable for the use intended, and that conforms to requirements specified herein. Recognized standards of good practice are outlined in various industry publications such as are issued by American Concrete Institute, AASHTO, or the Department.
- The cementitious material content of minor concrete shall conform to the provisions in Section 90-1.01, "Description."
- The amount of water used shall result in a consistency of concrete conforming to the provisions in Section 90-6.06, "Amount of Water and Penetration." Additional mixing water shall not be incorporated into the concrete during hauling or after arrival at the delivery point, unless authorized by the Engineer.
- Discharge of ready-mixed concrete from the transporting vehicle shall be made while the concrete is still plastic and before stiffening occurs. An elapsed time of 1.5 hours (one hour in non-agitating hauling equipment), or more than 250 revolutions of the drum or blades, after the introduction of the cementitious material to the aggregates, or a temperature of concrete of more than 90° F will be considered conditions contributing to the quick stiffening of concrete. The Contractor shall take whatever action is necessary to eliminate quick stiffening, except that the addition of water will not be permitted.
- The required mixing time in stationary mixers shall be not less than 50 seconds or more than 5 minutes.

- The minimum required revolutions at mixing speed for transit-mixed concrete shall be not less than that recommended by the mixer manufacturer, and shall be increased, if necessary, to produce thoroughly and uniformly mixed concrete.
- When a high range water-reducing admixture is added to the concrete at the job site, the total number of revolutions shall not exceed 300.
- Each load of ready-mixed concrete shall be accompanied by a weighmaster certificate that shall be delivered to the Engineer at the discharge location of the concrete, unless otherwise directed by the Engineer. The weighmaster certificate shall be clearly marked with the date and time of day when the load left the batching plant and, if hauled in truck mixers or agitators, the time the mixing cycle started.
- A Certificate of Compliance conforming to the provisions in Section 6–1.07, "Certificates of Compliance," shall be furnished to the Engineer, prior to placing minor concrete from a source not previously used on the contract, stating that minor concrete to be furnished meets contract requirements, including minimum cementitious material content specified.

90-10.04 CURING MINOR CONCRETE

- Curing minor concrete shall conform to the provisions in Section 90-7, "Curing Concrete."

90-10.05 PROTECTING MINOR CONCRETE

- Protecting minor concrete shall conform to the provisions in Section 90-8, "Protecting Concrete," except the concrete shall be maintained at a temperature of not less than 40° F for 72 hours after placing.

90-10.06 MEASUREMENT AND PAYMENT

- Minor concrete will be measured and paid for in conformance with the provisions specified in the various sections of these specifications covering concrete construction when minor concrete is specified in the specifications, shown on the plans, or indicated by contract item in the Engineer's Estimate.

90-11 MEASUREMENT AND PAYMENT

90-11.01 MEASUREMENT

- Portland cement concrete will be measured in conformance with the provisions specified in the various sections of these specifications covering construction requiring concrete.
- For concrete measured at the mixer, the volume in cubic feet shall be computed as the total weight of the batch in pounds divided by the density of the concrete in pounds per cubic foot. The total weight of the batch shall be calculated as the sum of all materials, including water, entering the batch. The density of the concrete will be determined in conformance with the requirements in California Test 518.

90-11.02 PAYMENT

- Portland cement concrete will be paid for in conformance with the provisions specified in the various sections of these specifications covering construction requiring concrete.

• Full compensation for furnishing and incorporating admixtures required by these specifications or the special provisions will be considered as included in the contract prices paid for the concrete involved and no additional compensation will be allowed therefor.
• Should the Engineer order the Contractor to incorporate any admixtures in the concrete when their use is not required by these specifications or the special provisions, furnishing the admixtures and adding them to the concrete will be paid for as extra work as provided in Section 4-1.03D, "Extra Work."
• Should the Contractor use admixtures in conformance with the provisions in Section 90-4.05, "Optional Use of Chemical Admixtures," or Section 90-4.07, "Optional Use of Air-entraining Admixtures," or should the Contractor request and obtain permission to use other admixtures for the Contractor's benefit, the Contractor shall furnish those admixtures and incorporate them into the concrete at the Contractor's expense and no additional compensation will be allowed therefor.

SECTION 91: PAINT

Issue Date: May 1, 2006

Section 91-3, "Paints for Timber," of the State Standard Specifications is amended to read:

91-3 PAINTS FOR TIMBER

91-3.01 WOOD PRIMER, LATEX-BASE

Classification:

• This specification covers a ready-mixed priming paint for use on unpainted wood or exterior woodwork. It shall conform with the requirements in the Detailed Performance Standards of the Master Painters Institute (MPI) for exterior wood primers, and be listed on the Exterior Latex Wood Primer MPI List Number 6.

91-3.02 PAINT; LATEX-BASE FOR EXTERIOR WOOD, WHITE AND TINTS

Classification:

• This specification covers a ready-mixed paint for use on wood surfaces subject to outside exposures. This paint shall conform to the requirements in the Detailed Performance Standards of the Master Painters Institute (MPI) for Paint, Latex, Exterior, and shall be listed on the following MPI Approved Products List:

A. Exterior Latex, Flat MPI Gloss Level 1, MPI List Number 10.
B. Exterior Latex, Semi-Gloss, MPI Gloss Level 5, MPI List Number 11.
C. Exterior Latex, Gloss, MPI Gloss Level 6, MPI List Number 119.

• Unpainted wood shall first be primed with wood primer conforming to the provisions in Section 91-3.01, "Wood Primer, Latex-Base."

Section 91-4, "Miscellaneous Paints," of the State Standard Specifications is amended to read:

91-4 MISCELLANEOUS PAINTS

91-4.01 THROUGH 91-4.04 (BLANK)

91-4.05 PAINT; ACRYLIC EMULSION, EXTERIOR WHITE AND LIGHT AND MEDIUM TINTS

Classification:

• This specification covers an acrylic emulsion paint designed for use on exterior masonry. This paint shall conform to the requirements in the Detailed Performance Standards of the Master Painters Institute (MPI) for Paint, Latex, Exterior, and shall be listed on the following MPI Approved Products Lists:

A. Exterior Latex, Flat MPI Gloss Level 1, MPI List Number 10.
B. Exterior Latex, Semi-Gloss, MPI Gloss Level 5, MPI List Number 11.
C. Exterior Latex, Gloss, MPI Gloss Level 6, MPI List Number 119.

• This paint may be tinted by using "universal" or "all purpose" concentrates.

SECTION 92: ASPHALTS

Issue Date: March 21, 2008

Section 92, "Asphalts," of the State Standard Specifications is amended to read:

92-1.01 DESCRIPTION

• Asphalt is refined petroleum or a mixture of refined liquid asphalt and refined solid asphalt that are prepared from crude petroleum. Asphalt is:

1. Free from residues caused by the artificial distillation of coal, coal tar, or paraffin
2. Free from water
3. Homogeneous

92-1.02 MATERIALS

GENERAL

• Furnish asphalt under the Department's "Certification Program for Suppliers of Asphalt." The Department maintains the program requirements, procedures, and a list of approved suppliers at:

http://www.dot.ca.gov/hq/esc/Translab/fpm/fpmcoc.htm

• Transport, store, use, and dispose of asphalt safely.
• Prevent the formation of carbonized particles caused by overheating asphalt during manufacturing or construction.

GRADES

• Performance graded (PG) asphalt binder is:

Performance Graded Asphalt Binder

Property	AASHTO Test Method	Specification Grade				
		PG 58-22 [a]	PG 64-10	PG 64-16	PG 64-28	PG 70-10
Original Binder						
Flash Point, Minimum °C	T 48	230	230	230	230	230
Solubility, Minimum % [b]	T 44	99	99	99	99	99
Viscosity at 135°C, [c]	T 316					
Maximum, Pa·s		3.0	3.0	3.0	3.0	3.0
Dynamic Shear,	T 315					
Test Temp. at 10 rad/s, °C		58	64	64	64	70
Minimum G*/sin(delta), kPa		1.00	1.00	1.00	1.00	1.00
RTFO Test, [e]	T 240					
Mass Loss, Maximum, %		1.00	1.00	1.00	1.00	1.00
RTFO Test Aged Binder						
Dynamic Shear,	T 315					
Test Temp. at 10 rad/s, °C		58	64	64	64	70
Minimum G*/sin(delta), kPa		2.20	2.20	2.20	2.20	2.20
Ductility at 25°C	T 51					
Minimum, cm		75	75	75	75	75
PAV [f] Aging,	R 28					
Temperature, °C		100	100	100	100	110
RTFO Test and PAV Aged Binder						
Dynamic Shear,	T 315					
Test Temp. at 10 rad/s, °C		22 [d]	31 [d]	28 [d]	22 [d]	34 [d]
Maximum G*sin(delta), kPa		5000	5000	5000	5000	5000
Creep Stiffness,	T 313					
Test Temperature, °C		-12	0	-6	-18	0
Maximum S-value, Mpa		300	300	300	300	300
Minimum M-value		0.300	0.300	0.300	0.300	0.300

Notes:

a. Use as asphalt rubber base stock for high mountain and high desert area.
b. The Engineer waives this specification if the supplier is a Quality Supplier as defined by the Department's "Certification Program for Suppliers of Asphalt."
c. The Engineer waives this specification if the supplier certifies the asphalt binder can be adequately pumped and mixed at temperatures meeting applicable safety standards.
d. Test the sample at 3°C higher if it fails at the specified test temperature. G*sin(delta) remains 5000 kPa maximum.
e. "RTFO Test" means the asphaltic residue obtained using the Rolling Thin Film Oven Test, AASHTO Test Method T 240 or ASTM Designation: D 2872. The residue from mass change determination may be used for other tests.
f. "PAV" means Pressurized Aging Vessel.

- Performance graded polymer modified asphalt binder (PG Polymer Modified) is:

Performance Graded Polymer Modified Asphalt Binder [a]

Property	AASHTO Test Method	Specification Grade		
		PG 58-34 PM	PG 64-28 PM	PG 76-22 PM
Original Binder				
Flash Point, Minimum °C	T 48	230	230	230
Solubility, Minimum % [b]	T 44[c]	98.5	98.5	98.5
Viscosity at 135°C, [d]	T 316			
Maximum, Pa·s		3.0	3.0	3.0
Dynamic Shear,	T 315			
Test Temp. at 10 rad/s, °C		58	64	76
Minimum G*/sin(delta), kPa		1.00	1.00	1.00
RTFO Test ,	T 240			
Mass Loss, Maximum, %		1.00	1.00	1.00
RTFO Test Aged Binder				
Dynamic Shear,	T 315			
Test Temp. at 10 rad/s, °C		58	64	76
Minimum G*/sin(delta), kPa		2.20	2.20	2.20
Dynamic Shear,	T 315			
Test Temp. at 10 rad/s, °C		Note e	Note e	Note e
Maximum (delta), %		80	80	80
Elastic Recovery[f],	T 301			
Test Temp., °C		25	25	25
Minimum recovery, %		75	75	65
PAV[g] Aging,	R 28			
Temperature, °C		100	100	110
RTFO Test and PAV Aged Binder				
Dynamic Shear,	T 315			
Test Temp. at 10 rad/s, °C		16	22	31
Maximum G*sin(delta), kPa		5000	5000	5000
Creep Stiffness,	T 313			
Test Temperature, °C		-24	-18	-12
Maximum S-value, MPa		300	300	300
Minimum M-value		0.300	0.300	0.300

Notes:

a. Do not modify PG Polymer Modified using acid modification.

b. The Engineer waives this specification if the supplier is a Quality Supplier as defined by the Department's "Certification Program for Suppliers of Asphalt."

c. The Department allows ASTM D 5546 instead of AASHTO T 44

d. The Engineer waives this specification if the supplier certifies the asphalt binder can be adequately pumped and mixed at temperatures meeting applicable safety standards.

e. Test temperature is the temperature at which G*/sin(delta) is 2.2 kPa. A graph of log G*/sin(delta) plotted against temperature may be used to determine the test temperature when G*/sin(delta) is 2.2 kPa. A graph of (delta) versus temperature may be used to determine delta at the temperature when G*/sin(delta) is 2.2 kPa. The Engineer also accepts direct measurement of (delta) at the temperature when G*/sin(delta) is 2.2 kPa.

f. Tests without a force ductility clamp may be performed.

g. "PAV" means Pressurized Aging Vessel.

SAMPLING

• Provide a sampling device in the asphalt feed line connecting the plant storage tanks to the asphalt weighing system or spray bar. Make the sampling device accessible between 24 and 30 inches above the platform. Provide a receptacle for flushing the sampling device.
• Include with the sampling device a valve:

1. Between 1/2 and 3/4 inch in diameter
2. Manufactured in a manner that a one-quart sample may be taken slowly at any time during plant operations
3. Maintained in good condition

• Replace failed valves.
• In the Engineer's presence, take 2 one-quart samples per operating day. Provide round, friction top, one-quart containers for storing samples.

92-1.03 EXECUTION

• If asphalt is applied, you must comply with the heating and application specifications for liquid asphalt in Section 93, "Liquid Asphalts."

92-1.04 MEASUREMENT

• If the contract work item for asphalt is paid by weight, the Department measures asphalt tons by complying with the specifications for weight determination of liquid asphalt in Section 93, "Liquid Asphalts."
• The Engineer determines the asphalt weight from volumetric measurements if you:

1. Use a partial asphalt load
2. Use asphalt at a location other than a mixing plant and no scales within 20 miles are available and suitable
3. Deliver asphalt in either of the following:

3.1. A calibrated truck with each tank accompanied by its measuring stick and calibration card
3.2. A truck equipped with a calibrated thermometer that determines the asphalt temperature at the delivery time and with a vehicle tank meter complying with the specifications for weighing, measuring, and metering devices in Section 9-1.01, "Measurement of Quantities"

• If you furnish hot mix asphalt from a mixing plant producing material for only one project, the Engineer determines the asphalt quantity by measuring the volume in the tank at the project's start and end provided the tank is calibrated and equipped with its measuring stick and calibration card.
• The Engineer determines pay quantities from volumetric measurements as follows:

1. Before converting the volume to weight, the Engineer reduces the measured volume to that which the asphalt would occupy at 60 °F.

2. The Engineer uses 235 gallons per ton and 8.51 pounds per gallon for the average weight and volume for PG and PG Polymer Modified asphalt grades at 60 °F.
3. The Engineer uses the Conversion Table in Section 93, "Liquid Asphalts."

SECTION 93: LIQUID ASPHALTS

Issue Date: November 3, 2006

The ninth paragraph of Section 93-1.04, "Measurement," of the State Standard Specifications is amended to read:

• The following Legend and Conversion Table is to be used for converting volumes of liquid asphalt products, Grades 70 to 3000, inclusive, and paving asphalt Grades PG 58-22, PG 64-10, PG 64-16, PG 64-28, and PG 70-10, and Grades PG 58-34 PM, PG 64-28 PM, and PG 76-22 PM.

END OF AMENDMENTS

SECTION 2 THROUGH 4 (BLANK)

5-1.02 LABOR NONDISCRIMINATION

Attention is directed to the following Notice that is required by Chapter 5 of Division 4 of Title 2, California Code of Regulations.

NOTICE OF REQUIREMENT FOR NONDISCRIMINATION PROGRAM

(GOV. CODE, SECTION 12990)

Your attention is called to the "Nondiscrimination Clause", set forth in Section 7-1.01A(4), "Labor Nondiscrimination," of the State Standard Specifications, which is applicable to all nonexempt State contracts and subcontracts, and to the "Standard California Nondiscrimination Construction Contract Specifications" set forth therein. The specifications are applicable to all nonexempt State construction contracts and subcontracts of $5,000 or more.

5-1.04 PUBLIC SAFETY

The Contractor shall provide for the safety of traffic and the public in conformance with the provisions in Section 7-1.09, "Public Safety," of the State Standard Specifications and these special provisions.

The Contractor shall install temporary railing (Type K) between a lane open to public traffic and an excavation, obstacle or storage area when the following conditions exist:

A. Excavations-The near edge of the excavation is 12 feet or less from the edge of the lane, except:

1. Excavations covered with sheet steel or concrete covers of adequate thickness to prevent accidental entry by traffic or the public.
2. Excavations less than one foot deep.
3. Trenches less than one foot wide for irrigation pipe or electrical conduit, or excavations less than one foot in diameter.
4. Excavations parallel to the lane for the purpose of pavement widening or reconstruction.
5. Excavations in side slopes, where the slope is steeper than 4:1 (horizontal:vertical).
6. Excavations protected by existing barrier or railing.

B. Temporarily Unprotected Permanent Obstacles-The work includes the installation of a fixed obstacle together with a protective system, such as a sign structure together with protective railing, and the Contractor elects to install the obstacle prior to installing the protective system; or the Contractor, for the Contractor's convenience and with permission of the Engineer, removes a portion of an existing protective railing at an obstacle and does not replace such railing complete in place during the same day.

C. Storage Areas-Material or equipment is stored within 12 feet of the lane and the storage is not otherwise prohibited by the provisions of the State Standard Specifications and these special provisions.

The approach end of temporary railing (Type K), installed in conformance with the provisions in this section "Public Safety" and in Section 7-1.09, "Public Safety," of the State Standard Specifications, shall be offset a minimum of 15 feet from the edge of the traffic lane open to public traffic. The temporary railing shall be installed on a skew toward the edge of the traffic lane of not more than one foot transversely to 10 feet longitudinally with respect to the edge of the traffic lane. If the 15-foot minimum offset cannot be achieved, the temporary railing shall be installed on the 10 to 1 skew to obtain the maximum available offset between the approach end of the railing and the edge of the traffic lane, and an array of temporary crash cushion modules shall be installed at the approach end of the temporary railing.

Except for installing, maintaining and removing traffic control devices, whenever work is performed or equipment is operated in the following work areas, the Contractor shall close the adjacent traffic lane unless otherwise provided in the State Standard Specifications and these special provisions:

Approach Speed of Public Traffic (Posted Limit) (Miles Per Hour)	Work Areas
Over 45	Within 6 feet of a traffic lane but not on a traffic lane
35 to 45	Within 3 feet of a traffic lane but not on a traffic lane

The lane closure provisions of this section shall not apply if the work area is protected by permanent or temporary railing or barrier.
When traffic cones or delineators are used to delineate a temporary edge of a traffic lane, the line of cones or delineators shall be considered to be the edge of the traffic lane, however, the Contractor shall not reduce the width of an existing lane to less than 10 feet without written approval from the Engineer.
When work is not in progress on a trench or other excavation that required closure of an adjacent lane, the traffic cones or portable delineators used for the lane closure shall be placed off of and adjacent to the edge of the traveled way. The spacing of the cones or delineators shall be not more than the spacing used for the lane closure.
Suspended loads or equipment shall not be moved nor positioned over public traffic or pedestrians.
Full compensation for conforming to the provisions in this section "Public Safety," including furnishing and installing temporary railing (Type K) and temporary crash cushion modules, shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

5-1.05 TESTING

Testing of materials and work shall conform to the provisions in Section 6-3, "Testing," of the State Standard Specifications and these special provisions.
Whenever the provisions of Section 6-3.01, "General," of the State Standard Specifications refer to tests or testing, it shall mean tests to assure the quality and to determine the acceptability of the materials and work.
The Engineer will deduct the costs for testing of materials and work found to be unacceptable, as determined by the tests performed by the Department, and the costs for testing of material sources identified by the Contractor which are not used for the work, from moneys due or to become due to the Contractor. The amount deducted will be determined by the Engineer.

5-1.06 REMOVAL OF ASBESTOS AND HAZARDOUS SUBSTANCES

When the presence of asbestos or hazardous substances are not shown on the plans or indicated in the specifications and the Contractor encounters materials which the Contractor reasonably believes to be asbestos or a hazardous substance as defined in Section 25914.1 of the Health and

Safety Code, and the asbestos or hazardous substance has not been rendered harmless, the Contractor may continue work in unaffected areas reasonably believed to be safe. The Contractor shall immediately cease work in the affected area and report the condition to the Engineer in writing.
In conformance with Section 25914.1 of the Health and Safety Code, removal of asbestos or hazardous substances including exploratory work to identify and determine the extent of the asbestos or hazardous substance will be performed by separate contract.
If delay of work in the area delays the current controlling operation, the delay will be considered a right of way delay and the Contractor will be compensated for the delay in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the State Standard Specifications.

5-1.07 WATER CONSERVATION

Attention is directed to the various sections of the State Standard Specifications and these special provisions which require the use of water for the construction of this project. Attention is directed to Section 7, "Legal Relations and Responsibility," of the State Standard Specifications with regards to the Contractor's responsibilities for public convenience, public safety, preservation of property, indemnification, and insurance.
Nothing in this section "Water Conservation" shall relieve the Contractor from furnishing an adequate supply of water required for the proper construction of this project in conformance with the provisions in the State Standard Specifications or these special provisions or relieve the Contractor from the legal responsibilities defined in Section 7.
The Contractor shall, whenever possible and not in conflict with the above requirements, minimize the use of water during construction of the project. Watering equipment shall be kept in good working order; water leaks shall be repaired promptly; and washing of equipment, except when necessary for safety or for the protection of equipment, shall be discouraged.

5-1.08 HIGHWAY CONSTRUCTION EQUIPMENT

The first paragraph of Section 7-1.01D, "Vehicle Code," of the State Standard Specifications shall not apply.

Pursuant to the authority contained in Section 591 of the Vehicle Code, the Department has determined that, within such areas as are within the limits of the project and are open to public traffic, the following requirements of the Vehicle Code will apply: the lighting requirements in Section 25803; the brake requirements in Chapter 3, Division 12; the splash apron requirements in Section 27600; and, when operated on completed or existing treated base, surfacing, pavement or structures, except as otherwise provided in Section 7-1.02, "Load Limitations," of the Standard Specifications, the weight limitation requirements contained in Division 15.

5-1.09 RELATIONS WITH CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

This project lies within the boundaries of the Colorado River Basin Regional Water Quality Control Board (RWQCB).

The State Water Resources Control Board (SWRCB) has issued to the Department a permit that governs storm water and non-storm water discharges from the Department's properties, facilities, and activities. The Department's permit is entitled "Order No. 99 - 06 - DWQ, NPDES No. CAS000003, National Pollutant Discharge Elimination System (NPDES) Permit, Statewide Storm Water Permit and Waste Discharge Requirements (WDRs) for the State of California, Department of Transportation (Caltrans)." Copies of the Department's permit are available for review from the SWRCB, Storm Water Permit Unit, 1001 "I" Street, P.O. Box 1977, Sacramento, California 95812-1977, Telephone: (916) 341-5254, and may also be obtained at:

http://www.swrcb.ca.gov/stormwtr/caltrans.html

The Department's permit references and incorporates by reference the current statewide general permit issued by the SWRCB entitled "Order No. 99-08-DWQ, National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002, Waste Discharge Requirements (WDRs) for Discharges of Storm Water Runoff Associated with Construction Activity" that regulates discharges of storm water and non-storm water from construction activities disturbing one acre or more of soil in a common plan of development. Sampling and analysis requirements as specified in SWRCB Resolution No. 2001-46 are added to the statewide general permit. Copies of the statewide permit and modifications thereto are available for review from the SWRCB, Storm Water Permit Unit, 1001 "I" Street, P.O. Box 1977, Sacramento, California 95812-1977, Telephone: (916) 341-5254 and may also be obtained at:

http://www.swrcb.ca.gov/stormwtr/construction.html

This project shall conform to the permits and modifications thereto. The Contractor shall maintain copies of the permits at the project site and shall make them available during construction.

The Contractor shall know and comply with provisions of Federal, State, and local regulations and requirements that govern the Contractor's operations and storm water and non-storm water

discharges from the project site and areas of disturbance outside the project limits during construction. Attention is directed to Sections 7-1.01, "Laws to be Observed," 7-1.11, "Preservation of Property," and 7-1.12, "Indemnification and Insurance," of the Standard Specifications.

The Contractor shall be responsible for penalties assessed on the Contractor or the Department as a result of the Contractor's failure to comply with the provisions in "Water Pollution Control" of these special provisions or with the applicable provisions of the Federal, State, and local regulations and requirements.

Penalties as used in this section shall include fines, penalties, and damages, whether proposed, assessed, or levied against the Department or the Contractor, including those levied under the Federal Clean Water Act and the State Porter-Cologne Water Quality Control Act, by governmental agencies or as a result of citizen suits. Penalties shall also include payments made or costs incurred in settlement for alleged violations of applicable laws, regulations, or requirements. Costs incurred could include sums spent instead of penalties, in mitigation or to remediate or correct violations.

WITHHOLDS

The Department will withhold money due the Contractor, in an amount estimated by the Department, to include the full amount of penalties and mitigation costs proposed, assessed, or levied as a result of the Contractor's violation of the permits, or Federal or State law, regulations, or requirements. Funds will be withheld by the Department until final disposition of these costs has been made. The Contractor shall remain liable for the full amount until the potential liability is finally resolved with the entity seeking the penalties. Instead of the withhold, the Contractor may provide a suitable bond in favor of the Department to cover the highest estimated liability for any disputed penalties proposed as a result of the Contractor's violation of the permits, law, regulations, or requirements.

If a regulatory agency identifies a failure to comply with the permits and modifications thereto, or other Federal, State, or local requirements, the Department will withhold money due the Contractor, subject to the following:

A. The Department will give the Contractor 30 days notice of the Department's intention to withhold funds from payments which may become due to the Contractor before acceptance of the contract. Funds withheld after acceptance of the contract will be made without prior notice to the Contractor.
B. No withholds of additional amounts out of payments will be made if the amount to be withheld does not exceed the amount being withheld from partial payments in accordance with Section 9-1.06, "Partial Payments," of the Standard Specifications.
C. If the Department has withheld funds and it is subsequently determined that the State is not subject to the entire amount of the costs and liabilities assessed or proposed in connection with the matter for which the withhold was made, the Department will return the excess amount withheld to the Contractor in the progress payment following the determination. If the matter is resolved for less than the amount withheld, the Department will pay interest at a rate of 6 percent per year on the excess withhold.

The Contractor shall notify the Engineer immediately upon request from the regulatory agencies to enter, inspect, sample, monitor, or otherwise access the project site or the Contractor's records

pertaining to water pollution control work. The Contractor and the Department shall provide copies of correspondence, notices of violation, enforcement actions, or proposed fines by regulatory agencies to the requesting regulatory agency.

An environmentally sensitive area (ESA) shall consist of an area within and near the limits of construction where access is prohibited or limited for the preservation of archeological site or existing vegetation, or protection of biological habitat as shown on the plans. The Engineer will determine the exact location of the boundaries of the ESA. No work shall be conducted within the ESA.
Attention is directed to Section 7—1.01 "Laws to be Observed," and Section 7—1.04 "Permits and Licenses," of the State Standard Specifications regarding State and Federal regulations, permits, or agreements which pertain to an ESA.

5-1.10 PRESERVATION OF PROPERTY

Attention is directed to Section 7-1.11, "Preservation of Property," of the State Standard Specifications and these special provisions.
Existing trees, shrubs and other plants, that are not to be removed as shown on the plans or specified in these special provisions, and are injured or damaged by reason of the Contractor's operations, shall be replaced by the Contractor. The minimum size of tree replacement shall be 24 inch box and the minimum size of shrub replacement shall be 15-gallon. Replacement ground cover plants shall be from flats and shall be planted 12 inches on center. Replacement of Carpobrotus ground cover plants shall be from cuttings and shall be planted 12 inches on center. Replacement planting shall conform to the requirements in Section 20-4.07, "Replacement," of the State Standard Specifications. The Contractor shall water replacement plants in conformance with the provisions in Section 20-4.06, "Watering," of the State Standard Specifications. Damaged or injured plants shall be removed and disposed of in conformance with the provisions in Section 7-l.13,"Disposal of Material Outside the Highway Right of Way," of the State Standard Specifications. At the option of the Contractor, removed trees and shrubs may be reduced to chips. The chipped material shall be spread within the highway right of way at locations designated by the Engineer.
Replacement planting of injured or damaged trees, shrubs and other plants shall be completed not less than 20 working days prior to acceptance of the contract. Replacement plants shall be watered as necessary to maintain the plants in a healthy condition.

SECTION 6 (BLANK)

SECTION 7 (BLANK)

SECTION 8 MATERIALS

SECTION 8 MISCELLANEOUS

8-1.01 PREQUALIFIED AND TESTED SIGNING AND DELINEATION MATERIALS

The Department maintains the following list of Prequalified and Tested Signing and Delineation Materials. The Engineer shall not be precluded from sampling and testing products on the list of Prequalified and Tested Signing and Delineation Materials.
The manufacturer of products on the list of Prequalified and Tested Signing and Delineation Materials shall furnish the Engineer a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the State Standard Specifications for each type of traffic product supplied.
For those categories of materials included on the list of Prequalified and Tested Signing and Delineation Materials, only those products shown within the listing may be used in the work. Other categories of products, not included on the list of Prequalified and Tested Signing and Delineation Materials, may be used in the work provided they conform to the requirements of the State Standard Specifications.
Materials and products may be added to the list of Prequalified and Tested Signing and Delineation Materials if the manufacturer submits a New Product Information Form to the New Product Coordinator at the Transportation Laboratory. Upon a Departmental request for samples, sufficient samples shall be submitted to permit performance of required tests. Approval of materials or products will depend upon compliance with the specifications and tests the Department may elect to perform.

PAVEMENT MARKERS, PERMANENT TYPE

Retroreflective With Abrasion Resistant Surface (ARS)

1. Apex, Model 921AR (4" x 4")
2. Ennis Paint, Models C88 (4" x 4"), 911 (4" x 4") and C80FH
3. Ray-O-Lite, Models "AA" ARS (4" x 4") and ARC Round Shoulder (4" x 4")
4. 3M Series 290 (3.5" x 4")
5. 3M Series 290 PSA
6. Glowlite, Inc Model 988AR (4" x 4")

Retroreflective With Abrasion Resistant Surface (ARS)

(for recessed applications only)

1. Ennis Paint, Model 948 (2.3" x 4.7")
2. Ennis Paint, Model 944SB (2" x 4")*
3. Ray-O-Lite, Model 2002 (2" x 4.6")
4. Ray-O-Lite, Model 2004 ARS (2" x 4")*

*For use only in 4.5 inch wide (older) recessed slots

Non-Reflective, 4-inch Round

1. Apex Universal (Ceramic)
2. Apex Universal, Models 929 (ABS) and 929PP (Polypropylene)
3. Glowlite, Inc. (Ceramic) and PP (Polypropylene)

4. Hi-Way Safety, Inc., Models P20-2000W and 2001Y (ABS)
5. Interstate Sales, "Diamond Back" (Polypropylene)
6. Novabrite Models Cdot (White) Cdot-y (Yellow), Ceramic
7. Novabrite Models Pdot-w (White) Pdot-y (Yellow), Polypropylene
8. Three D Traffic Works TD10000 (ABS), TD10500 (Polypropylene)

PAVEMENT MARKERS, TEMPORARY TYPE

Temporary Markers For Long Term Day/Night Use (180 days or less)

1. Vega Molded Products "Temporary Road Marker" (3" x 4")

Temporary Markers For Short Term Day/Night Use (14 days or less)

(For seal coat or chip seal applications, clear protective covers are required)

1. Apex Universal, Model 932
2. Filtrona Extrusion, Models T.O.M., T.R.P.M., and "HH" (High Heat)
3. Hi-Way Safety, Inc., Model 1280/1281
4. Glowlite, Inc., Model 932

STRIPING AND PAVEMENT MARKING MATERIAL

Permanent Traffic Striping and Pavement Marking Tape

1. Advanced Traffic Marking, Series 300 and 400
2. Brite-Line, Series 1000
3. Brite-Line, "DeltaLine XRP"
4. Swarco Industries, "Director 35" (For transverse application only)
5. Swarco Industries, "Director 60"
6. 3M, "Stamark" Series 380 and 5730
7. 3M, "Stamark" Series 420 (For transverse application only)

Temporary (Removable) Striping and Pavement Marking Tape (180 days or less)

1. Advanced Traffic Marking, Series 200
2. Brite-Line, Series 100
3. Garlock Rubber Technologies, Series 2000
4. P.B. Laminations, Aztec, Grade 102
5. Swarco Industries, "Director-2"
6. Trelleborg Industries, R140 Series
7. 3M Series 620 "CR", and Series A750
8. 3M Series A145, Removable Black Line Mask
   (Black Tape: for use only on Hot mix asphalt surfaces)
9. Advanced Traffic Marking Black "Hide-A-Line"
   (Black Tape: for use only on Hot mix asphalt surfaces)
10. Brite-Line "BTR" Black Removable Tape

(Black Tape: for use only on Hot mix asphalt surfaces)

11. Trelleborg Industries, RB-140
    (Black Tape: for use only on Hot mix asphalt surfaces)

Preformed Thermoplastic (Heated in place)

1. Flint Trading Inc., "Hot Tape"
2. Flint Trading Inc., "Premark Plus"
3. Ennis Paint Inc., "Flametape"

Ceramic Surfacing Laminate, 6" x 6"

1. Highway Ceramics, Inc.

CLASS 1 DELINEATORS

One Piece Driveable Flexible Type, 66-inch

1. Filtrona Extrusion, "Flexi-Guide Models 400 and 566"
2. Carsonite, Curve-Flex CFRM-400
3. Carsonite, Roadmarker CRM-375
4. FlexStake, Model 654 TM
5. GreenLine Model CGD1-66

Special Use Type, 66-inch

1. Filtrona Extrusion, Model FG 560 (with 18-inch U-Channel base)
2. Carsonite, "Survivor" (with 18-inch U-Channel base)
3. Carsonite, Roadmarker CRM-375 (with 18-inch U-Channel base)
4. FlexStake, Model 604
5. GreenLine Model CGD (with 18-inch U-Channel base)
6. Impact Recovery Model D36, with #105 Driveable Base
7. Safe-Hit with 8-inch pavement anchor (SH248-GP1)
8. Safe-Hit with 15-inch soil anchor (SH248-GP2) and with 18-inch soil anchor (SH248-GP3)

Surface Mount Type, 48-inch

1. Bent Manufacturing Company, Masterflex Model MF-180EX-48
2. Carsonite, "Channelizer"
3. FlexStake, Models 704, 754 TM, and EB4
4. Impact Recovery Model D48, with #101 Fixed (Surface-Mount) Base
5. Three D Traffic Works "Channelflex" ID No. 522248W

CHANNELIZERS

Surface Mount Type, 36-inch

1. Bent Manufacturing Company, Masterflex Models MF-360-36 (Round) and MF-180-36 (Flat)
2. Filtrona Extrusion, Flexi-Guide Models FG300PE, FG300UR, and FG300EFX
3. Carsonite, "Super Duck" (Round SDR-336)
4. Carsonite, Model SDCF03601MB "Channelizer"
5. FlexStake, Models 703, 753 TM, and EB3
6. GreenLine, Model SMD-36
7. Hi-way Safety, Inc. "Channel Guide Channelizer" Model CGC36
8. Impact Recovery Model D36, with #101 Fixed (Surface-Mount) Base
9. Safe-Hit, Guide Post, Model SH236SMA and Dura-Post, Model SHL36SMA
10. Three D Traffic Works "Boomerang" 5200 Series

Lane Separation System

1. Filtrona Extrusion, "Flexi-Guide (FG) 300 Curb System"
2. Qwick Kurb, "Klemmfix Guide System"
3. Dura-Curb System
4. Tuff Curb

CONICAL DELINEATORS, 42-inch

(For 28-inch Traffic Cones, see State Standard Specifications)

1. Bent Manufacturing Company "T-Top"
2. Plastic Safety Systems "Navigator-42"
3. TrafFix Devices "Grabber"
4. Three D Traffic Works "Ringtop" TD7000, ID No. 742143
5. Three D Traffic Works, TD7500
6. Work Area Protection Corp. C-42

OBJECT MARKERS

Type "K", 18-inch

1. Filtrona Extrusion, Model FG318PE
2. Carsonite, Model SMD 615
3. FlexStake, Model 701 KM
4. Safe-Hit, Model SH718SMA

Type "K-4" / "Q" Object Markers, 24-inch

1. Bent Manufacturing "Masterflex" Model MF-360-24
2. Filtrona Extrusion, Model FG324PE
3. Carsonite, "Channelizer"
4. FlexStake, Model 701KM

5. Safe-Hit, Models SH824SMA_WA and SH824GP3_WA
6. Three D Traffic Works ID No. 531702W and TD 5200
7. Three D Traffic Works ID No. 520896W

CONCRETE BARRIER MARKERS AND
TEMPORARY RAILING (TYPE K) REFLECTORS

Impactable Type

1. ARTUK, "FB"
2. Filtrona Extrusion, Models PCBM-12 and PCBM-T12
3. Duraflex Corp., "Flexx 2020" and "Electriflexx"
4. Hi-Way Safety, Inc., Model GMKRM100
5. Plastic Safety Systems "BAM" Models OM-BARR and OM-BWAR
6. Three D Traffic Works "Roadguide" Model TD 9304

Non-Impactable Type

1. ARTUK, JD Series
2. Plastic Safety Systems "BAM" Models OM-BITARW and OM-BITARA
3. Vega Molded Products, Models GBM and JD
4. Plastic Vacuum Forming, "Cap-It C400"

METAL BEAM GUARD RAIL POST MARKERS

(For use to the left of traffic)

1. Filtrona Extrusion, "Mini" (3" x 10")
2. Creative Building Products, "Dura-Bull, Model 11201"
3. Duraflex Corp., "Railrider"
4. Plastic Vacuum Forming, "Cap-It C300"

CONCRETE BARRIER DELINEATORS, 16-inch

(For use to the right of traffic)

1. Filtrona Extrusion, Model PCBM T-16
2. Safe-Hit, Model SH216RBM

CONCRETE BARRIER-MOUNTED MINI-DRUM (10" x 14" x 22")

1. Stinson Equipment Company "SaddleMarker"

GUARD RAILING DELINEATOR

(Place top of reflective element at 48 inches above plane of roadway)

Wood Post Type, 27-inch

1. Filtrona Extrusion, FG 427 and FG 527
2. Carsonite, Model 427
3. FlexStake, Model 102 GR

4. GreenLine GRD 27
5. Safe-Hit, Model SH227GRD
6. Three D Traffic Works "Guardflex" TD9100
7. New Directions Mfg, NDM27

Steel Post Type

1. Carsonite, Model CFGR-327

RETROREFLECTIVE SHEETING

Channelizers, Barrier Markers, and Delineators

1. Avery Dennison T-6500 Series (For rigid substrate devices only)
2. Avery Dennison WR-7100 Series
3. Nippon Carbide Industries, Flexible Ultralite Grade (ULG) II
4. Reflexite, PC-1000 Metalized Polycarbonate
5. Reflexite, AC-1000 Acrylic
6. Reflexite, AP-1000 Metalized Polyester
7. Reflexite, Conformalight, AR-1000 Abrasion Resistant Coating
8. 3M, High Intensity

Traffic Cones, 4-inch and 6-inch Sleeves

1. Nippon Carbide Industries, Flexible Ultralite Grade (ULG) II
2. Reflexite, Vinyl, "TR" (Semi-transparent) or "Conformalight"
3. 3M Series 3840
4. Avery Dennison S-9000C

Drums

1. Avery Dennison WR-6100
2. Nippon Carbide Industries, Flexible Ultralite Grade (ULG) II
3. Reflexite, "Conformalight", "Super High Intensity" or "High Impact Drum Sheeting"
4. 3M Series 3810

Barricades: Type I, Medium-Intensity (Typically Enclosed Lens, Glass-Bead Element)

1. Nippon Carbide Industries, CN8117
2. Avery Dennison, W 1100 series
3. 3M Series CW 44

Barricades: Type II, Medium-High-Intensity (Typically Enclosed Lens, Glass-Bead Element)

1. Avery Dennison, W-2100 Series

Signs: Type II, Medium-High-Intensity (Typically Enclosed Lens, Glass-Bead Element)

1. Avery Dennison, T-2500 Series
2. Nippon Carbide Industries, Nikkalite 18000

Signs: Type III, High-Intensity (Typically Encapsulated Glass-Bead Element)

1. Avery Dennison, T-5500A and T-6500 Series
2. Nippon Carbide Industries, Nikkalite Brand Ultralite Grade II
3. 3M 3870 and 3930 Series

Signs: Type IV, High-Intensity (Typically Unmetallized Microprismatic Element)

1. Avery Dennison, T-6500 Series
2. Nippon Carbide Industries, Crystal Grade, 94000 Series
3. Nippon Carbide Industries, Model No. 94847 Fluorescent Orange
4. 3M Series 3930 and Series 3924S

Signs: Type VI, Elastomeric (Roll-Up) High-Intensity, without Adhesive

1. Avery Dennison, WU-6014
2. Novabrite LLC, "Econobrite"
3. Reflexite "Vinyl"
4. Reflexite "SuperBright"
5. Reflexite "Marathon"
6. 3M Series RS20

Signs: Type VII, Super-High-Intensity (Typically Unmetallized Microprismatic Element)

1. 3M Series 3924S, Fluorescent Orange
2. 3M LDP Series 3970

Signs: Type VIII, Super-High-Intensity (Typically Unmetallized Microprismatic Element)

1. Avery Dennison, T-7500 Series
2. Avery Dennison, T-7511 Fluorescent Yellow

3. Avery Dennison, T-7513 Fluorescent Yellow Green
4. Avery Dennison, W-7514 Fluorescent Orange
5. Nippon Carbide Industries, Nikkalite Crystal Grade Series 92800
6. Nippon Carbide Industries, Nikkalite Crystal Grade Model 92847 Fluorescent Orange

Signs: Type IX, Very-High-Intensity (Typically Unmetallized Microprismatic Element)

1. 3M VIP Series 3981 Diamond Grade Fluorescent Yellow
2. 3M VIP Series 3983 Diamond Grade Fluorescent Yellow/Green
3. 3M VIP Series 3990 Diamond Grade
4. Avery Dennison T-9500 Series
5. Avery Dennison, T9513, Fluorescent Yellow Green
6. Avery Dennison, W9514, Fluorescent Orange
7. Avery Dennison, T-9511 Fluorescent Yellow

SPECIALTY SIGNS

1. Reflexite "Endurance" Work Zone Sign (with Semi-Rigid Plastic Substrate)

ALTERNATIVE SIGN SUBSTRATES

Fiberglass Reinforced Plastic (FRP) and Expanded Foam PVC

1. Fiber-Brite (FRP)
2. Sequentia, "Polyplate" (FRP)
3. Inteplast Group "InteCel" (0.5 inch for Post-Mounted CZ Signs, 48-inch or less)(PVC)

Aluminum Composite, Temporary Construction Signs and Permanent Signs up to 4 foot, 7 Inches

1. Alcan Composites "Dibond Material, 80 mils"
2. Mitsubishi Chemical America, Alpolic 350

8-1.02 SLAG AGGREGATE

Air-cooled iron blast furnace slag shall not be used to produce aggregate for:

1. Structure backfill material.
2. Pervious backfill material.
3. Permeable material.
4. Reinforced or prestressed portland cement concrete component or structure.
5. Nonreinforced portland cement concrete component or structure for which a Class 1 Surface Finish is required by the provisions in Section 51-1.18B, "Class 1 Surface Finish," of the State Standard Specifications.

Aggregate produced from slag resulting from a steel-making process shall not be used for a highway construction project except for the following items:

1. Imported Borrow.
2. Aggregate Subbase.
3. Class 2 Aggregate Base.
4. Hot Mix Asphalt.

Steel slag to be used to produce aggregate for aggregate subbase and Class 2 aggregate base shall be crushed so that 100 percent of the material will pass a 3/4-inch sieve and then shall be control aged for a period of at least 3 months under conditions that will maintain all portions of the stockpiled material at a moisture content in excess of 6 percent of the dry weight of the aggregate.

A supplier of steel slag aggregate shall provide separate stockpiles for controlled aging of the slag. An individual stockpile shall contain not less than 10,000 tons nor more than 50,000 tons of slag. The material in each individual stockpile shall be assigned a unique lot number and each stockpile shall be identified with a permanent system of signs. The supplier shall maintain a permanent record of the dates on which stockpiles are completed and controlled aging begun, of the dates when controlled aging was completed, and of the dates tests were made and the results of these tests. Moisture tests shall be made at least once each week. No credit for aging will be given for the time period covered by tests which show a moisture content of 6 percent or less. The stockpiles and records shall be available to the Engineer during normal working hours for inspection, check testing and review.

The supplier shall notify the Transportation Laboratory when each stockpile is completed and controlled aging begun. No more aggregate shall be added to the stockpile unless a new aging period is initiated. A further notification shall be sent when controlled aging is completed.

The supplier shall provide a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the State Standard Specifications. Each stockpile or portion of a stockpile that is used in the work will be considered a lot. The Certificates of Compliance shall state that the steel slag aggregate has been aged in a stockpile for at least 3 months at a moisture content in excess of 6 percent of the dry weight of the aggregate.

Steel slag used for imported borrow shall be weathered for at least 3 months. Prior to the use of steel slag as imported borrow, the supplier shall furnish a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the State Standard Specifications. The Certificate of Compliance shall state that the steel slag has been weathered for at least 3 months.

Each delivery of aggregate containing steel slag for use as aggregate subbase or Class 2 aggregate base shall be accompanied by a delivery tag for each load which will identify the lot of material by stockpile number, where the slag was aged, and the date that the stockpile was completed and controlled aging begun.

Air-cooled iron blast furnace slag or natural aggregate may be blended in proper combinations with steel slag aggregate to produce the specified gradings, for those items for which steel slag aggregate is permitted, unless otherwise provided.

Aggregate containing slag shall meet the applicable quality requirements for the items in which the aggregate is used.

The combined slag aggregate shall conform to the specified grading for the item in which it is used. The grading will be determined by California Test 202, modified by California Test 105 when there is a difference in specific gravity of 0.2 or more between the coarse and fine portion of the aggregate or between blends of different aggregates.
No aggregate produced from slag shall be placed within one foot, measured in any direction, of a non-cathodically protected pipe or structure unless the aggregate is incorporated in portland cement concrete pavement, in hot mix asphalt, or in treated base.
When slag is used as aggregate in hot mix asphalt, the K_c factor requirements, as determined by California Test 303, will not apply.
Slag aggregate used for embankment construction shall not be placed within 18 inches of finished slope lines, measured normal to the plane of the slope.
If steel slag aggregates are used to make hot mix asphalt, there shall be no other aggregates used in the mixture, except that up to 50 percent of the material passing the No. 4 sieve may consist of iron blast furnace slag aggregates or natural aggregates, or a combination thereof. If iron blast furnace aggregates or natural aggregates or a combination thereof are used in the mix, each type of aggregate shall be fed to the drier at a uniform rate. The rate of feed of each type of aggregate shall be maintained within 10 percent of the amount set. Adequate means shall be provided for controlling and checking the accuracy of the feeder.
Steel slag aggregate shall be stored separately from iron blast furnace slag aggregate and each type of slag aggregate shall also be stored separately from natural aggregate.
Hot mix asphalt produced from more than one of the following shall not be placed in the same layer: steel slag aggregates, iron blast furnace slag aggregates, natural aggregates or any combination thereof. Once a type of aggregate or aggregates is selected, it shall not be changed without prior approval by the Engineer.
If steel slag aggregates are used to produce hot mix asphalt, and if the specific gravity of a compacted stabilometer test specimen is in excess of 2.40, the quantity of hot mix asphalt to be paid for will be reduced. The stabilometer test specimen will be fabricated in conformance with the procedures in California Test 304 and the specific gravity of the specimen will be determined in conformance with Method C of California Test 308. The pay quantity of hot mix asphalt will be determined by multiplying the quantity of hot mix asphalt placed in the work by 2.40 and dividing the result by the specific gravity of the compacted stabilometer test specimen. Such reduction in quantity will be determined and applied as often as is necessary to ensure accurate results as determined by the Engineer.

SECTION 8-2. CONCRETE

8-2.01 PORTLAND CEMENT CONCRETE

Portland cement concrete shall conform to the provisions in Section 90, "Portland Cement Concrete," of the State Standard Specifications and these special provisions.
The Department maintains a list of sources of fine and coarse aggregate that have been approved for use with a reduced amount of supplementary cementitious material in the total amount of cementitious material to be used. A source of aggregate will be considered for addition to the approved list if the producer of the aggregate submits to the Transportation Laboratory certified test results from a qualified testing laboratory that verify the aggregate complies with the

requirements. Before the testing starts, the aggregate test shall be registered with the Department. A registration number can be obtained by calling (916) 227-7228. The registration number shall be used as the identification for the aggregate sample in correspondence with the Department. Upon request, a split of the tested sample shall be provided to the Department. Approval of aggregate will depend upon compliance with the specifications, based on the certified test results submitted, together with any replicate testing the Department may elect to perform. Approval will expire 3 years from the date the most recent registered and evaluated sample was collected from the aggregate source.
Qualified testing laboratories shall conform to the following requirements:

1. Laboratories performing ASTM Designation: C 1293 shall participate in the Cement and Concrete Reference Laboratory (CCRL) Concrete Proficiency Sample Program and shall have received a score of 3 or better on each test of the previous 2 sets of concrete samples.
2. Laboratories performing ASTM Designation: C 1260 shall participate in the Cement and Concrete Reference Laboratory (CCRL) Pozzolan Proficiency Sample Program and shall have received a score of 3 or better on the shrinkage and soundness tests of the previous 2 sets of pozzolan samples.

Aggregates on the list shall conform to one of the following requirements:

1. When the aggregate is tested in conformance with the requirements in California Test 554 and ASTM Designation: C 1293, the average expansion at one year shall be less than or equal to 0.040 percent; or
2. When the aggregate is tested in conformance with the requirements in California Test 554 and ASTM Designation: C 1260, the average of the expansion at 16 days shall be less than or equal to 0.15 percent.

If the aggregates used in the concrete are on the Department's list, the minimum amount of supplementary cementitious material shall conform to the following:

1. If fly ash or natural pozzolan conforming to the provisions in Section 90-2.01C, "Required Use of Supplementary Cementitious Materials," of the State Standard Specifications is used, the minimum amount of supplementary cementitious material shall be 15 percent by weight of the total cementitious material; or
2. If silica fume conforming to the provisions in Section 90-2.01C, "Required Use of Supplementary Cementitious Materials," of the State Standard Specifications is used, the minimum amount of supplementary cementitious material shall be 7 percent by weight of the total cementitious material.

The limitation on tricalcium silicate (C_3S) content in Type II cement specified in Section 90-2.01A, "Cement," of the State Standard Specifications shall not apply.

8-2.02 CEMENTITIOUS MATERIAL AND AIR CONTENT

Except for concrete listed below, all concrete that is designated as Class 2 and all concrete for use in structures shall contain not less than 630 pounds of cementitious material per cubic yard and shall be air entrained as provided in Section 90-4, "Admixtures," of the State Standard Specifications. The air content at time of mixing and prior to placing shall be 3.0 ± 1.0 percent.

A. Paving concrete.
B. Concrete designated by 28-day compressive strength.
C. Concrete specified to have a cementitious material content that exceeds 630 pounds per cubic yard.
D. Seal course concrete.
E. Concrete for deck slabs of bridges and structure approach slabs.
F. Concrete for piling.

SECTION 8-3. WELDING

8-3.__ WELDING

GENERAL

Flux cored welding electrodes conforming to the requirements of AWS A5.20 E6XT-4 or E7XT-4 shall not be used to perform welding for this project.
Wherever reference is made to the following AWS welding codes in the Standard Specifications, on the plans, or in these special provisions, the year of adoption for these codes shall be as listed:

AWS Code	Year of Adoption
D1.1	2006
D1.4	2005
D1.5	2002
D1.6	1999

Requirements of the AWS welding codes shall apply unless otherwise specified in the Standard Specifications, on the plans, or in these special provisions. Wherever the abbreviation AWS is used, it shall be equivalent to the abbreviations ANSI/AWS or AASHTO/AWS.
Section 6.1.1.1 of AWS D1.5 is replaced with the following:

Quality Control (QC) shall be the responsibility of the Contractor. As a minimum, the Contractor shall perform inspection and testing of each weld joint prior to welding, during welding, and after welding as specified in this section and as necessary to ensure that materials and workmanship conform to the requirements of the contract documents.
Unless otherwise specified, Sections 6.1.3 through 6.1.4.3 of AWS D1.1, Section 7.1.2 of AWS D1.4, and Sections 6.1.1.2 through 6.1.3.3 of AWS D1.5 are replaced with the following:

The QC Inspector shall be the duly designated person who acts for and on behalf of the Contractor for inspection, testing, and quality related matters for all welding.
Quality Assurance (QA) is the prerogative of the Engineer. The QA Inspector is the duly designated person who acts for and on behalf of the Engineer.
The QC Inspector shall be responsible for quality control acceptance or rejection of materials and workmanship, and shall be currently certified as an AWS Certified Welding Inspector (CWI) in conformance with the requirements in AWS QC1, "Standard for AWS Certification of Welding Inspectors."

The QC Inspector may be assisted by an Assistant QC Inspector provided that this individual is currently certified as an AWS Certified Associate Welding Inspector (CAWI) in conformance with the requirements in AWS QC1, "Standard for AWS Certification of Welding Inspectors." The Assistant QC Inspector may perform inspection under the direct supervision of the QC Inspector provided the assistant is always within visible and audible range of the QC Inspector. The QC Inspector shall be responsible for signing all reports and for determining if welded materials conform to workmanship and acceptance criteria. The ratio of QC Assistants to QC Inspectors shall not exceed 5 to 1.
When the term "Inspector" is used without further qualification, it shall refer to the QC Inspector.
When any work is welded in conformance with the provisions in Section 75, "Miscellaneous Metal," of the Standard Specifications, not including Section 75-1.035, "Bridge Joint Restrainer Units," of the Standard Specifications, Section 6.1.4 of AWS D1.1 is replaced with the following:

The QC Inspector shall be responsible for quality control acceptance or rejection of materials and workmanship and shall be currently certified as an AWS CWI in conformance with the requirements in AWS QC1, "Standard for AWS Certification of Welding Inspectors," or as a Welding Inspector Specialist (WIS) in conformance with the requirements in AWS B5.2, "Specification for the Qualification of Welding Inspector Specialists and Welding Inspector Assistants."

Section 6.14.6, "Personnel Qualification," of AWS D1.1, Section 7.8, "Personnel Qualification," of AWS D1.4, and Section 6.1.3.4, "Personnel Qualification," of AWS D1.5 are replaced with the following:

Personnel performing nondestructive testing (NDT) shall be qualified and certified in conformance with the requirements of the American Society for Nondestructive Testing (ASNT) Recommended Practice No. SNT-TC-1A and the Written Practice of the NDT firm. The Written Practice of the NDT firm shall meet or exceed the guidelines of the ASNT Recommended Practice No. SNT-TC-1A. Individuals who perform NDT, review the results, and prepare the written reports shall be either:

A. Certified NDT Level II technicians, or;
B. Level III technicians who hold a current ASNT Level III certificate in that discipline and are authorized and certified to perform the work of Level II technicians.

Section 6.5.4 of AWS D1.5 is replaced with the following:

The QC Inspector shall inspect and approve each joint preparation, assembly practice, welding technique, joint fit-up, and the performance of each welder, welding operator, and tack welder to make certain that the applicable requirements of this code and the approved Welding Procedure Specification (WPS) are met. The QC Inspector shall examine the work to make certain that it meets the requirements of Sections 3 and 6.26. The size and contour of all welds shall be measured using suitable gages. Visual inspection for cracks in welds and base metal, and for other discontinuities shall be aided by strong light, magnifiers, or such other devices as may be

helpful. Acceptance criteria different from those specified in this code may be used when approved by the Engineer.

Section 6.6.5, "Nonspecified NDT Other than Visual," of AWS D1.1, Section 7.6.5 of AWS D1.4 and Section 6.6.5 of AWS D1.5 shall not apply.

For any welding, the Engineer may direct the Contractor to perform NDT that is in addition to the visual inspection or NDT specified in the AWS or other specified welding codes, in the Standard Specifications, or in these special provisions. Except as provided for in these special provisions, additional NDT required by the Engineer, and associated repair work, will be paid for as extra work as provided in Section 4-1.03D, "Extra Work," of the Standard Specifications.

Prior to release of welded material by the Engineer, if testing by NDT methods other than those originally specified discloses an attempt to defraud or reveals a gross nonconformance, all costs associated with the repair of the deficient area, including NDT of the weld and of the repair, and any delays caused by the repair, shall be at the Contractor’s expense. A gross nonconformance is defined as the sum of planar type rejectable indications in more than 20 percent of the tested length.

When less than 100 percent of NDT is specified for any weld, it is expected that the entire length of weld meet the specified acceptance-rejection criteria. Should any welding deficiencies be discovered by additional NDT directed or performed by the Engineer that utilizes the same NDT method as that originally specified, all costs associated with the repair of the deficient area, including NDT of the weld and of the weld repair, and any delays caused by the repair, shall be at the Contractor's expense.

Repair work to correct welding deficiencies discovered by visual inspection directed or performed by the Engineer, and any associated delays or expenses caused to the Contractor by performing these repairs, shall be at the Contractor's expense.

The Engineer shall have the authority to verify the qualifications or certifications of any welder, QC Inspector, or NDT personnel to specified levels by retests or other means approved by the Engineer.

Inspection and approval of all joint preparations, assembly practices, joint fit-ups, welding techniques, and the performance of each welder, welding operator, and tack welder shall be documented by the QC Inspector on a daily basis for each day welding is performed. For each inspection, including fit-up, Welding Procedure Specification (WPS) verification, and final weld inspection, the QC Inspector shall confirm and document compliance with the requirements of the AWS or other specified code criteria and the requirements of these special provisions on all welded joints before welding, during welding, and after the completion of each weld.

In addition to the requirements specified in the applicable code, the period of effectiveness for a welder's or welding operator's qualification shall be a maximum of 3 years for the same weld process, welding position, and weld type. If welding will be performed without gas shielding, then qualification shall also be without gas shielding. Excluding welding of fracture critical members, a valid qualification at the beginning of work on a contract will be acceptable for the entire period of the contract, as long as the welder's or welding operator's work remains satisfactory.

In addition to the requirements of AWS D1.1, welding procedures qualification for work welded in conformance with that code shall conform to the following requirements:

A. The travel speed, amperage, and voltage values that are used for tests conducted per AWS D1.1, Section 4.1.1, shall be consistent for each pass in a weld joint and shall in no

case vary by more than ±10 percent for travel speed, ±10 percent for amperage, and ±7 percent for voltage as measured from a predetermined target value or average within each weld pass. The travel speed shall in no case vary by more than ±15 percent when using submerged arc welding.

B. When a nonstandard weld joint is to be made using a combination of WPSs, a single test may be conducted combining the WPSs to be used in production, provided the essential variables, including weld bead placement, of each process are limited to those established in Table 4.5.

In addition to the requirements of AWS D1.5, Section 5.12 or 5.13, welding procedures qualification for work welded in conformance with that code shall conform to the following requirements:

A. Unless considered prequalified, fillet welds shall be qualified in each position. The fillet weld soundness test shall be conducted using the essential variables of the WPS as established by the Procedure Qualification Record (PQR).
B. For qualification of joints that do not conform to Figures 2.4 and 2.5 of AWS D1.5, a minimum of two WPS qualification tests are required. The tests shall be conducted using both Figure 5.1 and Figure 5.3. The test conforming to Figure 5.1 shall be conducted in conformance with AWS D1.5, Section 5.12 or 5.13. The test conforming to Figure 5.3 shall be conducted using the welding electrical parameters that were established for the test conducted conforming to Figure 5.1. The ranges of welding electrical parameters established during welding per Figure 5.1 in conformance with AWS D1.5, Section 5.12, shall be further restricted according to the limits in Table 5.3 during welding per Figure 5.3.
C. Multiple zones within a weld joint may be qualified. The travel speed, amperage, and voltage values that are used for tests conducted per AWS D1.5 Section 5.13 shall be consistent for each pass in a weld joint, and shall in no case vary by more than ±10 percent for travel speed, ±10 percent for amperage, and ±7 percent for voltage as measured from a predetermined target value or average within each weld pass or zone. The travel speed shall in no case vary by more than ±15 percent when using submerged arc welding.
D. For a WPS qualified in conformance with AWS D1.5 Section 5.13, the values to be used for calculating ranges for current and voltage shall be based on the average of all weld passes made in the test. Heat input shall be calculated using the average of current and voltage of all weld passes made in the test for a WPS qualified in conformance with Section 5.12 or 5.13.
E. Macroetch tests are required for WPS qualification tests, and acceptance shall be per AWS D1.5 Section 5.19.3.
F. When a nonstandard weld joint is to be made using a combination of WPSs, a test conforming to Figure 5.3 may be conducted combining the WPSs to be used in production, provided the essential variables, including weld bead placement, of each process are limited to those established in Table 5.3.
G. Prior to preparing mechanical test specimens, the PQR welds shall be inspected by visual and radiographic tests. Backing bar shall be 3 inches in width and shall remain in place during NDT testing. Results of the visual and radiographic tests shall comply with AWS D1.5 Section 6.26.2, excluding Section 6.26.2.2. Test plates that do not comply with both tests shall not be used.

WELDING QUALITY CONTROL

Unless the QCM is hired by a subcontractor providing only QC services, the QCM shall not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project. The QCM may be an employee of the Contractor.

SECTION 9. (BLANK)

SECTION 10. CONSTRUCTION DETAILS

SECTION 10-1. GENERAL

10-1.00 CONSTRUCTION PROJECT INFORMATION SIGNS

Before any major physical construction work readily visible to highway users is started on this contract, the Contractor shall furnish and erect 2 Type 2 Construction Project Information signs at the locations designated by the Engineer.
The signs and overlays shall be of a type and material consistent with the estimated time of completion of the project and shall conform to the details shown on the plans.
The sign letters, the border and the Department's construction logos shall conform to the colors (non-reflective) and details shown on the plans, and shall be on a white background (non-reflective). The colors blue and orange shall conform to PR Color Number 3 and Number 6, respectively, as specified in the Federal Highway Administration's Color Tolerance Chart.
The sign message to be used for fund types shall consist of the following, in the order shown:

U.S. DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION

The sign message to be used for type of work shall consist of the following:

ROADSIDE WORK

The sign message to be used for the Year of Completion of Project Construction will be furnished by the Engineer. The Contractor shall furnish and install the "Year" sign overlay within 10 working days of notification of the year date to be used.
The letter sizes to be used shall be as shown on the plans. The information shown on the signs shall be limited to that shown on the plans.
The signs shall be kept clean and in good repair by the Contractor.

Upon completion of the work, the signs shall be removed and disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13 of the State Standard Specifications.
Full compensation for furnishing, erecting, maintaining, and removing and disposing of the construction project information signs shall be considered as included in the prices paid for the various contract items of work involved and no additional compensation will be allowed therefor.

10-1.01 ORDER OF WORK

Order of work shall conform to the provisions in Section 5-1.05, "Order of Work," of the State Standard Specifications and these special provisions.
Attention is directed to "Maintaining Traffic" and "Temporary Pavement Delineation" of these special provisions and to the stage construction sheets of the plans.
The work shall be performed in conformance with the stages of construction shown on the plans. Nonconflicting work in subsequent stages may proceed concurrently with work in preceding stages, provided satisfactory progress is maintained in the preceding stages of construction.
In each stage, after completion of the preceding stage, the first order of work shall be the removal of existing pavement delineation as directed by the Engineer. Pavement delineation removal shall be coordinated with new delineation so that lane lines are provided at all times on traveled ways open to public traffic.
Before obliterating any pavement delineation (traffic stripes, pavement markings, and pavement markers) that is to be replaced on the same alignment and location, as determined by the Engineer, the pavement delineation shall be referenced by the Contractor, with a sufficient number of control points to reestablish the alignment and location of the new pavement delineation. The references shall include the limits or changes in striping pattern, including one- and 2-way barrier lines, limit lines, crosswalks and other pavement markings. Full compensation for referencing existing pavement delineation shall be considered as included in the contract prices paid for new pavement delineation and no additional compensation will be allowed therefor.

10-1.___ WATER POLLUTION CONTROL

GENERAL

Water pollution control work shall conform to the provisions in Section 7-1.01G, "Water Pollution," of the State Standard Specifications, section of these special provisions entitled "Relations With California Regional Water Quality Control Board," and these special provisions.
The Contractor may obtain other National Pollutant Discharge Elimination System (NPDES) permits that apply to activities and mobile operations within or outside of the project limits including hot mix asphalt batch plants, material borrow areas, concrete plants, staging areas, storage yards, or access roads.
The Contractor shall perform water pollution control work in conformance with the requirements in the "Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual" and its addenda in effect on the day the Notice to Contractors is dated. This manual is referred to as the "Preparation Manual." Copies of the Preparation Manual may be obtained from:

State of California
Department of Transportation
Publication Distribution Unit
1900 Royal Oaks Drive
Sacramento, California 95815
Telephone: (916) 445-3520

Office of the Duty Senior for Construction
Department of Transportation
4050 Taylor Street
San Diego, California 92110
Telephone: (619) 688-6635

The Preparation Manual and other references for performing water pollution control work are available from the Department's Construction Storm Water and Water Pollution Control web site at:

http://www.dot.ca.gov/hq/construc/stormwater/stormwater1.htm

Before the start of job site activities, the Contractor shall provide training for project managers, supervisory personnel, and employees involved with water pollution control work. The training shall include:

A. Rules and regulations
B. Implementation and maintenance for:

1. Temporary Soil Stabilization
2. Temporary Sediment Control
3. Tracking Control
4. Wind Erosion Control

The Contractor shall designate in writing a Water Pollution Control Manager (WPCM). The Contractor shall submit a statement of qualifications describing the training, work history, and expertise of the proposed WPCM. The qualifications shall include either:

A. A minimum of 24 hours of Department approved storm water management training described at Department's Construction Storm Water and Water Pollution Control web site.
B. Certification as a Certified Professional in Erosion and Sediment Control (CPESC).

The WPCM shall be:

A. Responsible for water pollution control work.
B. The primary contact for water pollution control work.
C. Have authority to mobilize crews to make immediate repairs to water pollution control practices.

The Contractor may designate one manager to prepare the SWPPP and a different manager to implement the plan. The WPCP preparer shall meet the training requirements for the WPCM.

STORM WATER POLLUTION PREVENTION PLAN

The Contractor shall submit a Storm Water Pollution Prevention Plan (SWPPP) to the Engineer for approval. The SWPPP shall conform to the requirements in the Preparation Manual, the NPDES permit, and these special provisions. The SWPPP shall be submitted in place of the water pollution control program required by the provisions in Section 7-1.01G, "Water Pollution," of the State Standard Specifications.
The SWPPP shall include water pollution control practices:

A. For storm water and non-storm water from areas outside of the job site related to construction activities for this contract such as:

    1. Staging areas.
    2. Storage yards.
    3. Access roads.

B. Appropriate for each season as described in "Implementation Requirements" of these special provisions.
C. For activities or mobile operations related to all NPDES permits.

The SWPPP shall include a schedule that:

A. Describes when work activities that could cause water pollution will be performed.
B. Identifies soil stabilization and sediment control practices for disturbed soil area.
C. Includes dates when these practices will be 25, 50, and 100 percent complete.
D. Shows 100 percent completion of these practices before the rainy season.

The SWPPP shall include the following temporary water pollution control practices and their associated contract items of work as shown on the plans or specified in these special provisions:

A. Temporary Sediment Control

    1. Temporary Fiber Roll
    2. Street Sweeping

B. Tracking Control

    1. Temporary Construction Entrance
    2. Street Sweeping

C. Wind Erosion Control

    1. Construction Site Management

D. Non-Storm Water Management

1. Construction Site Management

E. Waste Management and Materials Pollution Control

1. Construction Site Management
2. Temporary Concrete Washout (Portable)

Within 20 days after contract approval, the Contractor shall submit 3 copies of the SWPPP to the Engineer. The Contractor shall allow 20 days for the Engineer's review. If revisions are required, the Engineer will provide comments and specify the date that the review stopped. The Contractor shall revise and resubmit the SWPPP within 15 days of receipt of the Engineer's comments. The Engineer's review will resume when the complete SWPPP is resubmitted. When the Engineer approves the SWPPP, the Contractor shall submit 4 copies of the approved SWPPP to the Engineer. The Contractor may proceed with construction activities if the Engineer conditionally approves the SWPPP while minor revisions are being completed. If the Engineer fails to complete the review within the time allowed and if, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay, the Contractor will be compensated for resulting losses, and an extension of time will be granted, as provided for in Section 8-1.09, "Right of Way Delays," of the State Standard Specifications.
The SWPPP shall include a copy of the Notification of Construction.
The Contractor shall not perform work that may cause water pollution until the SWPPP has been approved by the Engineer. The Engineer's review and approval shall not waive any contract requirements and shall not relieve the Contractor from complying with Federal, State and local laws, regulations, and requirements.
If there is a change in construction schedule or activities, the Contractor shall prepare an amendment to the SWPPP to identify additional or revised water pollution control practices. The Contractor shall submit the amendment to the Engineer for review within a time agreed to by the Engineer not to exceed the number of days specified for the initial submittal of the SWPPP. The Engineer will review the amendment within the same time allotted for the review of the initial submittal of the SWPPP.
The Contractor shall keep a copy of the approved SWPPP at the job site. The SWPPP shall be made available when requested by a representative of the Regional Water Quality Control Board, State Water Resources Control Board, United States Environmental Protection Agency, or the local storm water management agency. Requests from the public shall be directed to the Engineer.

SAMPLING AND ANALYSIS

The Contractor shall include a Sampling and Analysis Plan (SAP) in the SWPPP to monitor the effectiveness of the water pollution control practices. The Contractor shall prepare the SAP in conformance with the Preparation Manual.
The Contractor shall designate trained personnel to collect water quality samples. The personnel and training shall be documented in the SAP. Training shall consist of the following elements:

A. SAP review,
B. Health and safety review, and
C. Sampling simulations.

In the SAP the Contractor shall describe the following water quality sampling procedures:

A. Sampling preparation,
B. Collection,
C. Quality assurance and quality control,
D. Sample labeling,
E. Collection documentation,
F. Sample shipping,
G. Chain of custody,
H. Sample numbering, and
I. Precautions from the construction site health and safety plan.

The Contractor shall document sample collection during precipitation.
Samples to be analyzed in the field shall be taken by the Contractor's designated sampling personnel using collection and analysis methods, and equipment calibration specified by the manufacturer of the sampling equipment. Samples to be analyzed by a laboratory, shall be sampled, preserved, and analyzed by a State-certified laboratory in conformance with the requirements in 40 CFR Part 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants." The Contractor shall identify the State-certified laboratory, sample containers, preservation requirements, holding times, and analysis method in the SAP. A list of State-certified laboratories that are approved by the Department is available at:

http://www.dhs.ca.gov/ps/ls/ELAP/html/lablist.htm

Sediment and Turbidity

This project discharges directly into _____, a body of water required by the Clean Water Act, Section 303(d) to be listed as impaired due to _____. The Contractor shall describe in the SAP the schedule and strategy for monitoring _____ in the listed body of water in accordance with the provisions in this section.
The Contractor shall develop the SAP schedule so that water quality samples are taken within 2 hours of discharge from precipitation during daylight hours (sunrise to sunset), regardless of the time of year, day of the week, or condition of the construction site. If precipitation occurs again after at least 72 hours of dry weather the Contractor shall take new samples, however, sampling will not be required more than 4 times in 30 days.
In the SAP the Contractor shall identify the locations where runoff sources on the construction site discharge directly into the listed body of water, and the locations where water flows onto the project with the potential to combine with runoff that discharges directly into the listed body of water. These locations shall also be shown on the SWPPP Water Pollution Control Drawings.
The Contractor shall identify locations for collecting water quality samples and the reason for their selection. Sampling locations shall also be shown on the SWPPP Water Pollution Control Drawings. The sampling locations shall include:

A. Upstream from direct discharges from the construction site,

B. Immediately downstream from the last point of direct discharge from the construction site, and
C. Immediately downhill from the locations where water flows onto the right of way.

The Contractor shall specify in the SAP that for discharges into bodies of water listed as impaired due to sedimentation/siltation, samples will be analyzed for both settleable solids in accordance with the requirements of EPA Test Method 160.5, and total suspended solids in accordance with EPA Test Method 160.2; or for suspended sediment concentration in accordance with the requirements in ASTM Designation: D 3977.
For discharges to 303(d) bodies of water listed as impaired due to turbidity the Contractor shall specify in the SAP that samples will be analyzed for turbidity in accordance with the requirements in EPA Test Method 180.1.

Non-Visible Pollutants

This project has the potential to discharge non-visible pollutants in storm water from the construction site. The Contractor shall include in the SAP a description of the sampling and analysis strategy to be implemented on the project for monitoring non-visible pollutants.
In the SAP the Contractor shall identify potential non-visible pollutants that will be present on the construction site associated with the following:

A. Construction materials and wastes;
B. Existing contamination due to historical site usage; or
C. Application of soil amendments, including soil stabilization products, with the potential to alter pH or contribute toxic pollutants to storm water.

The Contractor shall show the locations planned for storage and use of the potential non-visible pollutants on the SWPPP Water Pollution Control Drawings.
The Contractor shall include in the SAP the following list of conditions that require sampling when observed during a storm water inspection:

A. Materials or wastes containing potential non-visible pollutants are not stored under watertight conditions.
B. Materials or wastes containing potential non-visible pollutants are stored under watertight conditions, but:

    1. A breach, leakage, malfunction, or spill is observed;
    2. The leak or spill has not been cleaned up before precipitation; and
    3. There is the potential for discharge of non-visible pollutants to surface waters or drainage system.

C. Construction activities; such as application of fertilizer, pesticide, herbicide, methyl methacrylate concrete sealant, or non-pigmented curing compound; have occurred during precipitation or within 24 hours preceding precipitation, and have the potential to discharge pollutants to surface waters or drainage system.
D. Soil amendments, including soil stabilization products, with the potential to alter pH levels or contribute toxic pollutants to storm water runoff have been applied, and have the potential

to discharge pollutants to surface waters or drainage system (unless independent test data are available that demonstrate acceptable concentrations of non-visible pollutants in the soil amendment).

E. Storm water runoff from an area contaminated by historical usage of the site has the potential to discharge pollutants to surface waters or drainage system.

The Contractor shall describe in the SAP the schedule for collecting a sample downhill from each non-visible pollutant source and an uncontaminated control sample, during the first 2 hours of discharge from precipitation during daylight hours that result in enough discharge for sample collection. If discharge flows to the non-visible pollutant source, a sample shall be collected immediately downhill from where the discharge enters the Department's right of way. If precipitation occurs again after at least 72 hours of dry weather the Contractor shall take new samples.

In the SAP the Contractor shall identify sampling locations for collecting downstream and control samples, and the reason for their selection. The control sampling location shall be selected so the sample does not come into contact with materials, wastes or areas associated with potential non-visible pollutants or disturbed soil areas. The Contractor shall show non-visible pollutant sampling locations on the SWPPP Water Pollution Control Drawings.

The Contractor shall identify in the SAP the analytical method to be used for downhill and control samples for potential non-visible pollutants on the project.

Analytical Results and Evaluation

The Contractor shall submit a hard copy and electronic copy of water quality analytical results, and quality assurance and quality control data to the Engineer within 5 days of sampling for field analyses, and within 30 days for laboratory analyses. The Contractor shall also provide an evaluation of whether the downhill samples show levels of the tested parameter higher than in the control sample. If downhill or downstream samples show increased levels, the Contractor will assess the water pollution control measures, site conditions, and surrounding influences to determine the probable cause for the increase. As determined by the assessment, the Contractor will repair or modify water pollution control measures to address increases and amend the SWPPP as necessary. Electronic results (in one of the following file formats: .xls, .txt, .csv, .dbs, or .mdb) shall have the following information:

A. Sample identification number.
B. Contract number.
C. Constituent.
D. Reported value.
E. Analytical method.
F. Method detection limit.
G. Reported limit.

The Contractor shall maintain the water quality sampling documentation and analytical results with the SWPPP on the project site.

If construction activities or knowledge of site conditions change such that discharges or sampling locations change, the Contractor shall amend the SAP in conformance with this section, "Water Pollution Control."

IMPLEMENTATION REQUIREMENTS

The Contractor's responsibility for SWPPP implementation shall continue throughout any temporary suspension of work ordered in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the State Standard Specifications.
If the Contractor or the Engineer identifies a deficiency in the implementation of the approved SWPPP, the deficiency shall be corrected immediately, unless an agreed date for correction is approved in writing by the Engineer. The deficiency shall be corrected before the onset of precipitation. If the Contractor fails to correct the deficiency by the agreed date or before the onset of precipitation, the Department may correct the deficiency and deduct the cost of correcting deficiencies from payments.
If the Contractor fails to conform to the provisions of this section, "Water Pollution Control," the Engineer may order the suspension of work until the project complies with the requirements of this section.

Year-Round

The Contractor shall monitor the National Weather Service weather forecast on a daily basis during the contract. The Contractor may use an alternative weather forecasting service if approved by the Engineer. Appropriate water pollution control practices shall be in place before precipitation.
The Contractor may discontinue earthwork operations for a disturbed area for up to 21 days and the disturbed soil area will still be considered active. When earthwork operations in the disturbed area have been completed, the Contractor shall implement appropriate water pollution control practices within 15 days, or before predicted precipitation, whichever occurs first.

Rainy Season

The Contractor shall provide soil stabilization and sediment control practices during the rainy season between August 1 and October 1, and between November 1 and May 1.
The Contractor shall implement soil stabilization and sediment control practices a minimum of 10 days before the start of the rainy season.
During the defined rainy season, the active disturbed soil area of the project site shall be not more than 5 acres. The Engineer may approve expansions of the active disturbed soil area limit if requested in writing. The Contractor shall maintain soil stabilization and sediment control materials on site to protect disturbed soil areas.

INSPECTION AND MAINTENANCE

The WPCM shall inspect the water pollution control practices identified in the SWPPP as follows:

A. Before a forecasted storm,
B. After precipitation that causes site runoff,
C. At 24-hour intervals during extended precipitation,
D. On a predetermined schedule, a minimum of once every 2 weeks outside of the defined rainy season, and
E. On a predetermined schedule, a minimum of once a week during the defined rainy season.

The WPCM shall oversee the maintenance of the water pollution control practices.
The WPCM shall use the Storm Water Quality Construction Site Inspection Checklist provided in the Preparation Manual or an alternative inspection checklist provided by the Engineer. A copy of the completed site inspection checklist shall be submitted to the Engineer within 24 hours of finishing the inspection.

REPORTING REQUIREMENTS

If the Contractor identifies discharges into surface waters or drainage systems causing or potentially causing pollution, or if the project receives a written notice or order from a regulatory agency, the Contractor shall immediately inform the Engineer. The Contractor shall submit a written report to the Engineer within 3 days of the discharge, notice or order. The report shall include the following information:

A. The date, time, location, and nature of the operation, type of discharge and quantity, and the cause of the notice or order.
B. The water pollution control practices used before the discharge, or before receiving the notice or order.
C. The date of placement and type of additional or altered water pollution control practices placed after the discharge, or after receiving the notice or order.
D. A maintenance schedule for affected water pollution control practices.

Annual Certifications

By June 15 of each year, the Contractor shall complete and submit to the Engineer an Annual Certification of Compliance, as contained in the Preparation Manual.

PAYMENT

During each estimate period the Contractor fails to conform to the provisions in this section, "Water Pollution Control," or fails to implement the water pollution control practices shown on the plans or specified elsewhere in these special provisions as items of work, the Department will withhold 25 percent of the progress payment.
Withholds for failure to perform water pollution control work will be in addition to all other withholds provided for in the contract. The Department will return performance-failure withholds in the progress payment following the correction of noncompliance.

Payments for prepare storm water pollution prevention plan will be made as follows:

A. After the SWPPP has been approved by the Engineer, 50 percent of the contract item price for prepare storm water pollution prevention plan will be included in the monthly progress estimate.
B. Forty percent of the contract item price for prepare storm water pollution prevention plan will be paid over the life of the contract.
C. After acceptance of the contract in conformance with the provisions in Section 7-1.17, "Acceptance of Contract," of the State Standard Specifications, payment for the remaining 10 percent of the contract item price for prepare storm water pollution prevention plan will

be made in conformance with the provisions in Section 9-1.07A, "Payment Prior to Proposed Final Estimate."

Implementation of water pollution control practices in areas outside the highway right of way not specifically provided for in the SWPPP or in these special provisions will not be paid for. Water pollution control practices for which there are separate contract items of work will be measured and paid for as those contract items of work.

10-1.__ CONSTRUCTION SITE MANAGEMENT

Construction site management shall consist of controlling potential sources of water pollution before they come in contact with storm water systems or watercourses. The Contractor shall control material pollution and manage waste and non-storm water existing at the construction site by implementing effective handling, storage, use, and disposal practices.
Attention is directed to "Water Pollution Control" of these special provisions regarding the Contractor's appointment of a water pollution control manager (WPCM) for the project.
The Contractor shall train all employees and subcontractors regarding:

A. Material pollution prevention and control;
B. Waste management;
C. Non-storm water management;
D. Identifying and handling hazardous substances; and
E. Potential dangers to humans and the environment from spills and leaks or exposure to toxic or hazardous substances.

Training shall take place before starting work on this project. New employees shall receive the complete training before starting work on this project. The Contractor shall have regular meetings to discuss and reinforce spill prevention and control; material delivery, storage, use, and disposal; waste management; and non-storm water management procedures.
Instructions for material and waste handling, storage, and spill reporting and cleanup shall be posted at all times in an open, conspicuous, and accessible location at the construction site.
Nonhazardous construction site waste and excess material shall be recycled when practical or disposed of in accordance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the State Standard Specifications, unless otherwise specified.
Vehicles and equipment at the construction site shall be inspected by the WPCM on a frequent, predetermined schedule, and by the operator each day of use. Leaks shall be repaired immediately, or the vehicle or equipment shall be removed from the construction site.

SPILL PREVENTION AND CONTROL

The Contractor shall implement spill and leak prevention procedures when chemicals or hazardous substances are stored. Spills of petroleum products; substances listed under CFR Title 40, Parts 110, 117, and 302; and sanitary and septic waste shall be contained and cleaned up as soon as is safe.
Minor spills involve small quantities of oil, gasoline, paint, or other material that can be controlled by the first responder upon discovery of the spill. Cleanup of minor spills includes:

A. Containing the spread of the spill,
B. Recovering the spilled material using absorption,
C. Cleaning the contaminated area, and
D. Disposing of contaminated material promptly and properly.

Semi-significant spills are those that can be controlled by the first responder with the help of other personnel. Cleanup of semi-significant spills shall be immediate. Cleanup of semi-significant spills includes:

A. Containing the spread of the spill;
B. Recovering the spilled material using absorption if the spill occurs on paved or an impermeable surface;
C. Containing the spill with an earthen dike and digging up contaminated soil for disposal if the spill occurs on dirt;
D. Covering the spill with plastic or other material to prevent contaminating runoff if the spill occurs during precipitation; and
E. Disposing of contaminated material promptly and properly.

Significant or hazardous spills are those that cannot be controlled by construction personnel. Notifications of these spills shall be immediate. The following steps shall be taken:

A. Construction personnel shall not attempt to cleanup the spill until qualified staff have arrived;
B. Notify the Engineer and follow up with a written report;
C. Obtain the services of a spills contractor or hazardous material team immediately;
D. Notify the local emergency response team by dialing 911 and county officials at the emergency phone numbers kept on the construction site;
E. Notify the Governor's Office of Emergency Services Warning Center at (805) 852-7550;
F. Notify the National Response Center at (800) 424-8802 regarding spills of Federal reportable quantities in conformance with CFR Title 40, Parts 110, 119, and 302;
G. Notify other agencies as appropriate, including:

1. Fire Department,
2. Public Works Department,
3. Coast Guard,
4. Highway Patrol,
5. City Police or County Sheriff Department,
6 Department of Toxic Substances,
7. California Division of Oil and Gas,
8. Cal OSHA, or
9. Regional Water Resources Control Board.

The WPCM shall oversee and enforce proper spill prevention and control measures. Minor, semi-significant, and significant spills shall be reported to the Contractor's WPCM who shall notify the Engineer immediately.
The Contractor shall prevent spills from entering storm water runoff before and during cleanup. Spills shall not be buried or washed with water.

The Contractor shall keep material or waste storage areas clean, well organized, and equipped with enough cleanup supplies for the material being stored. Plastic shall be placed under paving equipment when not in use to catch drips.

MATERIAL MANAGEMENT

Material shall be delivered, used, and stored for this contract in a manner that minimizes or eliminates discharge of material into the air, storm drain systems, or watercourses.
The Contractor shall implement the practices described in this section when taking delivery of, using, or storing the following materials:

A. Hazardous chemicals including:

   1. Acids,
   2. Lime,
   3. Glues,
   4. Adhesives,
   5. Paints,
   6. Solvents, and
   7. Curing compounds;

B. Soil stabilizers and binders;
C. Fertilizers;
D. Detergents;
E. Plaster;
F. Petroleum products including:

   1. Fuel,
   2. Oil, and
   3. Grease;

G. Asphalt components and concrete components; and
H. Pesticides and herbicides.

The Contractor shall supply the Material Safety Data Sheet to the Engineer for material used or stored. The Contractor shall keep an accurate inventory of material delivered and stored at the construction site.
Employees trained in emergency spill cleanup procedures shall be present when hazardous materials or chemicals are unloaded.
The Contractor shall use recycled or less hazardous products when practical.

Material Storage

The Contractor shall store liquids, petroleum products, and substances listed in CFR Title 40, Parts 110, 117, and 302 in containers or drums approved by the United States Environmental Protection Agency, and place them in secondary containment facilities.

Secondary containment facilities shall be impervious to the materials stored there for a minimum contact time of 72 hours.
Throughout the rainy season secondary containment facilities shall be covered during non-working days and when precipitation is predicted. Secondary containment facilities shall be adequately ventilated.
The Contractor shall keep the secondary containment facility free of accumulated rainwater or spills. After precipitation, or in the event of spills or leaks, accumulated liquid shall be collected and placed into drums within 24 hours. These liquids shall be handled as hazardous waste in accordance with the provisions in "Hazardous Waste" of these special provisions, unless testing determines them to be nonhazardous.
Incompatible materials, such as chlorine and ammonia, shall not be stored in the same secondary containment facility.
Materials shall be stored in the original containers with the original product labels maintained in legible condition. Damaged or illegible labels shall be replaced immediately.
The secondary containment facility shall have the capacity to contain precipitation from a 24-hour-long, 25-year storm; and 10 percent of the aggregate volume of all containers, or all of the volume of the largest container within the facility, whichever is greater.
The Contractor shall store bagged or boxed material on pallets. Throughout the rainy season, bagged or boxed material shall be protected from wind and rain during non-working days and when precipitation is predicted.
The Contractor shall provide sufficient separation between stored containers to allow for spill cleanup or emergency response access. Storage areas shall be kept clean, well organized, and equipped with cleanup supplies appropriate for the materials being stored.
The Contractor shall repair or replace perimeter controls, containment structures, covers, and liners as needed. Storage areas shall be inspected before and after precipitation, and at least weekly during other times.

Stockpile Management

The Contractor shall reduce or eliminate potential air and water pollution from stockpiled material including soil, paving material, or pressure treated wood. Stockpiles shall be located out of floodplains when possible, and at least 50 feet from concentrated flows of storm water, drainage courses, or inlets unless written approval is obtained from the Engineer.
The Contractor may discontinue adding or removing material for up to 21 days and a stockpile will still be considered active.
The Contractor shall protect active stockpiles with plastic or geotextile cover, soil stabilization measures, or with linear sediment barrier when precipitation is predicted. Active stockpiles of cold mix asphalt concrete shall be placed on an impervious surface and covered with plastic when precipitation is predicted.
The Contractor shall protect inactive soil stockpiles with a plastic or geotextile cover, or with soil stabilization measures at all times during the rainy season. A linear sediment barrier around the perimeter of the stockpile shall also be used. During the non-rainy season soil stockpiles shall be covered and protected with a linear sediment barrier when precipitation is predicted.
The Contractor shall control wind erosion during dry weather as provided in Section 10, "Dust Control," of the State Standard Specifications.
Stockpiles of portland cement concrete rubble, asphalt concrete (AC), hot mix asphalt (HMA), AC and HMA rubble, aggregate base, or aggregate subbase shall be covered with plastic or

geotextile, or protected with a linear sediment barrier at all times during the rainy season, and when precipitation is predicted during the non-rainy season.
Stockpiles of cold mix asphalt concrete shall be placed on and covered with impermeable material at all times during the rainy season, and when precipitation is predicted during the non-rainy season.
Stockpiles of pressure treated wood shall be covered with impermeable material and placed on pallets at all times during the rainy season, and when precipitation is predicted during the non-rainy season.
The Contractor shall repair or replace linear sediment barriers and covers as needed or as directed by the Engineer to keep them functioning properly. Sediment shall be removed when it accumulates to 1/3 of the linear sediment barrier height.

WASTE MANAGEMENT

Solid Waste

The Contractor shall not allow litter or debris to accumulate anywhere on the construction site, including storm drain grates, trash racks, and ditch lines. The Contractor shall pick up and remove trash and debris from the construction site at least once a week. The WPCM shall monitor solid waste storage and disposal procedures on the construction site. The Contractor shall provide enough dumpsters of sufficient size to contain the solid waste generated by the project. Dumpsters shall be emptied when refuse reaches the fill line. Dumpsters shall be watertight. The Contractor shall not wash out dumpsters on the construction site. The Contractor shall provide additional containers and more frequent pickup during the demolition phase of construction
Solid waste includes:

A. Brick,
B. Mortar,
C. Timber,
D. Metal scraps,
E. Sawdust,
F. Pipe,
G. Electrical cuttings,
H. Non-hazardous equipment parts,
I. Styrofoam and other packaging materials,
J. Vegetative material and plant containers from highway planting, and
K. Litter and smoking material, including litter generated randomly by the public.

Trash receptacles shall be provided and used in the Contractor's yard, field trailers, and locations where workers gather for lunch and breaks.

Hazardous Waste

The Contractor shall implement hazardous waste management practices when waste is generated on the construction site from the following substances:

A. Petroleum products,
B. Asphalt products,
C. Concrete curing compound,
D. Pesticides,
E. Acids,
F. Paints,
G. Stains,
H. Solvents,
I. Wood preservatives,
J. Roofing tar, and
K. Materials classified as hazardous by California Code of Regulations, Title 22, Division 4.5; or listed in CFR Title 40, Parts 110, 117, 261, or 302.

Nothing in these special provisions shall relieve the Contractor of the responsibility for compliance with Federal, State, and local laws regarding storage, handling, transportation, and disposal of hazardous wastes.
The WPCM shall oversee and enforce hazardous waste management practices. Production of hazardous materials and hazardous waste on the construction site shall be kept to a minimum. Perimeter controls, containment structures, covers, and liners shall be repaired or replaced when damaged.
The Contractor shall have a laboratory certified by the Department of Health Services (DHS) sample and test waste when hazardous material levels are unknown to determine safe methods for storage and disposal.
The Contractor shall segregate potentially hazardous waste from nonhazardous waste at the construction site. Hazardous waste shall be handled, stored, and disposed of as required in California Code of Regulations, Title 22, Division 4.5, Section 66262.34; and in CFR Title 49, Parts 261, 262, and 263.
The Contractor shall store hazardous waste in sealed containers constructed and labeled with the contents and date accumulated as required in California Code of Regulations, Title 22, Division 4.5; and in CFR Title 49, Parts 172, 173, 178, and 179. Hazardous waste containers shall be kept in temporary containment facilities conforming to the provisions in "Material Storage" of these special provisions.
There shall be adequate storage volume and containers shall be conveniently located for hazardous waste collection. Containers of hazardous waste shall not be overfilled and hazardous wastes shall not be mixed. Containers of dry waste that are not watertight shall be stored on pallets. The Contractor shall not allow potentially hazardous waste to accumulate on the ground. Hazardous waste shall be stored away from storm drains, watercourses, moving vehicles, and equipment.
The Contractor shall clean water based or oil based paint from brushes or equipment within a contained area and shall not contaminate soil, watercourses, or storm drain systems. Paints, thinners, solvents, residues, and sludges that cannot be recycled or reused shall be disposed of as hazardous waste. When thoroughly dry, latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths shall be disposed of as solid waste.
The Contractor shall dispose of hazardous waste within 90 days of being generated. Hazardous waste shall be disposed of by a licensed hazardous waste transporter using uniform hazardous waste manifest forms and taken to a Class I Disposal Site. A copy of the manifest shall be provided to the Engineer.

Contaminated Soil

The Contractor shall identify contaminated soil from spills or leaks by noticing discoloration, odors, or differences in soil properties. Soil with evidence of contamination shall be sampled and tested by a laboratory certified by DHS. If levels of contamination are found to be hazardous, the soil shall be handled and disposed of as hazardous waste.
The Contractor shall prevent the flow of water, including ground water, from mixing with contaminated soil by using one or a combination of the following measures:

A. Berms,
B. Cofferdams,
C. Grout curtains,
D. Freeze walls, or
E. Concrete seal course.

If water mixes with contaminated soil and becomes contaminated, the water shall be sampled and tested by a laboratory certified by the DHS. If levels of contamination are found to be hazardous, the water shall be handled and disposed of as hazardous waste.

Concrete Waste

The Contractor shall implement practices to prevent the discharge of portland cement concrete, AC, or HMA waste into storm drain systems or watercourses.
Portland cement concrete, AC, or HMA waste shall be collected at the following locations and disposed of:

A. Where concrete material, including grout, is used;
B. Where concrete dust and debris result from demolition;
C. Where sawcutting, coring, grinding, grooving, or hydro-concrete demolition of portland cement concrete, AC, or HMA creates a residue or slurry; or
D. Where concrete trucks or other concrete-coated equipment is cleaned at the construction site.

Sanitary and Septic Waste

Wastewater from sanitary or septic systems shall not be discharged or buried within the Department right of way. The WPCM shall inspect sanitary or septic waste storage and monitor disposal procedures at least weekly. Sanitary facilities that discharge to the sanitary sewer system shall be properly connected and free from leaks.
The Contractor shall obtain written approval from the local health agency, city, county, and sewer district before discharging from a sanitary or septic system directly into a sanitary sewer system, and provide a copy to the Engineer. The Contractor shall comply with local health agency requirements when using an on-site disposal system.

Liquid Waste

The Contractor shall not allow construction site liquid waste, including the following, to enter storm drain systems or watercourses:

A. Drilling slurries or fluids,
B. Grease-free or oil-free wastewater or rinse water,
C. Dredgings,
D. Liquid waste running off a surface including wash or rinse water, or
E. Other non-storm water liquids not covered by separate permits.

The Contractor shall hold liquid waste in structurally sound, leak proof containers such as:

A. Sediment traps,
B. Roll-off bins, or
C. Portable tanks.

Liquid waste containers shall be of sufficient quantity and volume to prevent spills and leaks. The containers shall be stored at least 50 feet from storm drains, watercourses, moving vehicles, and equipment.
The Contractor shall remove and dispose of deposited solids from sediment traps as provided in "Solid Waste" of these special provisions, unless determined infeasible by the Engineer.
Liquid waste may require testing to determine hazardous material content before disposal. Drilling fluids and residue shall be disposed of outside the highway right of way. If the Engineer determines that an appropriate location is available, fluids and residue exempt under California Code of Regulations, Title 23, Section 2511(g) may be dried by infiltration and evaporation in a leak proof container. The remaining solid waste may be disposed of as provided in "Solid Waste" of these special provisions.

NON-STORM WATER MANAGEMENT

Water Control and Conservation

The Contractor shall prevent erosion or the discharge of pollutants into storm drain systems or watercourses by managing the water used for construction operations. The Contractor shall obtain the Engineer's approval before washing anything on the construction site with water that could discharge into a storm drain system or watercourse. Discharges shall be reported to the Engineer immediately.
The Contractor shall implement water conservation practices when water is used on the construction site. Irrigation areas shall be inspected and watering schedules shall be adjusted to prevent erosion, excess watering, or runoff. The Contractor shall shut off the water source to broken lines, sprinklers, or valves, and they shall be repaired as soon as possible. When possible, water from waterline flushing shall be reused for landscape irrigation. Paved areas shall be swept and vacuumed, not washed with water.
Construction water runoff, including water from water line repair, shall be directed to areas to infiltrate into the ground and shall not be allowed to enter storm drain systems or watercourses. Spilled water shall not be allowed to escape water truck filling areas. When possible, the

Contractor shall direct water from off-site sources around the construction site, or shall minimize contact with the construction site.

Illegal Connection and Discharge Detection and Reporting

The Contractor shall inspect the construction site and the site perimeter before beginning work for evidence of illegal connections, discharges, or dumping. Subsequently, the construction site and perimeter shall be inspected on a frequent, predetermined schedule.
The Contractor shall immediately notify the Engineer when illegal connections, discharges, or dumping are discovered. The Contractor shall take no further action unless directed by the Engineer. Unlabeled or unidentifiable material shall be assumed to be hazardous.
The Contractor shall look for the following evidence of illegal connections, discharges, or dumping:

A. Debris or trash piles,
B. Staining or discoloration on pavement or soils,
C. Pungent odors coming from drainage systems,
D. Discoloration or oily sheen on water,
E. Stains or residue in ditches, channels or drain boxes,
F. Abnormal water flow during dry weather,
G. Excessive sediment deposits,
H. Nonstandard drainage junction structures, or
I. Broken concrete or other disturbances near junction structures.

Vehicle and Equipment Cleaning

The Contractor shall limit vehicle and equipment cleaning or washing on the construction site to that necessary to control vehicle tracking or hazardous waste. Vehicles and equipment shall not be cleaned on the construction site with soap, solvents, or steam until the Engineer has been notified. The resulting waste shall be contained and recycled, or disposed of as provided in "Liquid Waste" or "Hazardous Waste" of these special provisions, whichever is applicable. The Contractor shall not use diesel to clean vehicles or equipment, and shall minimize the use of solvents.
The Contractor shall clean or wash vehicles and equipment in a structure equipped with disposal facilities. If using a structure is not possible, vehicles and equipment shall be cleaned or washed in an outside area with the following characteristics:

A. Located at least 50 feet from storm drainage systems or watercourses,
B. Paved with AC, HMA, or portland cement concrete,
C. Surrounded by a containment berm, and
D. Equipped with a sump to collect and dispose of wash water.

When washing vehicles or equipment with water, the Contractor shall use as little water as possible. Hoses shall be equipped with a positive shutoff valve.
Wash racks shall discharge to a recycle system or to another system approved by the Engineer. Sumps shall be inspected regularly, and liquids and sediments shall be removed as needed.

Vehicle and Equipment Fueling and Maintenance

The Contractor shall fuel or perform maintenance on vehicles and equipment off the construction site whenever practical. When fueling or maintenance must be done at the construction site, the Contractor shall designate a site, or sites, and obtain approval from the Engineer before using. The fueling or maintenance site shall be protected from storm water, shall be on level ground, and shall be located at least 50 feet from drainage inlets or watercourses. The WPCM shall inspect the fueling or maintenance site regularly. Mobile fueling or maintenance shall be kept to a minimum.

The Contractor shall use containment berms or dikes around the fueling and maintenance area. Adequate amounts of absorbent spill cleanup material and spill kits shall be kept in the fueling and maintenance area and on fueling trucks. Spill cleanup material and kits shall be disposed of immediately after use. Drip pans or absorbent pads shall be used during fueling or maintenance unless performed over an impermeable surface.

Fueling or maintenance operations shall not be left unattended. Fueling nozzles shall be equipped with an automatic shutoff control. Vapor recovery fueling nozzles shall be used where required by the Air Quality Management District. Nozzles shall be secured upright when not in use. Fuel tanks shall not be topped-off.

The Contractor shall recycle or properly dispose of used batteries and tires.

Material and Equipment Used Over Water

Drip pans and absorbent pads shall be placed under vehicles or equipment used over water, and an adequate supply of spill cleanup material shall be kept with the vehicle or equipment. Drip pans or plastic sheeting shall be placed under vehicles or equipment on docks, barges, or other surfaces over water when the vehicle or equipment will be idle for more than one hour.

The Contractor shall provide watertight curbs or toe boards on barges, platforms, docks, or other surfaces over water to contain material, debris, and tools. Material shall be secured to prevent spills or discharge into water due to wind.

Structure Removal Over or Adjacent to Water

The Contractor shall not allow demolished material to enter storm water systems or watercourses. The Contractor shall use covers and platforms approved by the Engineer to collect debris. Attachments shall be used on equipment to catch debris on small demolition operations. Debris catching devices shall be emptied regularly and debris shall be handled as provided in "Waste Management" of these special provisions.

The WPCM shall inspect demolition sites within 50 feet of storm water systems or watercourses every day.

Paving, Sealing, Sawcutting, and Grinding Operations

The Contractor shall prevent the following material from entering storm drain systems or water courses:

A. Cementitious material,
B. Asphaltic material,
C. Aggregate or screenings,
D. Grinding or sawcutting residue,
E. Pavement chunks, or
F. Shoulder backing.

The Contractor shall cover drainage inlets and use linear sediment barriers to protect downhill watercourses until paving, sealing, sawcutting, or grinding operations are completed and excess material has been removed. Drainage inlets and manholes shall be covered during the application of seal coat, tack coat, slurry seal, or fog seal.
During the rainy season or when precipitation is predicted, paving, sawcutting, and grinding operations shall be limited to places where runoff can be captured. Seal coat, tack coat, slurry seal, or fog seal operations shall not begin if precipitation is predicted for the application or the curing period. The Contractor shall not excavate material from existing roadways during precipitation.
The Contractor shall vacuum up slurry from sawcutting operations immediately after the slurry is produced. Slurry shall not be allowed to run onto lanes open to public traffic or off the pavement.
The Contractor shall collect residue from portland cement concrete grinding operations with a vacuum attachment on the grinding machine. The residue shall not be left on the pavement or allowed to flow across the pavement.
Material excavated from existing roadways may be stockpiled as provided in "Stockpile Management" of these special provisions if approved by the Engineer. AC or HMA chunks used in embankment shall be placed above the water table and covered by at least one foot of material.
Substances used to coat asphalt trucks and equipment shall not contain soap, foaming agents, or toxic chemicals.

Thermoplastic Striping and Pavement Markers

Thermoplastic striping and preheating equipment shutoff valves shall work properly at all times when on the construction site. The Contractor shall not preheat, transfer, or load thermoplastic within 50 feet of drainage inlets or watercourses. The Contractor shall not fill the preheating container to more than 6 inches from the top. Truck beds shall be cleaned daily of scraps or melted thermoplastic.
The Contractor shall not unload, transfer, or load bituminous material for pavement markers within 50 feet of drainage inlets or watercourses. All pressure shall be released from melting tanks before removing the lid to fill or service. Melting tanks shall not be filled to more than 6 inches from the top.
The Contractor shall collect bituminous material from the roadway after marker removal.

Pile Driving

The Contractor shall keep spill kits and cleanup material at pile driving locations. Pile driving equipment shall be parked over drip pans, absorbent pads, or plastic sheeting where possible.

When not in use, pile driving equipment shall be stored at least 50 feet from concentrated flows of storm water, drainage courses, or inlets. The Contractor shall protect pile driving equipment by parking it on plywood and covering it with plastic when precipitation is predicted. The WPCM shall inspect the pile driving area every day for leaks and spills.
The Contractor shall use vegetable oil instead of hydraulic fluid when practical.

Concrete Curing

The Contractor shall not overspray chemical curing compound. Drift shall be minimized by spraying as close to the concrete as possible. Drainage inlets shall be covered before applying curing compound.
The Contractor shall minimize the use and discharge of water by using wet blankets or similar methods to maintain moisture when curing concrete.

Concrete Finishing

The Contractor shall collect and dispose of water and solid waste from high-pressure water blasting. Drainage inlets within 50 feet shall be covered before sandblasting. The nozzle shall be kept as close to the surface of the concrete as possible to minimize drift of dust and blast material. Blast residue may contain hazardous material.
Containment structures for concrete finishing operations shall be inspected for damage before each day of use and before predicted precipitation. Liquid and solid waste shall be removed from the containment structure after each work shift.

DEWATERING

Dewatering shall consist of discharging accumulated storm water, ground water, or surface water from excavations or temporary containment facilities. The Contractor shall discharge water within the limits of the project.
Dewatering discharge shall not cause erosion, scour, or sedimentary deposits that impact natural bedding materials.
The Contractor shall conduct dewatering activities in accordance with the Field Guide for Construction Dewatering available at:

http://www.dot.ca.gov/hq/construc/stormwater/manuals.htm

Before dewatering the Contractor shall submit a Dewatering and Discharge Plan to the Engineer in conformance with the provisions in Section 5-1.02, "Plans and Working Drawings," of the State Standard Specifications and "Water Pollution Control," of these special provisions. At a minimum, the Dewatering and Discharge Plan shall include the following:

A. A title sheet and table of contents;
B. A description of the dewatering and discharge operations detailing the locations, quantity of water, equipment, and discharge point;
C. The estimated schedule for dewatering and discharge (begin and end dates, intermittent or continuous);
D. Discharge alternatives such as dust control or percolation; and

E. Visual monitoring procedures with inspection log.

The Contractor shall not discharge storm water or non-storm water that has an odor, discoloration other than sediment, an oily sheen, or foam on the surface and shall notify the Engineer immediately upon discovery.
If water cannot be discharged within the project limits due to site constraints it shall be disposed of in the same manner specified for material in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the State Standard Specifications.

PAYMENT

The contract lump sum price paid for construction site management shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in spill prevention and control, material management, waste management, non-storm water management, and dewatering and identifying, sampling, testing, handling, and disposing of hazardous waste, as specified in the State Standard Specifications and these special provisions, and as directed by the Engineer.

10.1__STREET SWEEPING

Street sweeping shall be conducted where sediment is tracked from the job site onto paved roads, as described in the approved Storm Water Pollution Prevention Plan (SWPPP) in accordance with "Water Pollution Control" of these special provisions, and as directed by the Engineer.
Street sweeping shall be one of the water pollution control practices for sediment control. The SWPPP shall include the use of street sweeping. Street sweeping shall be performed in accordance with Section 4, SC-7 in the Construction Site Best Management Practices Manual of the Caltrans Storm Water Quality Handbooks.
The number of street sweepers shall be as designated in the approved SWPPP. The Contractor shall maintain at least one sweeper on the job site at all times during the period that sweeping work is required. Sweepers shall be self-loading, motorized, and shall have spray nozzles. Sweepers may include a vacuum apparatus.
Street sweeping shall start at the beginning of clearing and grubbing and shall continue until completion of the project, or as directed by the Engineer. Street sweeping shall be performed immediately after soil disturbing activities occur or offsite tracking of material is observed. Street sweeping shall be performed so that dust is minimized. If dust generation is excessive or sediment pickup is ineffective as determined by the Engineer, the use of water or a vacuum will be required.
At the option of the Contractor, collected material may be temporarily stockpiled in accordance with the approved SWPPP. Collected material shall be disposed of at least once per week. Material collected during street sweeping operations shall be disposed of in conformance with Section 7-1.13, "Disposal of Material Outside The Highway Right Of Way," of the State Standard Specifications.

MEASUREMENT AND PAYMENT

The contract lump sum price paid for street sweeping shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in street sweeping, including disposal of collected material, as shown on the plans, as

specified in the State Standard Specifications, these special provisions, and as directed by the Engineer.

10-1.__ TEMPORARY CONCRETE WASHOUT FACILITY

Temporary concrete washout facilities shall be constructed, maintained, and later removed at the locations shown on the approved Storm Water Pollution Prevention Plan (SWPPP) in conformance with "Water Pollution Control" of these special provisions, and in conformance with details shown on the plans and these special provisions.
Temporary concrete washout facilities shall be one of the water pollution control practices for waste management and materials pollution control. The SWPPP shall include the use of temporary concrete washout facilities.

MATERIALS

Plastic Liner

Plastic liners shall be single ply, new polyethylene sheeting, a minimum of 10 mils thick and shall be free of holes, punctures, tears or other defects that compromise the impermeability of the material. Plastic liners shall not have seams or overlapping joints.

Gravel-filled Bags

Gravel bag fabric shall be nonwoven polypropylene geotextile (or comparable polymer) and shall conform to the following requirements:

Specification	Requirements
Weight per unit area, ounces per square yard, min. ASTM Designation: D 5261	8.0
Grab tensile strength (one inch grip), kilonewtons, min. ASTM Designation: D 4632*	205
Ultraviolet stability, percent tensile strength retained after 500 hours, ASTM Designation: D 4355, xenon arc lamp method	70

* or appropriate test method for specific polymer

Gravel bags shall be between 24 inches and 32 inches in length, and between 16 inches and 20 inches in width.
Yarn used for binding gravel bags shall be as recommended by the manufacturer or bag supplier and shall be of a contrasting color.
Gravel shall be between 3/8 inch and 3/4 inch in diameter, and shall be clean and free from clay balls, organic matter, and other deleterious materials.
The opening of gravel-filled bags shall be secured to prevent gravel from escaping. Gravel-filled bags shall be between 30 pounds and 50 pounds in weight.

Straw Bales

Straw for straw bales shall conform to the provisions in Section 20-2.06, "Straw," of the State Standard Specifications.
Straw bales shall be a minimum of 14 inches in width, 18 inches in height, 36 inches in length and shall have a minimum weight of 50 pounds. The straw bale shall be composed entirely of vegetative matter, except for binding material.
Straw bales shall be bound by either wire, nylon or polypropylene string. Jute or cotton binding shall not be used. Baling wire shall be a minimum of 16 gage in diameter. Nylon or polypropylene string shall be approximately 0.08-inch in diameter with 80 pounds of breaking strength.

Stakes

Stakes shall be wood or metal. Wood stakes shall be untreated fir, redwood, cedar, or pine and cut from sound timber. They shall be straight and free of loose or unsound knots or other defects which would render them unfit for the purpose intended. Wood stakes shall be a minimum 2" x 2" in size. Metal stakes may be used as an alternative, and shall be a minimum of 0.5-inch in diameter. Stakes shall be a minimum of 4 feet in length. The tops of the metal stakes shall be bent at a 90-degree angle or capped with an orange or red plastic safety cap that fits snugly to the metal stake. The Contractor shall submit a sample of the metal stake and plastic cap, if used, for the Engineer's approval before installation.

Staples

Staples shall be as shown on the plans. An alternative attachment device such as geotextile pins or plastic pegs may be used instead of staples. The Contractor shall submit a sample of the alternative attachment device for the Engineer's approval before installation.

Signs

Wood posts for signs shall conform to the provisions in Section 56-2.02B, "Wood Posts," of the State Standard Specifications. Lag screws shall conform to the provisions in Section 56-2.02D, "Sign Panel Fastening Hardware," of the State Standard Specifications.
Plywood shall be freshly painted for each installation with not less than 2 applications of flat white paint. Sign letters shown on the plans shall be stenciled with commercial quality exterior black paint. Testing of paint will not be required.

INSTALLATION

Temporary concrete washout facilities shall be as follows:

1. Temporary concrete washout facilities shall be installed before beginning placement of concrete and located a minimum of 50 feet from storm drain inlets, open drainage facilities, and water courses unless determined infeasible by the Engineer. Temporary concrete washout facilities shall be located away from construction traffic or access areas at a location determined by the Contractor and approved by the Engineer.

2. A sign shall be installed adjacent to each washout facility at a location determined by the Contractor and approved by the Engineer. Signs shall be installed in conformance with the provisions in Section 56-2.03, "Construction," and Section 56-2.04, "Sign Panel Installation," of the State Standard Specifications.
3. The length and width of a temporary concrete washout facility may be increased from the minimum dimensions shown on the plans upon approval of the Engineer.
4. Temporary concrete washout facilities shall be constructed in sufficient quantity and size to contain liquid and concrete waste generated by washout operations for concrete wastes. These facilities shall be constructed to contain liquid and concrete waste without seepage, spills, or overflow.
5. Berms for below grade temporary concrete washout facilities shall be constructed from compacted native material. Gravel may be used in conjunction with compacted native material.
6. A plastic liner shall be installed in below grade temporary concrete washout facilities.

Details for an alternative temporary concrete washout facility shall be submitted to the Engineer for approval at least 7 days before installation.
When temporary concrete washout facilities are no longer required for the work, as determined by the Engineer, the hardened concrete and liquid residue shall be removed and disposed of in conformance with the provisions in Section 15-3.02, "Removal Methods," of the State Standard Specifications. Temporary concrete washout facilities shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the State Standard Specifications.
Ground disturbance, including holes and depressions, caused by the installation and removal of the temporary concrete washout facilities shall be backfilled and repaired in conformance with the provisions in Section 15-1.02, "Preservation of Property," of the State Standard Specifications.

MAINTENANCE

Temporary concrete washout facilities shall be maintained to provide adequate holding capacity with a minimum freeboard of 12 inches. Maintaining temporary concrete washout facilities shall include removing and disposing of hardened concrete and returning the facilities to a functional condition. Hardened concrete materials shall be removed and disposed of in conformance with the provisions in Section 15-3.02, "Removal Methods," of the State Standard Specifications.
Holes, rips, and voids in the plastic liner shall be patched and repaired by taping or the plastic liner shall be replaced. The plastic liner shall be replaced when patches or repairs compromise the impermeability of the material as determined by the Engineer.
Gravel bags shall be replaced when the bag material is ruptured or when the yarn has failed, allowing the bag contents to spill out.
Temporary concrete washout facilities shall be repaired or replaced on the same day the damage occurs. Damage to temporary concrete washout facilities resulting from the Contractor's vehicles, equipment, or operations shall be repaired at the Contractor's expense.

MEASUREMENT AND PAYMENT

Quantities of temporary concrete washout facilities will be measured as units determined from actual count in place.

The contract unit price paid for temporary concrete washout facility shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in constructing a temporary concrete washout facility, complete in place, including excavation and backfill, maintenance, and removal, as shown on the plans, as specified in the State Standard Specifications and these special provisions, and as directed by the Engineer.

10-1.__ TEMPORARY FIBER ROLL

Temporary fiber roll shall be furnished, installed, maintained, and later removed at the locations shown on the approved Storm Water Pollution Prevention Plan (SWPPP) in conformance with "Water Pollution Control" of these special provisions, and in conformance with details shown on the plans and these special provisions.
Temporary fiber roll shall be installed on excavation and embankment slopes and other disturbed soil areas, active or nonactive.
Temporary fiber roll shall be one of the water pollution control practices for sediment control.
The SWPPP shall include the use of temporary fiber roll.
Temporary fiber roll shall be either Type 1 or Type 2.

MATERIALS

Fiber Roll

Fiber roll shall be either:

1. Constructed with a premanufactured blanket consisting of either wood excelsior, rice or wheat straw, or coconut fibers or a combination of these materials. The blanket shall be between 6 feet and 8 feet in width and between 65 feet and 95 feet in length. Wood excelsior shall be individual fibers, of which 80 percent shall be 6 inches or longer in length. The blanket shall have a photodegradable plastic netting or biodegradable jute, sisal, or coir fiber netting on at least one side. The blanket shall be rolled along the width and secured with jute twine spaced 6 feet apart along the full length of the roll and placed 6 inches from the ends of each roll. The finished roll shall be between 8 inches and 10 inches in diameter, a minimum of 20 feet in length, and shall weigh a minimum of 0.5 pound per linear foot. More than one blanket may be required to achieve the finished roll diameter. When more than one blanket is required, blankets shall be jointed longitudinally with an overlap of 6 inches along the length of the blanket.
2. A premanufactured roll of rice or wheat straw, wood excelsior, or coconut fiber encapsulated within a photodegradable plastic or biodegradable jute, sisal, or coir fiber netting. The netting shall have a minimum durability of one year after installation. The netting shall be secured tightly at each end of the roll. Rolls shall be between 8 inches and 12 inches in diameter. Rolls between 8 inches and 10 inches in diameter shall have a minimum weight of 1 pound per linear foot and a minimum length of 20 feet. Rolls between 10 inches and 12 inches in diameter shall have a minimum weight of 3 pounds per linear foot and a minimum length of 10 feet.

Stakes

Wood stakes shall be a minimum of 1" x 1" x 24" in size for Type 1 installation, or a minimum of 1" x 2" x 24" in size for Type 2 installation. Wood stakes shall be untreated fir, redwood, cedar, or pine and cut from sound timber. They shall be straight and free of loose or unsound knots and other defects which would render them unfit for the purpose intended. Metal stakes shall not be used.

Rope

Rope shall be biodegradable, such as sisal or manila, with a minimum diameter of 1/4 inch.

INSTALLATION

Temporary fiber roll shall be installed as follows:

1. Temporary fiber roll (Type 1): Furrows shall be constructed to a depth between 2 inches and 4 inches, and to a sufficient width to hold the fiber roll. Stakes shall be installed 24 inches apart along the length of the fiber rolls and stopped at 12 inches from each end of the rolls. Stakes shall be driven to a maximum of 2 inches above, or flush with the top of the roll.
2. Temporary fiber roll (Type 2): Rope and notched stakes shall be used to restrain the fiber rolls against the slope. Stakes shall be driven into the slope until the notch is even with the top of the fiber roll. Rope shall be knotted at each stake and laced between stakes. After installation of the rope, stakes shall be driven into the slope such that the rope will hold the fiber roll tightly to the slope. Furrows will not be required.
3. Temporary fiber rolls shall be placed 10 feet apart along the slope for slope inclination (horizontal:vertical) of 2:1 and steeper, 15 feet apart along the slope for slope inclination between 2:1 and 4:1, 20 feet apart along the slope for slope inclination between 4:1 and 10:1, and a maximum of 50 feet apart along the slope for slope inclination of 10:1 and flatter.
4. The bedding area for the fiber roll shall be cleared of obstructions including rocks, clods, and debris greater than one inch in diameter before installation.
5. Temporary fiber rolls shall be installed approximately parallel to the slope contour.
6. Temporary fiber rolls shall be installed before the application of other temporary erosion control or soil stabilization materials in the same area.

When no longer required, as determined by the Engineer, temporary fiber rolls shall be removed and disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the State Standard Specifications. Temporary fiber rolls may be abandoned in place when approved in writing by the Engineer.
Ground disturbances including holes and depressions caused by the installation and removal of the temporary fiber roll shall be backfilled and repaired in conformance with the provisions in Section 15-1.02, "Preservation of Property," of the State Standard Specifications.

MAINTENANCE

Temporary fiber rolls shall be maintained to disperse concentrated water runoff and to reduce runoff velocities. Split, torn, or unraveling rolls shall be repaired or replaced. Broken or split stakes shall be replaced. Sagging or slumping fiber rolls shall be repaired with additional stakes or replaced. Locations where rills and other evidence of concentrated runoff have occurred

beneath the rolls shall be corrected. Temporary fiber rolls shall be repaired or replaced within 24 hours of identifying the deficiency.

MEASUREMENT AND PAYMENT

Quantities of temporary fiber rolls to be paid for will be determined by the linear foot measured along the centerline of the installed roll. Where temporary fiber rolls are joined and overlapped, the overlap will be measured as a single installed roll.

The contract price paid per linear foot for temporary fiber roll shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing temporary fiber rolls, complete in place, including furrow excavation and backfill, maintenance, and removal, as shown on the plans, as specified in the State Standard Specifications and these special provisions, and as directed by the Engineer.

Damage to temporary fiber rolls resulting from the Contractor's vehicles, equipment, or operations shall be repaired at the Contractor's expense.

10-1.__ TEMPORARY FENCE (TYPE ESA)

Temporary fence (Type ESA) shall be furnished, installed, maintained, and later removed in conformance with the details shown on the plans, as specified in these special provisions and as directed by the Engineer.

MATERIALS

Used materials may be installed provided the used materials conform to these special provisions.

High Visibility Fabric

High visibility fabric shall be machine produced, orange colored mesh manufactured from polypropylene or polyethylene. High visibility fabric may be made of recycled materials. Materials shall not contain biodegradable filler materials that can degrade the physical or chemical characteristics of the finished fabric. High visibility fabric shall be fully stabilized ultraviolet resistant, shall be a minimum of 4 feet in width with a maximum mesh opening of 2" x 2". High visibility fabric shall be furnished in one continuous width and shall not be spliced to conform to the specified width dimension.

Posts

Posts for temporary fence (Type ESA) shall be of one of the following:

A. Wood posts shall be fir or pine, shall have a minimum cross section of 2" x 2", and a minimum length of 5.25 feet. The end of the post to be embedded in the soil shall be pointed. Wood posts shall not be treated with wood preservative.
B. Steel posts shall have a "U," "T," "L," or other cross sectional shape that resists failure from lateral loads. Steel posts shall have a minimum weight of 0.75 pounds per linear foot and a minimum length of 5.25 feet. One end of the steel post shall be pointed and the other end shall have a high visibility colored top.

Fasteners

Fasteners for attaching high visibility fabric to the posts shall be as follows:

A. The high visibility fabric shall be attached to wooden posts with commercial quality nails or staples, or as recommended by the manufacturer or supplier.
B. Tie wire or locking plastic fasteners shall be used for attaching the high visibility fabric to steel posts. Maximum spacing of tie wire or fasteners shall be 24 inches along the length of the steel post.

Signs

The sign legend and dimensions shall be as shown on the plans. The sign shall be weatherproof and fade-proof and may include plastic laminated printed paper affixed to an inflexible weatherproof backer board. The sign panel shall be affixed to the high visibility fabric with tie wire or locking plastic fasteners. The top of the sign panel shall be flush with the top of the high visibility fabric. Sign panels shall be placed 100 feet apart along the length of the temporary fence (Type ESA), and at each end of the fence.

INSTALLATION

Temporary fence (Type ESA) shall be installed as follows:

A. All fence construction activities shall be conducted from outside the ESA as shown on the plans or as staked.
B. Posts shall be embedded in the soil a minimum of 16 inches. Post spacing shall be 8 feet maximum from center to center and shall at all times support the fence in a vertical position.
C. Temporary fence (Type ESA) shall be constructed prior to clearing and grubbing work, shall enclose the foliage canopy (drip line) of protected plants, and shall not encroach upon visible roots of the plants.
D. Temporary fence (Type ESA) shall be located so that it is visible, as determined by the Engineer.

When Type ESA temporary fence is no longer required, as determined by the Engineer, the temporary fence shall be removed and disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the State Standard Specifications, except when reused as provided in this section.
Holes caused by the removal of temporary fence (Type ESA) shall be backfilled in conformance with the provisions in Section 15-1.02, "Preservation of Property," of the State Standard Specifications.

MAINTENANCE

Temporary fence (Type ESA) that is damaged during the progress of the work shall be repaired or replaced by the Contractor the same day the damage occurs.

10-1.__ TEMPORARY CONSTRUCTION ENTRANCE

Temporary construction entrances shall be constructed, maintained, and later removed at the locations shown on the approved Storm Water Pollution Prevention Plan (SWPPP) in conformance with "Water Pollution Control" of these special provisions, and in conformance with details shown on the plans and these special provisions.
Temporary construction entrances shall be one of the water pollution control practices for tracking control. The SWPPP shall include the use of temporary construction entrances.
Temporary construction entrances shall be either Type 1 or Type 2.

MATERIALS

Temporary Entrance Fabric

Temporary entrance fabric shall be manufactured from polyester, nylon, or polypropylene material, or any combination thereof. Temporary entrance fabric shall be a nonwoven, needle-punched fabric, free of needles which may have broken off during the manufacturing process. Temporary entrance fabric shall be permeable and shall not act as a wicking agent. Temporary entrance fabric shall be manufactured from virgin, recycled, or a combination of virgin and recycled polymer materials. No virgin or recycled materials shall contain biodegradable filler materials that can degrade the physical or chemical characteristics of the finished fabric. The Engineer may order tests to confirm the absence of biodegradable filler materials in conformance to the requirements in ASTM Designation: E 204 (Fourier Transformed Infrared Spectroscopy-FTIR).
Temporary entrance fabric shall conform to the following requirements:

Specification	Requirements
Weight per unit area, ounces per square yard, min. ASTM Designation: D 5261	6.5
Grab tensile strength (one inch grip), pounds, min. ASTM Designation: D 4632*	200
Elongation at break, percent min. ASTM Designation: D 4632*	50
Toughness, pounds, min. (percent elongation x grab tensile strength)	12,000

* or appropriate test method for specific polymer

Rocks

Rocks shall conform to the material quality requirements in Section 72-2.02, "Materials," of the State Standard Specifications for shape and for apparent specific gravity, absorption, and durability index. Rocks used for the temporary entrance shall conform to the following sizes:

Square Screen Size (inch)	Percentage Passing	Percentage Retained
6	100	0
3	0	100

Corrugated Steel Panels

Corrugated steel panels shall be prefabricated and shall be pressed or shop welded, with a slot or hooked section to facilitate coupling at the ends of the panels.

INSTALLATION

Temporary construction entrances shall be installed as follows:

1. Before placing the temporary entrance fabric, the areas shall be cleared of all trash and debris. Vegetation shall be removed to the ground level. Trash, debris, and removed vegetation shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the State Standard Specifications.
2. A sump shall be constructed within 20 feet of each temporary construction entrance as shown on the plans.
3. Before placing the temporary entrance fabric, the ground shall be graded to a uniform plane. The relative compaction of the top 1.5 feet shall be not less than 90 percent. The ground surface shall be free of sharp objects that may damage the temporary entrance fabric, and shall be graded to drain to the sump as shown on the plans.
4. Temporary entrance fabric shall be positioned longitudinally along the alignment of the entrance, as directed by the Engineer.
5. The adjacent ends of the fabric shall be overlapped a minimum length of 12 inches.
6. Rocks to be placed directly over the fabric shall be spread in the direction of traffic, longitudinally and along the alignment of the temporary construction entrance.
7. During spreading of the rocks, vehicles or equipment shall not be driven directly on the fabric. A layer of rocks a minimum 6 inches thick shall be placed between the fabric and the spreading equipment to prevent damage to the fabric.
8. For Type 2 temporary construction entrances, a minimum of 6 coupled panel sections shall be installed for each temporary construction entrance. Before installing the panels, the ground surface shall be cleared of all debris to ensure uniform contact with the ground surface.

Fabric damaged during rock placement shall be repaired by placing a new piece of fabric over the damaged area. The piece of fabric shall be large enough to cover the damaged area and provide a minimum 18-inch overlap on all edges.
Details for a proposed alternative temporary construction entrance or alternative sump shall be submitted to the Engineer for approval at least 7 days before installation. The Contractor may eliminate the sump if approved in writing by the Engineer.
When no longer required as determined by the Engineer, temporary construction entrances shall be removed and disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the State Standard Specifications.
Ground disturbance, including holes and depressions, caused by the installation and removal of the temporary construction entrance, including the sumps, shall be backfilled and repaired in conformance with the provisions in Section 15-1.02, "Preservation of Property," of the State Standard Specifications.

While the temporary construction entrance is in use, pavement shall be cleaned and sediment removed at least once a day, and as often as necessary when directed by the Engineer. Soil and sediment or other extraneous material tracked onto existing pavement shall not be allowed to enter drainage facilities.

MAINTENANCE

The Contractor shall maintain temporary construction entrances throughout the contract or until removed. The Contractor shall prevent displacement or migration of the rock surfacing or corrugated steel panels. Significant depressions resulting from settlement or heavy equipment shall be repaired by the Contractor as directed by the Engineer.
Temporary construction entrances shall be maintained to minimize tracking of soil and sediment onto existing public roads.
If buildup of soil and sediment deter the function of the temporary construction entrance, the Contractor shall immediately remove and dispose of the soil and sediment, and install additional corrugated steel panels and spread additional rocks to increase the capacity of the temporary construction entrance.
Temporary construction entrances shall be repaired or replaced on the same day the damage occurs. Damage to the temporary construction entrance resulting from the Contractor's vehicles, equipment, or operations shall be repaired at the Contractor's expense.

MEASUREMENT AND PAYMENT

Quantities of temporary construction entrances will be determined from actual count in place.

10-1.__ CONSTRUCTION AREA TRAFFIC CONTROL DEVICES

Flagging, signs, and temporary traffic control devices furnished, installed, maintained, and removed when no longer required shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the State Standard Specifications and these special provisions.
Category 1 temporary traffic control devices are defined as small and lightweight (less than 100 pounds) devices. These devices shall be certified as crashworthy by crash testing, crash testing of similar devices, or years of demonstrable safe performance. Category 1 temporary traffic control devices include traffic cones, plastic drums, portable delineators, and channelizers.
If requested by the Engineer, the Contractor shall provide written self-certification for crashworthiness of Category 1 temporary traffic control devices at least 5 days before beginning any work using the devices or within 2 days after the request if the devices are already in use.
Self-certification shall be provided by the manufacturer or Contractor and shall include the following:

A. Date,
B. Federal Aid number (if applicable),
C. Contract number, district, county, route and post mile of project limits,
D. Company name of certifying vendor, street address, city, state and zip code,
E. Printed name, signature and title of certifying person; and
F. Category 1 temporary traffic control devices that will be used on the project.

The Contractor may obtain a standard form for self-certification from the Engineer.

Category 2 temporary traffic control devices are defined as small and lightweight (less than 100 pounds) devices that are not expected to produce significant vehicular velocity change, but may cause potential harm to impacting vehicles. Category 2 temporary traffic control devices include barricades and portable sign supports.
Category 2 temporary traffic control devices shall be on the Federal Highway Administration's (FHWA) list of Acceptable Crashworthy Category 2 Hardware for Work Zones. This list is maintained by FHWA and can be located at:

http://safety.fhwa.dot.gov/roadway_dept/road_hardware/listing.cfm?code=workzone

The Department also maintains this list at:

http://www.dot.ca.gov/hq/traffops/signtech/signdel/pdf/Category2.pdf

Category 2 temporary traffic control devices that have not received FHWA acceptance shall not be used. Category 2 temporary traffic control devices in use that have received FHWA acceptance shall be labeled with the FHWA acceptance letter number and the name of the manufacturer. The label shall be readable and permanently affixed by the manufacturer.
Category 2 temporary traffic control devices without a label shall not be used.
If requested by the Engineer, the Contractor shall provide a written list of Category 2 temporary traffic control devices to be used on the project at least 5 days before beginning any work using the devices or within 2 days after the request if the devices are already in use.
Category 3 temporary traffic control devices consist of temporary traffic-handling equipment and devices that weigh 100 pounds or more and are expected to produce significant vehicular velocity change to impacting vehicles. Temporary traffic-handling equipment and devices include crash cushions, truck-mounted attenuators, temporary railing, temporary barrier, and end treatments for temporary railing and barrier.
Type III barricades may be used as sign supports if the barricades have been successfully crash tested, meeting the NCHRP Report 350 criteria, as one unit with a construction area sign attached.
Category 3 temporary traffic control devices shall be shown on the plans or on the Department's Highway Safety Features list. This list is maintained by the Division of Engineering Services and can be found at:

http://www.dot.ca.gov/hq/esc/approved_products_list/HighwaySafe.htm

Category 3 temporary traffic control devices that are not shown on the plans or not listed on the Department's Highway Safety Features list shall not be used.
Full compensation for providing self-certification for crashworthiness of Category 1 temporary traffic control devices and for providing a list of Category 2 temporary traffic control devices used on the project shall be considered as included in the prices paid for the various items of work requiring the use of the Category 1 or Category 2 temporary traffic control devices and no additional compensation will be allowed therefor.

10-1.__ CONSTRUCTION AREA SIGNS

Construction area signs for temporary traffic control shall be furnished, installed, maintained, and removed when no longer required in conformance with the provisions in Section 12, "Construction Area Traffic Control Devices," of the State Standard Specifications and these special provisions.

Attention is directed to "Furnish Sign" of these special provisions.

Attention is directed to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. Type II retroreflective sheeting shall not be used on construction area sign panels. Type III, IV, VII, VIII, or IX retroreflective sheeting shall be used for stationary mounted construction area sign panels.

Attention is directed to "Construction Project Information Signs" of these special provisions regarding the number and type of construction project information signs to be furnished, erected, maintained, and removed and disposed of.

Unless otherwise shown on the plans or specified in these special provisions, the color of construction area warning and guide signs shall have black legend and border on orange background, except W10-1 or W47(CA) (Highway-Rail Grade Crossing Advance Warning) sign shall have black legend and border on yellow background.

Orange background on construction area signs shall be fluorescent orange.

Repair to construction area sign panels will not be allowed, except when approved by the Engineer. At nighttime under vehicular headlight illumination, sign panels that exhibit irregular luminance, shadowing or dark blotches shall be immediately replaced at the Contractor's expense.

The Contractor shall notify the appropriate regional notification center for operators of subsurface installations at least 2 business days, but not more than 14 days, prior to commencing excavation for construction area sign posts. The regional notification centers include, but are not limited to, the following:

Notification Center	Telephone Number
Underground Service Alert	811

Excavations required to install construction area signs shall be performed by hand methods without the use of power equipment, except that power equipment may be used if it is determined there are no utility facilities in the area of the proposed post holes. The post hole diameter, if backfilled with portland cement concrete, shall be at least 4 inches greater than the longer dimension of the post cross section.

Construction area signs placed within 15 feet from the edge of the travel way shall be mounted on stationary mounted sign supports as specified in "Construction Area Traffic Control Devices" of these special provisions.

The Contractor shall maintain accurate information on construction area signs. Signs that are no longer required shall be immediately covered or removed. Signs that convey inaccurate information shall be immediately replaced or the information shall be corrected. Covers shall be replaced when they no longer cover the signs properly. The Contractor shall immediately restore to the original position and location any sign that is displaced or overturned, from any cause, during the progress of work.

10-1.__ MAINTAINING TRAFFIC

Maintaining traffic shall conform to the provisions in Sections 7-1.08, "Public Convenience," Section 7-1.09, "Public Safety," and Section 12, "Construction Area Traffic Control Devices," of the State Standard Specifications, "Public Safety" of these special provisions and these special provisions.

Closure is defined as the closure of a traffic lane or lanes, including shoulder, ramp or connector lanes, within a single traffic control system.

Closures shall conform to the provisions in "Traffic Control System for Lane Closure" of these special provisions.

Closures are only allowed during the hours shown in the lane requirement charts included in this section "Maintaining Traffic," except for work required under Sections 7-1.08, "Public Convenience," and Section 7-1.09, "Public Safety."

The full width of the traveled way shall be open for use by public traffic when construction operations are not actively in progress.

The full width of the traveled way shall be open for use by public traffic on Saturdays, Sundays, Special Days, designated legal holidays; after 3:00 p.m. on Fridays and the day preceding designated legal holidays; and when construction operations are not actively in progress.

On days that lane closures are not allowed, one lane may be closed to maintain the seal coat surface as required in Section 37-1.07, "Finishing," of the State Standard Specifications. Lane closures to maintain the seal coat surface shall be restricted to daylight hours when public traffic will be least inconvenienced and delayed, as determined by the Engineer.

Adjacent ramps, in the same direction of travel, servicing 2 consecutive local streets shall not be closed simultaneously unless directed by the Engineer.

Personal vehicles of the Contractor's employees shall not be parked on the traveled way or shoulders including sections closed to public traffic.

When work vehicles or equipment are parked on the shoulder within 6 feet of a traffic lane, the shoulder area shall be closed as shown on the plans.

Designated legal holidays are: January 1st, the third Monday in February, the last Monday in May, July 4th, the first Monday in September, November 11th, Thanksgiving Day, and December 25th. When a designated legal holiday falls on a Sunday, the following Monday shall be a designated legal holiday. When November 11th falls on a Saturday, the preceding Friday shall be a designated legal holiday.

Full compensation for furnishing, erecting, maintaining, and removing and disposing of the construction area signs shall be considered as included in the contract lump sum price paid for construction area signs and no additional compensation will be allowed therefor.

Chart No. 1
Complete Freeway/Expressway Closure Hours

County: IMP.	Route/Direction: 8/EB-WB	PM: R68.58/R69.08

Closure Description:
1.2 mi. west of Brock Research Center Rd. OC to 1.2 mi. east of Brock Research Center Rd. OC

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Fridays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Saturdays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C

Legend:

C	Freeway or expressway may be closed completely.

REMARKS:
No other closures that conflicts with or shares any elements of the following detour will be permitted.
This chart to be used for one time only for four (4) months.

Detour EB 8 traffic for full road closure
Detour EB 8 traffic via easterly on Rte. 8 to EB Temporary Detaur By Pass to EB Evan Hewes hwy. thence easterly on Evan Hewes hwy. to EB Temporary Detaur By Pass to EB 8.

When the Full FWY is closed, place a PCMS (Portable Changeable Message Sign) on EB 8 W. of Rte. 98/8 Sep. warning the traffic of the closure ahead.

Detour WB 8 traffic for full road closure
Detour WB 8 traffic via westerly on Rte. 8 to WB Temporary Detaur By Pass to WB Evan Hewes hwy. thence westerly on Evan Hewes hwy. to WB Temporary Detaur By Pass to WB 8.

When the Full FWY is closed, place a PCMS (Portable Changeable Message Sign) on WB 8 E. of Gordon Wells OC warning the traffic of the closure ahead.

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Chart No. 2
Complete Ramp Closure Hours/Ramp Lane Requirements

County: IMP	Route/Direction: 8/EB 8/WB	PM: R68.680 R68.952 R68.972 R68.700

Closure Description: EB Off-ramp to Brock Research Center Rd.
EB On-ramp from Brock Research Center Rd.
WB Off-ramp to Brock Research Center Rd.
WB On-ramp from Brock Research Center Rd.

FROM HOUR TO HOUR	24 1	1 2	2 3	3 4	4 5	5 6	6 7	7 8	8 9	9 10	10 11	11 12	12 13	13 14	14 15	15 16	16 17	17 18	18 19	19 20	20 21	21 22	22 23	23 24
Mondays through Thursdays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Fridays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Saturdays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C

Legend:
C Ramp may be closed completely

Work permitted within project right of way where shoulder or lane closure is not required.

REMARKS:
This chart to be used for one time only for four (4) months.

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10-1.__ CLOSURE REQUIREMENTS AND CONDITIONS

Closures shall conform to the provisions in "Maintaining Traffic" of these special provisions and these special provisions.

CLOSURE SCHEDULE

By noon Monday, the Contractor shall submit a written schedule of planned closures for the following week period, defined as Sunday noon through the following Sunday noon. Closures involving work (temporary barrier placement and paving operations) that will reduce horizontal clearances, traveled way inclusive of shoulders, to 2 lanes or less shall be submitted not less than 25 days and not more than 125 days before the anticipated start of operation. Closures involving work (pavement overlay, overhead sign installation, falsework and girder erection) that will reduce the vertical clearances available to the public, shall be submitted not less than 25 days and not more than 125 days before the anticipated start of operation.

The Closure Schedule shall show the locations and times of the proposed closures. The Closure Schedule request forms furnished by the Engineer shall be used. Closure Schedules submitted to the Engineer with incomplete or inaccurate information will be rejected and returned for correction and resubmittal. The Contractor will be notified of disapproved closures or closures that require coordination with other parties as a condition of approval.

Closure Schedule amendments, including adding additional closures, shall be submitted by noon to the Engineer, in writing, at least 3 business days in advance of a planned closure. Approval of Closure Schedule amendments will be at the discretion of the Engineer.

The Engineer shall be notified of cancelled closures 2 business days before the date of closure.

Closures that are cancelled due to unsuitable weather may be rescheduled at the discretion of the Engineer.

CONTINGENCY PLAN

A detailed contingency plan shall be prepared for reopening closures to public traffic. If required by "Beginning of Work, Time of Completion and Liquidated Damages" of these special provisions, the contingency plan shall be submitted to the Engineer before work at the job site begins. Otherwise, the contingency plan shall be submitted to the Engineer within one business day of the Engineer's request.

LATE REOPENING OF CLOSURES

If a closure is not reopened to public traffic by the specified time, work shall be suspended in conformance with the provisions in Section 8-1.05, "Temporary Suspension of Work," of the State Standard Specifications. No further closures are to be made until the Engineer has accepted a work plan, submitted by the Contractor, that will insure that future closures will be reopened to public traffic at the specified time. The Engineer will have 2 business days to accept or reject the Contractor's proposed work plan. The Contractor will not be entitled to compensation for the suspension of work resulting from the late reopening of closures.

COMPENSATION

The Engineer shall be notified of delays in the Contractor's operations due to the following conditions, and if, in the opinion of the Engineer, the Contractor's controlling operation is delayed or interfered with by reason of those conditions, and the Contractor's loss due to that delay could not have been avoided by rescheduling the affected closure or by judicious handling of forces, equipment and plant, the delay will be considered a right of way delay and will be compensated in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the State Standard Specifications:

1. The Contractor's proposed Closure Schedule is denied and his planned closures are within the time frame allowed for closures in "Maintaining Traffic" of these special provisions, except that the Contractor will not be entitled to compensation for amendments to the Closure Schedule that are not approved.
2. The Contractor is denied a confirmed closure.

Should the Engineer direct the Contractor to remove a closure before the time designated in the approved Closure Schedule, delay to the Contractor's schedule due to removal of the closure will be considered a right of way delay and compensation for the delay will be determined in conformance with the provisions in Section 8-1.09, "Right of Way Delays," of the State Standard Specifications.

10-1.__ TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE

A traffic control system shall consist of closing traffic lanes and ramps in conformance with the details shown on the plans, the provisions in Section 12, "Construction Area Traffic Control

Devices," of the Standard Specifications, the provisions under "Maintaining Traffic" and "Construction Area Signs" of these special provisions, and these special provisions.
The provisions in this section will not relieve the Contractor of responsibility for providing additional devices or taking measures as may be necessary to comply with the provisions in Section 7-1.09, "Public Safety," of the Standard Specifications.
During traffic stripe operations and pavement marker placement operations using bituminous adhesive, traffic shall be controlled, at the option of the Contractor, with either stationary or moving lane closures. During other operations, traffic shall be controlled with stationary lane closures. Attention is directed to the provisions in Section 84-1.04, "Protection From Damage," and Section 85-1.06, "Placement," of the Standard Specifications.
If components in the traffic control system are displaced or cease to operate or function as specified, from any cause, during the progress of the work, the Contractor shall immediately repair the components to the original condition or replace the components and shall restore the components to the original location.

STATIONARY LANE CLOSURE

When lane and ramp closures are made for work periods only, at the end of each work period, components of the traffic control system, except portable delineators placed along open trenches or excavation adjacent to the traveled way, shall be removed from the traveled way and shoulder. If the Contractor so elects, the components may be stored at selected central locations, designated by the Engineer within the limits of the highway right of way.

MOVING LANE CLOSURE

Flashing arrow signs used in moving lane closures shall be truck-mounted. Changeable message signs used in moving lane closure operations shall conform to the provisions in Section 12-3.12, "Portable Changeable Message Signs," of the Standard Specifications, except the signs shall be truck-mounted and the full operation height of the bottom of the sign may be less than 7 feet above the ground, but should be as high as practicable.
Truck-mounted attenuators (TMA) for use in moving lane closures shall be any of the following approved models, or equal:

1. Hexfoam TMA Series 3000, Alpha 1000 TMA Series 1000, and Alpha 2001 TMA Series 2001, manufactured by Energy Absorption Systems, Inc., 35 East Wacker Drive, Suite 1100, Chicago, IL 60601:

    1.1. Northern California: Traffic Control Service, Inc., 8585 Thys Court, Sacramento, CA 95828, telephone (800) 884-8274, FAX (916) 387-9734
    1.2. Southern California: Traffic Control Service, Inc., 1818 E. Orangethorpe, Fullerton, CA 92831-5324, telephone (800) 222-8274, FAX (714) 526-9501

2. Cal T–001 Model 2 or Model 3, manufacturer and distributor: Hexcel Corporation, 11711 Dublin Boulevard, P.O. Box 2312, Dublin, CA 94568, telephone (925) 551–4900

3. Renco Rengard Model Nos. CAM 8–815 and RAM 8–815, manufacturer and distributor: Renco Inc., 1582 Pflugerville Loop Road, P.O. Box 730, Pflugerville, TX 78660–0730, telephone (800) 654–8182

Each TMA shall be individually identified with the manufacturer's name, address, TMA model number, and a specific serial number. The names and numbers shall each be a minimum 1/2 inch high and located on the left (street) side at the lower front corner. Each TMA shall have the manufacturer's recommendation for mounting height above the ground marked in minimum 1-inch tall characters at conspicuous locations on the TMA. Any TMA which is damaged or appears to be in poor condition shall not be used unless recertified by the manufacturer. The Engineer shall be the sole judge as to whether used TMAs supplied under this contract need recertification. Each unit shall be certified by the manufacturer to meet the requirements for TMA in conformance with the standards established by the Transportation Laboratory.
Approvals for new TMA designs proposed as equal to the above approved models shall be in conformance with the procedures (including crash testing) established by the Transportation Laboratory. For information regarding submittal of new designs for evaluation contact: Transportation Laboratory, 5900 Folsom Boulevard, Sacramento, California 95819.
New TMAs proposed as equal to approved TMAs or approved TMAs determined by the Engineer to need recertification shall not be used until approved or recertified by the Transportation Laboratory.

PAYMENT

The contract lump sum price paid for traffic control system shall include full compensation for furnishing all labor, materials (including signs), tools, equipment, and incidentals, and for doing all the work involved in placing, removing, storing, maintaining, moving to new locations, replacing and disposing of the components of the traffic control system shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.
The adjustment provisions in Section 4-1.03, "Changes," of the Standard Specifications shall not apply to the item of traffic control system. Adjustments in compensation for traffic control system will be made only for increased or decreased traffic control system required by changes ordered by the Engineer and will be made on the basis of the cost of the increased or decreased traffic control necessary. The adjustment will be made on a force account basis as provided in Section 9-1.03, "Force Account Payment," of the Standard Specifications for increased work and estimated on the same basis in the case of decreased work.
Traffic control system required by work which is classed as extra work, as provided in Section 4-1.03D of the Standard Specifications, will be paid for as a part of the extra work.

10-1.__ TEMPORARY PAVEMENT DELINEATION

Temporary pavement delineation shall be furnished, placed, maintained, and removed in conformance with the provisions in Section 12-3.01, "General," of the State Standard Specifications and these special provisions. Nothing in these special provisions shall be construed as reducing the minimum standards specified in the California MUTCD or as relieving

the Contractor from the responsibilities specified in Section 7-1.09, "Public Safety," of the State Standard Specifications.

GENERAL

When the work causes obliteration of pavement delineation, temporary or permanent pavement delineation shall be in place before opening the traveled way to public traffic. Laneline or centerline pavement delineation shall be provided for traveled ways open to public traffic.
The Contractor shall perform the work necessary to establish the alignment of temporary pavement delineation, including required lines or markers. Surfaces to receive application of paint or removable traffic tape temporary pavement delineation shall be dry and free of dirt and loose material. Temporary pavement delineation shall not be applied over existing pavement delineation or other temporary pavement delineation. Temporary pavement delineation shall be maintained until superseded or replaced with a new pattern of temporary pavement delineation or permanent pavement delineation, or as determined by the Engineer.
Temporary pavement markers, including underlying adhesive, and removable traffic tape that are applied to the final layer of surfacing or existing pavement to remain in place or that conflicts with a subsequent or new traffic pattern for the area shall be removed when no longer required for the direction of public traffic, as determined by the Engineer.

TEMPORARY LANELINE AND CENTERLINE DELINEATION

When lanelines or centerlines are obliterated and temporary pavement delineation to replace the lines is not shown on the plans, the minimum laneline and centerline delineation to be provided for that area shall be temporary pavement markers placed at longitudinal intervals of not more than 24 feet. The temporary pavement markers shall be the same color as the laneline or centerline the pavement markers replace. Temporary pavement markers shall be, at the option of the Contractor, one of the temporary pavement markers listed for short term day/night use (14 days or less) or long term day/night use (180 days or less) in "Prequalified and Tested Signing and Delineation Materials" of these special provisions. The temporary pavement markers shall be placed in conformance with the manufacturer's instructions. Temporary pavement markers for long term day/night use (180 days or less) shall be cemented to the surfacing with the adhesive recommended by the manufacturer, except epoxy adhesive shall not be used to place the temporary pavement markers in areas where removal of the temporary pavement markers will be required.
Temporary laneline or centerline delineation consisting entirely of temporary pavement markers listed for short term day/night use (14 days or less), shall be placed on longitudinal intervals of not more than 24 feet and shall be used for a maximum of 14 days on lanes opened to public traffic. Before the end of the 14 days the permanent pavement delineation shall be placed. If the permanent pavement delineation is not placed within the 14 days, the Contractor shall replace the temporary pavement markers and provide additional temporary pavement delineation and shall bear the cost thereof. The additional temporary pavement delineation to be provided shall be equivalent to the pattern specified for the permanent pavement delineation for the area, as determined by the Engineer.

TEMPORARY EDGELINE DELINEATION

The lateral offset for traffic cones, portable delineators or channelizers used for temporary edgeline delineation shall be as determined by the Engineer. If traffic cones or portable

delineators are used as temporary pavement delineation for edgelines, the Contractor shall provide personnel to remain at the project site to maintain the cones or delineators during the hours of the day that the portable delineators are in use.
Channelizers used for temporary edgeline delineation shall be the surface mounted type and shall be orange in color. Channelizer bases shall be cemented to the pavement in the same manner provided for cementing pavement markers to pavement in "Pavement Markers" of these special provisions, except epoxy adhesive shall not be used to place channelizers on the top layer of pavement. Channelizers shall be, at the Contractor's option, one of the surface mount types (36 inch) listed in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.
Temporary edgeline delineation shall be removed when no longer required for the direction of public traffic as determined by the Engineer.

TEMPORARY TRAFFIC STRIPE (TAPE)

If tape is used, placing the tape shall conform to the following:

A. The temporary traffic stripe tape shall be complete in place at the location shown before opening the traveled way to public traffic.
B. Removable traffic stripe tape shall be the temporary removable traffic stripe tape as listed in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.
C. Removable traffic stripe tape shall be applied in conformance with the manufacturer's installation instructions and shall be rolled slowly with a rubber tired vehicle or roller to ensure complete contact with the pavement surface. Traffic stripe tape shall be applied straight on tangent alignment and on a true arc on curved alignment. Traffic stripe tape shall not be applied when the air or pavement temperature is less than 50°F, unless the installation procedures to be used are approved by the Engineer, before beginning installation of the tape.

TEMPORARY TRAFFIC STRIPE (PAINT)

The painted temporary traffic stripe shall be complete in place at the location shown before opening the traveled way to public traffic. Painted temporary traffic stripe delineation shall be removed when no longer required for the direction of public traffic as determined by the Engineer.
Temporary painted traffic stripe shall conform to the provisions in "Paint Traffic Stripe and Pavement Marking" of these special provisions. At the option of the Contractor, either one or 2 coats shall be applied regardless of whether on new or existing pavement.

Retroreflective pavement markers conforming to Section 85, "Pavement Markers," of the Standard Specifications may be used in place of temporary pavement markers for long term day/night use (180 days or less) except to simulate patterns of broken traffic stripe. Placement of the retroreflective pavement markers used for temporary pavement markers shall conform to the provisions in "Pavement Markers" of these special provisions except the waiting period provisions before placing the pavement markers on new hot mix asphalt surfacing as specified in Section 85-1.06, "Placement," of the Standard Specifications shall not apply and epoxy adhesive shall not be used to place pavement markers in areas where removal of the pavement markers will be required.

MEASUREMENT AND PAYMENT

Temporary traffic stripe (paint) and temporary pavement marking (paint) shown on the plans will be measured and paid for in the same manner specified for paint traffic stripe and paint pavement marking in Section 84-3.06, "Measurement," and Section 84-3.07, "Payment," of the Standard Specifications.

Removal of temporary traffic stripe (paint) and temporary pavement marking (paint) will be measured and paid as remove traffic stripe and pavement marking conforming to Section 15, "Existing Highway Facilities," of the Standard Specifications.

Temporary pavement markers shown on the plans will be measured and paid for by the unit in the same manner specified for retroreflective pavement markers in Section 85-1.08, "Measurement," and Section 85-1.09, "Payment," of the Standard Specifications.

Removal of temporary pavement marker will be measured and paid for as remove pavement markers conforming to remove pavement markers, except for pavement markers not shown on the plans, of these special provisions.

Full compensation for furnishing, placing, maintaining, and removing the temporary pavement markers (including underlying adhesive, layout (dribble) lines to establish alignment of temporary pavement markers or used for temporary laneline and centerline delineation and signing specified for "no passing" zones) for those areas where temporary laneline and centerline delineation is not shown on the plans and for providing equivalent patterns of permanent traffic lines for those areas when required, shall be considered as included in the contract prices paid for the items of work that obliterated the laneline and centerline pavement delineation and no separate payment will be made therefor.

Full compensation for furnishing, placing, maintaining, and removing temporary edgeline delineation not shown on the plans shall be considered as included in the contract prices paid for the items of work that obliterated the edgeline pavement delineation and no separate payment will be made therefor. The quantity of channelizers used as temporary edgeline delineation will not be included in the quantity of channelizer (surface mounted) to be paid for.

10-1.__ BARRICADE

Barricades shall be furnished, placed and maintained at the locations shown on the plans, specified in the Standard Specifications or in these special provisions or where designated by the Engineer. Barricades shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the State Standard Specifications and these special provisions.

Attention is directed to "Prequalified and Tested Signing and Delineation Materials" of these special provisions regarding retroreflective sheeting for barricades.

10-1.__ PORTABLE CHANGEABLE MESSAGE SIGN

Portable changeable message signs shall be furnished, placed, operated, and maintained at locations shown on the plans or where designated by the Engineer and shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the State Standard Specifications and these special provisions. Messages displayed on the portable changeable message signs shall be as specified on the plans and shall conform to Section 12-3.12 "Portable Changeable Message Signs," of the State Standard Specifications and “Maintaining Traffic” of these special provisions."

A portable changeable message sign shall be placed in advance of the first warning sign for each stationary lane closure.

10-1.__ TEMPORARY RAILING

Temporary railing (Type K) shall be placed as shown on the plans, as specified in the Standard Specifications or these special provisions or where ordered by the Engineer and shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the State Standard Specifications and these special provisions.

Reflectors on temporary railing (Type K) shall conform to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

Attention is directed to "Public Safety" and "Order of Work" of these special provisions.

Temporary railing (Type K) placed in conformance with the provisions in "Public Safety" of these special provisions will be neither measured nor paid for.

10-1.__ CHANNELIZER

Channelizers shall conform to the provisions in Section 12, "Construction Area Traffic Control Devices," of the State Standard Specifications and these special provisions.

Channelizers shall conform to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions.

When no longer required for the work as determined by the Engineer, channelizers and underlying adhesive used to cement the channelizer bases to the pavement shall be removed. Removed channelizers and adhesive shall become the property of the Contractor and shall be removed from the site of work.

10-1.__ TRAFFIC PLASTIC DRUMS

GENERAL

Summary

Work includes placing traffic plastic drums.

Comply with:

1. Section 12, "Construction Area Traffic Control Devices," of the State Standard Specifications
2. Section 6F.62, "Drums," of the California Manual On Uniform Traffic Control Devices
3. Traffic plastic drum manufacturer's recommendations for weight and ballast

Definitions

orange-colored: Orange-colored may be either orange, red-orange, fluorescent orange or fluorescent red-orange in color.

Submittals

Upon request, submit a Certificate of Compliance for Traffic Plastic Drum under Section 6-1.07, "Certificates of Compliance," of the State Standard Specifications.

Quality Control and Assurance

White and orange-colored retroreflective stripes must be a brand of retroreflective sheeting listed on the Department's "Prequalified and Tested Signing and Delineation Materials," of these special provisions. White and orange-colored stripe may be either Type III, Type IV, Type VI, Type VII, Type VIII, or Type IX retroreflective sheeting. Use the same type and brand of retroreflective sheeting for all traffic plastic drums.

MATERIALS

Traffic plastic drum must:

1. Be orange-colored low-density polyethylene
2. Be flexible and collapsible upon vehicle impact
3. Have a weighted-base to maintain an upright position and prevent displacement under passing traffic

Weighted-base must be:

1. Detachable
2. Shaped to prevent rolling upon impact
3. 38-inch maximum outside diameter
4. 4-inch maximum height above the ground surface

CONSTRUCTION

Place a traffic plastic drum on only one side of the traveled way, in a straight line on a tangent alignment, and in a true arc on a curved alignment.
Use only one type of traffic plastic drum on the job site. Do not intermix traffic plastic drums, portable delineators, tubular markers, traffic cones, and Type I and Type II barricades on the same alignment.
Do not use sandbags or comparable ballast.
Traffic plastic drum must be a minimum of 36 inches in height above the traveled way.

Immediately restore a displaced traffic plastic drum to its original location and upright position. Upon completion of work, traffic plastic drums become your property and must be removed from the job site.

10-1.__ TEMPORARY CRASH CUSHION MODULE

This work shall consist of furnishing, installing, and maintaining sand filled temporary crash cushion modules in groupings or arrays at each location shown on the plans, as specified in these special provisions or where designated by the Engineer. The grouping or array of sand filled modules shall form a complete sand filled temporary crash cushion in conformance with the details shown on the plans and these special provisions.

Attention is directed to "Public Safety", "Order of Work", and "Temporary Railing" of these special provisions.

Whenever the work or the Contractor's operations establishes a fixed obstacle, the exposed fixed obstacle shall be protected with a sand filled temporary crash cushion. The sand filled temporary crash cushion shall be in place prior to opening the lanes adjacent to the fixed obstacle to public traffic.

Sand filled temporary crash cushions shall be maintained in place at each location, including times when work is not actively in progress. Sand filled temporary crash cushions may be removed during a work period for access to the work provided that the exposed fixed obstacle is 15 feet or more from a lane carrying public traffic and the temporary crash cushion is reset to protect the obstacle prior to the end of the work period in which the fixed obstacle was exposed. When no longer required, as determined by the Engineer, sand filled temporary crash cushions shall be removed from the site of the work.

At the Contractor's option, the modules for use in sand filled temporary crash cushions shall be either Energite III Inertial Modules, Fitch Inertial Modules or TrafFix Sand Barrels manufactured after March 31, 1997, or equal:

1. Energite III and Fitch Inertial Modules, manufactured by Energy Absorption Systems, Inc., 35 East Wacker Drive, Suite 1100, Chicago, IL 60601:

    1.1. Northern California: Traffic Control Service, Inc., 8585 Thys Court, Sacramento, CA 95828, telephone (800) 884-8274, FAX (916) 387-9734
    1.2. Southern California: Traffic Control Service, Inc., 1818 E. Orangethorpe, Fullerton, CA 92831-5324, telephone (800) 222-8274, FAX (714) 526-9501

2. TrafFix Sand Barrels, manufactured by TrafFix Devices, Inc., 220 Calle Pintoresco, San Clemente, CA 92672, telephone (949) 361-5663, FAX (949) 361-9205

    2.1. Northern California: United Rentals, Inc., 1533 Berger Drive, San Jose, CA 95112, telephone (408) 287-4303, FAX (408) 287-1929
    2.2. Southern California: Statewide Safety & Sign, Inc., P.O. Box 1440, Pismo Beach, CA 93448, telephone (800) 559-7080, FAX (805) 929-5786

Modules contained in each temporary crash cushion shall be of the same type at each location. The color of the modules shall be the standard yellow color, as furnished by the vendor, with black lids. The modules shall exhibit good workmanship free from structural flaws and

objectionable surface defects. The modules need not be new. Good used undamaged modules conforming to color and quality of the types specified herein may be utilized. If used Fitch modules requiring a seal are furnished, the top edge of the seal shall be securely fastened to the wall of the module by a continuous strip of heavy duty tape.
Modules shall be filled with sand in conformance with the manufacturer's directions, and to the sand capacity in pounds for each module shown on the plans. Sand for filling the modules shall be clean washed concrete sand of commercial quality. At the time of placing in the modules, the sand shall contain not more than 7 percent water as determined by California Test 226.
Modules damaged due to the Contractor's operations shall be repaired immediately by the Contractor at the Contractor's expense. Modules damaged beyond repair, as determined by the Engineer, due to the Contractor's operations shall be removed and replaced by the Contractor at the Contractor's expense.
Temporary crash cushion modules shall be placed on movable pallets or frames conforming to the dimensions shown on the plans. The pallets or frames shall provide a full bearing base beneath the modules. The modules and supporting pallets or frames shall not be moved by sliding or skidding along the pavement or bridge deck.
A Type R or P marker panel shall be attached to the front of the crash cushion as shown on the plans, when the closest point of the crash cushion array is within 12 feet of the traveled way. The marker panel, when required, shall be firmly fastened to the crash cushion with commercial quality hardware or by other methods determined by the Engineer.
At the completion of the project, temporary crash cushion modules, sand filling, pallets or frames, and marker panels shall become the property of the Contractor and shall be removed from the site of the work. Temporary crash cushion modules shall not be installed in the permanent work.
Temporary crash cushion modules placed in conformance with the provisions in "Public Safety" of these special provisions will not be measured nor paid for.

10-1.__ EXISTING HIGHWAY FACILITIES

The work performed in connection with various existing highway facilities shall conform to the provisions in Section 15, "Existing Highway Facilities," of the State Standard Specifications and these special provisions.

RESET ROADSIDE SIGN

Existing roadside signs, where shown on the plans to be reset, shall be removed and reset.
Each roadside sign shall be reset on the same day that the sign is removed.
Two holes shall be drilled in each existing post as required to provide the breakaway feature shown on the plans.

REMOVE BASE AND SURFACING

Existing base and bituminous surfacing shown on the plans to be removed, shall be removed to a depth of at least 6 inches below the grade of the existing surfacing. Resulting holes and depressions shall be backfilled with earthy material selected from excavation to the lines and grade established by the Engineer.

Removing base and surfacing will be measured and paid for as roadway excavation.

COLD PLANE ASPHALT CONCRETE PAVEMENT

Existing asphalt concrete pavement shall be cold planed at the locations and to the dimensions shown on the plans.

Planing asphalt concrete pavement shall be performed by the cold planing method. Planing of the asphalt concrete pavement shall not be done by the heater planing method.

Cold planing machines shall be equipped with a cutter head not less than 30 inches in width and shall be operated so that no fumes or smoke will be produced. The cold planing machine shall plane the pavement without requiring the use of a heating device to soften the pavement during or prior to the planing operation.

The depth, width, and shape of the cut shall be as shown on the plans or as designated by the Engineer. The final cut shall result in a uniform surface conforming to the plans. The outside lines of the planed area shall be neat and uniform. Planing asphalt concrete pavement operations shall be performed without damage to the surfacing to remain in place.

Planed widths of pavement shall be continuous except for intersections at cross streets where the planing shall be carried around the corners and through the conform lines. Following planing operations, a drop-off of more than 0.15-foot will not be allowed between adjacent lanes open to public traffic.

Where transverse joints are planed in the pavement at conform lines no drop-off shall remain between the existing pavement and the planed area when the pavement is opened to public traffic. If Hot Mix Asphalt (HMA) has not been placed to the level of existing pavement before the pavement is to be opened to public traffic a temporary HMA taper shall be constructed. HMA for temporary tapers shall be placed to the level of the existing pavement and tapered on a slope of 30:1 (Horizontal: Vertical) or flatter to the level of the planed area.

HMA for temporary tapers shall be the same quality as the HMA used elsewhere on the project or shall conform to the material requirements for minor HMA. HMA for tapers shall be compacted by any method that will produce a smooth riding surface. Temporary HMA tapers shall be completely removed, including the removal of loose material from the underlying surface, before placing the permanent surfacing. The removed material shall be disposed of outside the highway right of way in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

The material planed from the roadway surface, including material deposited in existing gutters or on the adjacent traveled way, shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications. Removal operations of cold planed material shall be concurrent with planing operations and follow within 50 feet of the planer, unless otherwise directed by the Engineer.

Cold plane asphalt concrete pavement will be measured by the square yard. The quantity to be paid for will be the actual area of surface cold planed irrespective of the number of passes required to obtain the depth shown on the plans.

The contract price paid per square yard for cold plane asphalt concrete pavement shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in cold planing asphalt concrete surfacing and disposing of planed material, including furnishing the HMA for and constructing, maintaining, removing, and disposing of temporary HMA tapers, as specified in the Standard Specifications and these special provisions and as directed by the Engineer.

10-1.__ CLEARING AND GRUBBING

Clearing and grubbing shall conform to the provisions in Section 16, "Clearing and Grubbing," of the State Standard Specifications and these special provisions.
Vegetable growth from clearing and grubbing operations may be disposed of in embankments in conformance with the provisions in "Earthwork" of these special provisions.

10-1.__ EARTHWORK

Earthwork shall conform to the provisions in Section 19, "Earthwork," of the State Standard Specifications and these special provisions.

Section 19-5.03, "Relative Compaction (95 Percent)," of the Standard Specifications is amended to read:

Relative compaction of not less than 98 percent shall be obtained for a minimum depth of 0.5-foot below the grading plane for the width between the outer edges of the shoulders , whether in excavation or embankment.

In addition, relative compaction of not less than 98 percent shall be obtained for a minimum depth of 2.5 feet below finished grade for the width of the traveled way plus 3 feet on each side thereof, whether in excavation or in embankment.

Except for the outer 5 feet measured horizontallyfrom the embankment side slopes, the full width of embankment within 150 feet of bridge abutments shall be compacted to a relative compaction of not less than 98 percent. The 150-foot limit of 98 percent will be measured horizontally from the bridge abutment and either parallel or concentric with the roadway centerline. In addition, a relative compaction of not less than 98 percent shall be obtained for embankment under retaining wall footings without pile foundations within the limits established by inclined planes sloping 1.5:1 (horizontal:vertical) out and down form lines one foot outside the bottom edges of the footing.

Section 19-5.04, "Relative Compaction (90 Percent)," of the State Standard Specifications is amended to read:

Relative compaction of not less than 98 percent shall be obtained in all material in embankment.

10-1.__ AGGREGATE SUBBASE

Aggregate subbase must comply with Section 25, "Aggregate Subbases," of the State Standard Specifications and these special provisions.
Aggregate subbase must be Class 2.
Do not store reclaimed asphalt concrete or aggregate subbase with reclaimed asphalt concrete within 100 feet measured horizontally of any culvert, watercourse, or bridge.

10-1.__ AGGREGATE BASE

Aggregate base must comply with Section 26, "Aggregate Bases," of the State Standard Specifications and these special provisions.
Aggregate base must be Class 2.
Do not store reclaimed asphalt concrete or aggregate base with reclaimed asphalt concrete within 100 feet measured horizontally of any culvert, watercourse, or bridge.

10-1.__ HOT MIX ASPHALT

GENERAL

Summary

This work includes producing and placing hot mix asphalt (HMA) Type A using the method process.
Comply with Section 39, "Hot Mix Asphalt," of the State Standard Specifications.

Submittals

MATERIALS

Asphalt Binder

The grade of asphalt binder mixed with aggregate for HMA Type A must be PG 70-10.

Aggregate

The aggregate for HMA Type A must comply with the 3/4-inch grading.

CONSTRUCTION

Rumble Strips

Construct shoulder rumble strips in the top layer of new HMA surfacing.

Vertical Joints

Before opening the lane to public traffic, pave shoulders and median borders adjacent to a lane being paved.
Do not leave a vertical joint more than 0.15 foot high between adjacent lanes open to public traffic.

Widening

If widening existing pavement, construct new structural section on both sides of the existing pavement to match the elevation of the existing pavement's edge for the project's entire length before placing HMA over the existing pavement.
22*. Use when the structural section is to be constructed to the elevation of **Conform Tapers**
23. Use when conform tapers are used in place of paving shoulders and/or Place additional HMA along the pavement's edge to conform to road connections and private drives. Hand rake, if necessary, and compact the additional HMA to form a smooth conform taper.

10-1.__ JOINTED PLAIN CONCRETE PAVEMENT

GENERAL

Jointed plain concrete pavement shall be constructed in conformance with the provisions in Section 40, "Portland Cement Concrete Pavement," of the State Standard Specifications and these special provisions, and as shown on the plans.
Insert method for forming joints in pavement shall not be used.

PREPAVING CONFERENCE

Supervisory personnel of the Contractor and subcontractors who are to be involved in the concrete paving work shall meet with the Engineer at a prepaving conference, at a mutually agreed time, to discuss methods of accomplishing the paving work.
The Contractor shall provide a facility for the prepaving conference within 3 miles of the construction site or at a nearby location agreed to by the Engineer. Attendance at the prepaving conference is mandatory for the Contractor's project superintendent, paving construction foreman, subcontractor's workers, including foremen and personnel performing saw cutting, joint sealing, concrete plant manager, and concrete plant operator. Conference attendees shall sign an attendance sheet provided by the Engineer. Production and placement shall not begin nor proceed unless the above-mentioned personnel have attended the mandatory prepaving conference.

JUST-IN-TIME TRAINING

Attending a 4-hour Just-In-Time Training (JITT) shall be mandatory, and consist of a formal joint training class on portland cement concrete and paving techniques. Construction operations for portland cement concrete paving shall not begin until the Contractor's and the Engineer's personnel have completed the mandatory JITT. The Contractor's personnel included in the list of participants for the prepaving conference as well as the Engineer's representatives shall attend JITT. JITT shall be in addition to the prepaving conference.

The JITT class will be conducted for not less than 4 hours on portland cement concrete pavement and paving techniques. The training class may be an extension of the prepaving conference and shall be conducted at a project field location convenient for both the Contractor and the Engineer. The JITT class shall be completed at least 15 days, not including Saturdays or holidays, prior to the start of portland cement concrete paving operations. The class shall be held during normal working hours.
The JITT instructor shall be experienced in the construction methods, materials, and test methods associated with construction of portland cement concrete pavement and paving techniques. The instructor shall not be an employee of the Contractor or a member of the Engineer's field staff. A copy of the course syllabus, handouts, and presentation material shall be submitted to the Engineer at least 7 days before the day of the training. The Contractor and the Engineer shall mutually agree to course instructor, the course content, and training site. The instructor shall issue a certificate of completion to the participants upon completion of the class. The certificate of completion shall include the course title, date and location of the class, the name of the participant, instructor's name, location and telephone number.
The Contractor's or Engineer's personnel involved with portland cement concrete paving operations will not be required to attend JITT if they have completed equivalent training within the previous 12 months of the date of the JITT for this project. The Contractor shall provide a certificate of class completion as described above for each staff member to be excluded from the JITT class. The Engineer will provide the final determination for exclusion of staff member's participation. Attendees of the JITT shall complete, and submit to the Engineer, an evaluation of the training. The Engineer will provide the course evaluation form.
Just-In-Time Training shall not relieve the Contractor of responsibility under the contract for the successful completion of the work in conformance with the requirements of the plans and specifications.

MATERIALS

Concrete

Attention is directed to Section 90, "Portland Cement Concrete," of the State Standard Specifications, regarding mix proportions for concrete being determined by the Contractor. Primary aggregate gradings shall conform to the gradation requirements of Section 90-3, "Aggregate Gradings," of the State Standard Specifications. When combined in the proportions determined by the Contractor, the percent passing the 3/8-inch sieve and retained on the No. 8 sieve shall not be less than 16 percent of the total aggregate.
The cementitious material content shall not exceed 675 pounds per cubic yard.

Tie Bars

Tie bars shall be deformed reinforcing steel bars conforming to the requirements of ASTM Designation: A 615/A 615M, Grade 40 or 60, A 996/A 996M, Grade 50 or 60, or A 706/A 706M. Tie bars shall be epoxy-coated in conformance with the requirements in ASTM Designation: A 934/A 934M or A 775/A 775M and the provisions in Section 52-1.02B, "Epoxy-coated Reinforcement," of the State Standard Specifications, except the epoxy-coating thickness after curing shall be between 7 mils to 16 mils. Fabrication, sampling and jobsite handling shall conform to the requirements in ASTM Designation: D 3963 and the provisions in

Section 52-1.02B, "Epoxy-coated Reinforcement," of the State Standard Specifications, except the 2 samples shall be 30 inches long. Epoxy-coated tie bars shall not be bent.

Epoxy (Drill and Bond)

Epoxy for bonding tie bars and dowel bars to portland cement concrete shall be a two-component, epoxy-resin, conforming to the requirements of ASTM Designation: C 881, Type V, Grade 3 (Non-Sagging), Class A, B or C. The class used shall be dependent on the internal temperature of the hardened concrete at the time the epoxy is to be applied. Class A shall be used when the internal temperature is below 40 °F, but not lower than recommended by the manufacturer. Class B shall be used when the internal temperature is from 40 °F to 60 °F. Class C shall be used when the internal temperature is above 60 °F, but not higher than recommended by the manufacturer. A Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the State Standard Specifications shall be furnished with the epoxy. A copy of the manufacturer's recommended installation procedure shall be provided to the Engineer at least 7 days prior to the start of work. Epoxy shall be applied in conformance with the manufacturer's recommendations.

Dowel Bars

Dowel bars shall be plain round smooth, epoxy-coated steel conforming to the requirements in ASTM Designation: A 615/A 615M, Grade 40 or 60, the details shown on the plans and the provisions in Section 52-1.02B, "Epoxy-coated Reinforcement," of the State Standard Specifications, except that the two samples required in ASTM Designation: D 3963/D 3963M shall be 18 inches long. Epoxy coating of dowel bars shall conform to the provisions in ASTM Designation: A 884/A 884M, Class A, Type 1 or Type 2, except that the bend test shall not apply.

Dowel bars shall be free from burrs or other deformations detrimental to free movement of the bars in the concrete.

Bond Breaker

Dowel bars shall be lubricated with a bond breaker over the entire bar. A bond breaker application of petroleum paraffin based lubricant or white-pigmented curing compound shall be used to coat the dowel bars completely prior to placement. Oil and asphalt based bond breakers shall not be used. Paraffin based lubricant shall be Dayton Superior DSC BB-Coat or Valvoline Tectyl 506 or an approved equal. Paraffin based lubricant shall be factory applied. White pigmented curing compound shall conform to the requirements of ASTM Designation: C 309, Type 2, Class A, and shall contain 22 percent minimum nonvolatile vehicles consisting of at least 50 percent paraffin wax. Curing compound shall be applied in 2 separate applications, the last application not more than 8 hours prior to placement of the dowel bars. Each application of curing compound shall be applied at the approximate rate of one gallon per 15 square yards.

Dowel Bar Baskets

Dowel bar baskets shall be manufactured with a minimum welded wire gage number of MW 65. Baskets shall be either U-frame or A-frame shape. J-frame shapes shall not be used. Baskets shall be fabricated in conformance with the requirements in ASTM Designation: A 82. Welding of baskets shall conform to the requirements in AASHTO Designation: M 254. A broken weld will be a cause for rejection of the basket. Baskets shall be Class A, Type 1 epoxy-coated in conformance with the requirements in ASTM Designation: A 884/A 884M. Fabrication and job-site handling shall conform to the requirements in ASTM Designation: D 3963 and the provisions in Section 52-1.02B, "Epoxy-coated Reinforcement," of the State Standard Specifications, except that sampling of epoxy-coated wire reinforcement will not be required. A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," shall be furnished for each shipment of epoxy-coated wire reinforcement certifying that the coated bars conform to the requirements in ASTM Designation: A 884/A 884M and the provisions in Section 52-1.02B, "Epoxy-coated Bar Reinforcement," of the State Standard Specifications. The Certificate of Compliance shall include the certifications specified in ASTM Designation: A 884/A 884M and a statement that the coating material has been pre-qualified by acceptance testing performed by the Valley Forge Laboratories, Inc., Devon, Pennsylvania.

Concrete fasteners shall be used for anchoring dowel bar baskets to lean concrete base, hot mix asphalt used as base, asphalt treated permeable base, or cement treated permeable base. Concrete fasteners shall be driven fasteners such as concrete nails, used specifically for fastening to hardened concrete, or hot mix asphalt used as base. Concrete fasteners shall conform to the requirements of ASTM Designation: F 1667. Concrete nails used as fasteners on lean concrete base or hot mix asphalt used as base shall have a minimum shank diameter of 5/32 inch with a minimum shank length of 2-1/2 inches. Concrete nails used as fasteners on asphalt treated or cement treated permeable base shall have a minimum shank diameter of 5/32 inch with a minimum shank length of 4-3/4 inches. Shank length shall be the distance from the point to the bottom of the nail head. Clips and washers shall be commercial quality manufactured for use with dowel bar baskets. The surface of concrete fasteners, clips, and washers shall be either zinc electroplated or galvanized with a minimum coating thickness of 0.2-mil.

Tie Bar Baskets

Tie bar baskets shall be manufactured with a minimum welded wire gage number of MW 65. Baskets shall be either U-frame or A-frame shape. J-frame shapes shall not be used. Tie bar baskets shall be fabricated in conformance with the requirements in ASTM Designation: A 82. Welding of baskets shall conform to the requirements in AASHTO Designation: M 254. A broken weld will be a cause for rejection of the basket. Baskets shall be Class A, Type 1 epoxy-coated in conformance with the requirements in ASTM Designation: A 884/A 884M. Fabrication and job-site handling shall conform to the requirements in ASTM Designation: D 3963 and the provisions in Section 52-1.02B, "Epoxy-coated Reinforcement," of the State Standard Specifications, except that sampling of epoxy-coated wire reinforcement will not be required. A Certificate of Compliance conforming to the provisions in Section 6-1.07, "Certificates of Compliance," shall be furnished for each shipment of epoxy-coated wire reinforcement certifying that the coated bars conform to the requirements in ASTM Designation: A 884/A 884M and the provisions in Section 52-1.02B, "Epoxy-coated Bar Reinforcement," of

the State Standard Specifications. The Certificate of Compliance shall include the certifications specified in ASTM Designation: A 884/A 884M and a statement that the coating material has been pre-qualified by acceptance testing performed by the Valley Forge Laboratories, Inc., Devon, Pennsylvania.
Concrete fasteners shall be used for anchoring tie bar baskets to lean concrete base, hot mix asphalt used as base, asphalt treated permeable base, or cement treated permeable base. Concrete fasteners shall be driven fasteners such as concrete nails, used specifically for fastening to hardened concrete, or hot mix asphalt used as base. Concrete fasteners shall conform to the requirements of ASTM Designation: F 1667. Concrete nails used as fasteners on lean concrete base or hot mix asphalt used as base shall have a minimum shank diameter of 5/32 inch with a minimum shank length of 2-1/2 inches. Concrete nails used as fasteners on asphalt treated or cement treated permeable base shall have a minimum shank diameter of 5/32 inch with a minimum shank length of 4-3/4 inches. Shank length shall be the distance from the point to the bottom of the nail head. Clips and washers shall be commercial quality manufactured for use with tie bar baskets. The surface of concrete fasteners, clips, and washers shall be either zinc electroplated or galvanized with a minimum coating thickness of 0.2-mil.

Reinforcement

Reinforcement shall be epoxy coated and shall conform to the provisions in Section 52, "Reinforcement," of the State Standard Specifications.

Silicone Joint Sealant

Low modulus silicone joint sealant shall be furnished in a one-part silicone formulation. Acid cure sealant shall not be used. The compound shall be compatible with the surface to which it is applied and shall conform to the following requirements:

Property	Test Method	Requirement
Tensile stress, 150% elongation, 7-day cure at 77° F°±2° F and 45% to 55% R.H.[e]	ASTM D 412 (Die C)	45 psi max.
Flow at 77° F°±2° F	ASTM C 639[a]	Shall not flow from channel
Extrusion Rate at 77° F°±2° F	ASTM C 603[b]	3 to 9 ounces/minute
Specific Gravity	ASTM D 792 Method A	1.01 to 1.51
Durometer Hardness, at 0° F, Shore A, cured 7 days at 77° F°±2° F	ASTM C 661	10 to 25
Ozone and Ultraviolet Resistance, after 5,000 hours	ASTM C 793	No chalking, cracking or bond loss
Tack free at 77° F°±2° F and 45% to 55% R.H.[e]	ASTM C 679	Less than 75 minutes
Elongation, 7 day cure at 77° F°±2° F and 45% to 55% R.H.[e]	ASTM D 412 (Die C)	500 percent min.
Set to Touch, at 77° F°±2° F and 45% to 55% R.H.[e]	ASTM D 1640	Less than 75 minutes
Shelf Life, from date of shipment	—	6 months min.
Bond, to concrete mortar-concrete briquettes, air cured 7 days at 77° F°±2° F	AASHTO T 132[c]	50 psi min.
Movement Capability and Adhesion, 100% extension at 0° F after, air cured 7 days at 77° F°±2° F, and followed by 7 days in water at 77° F°±2° F	ASTM C 719[d]	No adhesive or cohesive failure after 5 cycles

Notes:

a. ASTM Designation: C 639 Modified (15 percent slope channel A).
b. ASTM Designation: C 603, through 1/8 inch opening at 50 psi.
c. Mold briquettes in conformance with AASHTO Designation: T 132, sawed in half and bonded with a 1/16 inch maximum thickness of sealant and tested in conformance with AASHTO Designation: T 132. Briquettes shall be dried to constant mass at 212 ±10° F.
d. Movement Capability and Adhesion: Prepare 12" x 1" x 3" concrete blocks in conformance with ASTM Designation: C 719. A sawed face shall be used for bond surface. Seal 2 inches of block leaving 1/2 inch on each end of specimen unsealed. The depth of sealant shall be 3/8 inch and the width 1/2 inch.
e. R.H. equals relative humidity.

The silicone joint sealant shall be formulated to cure rapidly enough to prevent flow after application on grades of up to 15 percent.

A Certificate of Compliance for the silicone sealant shall be furnished to the Engineer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the State Standard Specifications. The Certificate shall also be accompanied with a certified test report of the results of the required tests performed on the sealant material within the previous 12 months prior to proposed use. The Certificate and accompanying test report shall be provided for each lot of silicone joint sealant prior to use on the project.

Foam Backer Rods

Foam backer rods shall be Type 1, conforming to the requirements of ASTM Designation: D 5249. Foam backer rods shall have a diameter prior to placement at least 25 percent greater than the width of the sawcut and shall be expanded, crosslinked, closed-cell polyethylene foam that is compatible with the joint sealant so that no bond or adverse reaction occurs between the rod and sealant. Hot applied sealant that will melt the foam backer rod shall not be used. The Contractor shall submit a manufacturer's data sheet verifying that the foam backer rod is compatible with the sealant to be used.

Joint Filler Material

Joint filler material shall be preformed expansion joint filler for concrete (bituminous type), conforming to the requirements of ASTM Designation: D 994.
Joint filler material shall be Type 1 preformed expansion joint filler for concrete conforming to the requirements of ASTM Designation: D 1752.
Joint filler material shall be Type 2 preformed expansion joint filler for concrete conforming to the requirements of ASTM Designation: D 1752.
A Certificate of Compliance for the joint filler material shall be furnished to the Engineer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the State Standard Specifications. The certificate shall be accompanied with a certified test report of the results of the required tests performed on the joint filler material within the previous 12 months prior to proposed use. The certificate and accompanying test report shall be provided for each lot of joint filler material prior to use on the project.

Hydraulic Cement Grout (non-shrink)

Hydraulic cement grout (non-shrink) shall conform to the requirements in ASTM Designation: C 1107. At the Contractor's option, clean, uniformly rounded aggregate filler may be used to extend the grout. The extension of grout shall not exceed 60 percent of the weight of the grout or the maximum amount of grout extension recommended by the manufacturer, whichever is less. The moisture content of the aggregate filler shall not exceed 0.5-percent. Grading of the aggregate filler shall conform to the following:

Sieve Size	Percentage Passing
1/2 inch	100
3/8 inch	85 - 100
No. 4	10 - 30
No. 8	0 - 10
No. 16	0 - 5

PAVEMENT CONCRETE MIX PROPORTIONS

The Contractor shall determine the mix proportions for pavement concrete. The laboratory used to develop the mix proportions shall meet the requirements of ASTM Designation: C 1077, and shall have current AASHTO accreditation for test methods AASHTO Designation: T 97 or ASTM Designation: C 78, and AASHTO Designation: T 126 or ASTM Designation: C 192. The minimum cementitious materials content or the maximum water to cementitious materials ratio shall be determined in conformance with the requirements in California Test 559. Trial mixtures shall be made no more than 24 months before field qualification. The minimum cementitious materials content or the maximum water to cementitious materials ratio shall be that determined from the trial mixtures curve to produce a minimum modulus of rupture of 560 pounds per square inch at 28 days age and 650 pounds per square inch at 42 days age. To account for variances in materials, production of concrete, and modulus of rupture testing, the Contractor shall include as part of the proposed mix proportions an increase to the cementitious material content or a decrease to the water to cementitious materials ratio, determined from trial

mixtures, to ensure that portland cement concrete produced during paving operations conforms to the requirements in "Modulus of Rupture," in this section.
At least 15 days prior to field qualification, the Contractor shall submit the proposed pavement concrete mix proportions with laboratory test reports. Laboratory test reports shall include modulus of rupture determined for each trial mixture at ages of 10, 21, 28 and 42 days in conformance with the applicable portions of California Test 559.

Field Qualification

Field qualification of proposed mix proportions will be required prior to placement of pavement concrete. The Contractor shall perform field qualification and submit certified test data to the Engineer. Field qualification data shall be based upon the proposed use of materials, mix proportions, mixing equipment, procedures and size of batch.
Proposed concrete mix proportions will be field qualified when the test results of five beams from a single batch of concrete indicate the average modulus of rupture is at least 560 pounds per square inch with no single beam lower than 550 pounds per square inch at an age of the Contractor's choice but not later than 28 days. Beams shall be tested for modulus of rupture at a minimum of 10, 21, and 28 days of age. Test specimens shall be made and tested in conformance with the requirements in California Test 523.
The certified field qualification test data reports shall include the following:

1. Date of mixing,
2. Mixing equipment and procedures used,
3. Volume of batch in cubic yards and the weight or volume,
4. Type and source of ingredients used,
5. Penetration and slump of the concrete,
6. The air content of the concrete, and
7. The age at time of testing and strength of concrete specimens tested.

Field qualification test data reports shall be signed by a certified representative in charge of the laboratory that performed the tests.
If the Contractor changes a source of supply or proportions, the Contractor shall submit a new proposed mix design and furnish samples from the new source, or sources, at least 60 days prior to their intended use. The new mix proportions shall be trial batched and field qualified, unless, the Engineer determines the change is not substantive. No extension of contract time will be allowed for the time required to perform the sampling, testing, preparing and qualifying new mix proportions for new aggregate sources proposed by the Contractor.

MODULUS OF RUPTURE

The Engineer will test portland cement concrete pavement for modulus of rupture in conformance with the requirements in California Test 523. Acceptance will be on a lot basis. Each lot shall not to exceed 1,000 cubic yards of concrete pavement. The Engineer will determine sample locations. A minimum of six beam specimens shall be made from each sample. Beam specimens will be tested for modulus of rupture at 10, 21, and 28 days. The modulus of rupture for each lot will be calculated by averaging the results of two beams

representing that lot tested at 28 days of age. The difference in modulus of rupture between each individual beam result shall not exceed 65 pounds per square inch.
The Contractor shall perform sampling and testing of beam specimens to determine if concrete pavement has achieved a modulus of rupture of 350 pounds per square inch when requesting early use of concrete pavement in conformance with the provisions in Section 90-8.03, "Protecting Concrete Pavement," of the State Standard Specifications. Beam specimens shall be made and tested in conformance with the requirements in California Test 523.

INSTALLING TIE BARS

Tie bars shall be installed at longitudinal contact joints and longitudinal weakened plane joints as shown on the plans. Contiguous width of new portland cement concrete pavement tied together with tie bars shall not exceed 50 feet. Tie bars shall not be installed at joints between portland cement concrete and hot mix asphalt pavements.
Tie bars shall be installed at longitudinal joints by one of the following methods:

1. Drilling and bonding tie bars with two-component, epoxy-resin that conforms to this section. Drilled holes shall be cleaned in conformance with the epoxy manufacturer's instructions and shall be dry at the time of placing the epoxy and tie bars. Tie bars will be rotated 180º while being inserted into the epoxy filled holes. Immediately after inserting the tie bars into the epoxy, the tie bars shall be supported as necessary to prevent movement during curing and shall remain undisturbed until the epoxy has cured as specified by the manufacturer instructions. Tie bars that are improperly placed or bonded, as determined by the Engineer, will be rejected. If rejected, new holes shall be drilled and new tie bars shall be placed and securely bonded to the concrete. Rejected tie bars shall be cut flush with the joint face. Exposed ends of tie bars shall be epoxy coated. The center of the new holes shall be offset 3 inches horizontally from the center of the rejected hole to maintain the minimum clearance to the dowel bar. Work necessary to correct improperly bonded tie bars shall be performed at the Contractor's expense.
2. Inserting tie bars into the plastic slipformed concrete before finishing the concrete. Inserted tie bars shall have full contact between the bar and the concrete. When tie bars are inserted through the pavement surface, the concrete over the tie bars shall be reworked and refinished so that there is no evidence on the surface of the completed pavement that there has been an insertion performed. Loose tie bars shall be replaced by drilling and bonding as described in A above, at the Contractor's expense.
3. Using threaded dowel splice couplers fabricated from deformed bar reinforcement material, free of external welding or machining. Threaded dowel splice couplers shall be accompanied by a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the State Standard Specifications, and shall be accompanied with installation instructions. Installation of threaded dowel splice couplers shall conform to the requirements of the manufacturer's recommendations.
4. Using tie bar baskets that conform to these special provisions

Tie bars shall be oriented perpendicular to the pavement joint and parallel with the surface of the pavement at mid-slab depth. Tie bar alignment tolerances shall conform to the requirements for dowel bars except embedment length tolerance shall be ±2 inches.
If tie bar baskets are used, they shall be anchored to the base to hold the tie bars at the specified depth and alignment during concrete placement without displacement. A minimum of 8

alternating, equally spaced, concrete fasteners with clips shall be used to anchor each basket (4 per lower runner wire). Temporary spacer wires shall be cut or removed after the baskets are anchored into position before concrete placement. Concrete pavement shall not be placed if the baskets are not in place at least 200 feet in advance of the concrete placement operation. The Engineer may waive this requirement upon written request by the Contractor in areas where access is restricted or other construction limitations are encountered. The Contractor shall demonstrate that the baskets are anchored and shall not shift during concrete placement. The Contractor shall provide longer concrete nails than the minimum lengths for the varying bases beneath the portland cement concrete when baskets demonstrate movement.
Full compensation for providing longer concrete nails shall be considered as included in the contract unit price paid per cubic yard for concrete pavement and no additional compensation will be allowed therefor.

DOWEL PLACEMENT

Dowel bars shall be centered on the joint within a tolerance of ±2 inches in the longitudinal direction directly over the contact joint or sawcut for the transverse weakened plane joints, as shown on the plans. Prior to placement of dowel bars, the Contractor shall submit to the Engineer a written procedure to identify the transverse weakened plane joint locations relative to the middle of the dowel bars and the procedure for consolidating concrete around the dowel bars.
Dowel bars shall be placed at transverse weakened plane joints within shoulder areas except at drainage inlets.
Dowel bars shall be placed at longitudinal joints as shown on the plans.
Dowel bars shall be placed as shown on the plans by using dowel bar baskets or by mechanical insertion.
When dowel bars are placed by mechanical insertion, the concrete over the dowel bars shall be reworked and refinished so that there is no evidence on the surface of the completed pavement that there has been any insertion performed. When drill and bonding of dowel bars is performed at contact joints, a grout retention ring shall be used.When dowel bar baskets are used, they shall be anchored to the base to hold the dowel bars at the specified depth and alignment during concrete placement without displacement. A minimum of 8 alternating, equally spaced, concrete fasteners with clips shall be used to anchor each 12-foot dowel bar basket (4 per lower runner wire). At least 10 concrete fasteners shall be used for basket sections greater than 12 feet and less than or equal to 16 feet. Temporary spacer wires connecting dowel bar baskets shall be cut or removed after the dowel bar baskets are anchored into position prior to concrete placement. Paving shall be suspended when dowel bar baskets are not in place at least 200 feet in advance of the concrete placement operation. The Engineer may waive this requirement upon written request by the Contractor, in areas, where access is restricted, or other construction limitations are encountered. The Contractor shall demonstrate to the Engineer's satisfaction that dowel bar baskets are adequately anchored and not shift during concrete placement. The Contractor shall provide longer concrete nails than the minimum lengths for the varying bases beneath the portland cement concrete when anchored dowel bar baskets demonstrate movement.
Full compensation for providing longer concrete nails shall be considered as included in the contract unit price paid per cubic yard for concrete pavement and no additional compensation will be allowed therefor.

Dowel bar placement at transverse and longitudinal weakened plane joints	
Horizontal offset	±1 inch
Longitudinal translation	±2 inches
Horizontal skew	3/8 inch
Vertical skew	3/8 inch
Vertical depth	(d/3 +1/2 inch) from pavement surface to top of dowel bar or 5/8 inch below planned placement

Note: d = pavement thickness in inches

CORE DRILLING FOR DOWEL BAR AND TIE BAR PLACEMENT ALIGNMENT ASSURANCE TESTING

Coring to confirm dowel bar and tie bar placement, alignment, and concrete consolidation shall be provided by the Contractor throughout the project, at locations determined by the Engineer. Each day's paving shall be cored within 2 days by performing a minimum of 2 and a maximum of 4 tests for dowel bar placement and position for every 2,000 square yards of doweled pavement or fraction thereof and one test for tie bar placement and position for every 4,000 square yards of pavement with tie bars. One test shall consist of drilling two cores, one on each end of a dowel bar to expose both ends and allow measurement for proper alignment. The minimum core hole diameter shall be 5 inches. If the cores indicate that dowel bars or tie bars are not within the allowable tolerances or if air voids exist surrounding the dowel bars or tie bars, additional cores will be required to determine the limits and severity of unacceptable work. The holes shall be cored by methods that will not damage the concrete adjacent to the holes. Immediately after coring, the concrete cores shall be submitted to the Engineer for inspection, and the cores shall be identified by the Contractor with a location description.

After removal of cores, core hole voids in concrete pavement shall be cleaned and filled with hydraulic cement grout (non-shrink). After placement of hydraulic cement grout, the material while still plastic shall be finished and textured to match the adjacent pavement surface. The backfill material shall be the same level as the pavement surface.

Water for core drilling operations shall be from a local domestic water supply, and shall contain not more than 1,000 parts per million of chlorides as CL, nor more than 1,300 parts per million of sulfates as SO_4, nor shall it contain impurities in a sufficient amount to cause discoloration of the concrete or produce etching of the surface.

Water from core drilling operations shall not be permitted to fall on public traffic, to flow across shoulders or lanes occupied by public traffic, or to flow into gutters or other drainage facilities.

Dowel bar and tie bar alignment shall be within the specified tolerances. If dowel bars or tie bars are found to be installed improperly, the paving operations shall not continue until the Contractor has demonstrated to the Engineer that the problem which caused the improper dowel bar or tie bar positioning has been corrected.

Dowel bars in rejected joints shall be replaced by the Contractor by saw cutting on each side of the rejected joint a minimum of 3 feet, lifting out concrete to be removed, installing new dowel bars at the new transverse joints, installing dowel bars and preformed sponge rubber expansion joint filler along the longitudinal joints, placing concrete, and installing new joints. Preformed sponge rubber expansion joint filler shall conform to the requirements in ASTM Designation: D 1752. New dowel bar holes shall be drilled, not more than 1/8 inch greater than the dowel bar diameter, by the use of an automatic dowel-drilling rig for the dowels to be installed at the contact joints. Dowel bars shall be placed, as shown on the plans, for the 2 new transverse contact joints. Original exposed tie bars, located within the slab replacement area, shall be cut

flush with the lane or pavement edge and dowel bars shall be installed to replace the tie bars at an offset of 3 inches, horizontally from the tie bar location. Holes for dowel bars to be placed along the longitudinal joint shall be drilled, not more than 1/8 inch greater than the dowel bar diameter, by the use of an automatic dowel-drilling rig for the dowel bars to be installed at the contact joints.

When requested by the Contractor and approved by the Engineer, dowel bars which are more than ±2 inches but less than ±3 inches from being centered directly over the sawcut for the transverse weakened plane joint, may remain in place, and the Contractor shall pay to the State the amount of $27.00 per square yard for the quantity of concrete pavement panels represented by the cores indicating incorrect dowel bar alignment or improper concrete consolidation around dowels. The quantity of concrete pavement area used to determine the amount of payment to the State will be calculated using the panel dimensions for panels adjacent to and inclusive of the joints with incorrect dowel bar alignment or improper concrete consolidation around dowel bars. The Department will reduce compensation from moneys due, or that may become due to the Contractor under the contract. This reduced compensation shall be in addition to other adjustments for incorrect tie bar alignment or improper concrete consolidation around tie bars as specified in these special provisions and for pavement thickness deficiency in conformance with the provisions in Section 40-1.135, "Pavement Thickness," of the State Standard Specifications and in addition to other adjustments for deficient Cleanness Value and coarse aggregate grading; and for deficient Sand Equivalent and fine aggregate grading in conformance with the provisions in Section 90-2.02, "Aggregate," of the State Standard Specifications.

Tie bars which are not within the specified tolerance for placement and position, as determined from inspection and measurements of cores, may remain in place when requested by the Contractor and approved by the Engineer. The Contractor shall pay to the State the amount of $20 per square yard for the quantity of concrete pavement panels represented by the cores indicating incorrect tie bar alignment or improper concrete consolidation around tie bars. The quantity of concrete pavement area used to determine the amount of payment to the State will be calculated using the panel dimensions for panels adjacent to and inclusive of the joints with incorrect tie bar alignment or improper concrete consolidation around tie bars. The Department will reduce compensation from moneys due, or that may become due to the Contractor under the contract. This reduced compensation will be in addition to other adjustments for incorrect dowel bar alignment or improper concrete consolidation around dowel bars as specified in these special provisions and for pavement thickness deficiency in conformance with the provisions in Section 40-1.135, "Pavement Thickness," of the State Standard Specifications and in addition to other adjustments for deficient Cleanness Value and coarse aggregate grading; and for deficient Sand Equivalent and fine aggregate grading in conformance with the provisions in Section 90-2.02, "Aggregate," of the State Standard Specifications.

LIQUID JOINT SEALANT INSTALLATION

The joint sealant detail for transverse and longitudinal joints, as shown on the plans, shall apply only to weakened plane joints. Weakened plane joints shall be constructed by the sawing method. Should grinding or grooving be required over or adjacent to joints after sealant has been placed, the joint materials shall be removed and disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the State Standard Specifications, and replaced at the Contractor's expense. Immediately after sawing, a water wash using less than 100 pounds per square inch of pressure shall be used to remove the slurry from the sawing operation.

Transverse weakened plane joints shall be Type B as shown on the plans. Longitudinal weakened plane joints shall be Type B as shown on the plans.

Seven days after the concrete pavement placement and not more than 4 hours before placing backer rods and joint sealant materials, the joint walls shall be cleaned by the dry sand blast method and other means as necessary to remove from the joint objectionable material such as soil, asphalt, curing compound, paint and rust. Sand blasting shall be performed in at least 2 passes, one for each side of the joint, with the nozzle held at an angle to the joint within one inch to 2 inches of the pavement. After cleaning the joint, traces of sand, dust and loose material shall be removed from and near the joint for a distance along the pavement surfaces of at least 2 inches on each side of the joint by the use of a vacuum device. Surface moisture or dampness shall be removed at the joints by means of compressed air or moderate hot compressed air or other means approved by the Engineer. Drying procedures that leave a residue or film on the joint wall shall not be used. Sandblasting equipment shall have a maximum nozzle diameter size of 1/4 inch ± 1/32 inch and a minimum pressure of 90 pounds per square inch.

Backer rods shall be installed when the temperature of the portland cement concrete pavement is above the dew point of the air and when the air temperature is 40 °F or above. Backer rod shall be installed when the joints to be sealed have been properly patched, cleaned and dried, as determined by the Engineer. Methods of placing backer rod that leave a residue or film on joint walls shall not be used.

Immediately after placement of the backer rod, joint sealant shall be placed in the clean, dry, prepared joints as shown on the plans. The joint sealant shall be applied using a mechanical device with a nozzle shaped to fit inside the joint to introduce the sealant from inside the joint. Adequate pressure shall be applied to the sealant to ensure that the sealant material is extruded evenly and that full continuous contact is made with the joint walls. After application of the sealant, the surface of the sealant shall be recessed as shown on the plans.

Failure of the joint material in either adhesion or cohesion will be cause for rejection of the joint. The finished surface of joint sealant shall conform to the dimensions and allowable tolerances shown on the plans. Rejected joint materials or joint material whose finished surface does not conform to the dimensions shown on the plans, as determined by the Engineer, shall be repaired or replaced, at the Contractor's expense, with joint material that conforms to the requirements. After each joint is sealed, surplus joint sealer on the pavement surface shall be removed. Traffic shall not be permitted over the sealed joints until the sealant is tack free and set sufficiently to prevent embedment of roadway debris into the sealant.

CONSTRUCTING TRANSVERSE CONTACT JOINTS

A transverse contact (construction) joint shall be constructed, including dowel bars, at the end of each day's work or where concrete placement is interrupted for more than 30 minutes, to coincide with the next weakened plane joint location.

If sufficient concrete has not been mixed to form a slab to match the next weakened plane joint, when an interruption occurs, the excess concrete shall be removed and disposed of back to the last preceding joint. The cost of removing and disposing of excess concrete shall be at the Contractor's expense. Excess material shall become the property of the Contractor and shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the State Standard Specifications.

A metal or wooden bulkhead (header) shall be used to form the joint. The bulkhead shall be designed to accommodate the installation of dowel bars.

CONSTRUCTING TRANSVERSE JOINT CONNECTIONS AND ANCHORS

Concrete pavement joints at transitions to hot mix asphalt pavement, pavement end anchors and bridge approach slabs shall conform to the details as shown on the plans. Paint binder shall be applied to the concrete surface that hot mix asphalt pavement will contact. Paint binder shall be applied in conformance with the provisions in Section 39, "Hot Mix Asphalt," of the State Standard Specifications.

PROFILE INDEX

The pavement surface shall be profiled, by the Contractor not more than 10 days following concrete placement, in the presence of the Engineer, using a California Profilograph or equivalent in conformance with the requirements in California Test 526, except a blanking band of zero (null) shall be used to determine the Profile Index. Two profiles shall be made within each traffic lane, one yard from and parallel with each lane line.
Profiled pavement shall conform to the following Profile Index requirements:

1. Pavement on tangent alignment and pavement on horizontal curves having a centerline radius of curve 2,000 feet or more shall have a Profile Index of 40 inches per mile or less.
2. Pavement on horizontal curves having a centerline radius of curve 1,000 feet or more but less than 2,000 feet and pavement within the superelevation transition of those curves shall have a Profile Index of 80 inches per mile or less.

Individual high points in excess of 5/16 inch, as determined by measurements of the profilogram in conformance with the requirements in California Test 526, except using a blanking band of zero (null), shall be reduced by grinding in conformance with the requirements in Section 40-1.10, "Final Finishing," of the State Standard Specifications until the high points as indicated by reruns of the profilograph do not exceed 5/16 inch.
Pavement grinding shall not be performed before 10 days have elapsed after concrete placement, nor before the concrete has developed a modulus of rupture of at least 550 pounds per square inch.

CONSTRUCTING WEAKENED PLANE JOINTS (EARLY ENTRY SAW METHOD)

The Contractor may construct weakened plane joints using lighter weight concrete saws (early entry saws) specifically designed for sawing fresh concrete without the use of water. The early entry saws shall be capable of sawing joints within 2 hours of cure time after placement of the concrete pavement without ravelling or tearing, as defined in Section 40-1.08B(1), "Sawing Method," of the State Standard Specifications. Joints sawed with early entry saws that develop random cracking shall be removed to the nearest controlled joint and replaced with concrete pavement containing dowel bars and tie bars in conformance with these special provisions and as shown on the plans. The removal and replacement work shall be at the Contractor's expense.
Weakened plane joints not sawed within 2 hours of placing concrete pavement shall be sawed by conventional power driven wet-type concrete saws in conformance with the requirements of Section 40-1.08B(1), "Sawing Method," of the State Standard Specifications.
Sawed grooves shall be cut to a maximum of 0.12-inch in width for longitudinal and transverse weakened plane joints made with early entry saws. The minimum depth of cut shall be calculated utilizing the formula in Section 40-1.08B(1), "Sawing Method," of the State Standard Specifications except $d = t/4$.

TIE BARS ALONG LONGITUDINAL JOINT FOR SHORT RADIUS CURVES

When paving along short radius curves, the transverse joints shall be maintained in a single continuous straight line across lanes, through the radius point. Tie bars shall maintain minimum clearance from the transverse joint as shown on the plans. If the inside or outside curve of the panel does not allow equal uniform spacing of tie bars at 30 inches between tie bars, then the tie bars shall be equally spaced so that a minimum spacing of 15 inches to a maximum spacing of 30 inches is maintained between tie bars. Additional tie bars shall be considered as included in the contract price paid per cubic yard for concrete pavement and no additional compensation will be allowed therefor.

If dowel bars are specified along longitudinal joint for short radius curves, then dowel bars shall conform to the requirements of this special provision for tie bars spacing and tolerance.

10-1.__ ROADSIDE SIGNS

Roadside signs shall be furnished and installed at the locations shown on the plans or where designated by the Engineer and in conformance with the provisions in Section 56-2, "Roadside Signs," of the Standard Specifications and these special provisions.

The Contractor shall furnish roadside sign panels in conformance with the provisions in "Furnish Sign" of these special provisions.

Wood posts shall be pressure treated after fabrication in conformance with the provisions in Section 58, "Preservative Treatment of Lumber, Timber and Piling," of the Standard Specifications and AWPA Use Category System: UC4A, Commodity Specification A or B.

10-1.__ FURNISH SIGN

Signs shall be fabricated and furnished in accordance with details shown on the plans, the Traffic Sign Specifications, and these special provisions.

Traffic Sign Specifications for California sign codes are available for review at:

http://www.dot.ca.gov/hq/traffops/signtech/signdel/specs.htm

Traffic Sign Specifications for signs referenced with Federal MUTCD sign codes can be found in Standard Highway Signs Book, administered by the Federal Highway Administration, which is available for review at:

http://mutcd.fhwa.dot.gov/ser-shs_millennium.htm

Information on cross-referencing California sign codes with the Federal MUTCD sign codes is available at:

http://www.dot.ca.gov/hq/traffops/signtech/signdel/specs.htm

Temporary or permanent signs shall be free from blemishes that may affect the serviceability and detract from the general sign color and appearance when viewing during daytime and nighttime from a distance of 25 feet. The face of each finished sign shall be uniform, flat, smooth, and free

of defects, scratches, wrinkles, gel, hard spots, streaks, extrusion marks, and air bubbles. The front, back, and edges of the sign panels shall be free of router chatter marks, burns, sharp edges, loose rivets, delaminated skins, excessive adhesive over spray and aluminum marks.

QUALITY CONTROL FOR SIGNS

The requirements of "Quality Control for Signs" in this section shall not apply to construction area signs.

No later than 14 days before sign fabrication, the Contractor shall submit a written copy of the quality control plan for signs to the Engineer for review. The Engineer will have 10 days to review the quality control plan. Sign fabrication shall not begin until the Engineer approves the Contractor's quality control plan in writing. The Contractor shall submit to the Engineer at least 3 copies of the approved quality control plan. The quality control plan shall include, but not be limited to the following requirements:

A. Identification of the party responsible for quality control of signs,
B. Basis of acceptance for incoming raw materials at the fabrication facility,
C. Type, method and frequency of quality control testing at the fabrication facility,
D. List (by manufacturer and product name) of process colors, protective overlay film, retroreflective sheeting and black non-reflective film,
E. Recommended cleaning procedure for each product, and
F. Method of packaging, transport and storage for signs.

No legend shall be installed at the project site. Legend shall include letters, numerals, tildes, bars, arrows, route shields, symbols, logos, borders, artwork, and miscellaneous characters. The style, font, size, and spacing of the legend shall conform to the Standard Alphabets published in the FHWA Standard Highway Signs Book. The legend shall be oriented in the same direction in accordance with the manufacturer's orientation marks found on the retroreflective sheeting.

On multiple panel signs, legend shall be placed across joints without affecting the size, shape, spacing, and appearance of the legend. Background and legend shall be wrapped around interior edges of formed panel signs as shown on plans to prevent delamination.

The following notation shall be placed on the lower right side of the back of each sign where the notation will not be blocked by the sign post or frame:

A. PROPERTY OF STATE OF CALIFORNIA,
B. Name of the sign manufacturer,
C. Month and year of fabrication,
D. Type of retroreflective sheeting, and
E. Manufacturer's identification and lot number of retroreflective sheeting.

The above notation shall be applied directly to the aluminum sign panels in 1/4-inch upper case letters and numerals by die-stamp and applied by similar method to the fiberglass reinforced plastic signs. Painting, screening, or engraving the notation will not be allowed. The notation shall be applied without damaging the finish of the sign.

Signs with a protective overlay film shall be marked with a dot of 3/8 inch in diameter. The dot placed on white border shall be black, while the dot placed on black border shall be white. The dot shall be placed on the lower border of the sign before application of the protective overlay

film and shall not be placed over the legend and bolt holes. The application method and exact location of the dot shall be determined by the manufacturer of the signs.
For sign panels that have a minor dimension of 48 inches or less, no splice will be allowed in the retroreflective sheet except for the splice produced during the manufacturing of the retroreflective sheeting. For sign panels that have a minor dimension greater than 48 inches, only one horizontal splice will be allowed in the retroreflective sheeting.
Unless specified by the manufacturer of the retroreflective sheeting, splices in retroreflective sheeting shall overlap by a minimum of one inch. Splices shall not be placed within 2 inches from edges of the panels. Except at the horizontal borders, the splices shall overlap in the direction from top to bottom of the sign to prevent moisture penetration. The retroreflective sheeting at the overlap shall not exhibit a color difference under the incident and reflected light. Signs exhibiting a significant color difference between daytime and nighttime shall be replaced immediately.
Repairing sign panels will not be allowed except when approved by the Engineer.
The Department will inspect signs at the Contractor's facility and delivery location, and in accordance with Section 6, "Control of Materials," of the State Standard Specifications. The Engineer will inspect signs for damage and defects before and after installation.
Regardless of kind, size, type, or whether delivered by the Contractor or by a common carrier, signs shall be protected by thorough wrapping, tarping, or other methods to ensure that signs are not damaged by weather conditions and during transit. Signs shall be dry during transit and shipped on palettes, in crates, or tier racks. Padding and protective materials shall be placed between signs as appropriate. Finished sign panels shall be transported and stored by method that protects the face of signs from damage. The Contractor shall replace wet, damaged, and defective signs.
Signs shall be stored in dry environment at all times. Signs shall not rest directly on the ground or become wet during storage. Signs, whether stored indoor or outdoor, shall be free standing. In areas of high heat and humidity, signs shall be stored in enclosed climate-controlled trailers or containers. Signs shall be stored indoor if duration of the storage will exceed 30 days.
Screen processed signs shall be protected, transported and stored as recommended by the manufacturer of the retroreflective sheeting.
When requested, the Contractor shall provide the Engineer test samples of signs and materials used at various stages of production. Sign samples shall be 12" x 12" in size with applied background, letter or numeral, and border strip.
The Contractor shall assume the costs and responsibilities resulting from the use of patented materials, equipment, devices, and processes for the Contractor's work.

SHEET ALUMINUM

Alloy and temper designations for sheet aluminum shall be in accordance with ASTM Designation: B 209.
The Contractor shall furnish the Engineer a Certificate of Compliance in conformance with Section 6-1.07, "Certificates of Compliance," of the State Standard Specifications for the sheet aluminum.
Sheet aluminum shall be pretreated in accordance to ASTM Designation: B 449. Surface of the sheet aluminum shall be cleaned, deoxidized, and coated with a light and tightly adherent chromate conversion coating free of powdery residue. The conversion coating shall be Class 2 with a weight between 10 milligrams per square foot and 35 milligrams per square foot, and an

average weight of 25 milligrams per square foot. Following the cleaning and coating process, the sheet aluminum shall be protected from exposure to grease, oils, dust, and contaminants. Sheet aluminum shall be free of buckles, warps, dents, cockles, burrs, and defects resulting from fabrication.
Base plate for standard route marker shall be die cut.

RETROREFLECTIVE SHEETING

The Contractor shall furnish retroreflective sheeting for sign background and legend in conformance with ASTM Designation: D 4956 and "Prequalified and Tested Signing and Delineation Materials" of these special provisions.
Retroreflective sheeting shall be applied to sign panels as recommended by the retroreflective sheeting manufacturer without stretching, tearing, and damage.
Class 1, 3, or 4 adhesive backing shall be used for Type II, III, IV, VII, VIII, and IX retroreflective sheeting. Class 2 adhesive backing may also be used for Type II retroreflective sheeting. The adhesive backing shall be pressure sensitive and fungus resistant.
When the color of the retroreflective sheeting determined from instrumental testing is in dispute, the Engineer's visual test will govern.

PROCESS COLOR AND FILM

The Contractor shall furnish and apply screened process color, non-reflective opaque black film, and protective overlay film of the type, kind, and product that are approved by the manufacturer of the retroreflective sheeting.
The Contractor shall furnish the Engineer a Certificate of Compliance in accordance to Section 6-1.07, "Certificates of Compliance," of the State Standard Specifications for the screened process color, non-reflective opaque black film, and protective overlay film.
The surface of the screened process color shall be flat and smooth. When the screened process colors determined from the instrumental testing in accordance to ASTM Designation: D 4956 are in dispute, the Engineer's visual test will govern.
The Contractor shall provide patterns, layouts, and set-ups necessary for the screened process.
The Contractor may use green, red, blue, and brown reverse-screened process colors for background and non-reflective opaque black film or black screened process color for legend.
The coefficient of retroreflection for reverse-screened process colors on white retroreflective sheeting shall not be less than 70 percent of the coefficient of retroreflection specified in ASTM Designation: D 4956.
The screened process colors and non-reflective opaque black film shall have the same outdoor weatherability as that of the retroreflective sheeting.
After curing, screened process colors shall withstand removal when tested by applying 3M Company Scotch Brand Cellophane Tape No. 600 or equivalent tape over the color and removing with one quick motion at 90° angle.

SINGLE SHEET ALUMINUM SIGN

Single sheet aluminum signs shall be fabricated and furnished with or without frame. The Contractor shall furnish the sheet aluminum in accordance to "Sheet Aluminum" of these special

provisions. Single sheet aluminum signs shall be fabricated from sheet aluminum alloy 6061-T6 or 5052-H38.

Single sheet aluminum signs shall not have a vertical splice in the sheet aluminum. For signs with depth greater than 48 inches, one horizontal splice will be allowed in the sheet aluminum. Framing for single sheet aluminum signs shall consist of aluminum channel or rectangular aluminum tubing. The framing shall have a length tolerance of ±1/8 inch. The face sheet shall be affixed to the frame with rivets of 3/16-inch diameter. Rivets shall be placed within the web of channels and shall not be placed less than 1/2 inch from edges of the sign panels. Rivets shall be made of aluminum alloy 5052 and shall be anodized or treated with conversion coating to prevent corrosion. The exposed portion of rivets on the face of signs shall be the same color as the background or legend where the rivets are placed.

Finished signs shall be flat within a tolerance of ±1/32 inch per linear foot when measured across the plane of the sign in all directions. The finished signs shall have an overall tolerance within ±1/8 inch of the detailed dimensions.

Aluminum channels or rectangular aluminum tubings shall be welded together with the inert gas shielded-arc welding process using E4043 aluminum electrode filler wires as shown on the plans. Width of the filler shall be equal to wall thickness of smallest welded channel or tubing.

MEASUREMENT AND PAYMENT

Furnishing signs (except for construction area signs) will be measured by the square foot to the nearest 1.0 ft^2, of the sign panel types installed in place.

Installation of the sign panels will be measured and paid for as per sections 56-2.05, "Measurement," and 56-2.06, "Payment," of the Standard Specifications except all references to State-Furnished materials is deleted.

10-1.__ ALTERNATIVE PIPE

Alternative pipe culverts shall conform to the provisions in Section 62, "Alternative Culverts," of the Standard Specifications and these special provisions.

10-1.__ PLASTIC PIPE

Plastic pipe shall conform to the provisions in Section 64, "Plastic Pipe," of the Standard Specifications and these special provisions.

10-1.__ CORRUGATED METAL PIPE

Corrugated steel pipe culverts shall conform to the provisions in Section 66, "Corrugated Metal Pipe," of the Standard Specifications and these special provisions.

Asphaltic mastic coating or polymeric sheet coating shall be placed on the outside and inside surfaces of the pipe.

Corrugated steel pipe shall be fabricated from zinc-coated steel sheet.

10-1.__ TYPE BW FENCE

Type BW fence shall conform to the provisions in Section 80, "Fences," of the Standard Specifications and these special provisions.
The fence material shall be fastened to metal posts. Metal posts shall be galvanized.

10-1.__ PAINT TRAFFIC STRIPE AND PAVEMENT MARKING

Painted traffic stripes (traffic lines) and pavement markings shall be applied in conformance with the provisions in Section 84, "Traffic Stripes and Pavement Markings," of the State Standard Specifications and these special provisions.
Traffic stripe and pavement marking paint shall conform to the requirements in State Specification No. PTWB-01.
The color of the painted traffic stripes and pavement markings shall conform to the requirements in ASTM Designation: D 6628-01.
Retroreflectivity of the paint traffic stripes and pavement markings shall conform to the requirements in ASTM Designation: D 6359-99. White painted traffic stripes and pavement markings shall have a minimum initial retroreflectivity of 250 mcd m^{-2} lx^{-1}. Yellow painted traffic stripes and pavement markings shall have a minimum initial retroreflectivity of 150 mcd m^{-2} lx^{-1}.
At the option of the Contractor, permanent traffic striping and pavement marking tape conforming to the provisions in "Prequalified and Tested Signing and Delineation Materials" of these special provisions may be placed instead of painted traffic stripes and pavement markings. Permanent tape, if used, shall be placed in conformance with the manufacturer's specifications.
If permanent tape is placed instead of painted traffic stripes and pavement markings, the tape will be measured and paid for by the linear foot as paint traffic stripe and by the square foot as paint pavement marking of the number of coats designated in the Engineer's Estimate.
Where striping joins existing striping, as shown on the plans, the Contractor shall begin and end the transition from the existing striping pattern into or from the new striping pattern a sufficient distance to ensure continuity of the striping pattern.

10-1.__ PAVEMENT MARKERS

Pavement markers shall be placed in conformance with the provisions in Section 85, "Pavement Markers," of the State Standard Specifications and these special provisions.

Testing of adhesive bond strength will be performed on sandblasted concrete brick surface in conformance with the requirements in California Test 669 and these special provisions. The concrete brick surface will be sandblasted in conformance with the requirements in California Test 423. The test plugs of 2-inch diameter will be conditioned at 221° F for a minimum of 2 hours before bonding to the sandblasted concrete surface. The adhesive sample will be heated to the application temperature as recommended by the manufacturer and a sample of 3 inch diameter in area will be poured onto the sandblasted concrete surface. The heated plug will immediately be pressed onto the puddle of hot adhesive to squeeze out excess adhesive. The excess adhesive extruding from under the plug will be removed. The assembly will be allowed to cure for 24 hours at 73° F ± 3.6° F and then be tested to bond failure at a crosshead speed of 2 inches per minute. The reported peak load and the bond strength value will be the average of

3 tests, respectively. The same bond strength test will be performed on retroreflective pavement markers. Instead of placing the heated adhesive sample on the sandblasted concrete surface, it will be placed on the bottom of the pavement markers.

Minimum bond strength to the sandblasted concrete brick surface shall be 100 psi and minimum bond strength to retroreflective pavement markers shall be 119 psi.

Adhesive placed in pavement recesses shall be applied as recommended by the manufacturer.

Retroreflective pavement markers placed in pavement recesses will be measured and paid for as pavement marker (retroreflective-recessed).

Standard Plans List

The Standard Plan sheets applicable to this contract include, but are not limited to those indicated below. Applicable Revised Standard Plans (RSP) and New Standard Plans (NSP) indicated below are included in the project plans as individual Standard Plan sheets.

ACRONYMS, ABBREVIATIONS AND SYMBOLS

A10A	Acronyms and Abbreviations (Sheet 1 of 2)
A10B	Acronyms and Abbreviations (Sheet 2 of 2)
A10C	Symbols (Sheet 1 of 2)
A10D	Symbols (Sheet 2 of 2)

PAVEMENT MARKERS, TRAFFIC LINES, AND PAVEMENT MARKINGS

A20A	Pavement Markers and Traffic Lines, Typical Details
A20B	Pavement Markers and Traffic Lines, Typical Details
A20C	Pavement Markers and Traffic Lines, Typical Details
A20D	Pavement Markers and Traffic Lines, Typical Details
A24A	Pavement Markings – Arrows
A24B	Pavement Markings – Arrows

RUMBLE STRIP

A40A	Shoulder Rumble Strip Details – Rolled-In Indentations

EXCAVATION AND BACKFILL

A62A	Excavation and Backfill – Miscellaneous Details
A73C	Delineators, Channelizers and Barricades

CRASH CUSHIONS

A81A	Crash Cushion, Sand Filled (Unidirectional)

TEMPORARY CRASH CUSHIONS, RAILING AND TRAFFIC SCREEN

T1A	Temporary Crash Cushion, Sand Filled (Unidirectional)
T1B	Temporary Crash Cushion, Sand Filled (Bidirectional)

T2	Temporary Crash Cushion, Sand Filled (Shoulder Installations)
T3	Temporary Railing (Type K)

ROADSIDE SIGNS

RS1	Roadside Signs, Typical Installation Details No. 1
RS2	Roadside Signs – Wood Post, Typical Installation Details No. 2
RS4	Roadside Signs, Typical Installation Details No. 4

SECTION 02202 - WATER FOR DUST ABATEMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Water for Dust Abatement:

1. Measurement: Volume of water applied for dust abatement as directed by the COR.
    a. Only water used for dust abatement as directed by the COR will be included.
    b. Quantity will be measured in tanks or tank trucks of predetermined capacity or by means of water meters.
    c. Types of water meters used for measuring water for dust abatement subject to COR's approval.
2. Payment: M (1,000) gallons price offered in the schedule.

PART 2 PRODUCTS

2.01 WATER FOR DUST ABATEMENT

A. In accordance with Section 01510 – Temporary Utilities.

PART 3 EXECUTION

3.01 APPLYING WATER FOR DUST ABATEMENT

A. Provide water in accordance with Section 01510 - Temporary Utilities.

B. Provide means of conveying water to point of use and applying water.

C. Use pressure spray or distributor bar to apply water evenly.

D. Apply water as directed by COR.

END OF SECTION

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SECTION 02226 – REMOVING EXISTING WELL PROTECTIVE PIPES AND GROUTING STANDPIPES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Removing Existing 18-Inch Diameter Steel Well Protective Pipes up to 250 Foot Depth and Grouting Standpipes:

1. Measurement: Number of existing 18-inch diameter steel wells removed and grouted.

2. Payment: Well price offered in the schedule.

   a. Includes field locating existing wells, removing existing protective pipes and standpipes or manhole covers above excavated ground surface and grouting each standpipe below excavated ground surface and compacting earth materials to final grade.

B. Removing Existing 2- to 2.5-Inch Diameter PVC Well Protective Pipes up to 50 Foot Depth and Grouting Standpipes:

1. Measurement: Number of existing 2- to 2.5-inch diameter PVC wells removed and grouted.

2. Payment: Well price offered in the schedule.

   a. Includes field locating existing wells, removing existing protective pipes and standpipes or manhole covers above excavated ground surface and grouting each standpipe below excavated ground surface and compacting earth materials to final grade.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM C 33-07	Concrete Aggregates
2.	ASTM C 150-07	Portland Cement
3.	ASTM C 1602/C 1602M-06	Mixing Water Used in the Production of Hydraulic Cement Concrete

1.03 SITE CONDITIONS

A. All known explorations conducted by Reclamation and recently surveyed locations of explorations by others are shown on the drawings. A tabulation of those explorations that potentially will be found within the excavation footprint of the Inlet Canal, Inlet/Outlet Structure, Storage Reservoir and Siphon alignment are shown on the

drawings. Any open exploration drill hole encountered in excavation for work in these specifications will require abandonment as outlined below in the article Grouting and Removal.

PART 2 PRODUCTS

2.01 GROUT MATERIALS

A. Portland cement:

1. ASTM C 150, Type V.
2. Meet equivalent alkalies requirements of ASTM C 150 – Table 2.
3. Meet false-set requirements of ASTM C 150 – Table 4.

B. Water:

1. ASTM C 1602, including optional requirement of Table 2.

C. Bentonite:

1. Type Volclay SPV 200 powdered sodium bentonite manufactured by American Colloid Company, 1500 West Shure Drive, Arlington Heights IL 60004; or equal having the following essential characteristics:
   a. Minimum purity of 90 percent montmorillonite clay.
   b. Moisture content not more than 12 percent as packaged.
   c. Minimum 65 percent dry particle size finer than US Standard No. 200 sieve.
   d. Minimum dry bulk density: 55 pounds per cubic foot.
   e. Specific gravity: 2.5.

2.02 GROUT MIX

A. Neat cement containing 4 pounds of powered bentonite and approximately 7.5 gallons of water added per 94-pound bag of cement.

PART 3 EXECUTION

3.01 PREPARATION

A. Field verify locations and physical features including the depths and material compositions of the wells tabulated on the drawings, prior to grouting.

3.02 GROUTING AND REMOVAL

A. Do not proceed with grouting and removal of any well until approved by the COR.

B. Existing water, site characterization and observation wells that are targeted for grouting and removal are shown on the drawings. However other wells may exist that are not included in the tabulation, and those shall be grouted and removed if they are within any excavation for this project. Work and materials for other existing wells not included in the tabulation shall be in accordance with the clause at FAR 52.243-5 "Changes and Changed Conditions."

C. Remove existing pumps or instrumentation from protective pipes if encountered, and grout each standpipe before beginning foundation excavation.

D. Pump grout by tremie, pumping grout mix from designated bottom of hole up in one continuous operation.

E. Grout to two-foot below final excavated grade or as otherwise directed by COR.

F. Remove existing well pipe in accordance with following:

1. Remove protective covers on wells to two-feet below final excavation grade.
2. Remove existing steel or plastic protective pipes, and plastic well standpipes to top of grout at two-feet below final excavation grade.
3. Replace the upper two-feet of earth materials in accordance with Section 02319 – Reservoir Earthwork, to ensure that no settlement will occur over the removed well.

3.03 DISPOSAL

A. Dispose of removed materials in accordance with Section 01740 – Cleaning.

END OF SECTION

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SECTION 02227 – REMOVING EXISTING ROADWAY PAVEMENT AND BASE COURSE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Removing Existing Roadway Pavement and Base Course:

1. Payment: Lump sum price offered in the schedule.

   a. Includes removing existing roadway pavement and base course of Evan Hewes Highway for steel pipe crossing.

   b. Includes removing existing roadway pavement and base course for Drop 2 power plant access road at the outlet canal crossing.

   c. Does not include removing existing roadway and base course for Evan Hewes Highway for Interstate 8 Highway detour. Refer to Section 02052 – Interstate 8 Highway Work.

1.02 REFERENCES

A. State of California Department of Transportation (CALTRANS)

1.	CALTRANS SS	Standard Specifications, State of California, Business, Transportation, and Housing Agency, Department of Transportation, May 2006

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 PREPARATION

A. Verify with COR the portions of roadway pavement and base course that require removal.

1. In area of Evan Hewes Highway requiring removal for steel pipe crossing.

2. In area of Drop 2 Powerplant Access Road outlet canal crossing requiring removal.

3.02 PROTECTION

A. Protect existing roadway pavements and base courses that are to remain in place.

B. Repair damage to existing roadway pavements and base courses that are to remain at the Contractor's expense and to the satisfaction of the COR.

3.03 REMOVAL

A. Remove existing roadway pavements and base course at locations and to limits shown on drawings or as directed by the COR.

B. Saw cut existing asphaltic concrete pavement perpendicular to centerline of pavement and form straight vertical edges free from surface irregularities where new construction will join existing pavement in accordance with CALTRANS SS Section 40.

C. Remove existing roadway pavements and base courses down to subgrade.

D. Excavate base courses.

E. Removed existing roadway pavements and base courses may be stockpiled and reused for permanent roadway pavement or base course subject to approval of COR. If reused, mill with approved machine removed existing roadway pavements or base courses to meet specification requirements.

3.04 DISPOSAL

A. Dispose of removed materials not stockpiled and reused for permanent roadway pavement or base course from work site in accordance with Section 01740 – Cleaning.

3.05 OBLITERATION

A. Fill depressions and grade to blend surfaces not covered by new construction with surrounding landscape contours.

END OF SECTION

SECTION 02232 - CLEARING AND GRUBBING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Clearing and Grubbing:

1. Measurement: Area cleared measured on sloping surface.
2. Payment: Acre price offered in the schedule.
    a. Includes costs of disposing of cleared material.

1.02 DEFINITIONS

A. Vegetation: Trees, shrubs, brush, stumps, exposed roots, down timber, branches, grass, and weeds.

1.03 PROJECT CONDITIONS

A. Area where clearing and grubbing are primarily anticipated to be performed is the canal alignment.

B. The tree line along the south section line of the Brock Site which is parallel to Evan Hewes Highway will be cleared and grubbed by others.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CLEARING

A. Clear all areas to be occupied by permanent construction, rights-of-way required for access to the work, and surfaces of stockpile sites and wastepile sites.

B. Clear adjacent to cut or fill sections to a minimum distance of 3 feet outside of slope lines.

C. Remove vegetation, rubbish, and objectionable material as determined by the COR.

D. Preserve and protect vegetation designated for preservation within clearing limits and vegetation outside clearing limits in accordance with Section 01569 - Tree and Plant Protection.

3.02 GRUBBING

A. Grub ground surfaces to be under embankment and surfaces of excavation to be used for embankment.

B. Remove stumps, roots, and vegetative matter.

C. Perform grubbing in advance of grading operations.

3.03 DISPOSAL OF CLEARED MATERIAL

A. Nonvegetative material: Dispose of as noncombustible material in accordance with Section 01740 - Cleaning.

B. Vegetative materials: Remove from jobsite.

1. Removing from jobsite: Dispose of as combustible material in accordance with Section 01740 - Cleaning.

END OF SECTION

SECTION 02236 - STRIPPING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Stripping:

1. Measurement: Area stripped to lateral dimensions as specified or directed by the COR.

2. Payment: Square yard price offered in the schedule.

   a. Includes stockpiling, loading, hauling, and spreading of topsoil obtained by stripping on embankment slopes, filling of borrow sites, and disposal on project site as directed by COR.

   b. Includes stripping of borrow areas as approved by COR.

1.02 PROJECT CONDITIONS

A. The reservoir site was used for farming operations. Buildings have been removed. Clearing of trees and brush has been completed. Existing vegetation consists of grasses and weeds.

B. Vegetation along canal alignment consists of native plants.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 STRIPPING

A. Strip topsoil from areas to be excavated.

B. Strip topsoil from areas to be under embankments.

C. Strip topsoil from areas adjacent to pipe trench excavation and canal excavation that will be used for spoil pile.

D. Remove topsoil to a depth of 6 inches and to additional depths where directed by COR. If a true topsoil structure does not exist, consider the top 6 inches of surface soils removed to be topsoil for the purpose of these specifications.

3.02 USE OF TOPSOIL

A. Do not use topsoil removed by stripping for backfill or constructing embankments, except as required below.

B. Transport and place topsoil to form the upper 6 inches of embankment slopes.

C. Transport and place topsoil in borrow pits to the level of the surrounding ground surface.

D. Spread remaining topsoil over disposal areas and disturbed construction areas as directed by the COR.

3.03 STOCKPILE

A. Transport and stockpile topsoil as necessary prior to final hauling and placing as approved by COR.

B. Locate stockpiles in Contractor use areas or as otherwise approved by COR.

C. Do not compact topsoil in stockpile.

D. Protect stockpile from contamination and erosion.

END OF SECTION

SECTION 02242 – REMOVAL OF WATER

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Removal of Water for Coachella Canal Modification:

1. Payment: Lump sum price offered in the schedule.

   a. Includes costs of furnishing labor, equipment, and materials for maintaining the work free from water and other work required by this section.

2. Payment Allocation:

   a. In the plan for removal of water for Coachella Canal Modification, allocate the total lump sum price to not less than 3 major divisions of work to be performed for removal of water.

   b. Outline each major division of work and identify by title.

   c. Allocation of the lump-sum price is subject to approval of the Contracting Officer.

   d. In preparing monthly estimates for progress payments, consideration will be given to the percentage of each major division of work performed during that month.

B. Removal of Water for Steel Pipe and Outlet Canal Construction:

1. Payment: Lump sum price offered in the schedule.

   a. Includes costs of furnishing labor, equipment, and materials for maintaining the work free from water and other work required by this section.

2. Payment Allocation:

   a. In the plan for removal of water for steel pipe and outlet canal construction, allocate the total lump sum price to not less than 3 major divisions of work to be performed for removal of water.

   b. Outline each major division of work and identify by title.

   c. Allocation of the lump-sum price is subject to approval of the Contracting Officer.

   d. In preparing monthly estimates for progress payments, consideration will be given to the percentage of each major division of work performed during that month.

1.02 DEFINITIONS

A. Unwatering: Removal and control of ponded or flowing surface water, including surface seepage and precipitation, from within and adjacent to excavations.

B. Dewatering: Removal and control of groundwater from pores or other open spaces in soil or rock formations to allow construction activities to proceed as intended, and includes relief of groundwater pressure.

1.03 SYSTEM DESCRIPTION

A. Design, furnish, install, maintain, operate, monitor, and remove facilities required for removal of water during required excavations and construction of facilities.

B. Dewatering and unwatering operations are dependent on the construction methods used and the sequence of excavation and construction operations used for work completion.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 02242-1, Removal of water plan for Coachella Canal modification:

1. Show proposed methods and equipment to be used for achieving and maintaining construction areas in a dewatered and hydrostatically relieved condition for excavations and foundation activities to occur. Show proposed methods and equipment to be used for unwatering excavations and foundation activities. Include:

    a. Experience for dewatering and unwatering systems designer, installer, and operator. Include brief descriptions for each of at least two previous successful projects of complexity comparable to that required for this contract.

    b. Layout, description, and materials of dewatering system equipment and materials and unwatering equipment and materials.

    c. Dewatering and unwatering methods and equipment.

    d. Locations, depths, layout, and sizes for well points, deep wells, monitoring wells, discharge headers and disposal lines, disposal areas and facilities, sumps, drains, ditches, and other dewatering and unwatering system features.

    e. Types, sizes, quantities, capacities, and other identifying characteristics for pumps, prime movers, standby equipment, power systems, well screens, filter materials, monitoring equipment, and other dewatering and unwatering system components.

f. Methods and procedures for installation (include sterilization if required by State or local statute), testing, operation, maintenance, monitoring, and removal of dewatering systems. Include personnel list, schedules, drilling methods, well development techniques, interruption prevention and correction, system supplementation or revision, and other operations related to dewatering.

g. Design calculations and supporting data upon which each dewatering and unwatering system to be used is based. Include a description and profile of the geology, soil, groundwater conditions, and other pertinent characteristics used in the design calculations at each site.

h. Plan, procedure, location, and details for disposal of flows from dewatering and unwatering systems.

i. Compliance with Water Pollution Control discharge permits.

j. Final removal methods upon completion.

2. Plan shall be prepared by a registered professional engineer.

3. Design drawings, calculations, data, and other documents shall be stamped by the registered professional engineer.

4. For payment purposes, prepare the plan with not less than 3 major divisions.

5. The plan may be placed in operation upon approval, but nothing in this paragraph shall relieve the Contractor from full responsibility for the adequacy of the water control installation.

C. RSN 02242-2, Removal of water plan for steel pipe and outlet canal construction:

1. Show proposed methods and equipment to be used for achieving and maintaining construction areas in a dewatered and hydrostatically relieved condition for excavations and foundation activities to occur. Show proposed methods and equipment to be used for unwatering excavations and foundation activities. Include:

a. Experience for dewatering and unwatering systems designer, installer, and operator. Include brief descriptions for each of at least two previous successful projects of complexity comparable to that required for this contract.

b. Layout, description, and materials of dewatering system equipment and materials and unwatering equipment and materials.

c. Dewatering and unwatering methods and equipment.

d. Locations, depths, layout, and sizes for well points, deep wells, monitoring wells, discharge headers and disposal lines, disposal areas and facilities, sumps, drains, ditches, and other dewatering and unwatering system features.

e. Types, sizes, quantities, capacities, and other identifying characteristics for pumps, prime movers, standby equipment, power systems, well screens, filter materials, monitoring equipment, and other dewatering and unwatering system components.

f. Methods and procedures for installation (include sterilization if required by State or local statute), testing, operation, maintenance, monitoring, and removal of dewatering systems. Include personnel list, schedules, drilling methods, well development techniques, interruption prevention and correction, system supplementation or revision, and other operations related to dewatering.

g. Design calculations and supporting data upon which each dewatering and unwatering system to be used is based. Include a description and profile of the geology, soil, groundwater conditions, and other pertinent characteristics used in the design calculations at each site.

h. Plan, procedure, location, and details for disposal of flows from dewatering and unwatering systems.

i. Compliance with Water Pollution Control discharge permits.

j. Final removal methods upon completion.

2. Plan shall be prepared by registered professional engineer.

3. Design drawings, calculations, data, and other documents shall be stamped by the registered professional engineer.

4. For payment purposes, prepare the plan with not less than three major divisions.

5. The plan may be placed in operation upon approval, but nothing in this paragraph shall relieve the Contractor from full responsibility for the adequacy of the water control installation.

D. RSN 02242-3, Installation Data.

1. A complete set of “As-built” drawings showing locations, depths, screen lengths, screen sizes, filter pack quantities, and geologic data for all installed wells, well points, and monitoring wells for each area.

E. RSN 02242-4, Records:

1. Water level readings taken from each monitoring system within each area.

2. Discharge monitoring records required by permits.

1.05 QUALIFICATIONS

A. Dewatering and unwatering systems shall be designed by a registered professional engineer with a minimum of 10 years of experience in the design, installation, and

operation of dewatering systems of complexity comparable to that required for this contract.

B. Installation and operation of dewatering and unwatering system shall be under direct supervision of qualified personnel with a minimum of 5 years of experience in installation and operation of dewatering systems of complexity comparable to that required for this contract.

1.06 PROJECT CONDITIONS

A. Refer to Section 00321 – Geologic Investigations and Section 00322 – Records of Geologic and Subsurface Investigations for groundwater conditions.

B. Actual groundwater conditions may be different from those indicated in the data provided and listed in Section 00322 – Records of Geologic and Subsurface Investigations. The Contractor shall be prepared for differences between actual conditions and that presented in provided data. The Contractor is responsible to design and operate unwatering and dewatering facilities to complete the work.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL

A. Provide, maintain, and operate necessary equipment for control of water from various parts of the work and for maintaining foundations and other parts of the work free from water as required for constructing each part.

B. Logs of borings and other soil and water-level data are included in Section 00322 – Records of Geologic Subsurface Investigations. The Contractor shall gather any additional data necessary to properly design the dewatering and unwatering systems, at no additional cost to the Government.

3.02 DEWATERING

A. Accomplish dewatering by use of sufficient number of properly screened dewatering wells, vacuum well point systems, or other equivalent methods. Wells and wellpoints shall be installed with suitable screens and filters so that continuous pumping of fines does not occur.

B. Maintain construction area in a dewatered and hydrostatically relieved condition until receipt of a written directive from the COR to cease pumping operations or portions thereof.

C. Control of groundwater shall be accomplished in a manner that will preserve the strength of the foundation soils, will not cause instability of the excavation slopes, and will not result in damage to existing structures. Where necessary to these purposes, the water level shall be lowered in advance of excavation, utilizing wells, wellpoints, or similar methods. The water level below excavations shall be maintained a minimum of 5 feet below the deepest excavation level.

D. Reliability:

1. Design system for continuous operation.
2. Make provisions to prevent interruptions due to power outages, mechanical failure, or other reasons.
3. Provide for a backup power supply to minimize downtime due to power failure.
4. Provide one complete spare pumping unit for each five pumps used, with no less than one standby pumping unit provided at all times.

E. Design Requirements:

1. Retain 95 percent or more of native materials on well screens.
2. If a filter pack is used:
    a. Pack thickness, minimum: 3 inches.
    b. Completely surround the screened interval.
    c. Designed to retain 95 percent or more of the native materials.

F. Installation and operation:

1. Install and operate dewatering system in accordance with approved plan.
2. Keep construction areas in a dewatered and hydrostatically relieved condition until acceptance of all work within each respective construction area.

G. Water depth:

1. Operate dewatering system to maintain groundwater at least 5 feet below the bottom of all pipe trenches, canal lining operations, and excavations for structures.
2. Maintain this water level until the existing earth plug has been removed in accordance with Section 02322 – Excavation of Existing Earth Plug.

H. Maintenance:

1. Include 24-hour pump watch by personnel skilled in the operation, maintenance, and repair and replacement of system components with supervision available.

I. Monitoring:

1. Install monitoring wells as necessary at locations and to such depths as required to ensure compliance with specifications requirements.
2. Design and install monitoring wells to provide accurate measurements of water levels and pressures.
3. Monitor system performance and adequacy by taking water level readings at least daily, or as directed otherwise by COR.
4. Record and submit water level readings and discharge quantities.
5. Should monitoring by the Contractor, or other conditions disclose inadequate dewatering system performance, the Contractor shall supplement, revise, or change the system as required to comply with specifications requirements.

J. Discharge:

1. Discharge flows from dewatering systems in accordance with approved plan and meeting requirements of Section 01563 – Water Pollution Control.

3.03 UNWATERING

A. Provide and operate equipment to unwater excavations as needed to allow for construction activities.

B. Provide pumping equipment, discharge lines, sand bags, and other equipment necessary to control seepage and prevent accumulation of surface water that will interfere with construction, damage in-place work or excavated surfaces.

C. Open pumping with sumps and ditches, if results in boils, loss of fines, softening of the ground, or instability of slopes, will not be permitted. The discharge shall be arranged to facilitate collection of samples by the COR.

D. Locate unwatering equipment and facilities to maximize water removal and minimize construction interference.

E. Equipment includes, but is not limited to, motor driven pumps, engine-driven pumps or both with adequate lift capacity, supplemental pumping capacity, discharge piping, hoses and pipelines, valves, intakes, and flow-measuring devices.

F. Locate ditches, sumps, or settling ponds required to collect and control seepage and runoff as approved by COR.

G. Filter or position pump intakes to minimize sediment pumping.

H. Make precautions to operate all unwatering equipment during freezing weather conditions.

I. Surface runoff may discharge into excavations in quantities and at locations which cannot be precisely predicted. Divert or collect these discharges and pump to acceptable discharge points.

J. Meet requirements of Section 01563 – Water Pollution Control for discharges from unwatering facilities.

3.04 REMOVAL

A. Remove equipment following ending of operations.

B. Remove equipment from the site, including standby and spare equipment and temporary electrical supply.

C. Fill and seal wells, which include deep wells, well-point wells, monitoring wells, and spare wells, in accordance with State well abandonment regulations and the following:

1. Attempt to pull and remove the entire casing-screen string and allow the filter material to collapse into the hole.
2. Fill abandoned wells, well points, monitoring wells, and spare wells by tremieing clean sand or other approved material from the bottom up to the top of the hole.
3. If entire casing-screen string cannot be removed, attempt to pull and remove the casing by separating it from the screen at the disconnect joint. If this cannot be done, abandon the entire casing-screen string in the hole, except as required below. Seal and fill wells as required above.
4. Cut off casing remaining in the hole not less than 3 feet below ground surface. Backfill and compact hole with clean sand or other approved material.
5. Remove drain pipes associated with sumps or other dewatering activities. If drain pipes can not be removed, backfill and abandon them in accordance with requirements above.
6. Backfill and compact with native materials sumps, trenches, and holes.

3.05 REPAIRS

A. Repair or replace damage to the work resulting from negligence, inadequate performance, or mechanical or electrical failure of dewatering or unwatering system components.

1. Damages to the work include work in place and excavation.
2. Damages may be due to, but are not limited to, bottom heave or flotation.

B. Remove and replace damaged materials as approved by COR.

END OF SECTION

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SECTION 02261 - DIVERSION AND CARE OF COACHELLA CANAL DURING CONSTRUCTION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Diversion and Care of Coachella Canal During Coachella Canal Flume and Transition Construction:

1. Payment: Lump-sum price offered in the schedule.

a. Includes:

1) Constructing and maintaining cofferdams, temporary bypass channel, drains, sumps, and other temporary diversion and protective works for purposes of constructing Coachella Canal Flume and Transition Structure.

2) At the Contractor's option, removing existing slide gate at Coachella Turnout Structure.

3) Removing existing portion of abandoned turnout delivery pipe, toe drains, and concrete wells at existing Coachella Canal turnout structure as shown on drawings.

4) Abandoning remaining existing turnout pipe in place and installing permanent concrete plug at each end of the pipe.

5) Constructing temporary bypass channel which is designed to be capable of conveying flows ranging from 200 cfs to 550 cfs being released from existing Coachella Canal turnout structure during low flow period.

6) Performing required earthwork for constructing diversion channel as shown on drawings.

7) Placing rock in temporary bypass channel.

8) Placing gravel in temporary bypass channel.

9) Installing and removing concrete blocks in parshall flume.

10) Removing or leveling such works, where required.

11) Disposing of all temporary canal bypass materials.

12) Maintaining Coachella Valley Water District operation and maintenance access to existing Coachella Canal west operation and maintenance road.

13) Maintaining public access to recreational area access over existing turnout structure.

14) Coordinating all diversion work with COR and others.

15) Making required closures.

16) Other work required by this section.

b. Does not include removal of water. Refer to Section 02242 – Removal of Water.

c. Does not include sheet pile walls. Refer to Section 02460 – Sheet Pile Wall.

d. Monthly progress payments will be based on approved cost allocations to the major work divisions and the percentage of each major division of work performed.

1.02 REFERENCES

A. Geosynthetics Institute (GSI) – Geosynthetic Research Institute (GRI)

1. GRI GM 18 Test Methods, Properties and Testing Frequency for Flexible Polypropylene (fPP and fPP-R) Nonreinforced and Reinforced Geomembranes

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 02261-1, Coachella Canal water control plan:

1. Describe proposed method for diversion and care of Coachella Canal during construction and measures to be taken to meet permit requirements and water quality standards required in Section 01563 - Water Pollution Control.

2. Include plans for cofferdam and flume designs.

3. Include detailed sequence for the diversion of flows from existing Coachella Canal Turnout Structure and Coachella Canal; to temporary diversions of bypass canal channel; to complete construction of Coachella Canal Turnout Flume and Transition Modification.

4. Include delivery dates for Coachella Canal Turnout Combined Flume Modification stoplogs.

5. Include means and methods for meeting requirements of Coachella Valley Water District water deliveries.

6. The water control plan shall contain not more than three major divisions of work for diversion and care of Coachella Canal during construction.

a. Outline and identify each major division by title.

b. Allocate a proportionate part of the lump-sum price to each major division of work of the water control and diversion plan. The price allocation is subject to the COR's approval.

7. Plan shall be prepared by a registered professional engineer.

C. RSN 02261-2, Concrete Plug plan:

1. Plan for abandoning existing concrete pipe and plugging existing concrete pipe at both ends.

a. Include methods, materials and equipment.

1.04 DESIGN REQUIREMENTS

A. Design cofferdams to be constructed in Coachella Canal for diverting flows in accordance with the following and as shown on drawings.

1. Minimum cofferdam crest elevation: El. 156 given bypass channel dimensions shown on drawings.

2. Maintain construction areas in dry conditions.

1.05 SITE CONDITIONS

A. The Government assumes no responsibility for deductions, interpretations, or conclusions made by the Contractor based on information made available by the Government, in accordance with the clause at FAR 52.236-3 "Site Investigations and Conditions Affecting the Work."

B. The Contractor is responsible for making the Contractor’s own interpretations and investigations of site conditions.

C. Do not interrupt Coachella Canal flows at anytime except as approved by the COR.

D. Maintain access for Coachella Valley Water District to existing Coachella Canal operations and maintenance roads. Refer to Section 01313 – Coordination Of Work With Other Agencies.

1.06 SEQUENCING

A. The diversion of Coachella Canal flows through the temporary bypass channel shall occur between December 1 and February 28, 2009. The Contractor is advised that normal Coachella Valley Water District water releases from the Coachella Canal Turnout Structure between March 1 and November 30 of each year exceed the design capacity of the temporary bypass channel.

B. The diversion of Coachella Canal flows is to be constructed in stages. A proposed sequence for the staged construction for diversion of Coachella Canal flows has been prepared by the Government and is included in drawings.

C. If the Contractor's schedule for diversion work extends beyond February 28 of any year, the Contractor is responsible for a diversion channel design to meet Coachella Valley Water District additional flows above 550 cfs.

PART 2 PRODUCTS

2.01 GEOMEMBRANE

A. Exposed geomembrane for temporary bypass channel: 45-mil reinforced flexible polypropylene (fPP-R) conforming to requirements of GRI GM-18.

2.02 CONCRETE BLOCKS

A. Precast concrete block, plain face, full flat top as manufactured by Ultrablock, 815 NE 172nd Avenue, Vancouver, WA 98685, 800-377-3877, 360-694-0141, http://www.ultrablock.com; or equal having the following essential characteristics:

1. Manufactured with concrete meeting requirements of Section 03300 – Cast-In-Place Concrete.
    a. Recycled concrete not allowed.
2. Dimensions: 2-1/2 feet wide by 2-1/2 feet high by 5 feet long.
3. Weight, minimum, of each block: 4,300 pounds.
4. Standard No. 7 strand steel loop attached to top center of each block for lifting.

2.03 METALWORK

A. Galvanized steel angles in accordance with Section 05500 – Metal Fabrications.

2.04 EXPANSION ANCHORS

A. In accordance with Section 05500 – Metal Fabrications.

2.05 ROCK

A. In accordance with Section 02332 – Rockfill with the following exceptions:

1. Particle size:
    a. Minimum: 6 inches.
    b. Maximum: 12 inches.

B. Obtain from Government furnished stockpile in accordance with Section 01640 – Government Furnished Materials.

2.06 GRAVEL

A. In accordance with Section 02722 – Aggregate Base Course.

2.07 BYPASS CHANNEL REFILL

A. Stockpiled material from excavated bypass channel.

PART 3 EXECUTION

3.01 DIVERSION

A. Required Coachella Canal diversion to be constructed and available for diverting flows from December 1 through February 28 only.

B. When required, divert the flow of Coachella Canal around the construction area subject to the following:

1. Perform traffic control in accordance with Section 01555 – Traffic Control.
2. Install temporary security fencing in accordance with 01566 – Temporary Safety Fence.
3. Clear and grub diversion channel area to be excavated in accordance with Section 02232 – Clearing and Grubbing.
4. Strip temporary bypass channel area to be excavated in accordance with Section 02236 – Stripping.
5. Construct temporary bypass channel in accordance with drawings or approved alternate plan.
6. Protect sensitive vegetation in accordance with Section 01569 – Tree and Plant Protection.
7. Stockpile excavated materials separately from stockpiled topsoil at approved stockpile locations.

C. Construct and maintain cofferdams and temporary bypass channel in accordance with approved plan.

1. Line flumes with exposed geomembrane.

D. Construct and maintain other temporary diversion and protective works necessary for diversion and care of Coachella Canal with minimum flow of 550 cfs during construction, including, but not limited to, cofferdams, channels, temporary bypass channel, drains, and sumps.

E. Place Government furnished rock materials in temporary bypass channel as shown on drawings. Control drop height and placement technique so as to not damage geomembrane.

F. Furnish and place gravel in temporary bypass channel as shown on drawings.

G. Furnish and install concrete blocks in parshall flume.

H. Abandon existing concrete pipe and plug concrete pipe in accordance with approved plan.

I. For the purpose of diversion, the Contractor may provide an alternate design and plan for COR review and approval provided work limitation dates are maintained.

J. Whenever a change in Coachella Valley Water District canal operations is necessary, the Contractor shall notify COR a minimum of 24 hours in advance.

K. Make requests for a canal outage to the COR at least 7 weeks in advance. Outages may or may not be approved based on Coachella Canal Irrigation requirements.

3.02 REMOVAL AND CLEANUP

A. Remove diversion and care facilities when no longer required as approved by COR.

B. Meet requirements of Section 01563 – Water Pollution Control for work in Coachella Canal.

C. Do not allow damage to existing concrete features or newly constructed concrete features with removal of cofferdams.

D. Place refill in temporary bypass channel in continuous and approximately horizontal layers.

1. Place and compact in accordance with Section 02302 – Compacting Earth Materials.
2. Place and compact material to finished lines and grades as shown on drawings.

E. Remove concrete blocks from parshall flume when no longer required as approved by COR.

F. Remove other temporary diversion and protective works as described below, in a manner approved by the COR.

1. Remove so as not to interfere with operation or usefulness of Coachella Canal.
2. Removed materials remain property of the Contractor.
3. Dispose of removed material in accordance with Section 01740 - Cleaning.

G. Install stoplogs in Coachella Canal Flume guides and divert the canal flows through the new Coachella Canal Turnout Flume and Transition Structure before removing temporary bypass channel and other protective works.

1. Install in accordance with Section 11285 – Stoplogs.

END OF SECTION

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SECTION 02302 - COMPACTING EARTH MATERIALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of compacting earth materials in prices offered in the schedule for moistening and compacting embankments, backfill, and for other items of work where earth materials are required to be compacted.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM D 422-63(2007)	Particle-Size Analysis of Soils
2.	ASTM D 653-07f	Terminology Relating to Soil, Rock, and Contained Fluids
3.	ASTM D 698-07	Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
4.	ASTM D 1140-00(2006)	Amount of Material in Soils Finer than the No. 200 (75-µm) Sieve
5.	ASTM D 1556-07	Density and Unit Weight of Soil in Place by the Sand-Cone Method
6.	ASTM D 2216-05	Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
7.	ASTM D 2487-06	Classification of Soils for Engineering Purposes (Unified Soil Classification System)
8.	ASTM D 2488-06	Description and Identification of Soils (Visual-Manual Procedure)
9.	ASTM D 4253-00(2006)	Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
10.	ASTM D 4254-00(2006)	Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
11.	ASTM D 4318-05	Liquid Limit, Plastic Limit, and Plasticity Index of Soils
12.	ASTM D 4643-08	Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating

13.	ASTM D 4718-87(2007)	Correction of Unit Weight and Water Content for Soils Containing Oversize Particles
14.	ASTM D 4914-08	Density of Soil and Rock in Place by the Sand Replacement Method in a Test Pit
15.	ASTM D 4959-07	Determination of Water (Moisture) Content of Soil by Direct Heating
16.	ASTM D 5030-04	Density of Soil and Rock in Place by the Water Replacement Method in a Test Pit
17.	ASTM D 5080-08	Rapid Determination of Percent Compaction
18.	ASTM D 6938-08	In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
19.	ASTM D 7382-07	Determination of Maximum Dry Unit Weight and Water Content Range for Effective Compaction of Granular Soils Using a Vibratory Hammer

B. Bureau of Reclamation (USBR)

1. USBR EM - Earth Manual, Part 2, Third Edition (1990)

2. Procedure No. and Title:

a.	USBR 3900-89	Standard Definitions of Terms and Symbols Relating to Soil Mechanics
b.	USBR 5000-86	Determining Unified Soil Classification (Laboratory Method)
c.	USBR 5005-86	Determining Unified Soil Classification (Visual Method)
d.	USBR 5300-89	Determining Moisture Content of Soil and Rock by the Oven Method
e.	USBR 5315-89	Determining Moisture Content by the Microwave Method
f.	USBR 5325-89	Performing Gradation Analysis of Gravel Size Fraction of Soils
g.	USBR 5330-89	Performing Gradation Analysis of Fines and Sand Size Fraction of Soils, Including Hydrometer Analysis
h.	USBR 5335-89	Performing Gradation Analysis of Soils Without Hydrometer – Wet Sieve
i.	USBR 5500-89	Performing Laboratory Compaction of Soils--5.5-lbm Rammer and 18-in Drop

j.	USBR 5525-89	Determining the Minimum Index Unit Weight of Cohesionless Soils
k.	USBR 5530-89	Determining the Maximum Index Unit Weight of Cohesionless Soils
l.	USBR 5605-89	Determining Permeability and Settlement of Soils Containing Gravel
m.	USBR 7205-89	Determining Unit Weight of Soils In-Place by the Sand-Cone Method
n.	USBR 7220-89	Determining Unit Weight of Soils In-Place by the Sand Replacement Method in a Test Pit
o.	USBR 7221-89	Determining Unit Weight of Soils In-Place by the Water Replacement Method in a Test Pit
p.	USBR 7230-89	Determining Unit Weight and Moisture Content of Soil In-Place - Nuclear Moisture-Density Gauge
q.	USBR 7240-89	Performing Rapid Method of Construction Control
r.	USBR 7250-89	Determination of Percent Relative Density
s.	USBR 7255-89	Determining the Percent Compaction of Earthwork for Construction Control

1.03 DEFINITIONS

A. Use definitions from USBR 3900 or ASTM D 653.

B. Control Fraction: The portion of a soil sample consisting of particles smaller than a designated sieve size for the laboratory compaction test. The fraction is used to compare in-place unit weight with standard laboratory unit weight. The control sieve size depends on the laboratory test used (ASTM D 698, D 4253, D 4254, and D 7382).

C. C-Value: The expressed as a percentage of (1) in-place wet unit weight at fill moisture content to (2) the wet unit weight of a laboratory-compacted specimen prepared at fill moisture content as determined by the rapid method of construction control (USBR 7240, ASTM D 5080). The C-Value is a comparison of compactive effort of field compaction equipment to standard laboratory compactive effort.

D. D-value: The ratio expressed as a percentage of (1) in-place wet unit weight at fill moisture content to (2) laboratory maximum wet unit weight as determined from a compaction curve constructed at fill moisture content as determined by the rapid method of construction control. The D-value is the equivalent of percent compaction (USBR 7240, ASTM D 5080).

E. Percent Relative Compaction: The percent compaction of a cohesionless soil where the laboratory maximum density is determined by Maximum Index Unit Weight test (USBR 5530, ASTM D 4253) or vibrating hammer test (ASTM D 7382).

F. Percent Relative Density - (D_d percent) : The ratio of, (1) the difference between void ratio of a cohesionless soil in the loosest state and any given void ratio, to (2) the difference between its void ratios in the loosest state and densest state (USBR 7250).

G. Special Compaction: Compaction close to structures or in confined space.

1.04 PROJECT ENVIRONMENT REQUIREMENTS

A. Do not place and compact soil under following conditions:

1. Ambient air temperature below freezing.
2. Rain that creates puddles in clayey or silty materials.
3. Material above or below specified moisture conditions. Maintain moisture content in accordance with the article 3.02.
4. Ice or snow pockets are visible in soil being placed or on surfaces on which the soil will be placed.

PART 2 PRODUCTS

2.01 CLASSIFICATION

A. When required, classify earth materials using the Unified Soil Classification System (USCS) according to ASTM D 2487 (or USBR 5000) or ASTM D 2488 (or USBR 5005).

1. Gradation tests for classification: ASTM D 422 or D 1140 (USBR 5325, 5330, or 5335).
2. Atterberg limits testing for classification: ASTM D 4318 (USBR 5350, 5355, or 5360).

2.02 SOIL TYPES

A. Clean Fill:

1. Any soil classification except for Peat (PT), Organic Silts and Organic Clays (OL and OH), and Elastic Silt (MH).
2. Free of roots, stumps, limbs, vegetation, organic matter, clay clods, or clay balls, and ice.
3. Does not contain construction debris, scrap materials, refuse, man-made wastes, or chemical or hydro-carbon contamination.

B. Do not use frozen soils.

C. Special Gradations/Plasticity

1. In some cases, such as embedment for buried pipe, special gradations and/or plasticity characteristics may be required. These requirements are given for each special material required in the appropriate section.

2.03 DESIGNATION OF SOILS FOR COMPACTION

A. Requirements for lift thickness, method of compaction, and method of determining degree of compaction depends on whether soil is considered to be silty or clayey, or cohesionless.

B. Silty or Clayey Soils:

1. Contain appreciable amounts of fines (generally more than 30 percent fines).
2. Classified as GM, GC, SM, SC, CL, ML, CH, or any dual symbol or borderline soil beginning with one of these symbols.

C. Cohesionless Soils:

1. Contain few fines (generally less than 30 percent non-plastic fines).
2. Classified as GW, SW, GP, SP, or any borderline soil beginning with any of these symbols.
3. Classified as SM or GM soils with non-plastic fines.

D. Perform Atterberg Limits testing and Particle Size analysis of soils as required to classify the soil groups above (ASTM D 2487, USBR 5000).

2.04 MAXIMUM PARTICLE SIZE

A. Backfill against specific structures:

1. Maximum particle size limitations described in appropriate sections.
2. Otherwise, no cobbles or boulders.

B. Compacted Silty or Clayey soil for embankment: No cobbles larger than 5 inches or boulders.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Clear, grub, and strip.

B. Prepare surface so that first compacted lift will be placed on firm, stable base. Compact surface to specified compaction as required in specific section.

1. Report suspected unstable foundations to the COR.

C. For water-retaining compacted fill, scarify and moisten surface to provide satisfactory bonding surface before placing layer of material to be compacted.

D. Do not place soil on frozen surface.

3.02 SOIL MOISTURE CONTENT

A. Moisten or aerate material, as necessary, to provide moisture content that will readily facilitate obtaining specified compaction. Add water to soil only in increments that will permit moisture content to be uniform and homogenous throughout each layer after mixing.

B. Silty and Clayey Soils:

1. Moisture content during compaction: Not greater than 2 percentage points wet or not less than 2 percentage points dry of optimum moisture content.

2. Add no more than 2 percent water to fill by sprinkling just prior to compaction when fill is clayey and contains dry clods of clay.

   a. If clayey borrow soil is more than 2 percent below optimum moisture, pre-conditioning and curing may be required to obtain uniform and homogenous distribution of moisture in the clods.

   b. Use of disks, harrows, or rakes may be required to blend moisture in the borrow area.

3. Moisture content will be determined as follows:

   a. Moisture content is determined on the minus no. 4 sieve size control fraction material.

   b. Variation from Optimum Moisture Content:

      1) Difference between optimum moisture and compaction moisture can be measured in accordance with ASTM D 5080 (or USBR 7240).

   c. Moisture Content Comparison:

      1) Optimum moisture content determined by ASTM D 698 (or USBR 5500).

      2) Compared to field compaction moisture content with moisture contents determined in accordance with:

         a) ASTM D 2216 (or USBR 5300), or

         b) ASTM D 6938 (USBR 7230). The moisture from the nuclear gage will require corrections for gage error for the specific soils tested, or

c) ASTM D 4959, or ASTM D 4643 (USBR 5315), provided the results have been correlated to ASTM D 2216 (USBR 5300) for specific soil tested.

C. Cohesionless Soils:

1. In-place moisture should be within 2 percentage points of the optimum water content range for effective compaction as indicated in the vibratory hammer test (ASTM D 7382) or impact compaction test (ASTM D 698, USBR 5500).

2. For free draining soils with less than 5 percent fines (passing No. 200 seive) add water immediately prior to compaction to saturate the soil and facilitate vibratory compaction, as directed.

3. Field moisture content will be determined as follows:

   a. ASTM D 2216 (or USBR 5300), or

   b. ASTM D 6938 (USBR 7230). The moisture from the nuclear gage will require corrections for gage error for the specific soils tested, or

   c. ASTM D 4959, or ASTM D 4643 (USBR 5315), provided the results have been correlated to ASTM D 2216 (USBR 5300) for specific soil tested.

3.03 PLACEMENT

A. Place soils to be compacted in horizontal layers.

B. If necessary, blend materials so that compacted fill is homogenous and free from lenses, pockets, streaks, voids, laminations, or other imperfections.

3.04 COMPACTION

A. Compact material with following methods and techniques appropriate to type of soil.

B. Silty or clayey material:

1. Compact with mechanical impact tampers, tamping rollers, vibrating pad foot rollers, rubber tire rollers, other suitable compaction equipment, or equipment travel.

   a. Uniformly distribute equipment passes.

   b. Compact in horizontal layers to compacted thickness of 6 inches or less.

2. Special compaction: Compact with hand held impact tampers, or small tamping equipment.

   a. Uniformly distribute effort.

   b. Compact in horizontal layers to compacted thickness of 4inches.

3. Density requirement – unless specified in appropriate section:

a. Percent Compaction, minimum: 95 percent, or

b. D-value, minimum: 95 percent

c. As determined on portion of soil passing the No. 4 sieve.

C. Cohesionless free-draining material:

1. Compact in horizontal layers in maximum compacted lift thicknesses of:

a. Tampers or rollers: 6 inches

b. Vibrating drum rollers, surface vibrator, or similar equipment: 12 inches

c. Saturation and internal vibration: Penetrating depth of vibrator.

2. Special compaction: Compact with hand held impact tampers, vibrating plate tampers, or small tamping equipment.

a. Uniformly distribute effort.

b. Compact in horizontal layers to compacted thickness of 6 inches.

3. Density requirement – unless specified in appropriate section:

a. Relative Density, minimum: 70 percent, or

b. Relative Compaction. Minimum: 95 percent.

c. As determined on portion passing the 3/4-inch sieve

D. Adjustment:

1. Silty and clayey soils containing more than 10 percent gravel: Required D ratio or Percent Compaction may be adjusted in accordance with appropriate curve on Figure 4 in USBR 5605.

E. Demonstration:

1. Lift thicknesses may vary depending on material type, equipment, and compaction methods. Before changing requirements in this section, demonstrate that required density will be obtained.

2. Perform test fills for compaction equipment to be used to demonstrate the required density will be achieved.

3.05 MEASURE OF COMPACTION

A. Degree of soil compaction will be determined by one of the following.

B. Silty or clayey soils:

1. Unit weight of soils in-place:

a. ASTM D 1556 (or USBR 7205), or

b. ASTM D 4914 (or USBR 7220), or

c. ASTM D 5030 (or USBR 7221), or

d. ASTM D 6938 (or USBR 7230.

1) Nuclear gauge test results shall be checked with sand cone tests (ASTM D 1556, or USBR 7205) at a frequency to be determined by the COR.

2. Percent Compaction will be determined by one of the following:

a. Rapid Method: ASTM D 5080 (or USBR 7240).

b. Laboratory Compaction Test: Comparison of in-place density of minus no. 4 sieve size control fraction to laboratory maximum dry density as determined by ASTM D 698, Procedure A (or USBR 5500).

c. Silty and clayey soils containing more than 5 percent gravel:

1) In-place unit weight of minus no. 4 size control fraction determined by screening gravel, washing, and determining mass and volume by assuming surface saturated dried moisture as outlined in ASTM D 4718 (USBR 7205).

C. Cohesionless soils: Compaction will be measured by determination of Percent Relative Density or Percent Relative Compaction as specified.

1. Unit weight of soils in-place:

a. ASTM D 1556 (or USBR 7205), or

b. ASTM D 4564 (or USBR 7215), or

c. ASTM D 4914 (or USBR 7220), or

d. ASTM D 5030 (or USBR 7221), or

e. ASTM D 6938 (or USBR 7230).

1) Nuclear gauge test results shall be checked with sand cone tests (ASTM D 1556, or USBR 7205) at a frequency to be determined by the COR.

2. Percent relative compaction:

a. In-place density of minus 3/4-inch size control fraction is compared to maximum index density determined by ASTM D 7382.

b. In-place unit weight of minus 3/4-inch size control fraction determined by screening cobbles, washing, and determining mass and volume by assuming surface saturated dried moisture as outlined in ASTM D 4718 (or USBR 7205).

3. Percent Relative Density: ASTM D 4254 (or USBR 7250)

a. In-place density of minus 3-inch size control fraction is compared to minimum and maximum index densities.

b. Laboratory test for minimum index density: ASTM D 4254 (or USBR 5525)

c. Laboratory test for maximum index density, ASTM D 4253 (or USBR 5530).

d. Cohesionless soils containing more than 5 percent cobbles:

1) In-place unit weight of minus 3-inch size control fraction determined by screening cobbles, washing, and determining mass and volume by assuming surface saturated dried moisture as outlined in ASTM D 4718 (or USBR 7205).

3.06 CONTRACTOR QUALITY TESTING

A. The Contractor shall perform the following tests listed in Table 02302A – Testing Procedures and Standards used For Testing.

Table 02302A – Testing Procedures and Standards Used For Testing

TESTING PROCEDURE	STANDARD NO.
Soil Classification	ASTM D 2487 (or USBR 5000) ASTM D 2488 (or USBR 5005)
Gradation Analysis	ASTM D 422 (or USBR 5325, 5330, 5335)
Atterberg Limits	ASTM D 4318 (or USBR 5350, 5355, 5360)
Moisture Content	ASTM D 2216 (or USBR 5300) ASTM D 6938 (or USBR 7230) ASTM D 4643 (or USBR 5315)
Relative Density of Cohesionless Soils	ASTM D 4253 and ASTM D 4254 (or USBR 5525 and 5530 and 7250)
In-Place Density: Sand Cone Test Pits Nuclear	 ASTM D 1556 (or USBR 7205) ASTM D 4914 (or USBR 7220) ASTM D 5030 (or USBR 7221) ASTM D 6938 (or USBR 7230)
Rapid Construction Control	ASTM D 5080 (or USBR 7240)
Laboratory Maximum Density	ASTM D 698, Procedure A (USBR 5500)
Laboratory Maximum Dry	ASTM D 7382, no USBR equivalent

Table 02302A – Testing Procedures and Standards Used For Testing

TESTING PROCEDURE	STANDARD NO.
Unit Weight Using a Vibrating Hammer	

B. Frequency of Testing:

1. The Contractor shall perform earthwork testing as outlined in this section on test fills when demonstrating compaction equipment and as required as part of the Contractors quality control program, or as requested by the COR.

C. Test results shall be made available to the COR.

3.07 QUALITY ASSURANCE

A. The Government will inspect compaction operations.

B. Testing:

1. The Government will perform tests as required to verify that type of soil used, placement of soil, and compaction of soil conform to contract requirements.
2. Notify the COR 24 hours before compaction work begins and 24 hours before significant change in compaction operations (change in equipment or procedure used).
3. Notify the COR immediately of equipment change due to breakdown, or re-deployment.

C. Testing Frequency:

1. Frequency of testing is at discretion of the COR.
2. Greater frequency of testing is normally performed at beginning of new work, new work crew, or new equipment.
3. After a successful work operation pattern is established, testing frequency is normally performed at these minimum guidelines.
   a. At least one test for each shift for each compaction operation.
   b. Compacted embankment: One test for every 2,000 yd^3.
   c. Compacted backfill against structures, over pipe, and for building foundations: One test for every 500 yd^3.
   d. Compacted embedment: One test for every 1,000 linear feet around pipe.

e. Additional tests may be performed at sites considered questionable by a Government Inspector; such as suspected incomplete compaction, surfaces that may have become excessively wet or dry since compaction, compacted surfaces torn up by subsequent equipment travel, or other similar circumstances.

D. Tests:

1. Standards listed in Table 02302A – Testing Procedures and Standards Used for Testing, will be used by the Government for testing compacted soil for conformance with specification requirements. Substitution or modification of standards shall be done only with concurrence of all parties.

E. Contractor Support:

1. Provide timely access to areas for density testing and excavate and level an area in compacted material to provide a surface for testing.

a. Fills compacted by sheepsfoot rollers are normally tested one or two lifts below surface.

2. When density is being measured by a sand-cone device (ASTM D 1556, USBR 7205), cease construction activity in immediate vicinity of testing.

3. Dig test pits as requested to examine compacted soil.

4. Backfill test pits to original requirements.

5. Provide warning lights, flags, or other safety devices as needed by testing personnel.

6. Provide adequate lighting for performing test if required because of darkness.

7. Provide results of compaction equipment instrumentation, if used, to the COR upon request.

3.08 MATERIAL REPLACEMENT

A. Remove material which does not meet testing requirements and place and compact in accordance with this section.

B. Contractor may apply extra compactive effort, without removal of materials that fail density requirements as approved by the COR.

END OF SECTION

SECTION 02312 – BLADING FOR COUNTY ROAD

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Blading for County Road:

1. Payment: Lump sum price offered in the schedule.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 BLADING

A. Blade new county road to limits shown on drawings.

B. Blade new county road only to finished surface as directed by COR.

C. Blading equipment shall be subject to COR's approval.

D. Apply water for dust abatement. Refer to Section 02202 – Water for Dust Abatement.

END OF SECTION

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SECTION 02316 – STEEL PIPE EARTHWORK

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Excavation for Steel Pipe Trench:

1. Measurement: Volume to paylines and lengths shown on drawings.

   a. Regardless of actual widths, bottoms, and side slopes excavated, measurement will be made to paylines shown on drawings and to original ground surface and to paylines of Interstate 8 Highway pavement structure.

   b. Measurement for payment for excavation in steel pipe trench for additional excavation of steel pipe trench will be made to the trench widths (W_p) shown on drawings and to the depth directed by COR.

2. Payment: Cubic yard price offered in the schedule.

   a. Includes cost of labor and materials for shoring, sheeting, bracing, timbering, safety sloping, and other temporary construction; of removing such temporary construction where required; stockpiling excavated material for backfill; and disposal of unused or wasted excavated materials.

   b. Includes excavating and hauling to waste of any excess material.

   c. Overexcavation performed beyond specified or directed paylines and backfill and compaction of backfill for such overexcavation shall be at the expense of the Contractor.

   d. Where excavation is performed in backfill, no payment will be made for the resulting excavation, backfill, and compacting backfill.

B. Backfill for Steel Pipe Trench:

1. Measurement: Volume in place to the paylines and lengths shown on the drawings and will be made only for the quantities actually placed within the excavation paylines for the steel pipe trench.

   a. The volume of controlled low strength material bedding and embedment and the volume of pipe will be deducted based on the 108-inch diameter pipe shown on the drawings.

   b. Measurement for payment for backfill in pipe trench for additional excavation of pipe trench will be made to the trench widths (W_p) shown on drawings and to the depth directed by the COR.

c. Does not include volume of controlled low strength material bedding and embedment. Refer to Section 02323 – Controlled Low Strength Material (CSLM).

2. Payment: Cubic yard price offered in the schedule.

a. Includes cost of work associated with the processing and hauling of necessary backfill material.

b. Material from required excavation used for backfill in pipe crossing trench will be paid for both as excavation when removed from original position and as backfill when placed.

c. Where backfill material is obtained from other sources, payment will be made for backfill only. Include the cost of excavating or procuring, hauling, and processing of such material in the unit price offered in the schedule for backfill in steel pipe trench.

d. No payment will be made for backfill required to fill overexcavation.

e. No payment will be made for the removal and reconstruction of defective and nonconforming backfill compacted to an insufficient density.

C. Compacting Backfill in Steel Pipe Trench:

1. Measurement: Volume in place to the paylines and lengths shown on drawings, and will be made only for the quantities actually compacted within the excavation paylines for steel pipe trench.

a. The volume of controlled low strength material bedding and embedment and the volume of pipe will be deducted based on the 108-inch diameter shown on drawings, regardless of the actual diameters of pipe furnished.

b. Measurement for payment for compacting backfill in steel pipe trench for additional excavation of pipe trench will be made to the trench widths (W_p) shown on drawings and to the depth directed by the COR.

2. Payment: Cubic yard price offered in the schedule.

a. Includes specially compacted backfill placed over steel pipe. Refer to Section 02302 – Compacting Earth Materials.

b. Compacting backfill for overexcavation outside specified or directed excavation paylines will be at the expense of the Contractor.

1.02 REFERENCES

A. American Association of State Highway Officials (AASHTO)

1. AASHTO Highway Bridges Standard Specifications for Highway Bridges, 17th Edition

B. ASTM International (ASTM)

1.	ASTM D 6024-07	Ball Drop on Controlled Low Strength Material (CLSM) to Determine Suitability for Load Application

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals.

B. RSN 02316-1, Steel Pipe Earthwork and Pipeline Construction Sequence Plan.

1. Include schedule, sequence, methods, equipment, and plans to perform steel pipe trench earthwork and steel pipe construction.

1.04 DEFINITIONS

A. Additional Excavation: Excavation beyond specified lines as directed by the COR to remove unsuitable foundation material.

B. Overexcavation: Excavation performed for the convenience, fault, or operation of the Contractor beyond specified or directed additional excavation lines.

1.05 PROJECT CONDITIONS

A. Steel pipe earthwork includes work for steel pipe trench below original ground. Refer to Section 02052 – Interstate 8 Highway Work for Interstate 8 Highway detour construction and Interstate 8 Highway reconstruction above original ground. Steel pipe earthwork includes earthwork between the pipe inlet structure and the pipe outlet structure.

B. To facilitate excavation of the predominantly sandy soils, prewetting has been beneficial on the All American Canal lining project. The addition of water increases the firmness of the soil and allows more efficient operation of equipment.

PART 2 PRODUCTS

2.01 MATERIALS FOR BACKFILL

A. Use materials removed in excavating for Interstate 8 pipe crossing trench or from other sources arranged for by the Contractor.

1. The Government makes no guarantee that specified backfill materials are contained in or can be processed from materials excavated from Interstate 8 pipe crossing trench.

B. Provide processing equipment and perform work necessary to process excavated materials to produce materials meeting the requirements of these specifications.

C. Bedding and embedment:

1. Controlled low strength materials in accordance with Section 02323 - Controlled Low Strength Materials (CLSM) shall be used.

D. Particle size of material placed in compacted backfill, maximum: 3 inches.

PART 3 EXECUTION

3.01 EXCAVATION

A. Excavate steel pipe crossing trench to lines, grades, and dimensions shown on drawings.

B. Stage excavation to accommodate Interstate 8 Highway detours and Interstate 8 Highway crossing.

C. Finish bottom of trench accurately to lines and grades shown on drawings.

D. Perform excavation in the dry. Refer to Section 02242 – Removal of Water.

3.02 ADDITIONAL EXCAVATION

A. Perform additional excavation beyond specified lines as directed by the COR.

3.03 OVEREXCAVATION

A. When foundation material is overexcavated beyond specified or directed lines, fill the overexcavation with backfill materials and compact in accordance with Compacting Backfill article below.

B. If foundation material is overexcavated by being disturbed or loosened during excavation, compact material in place or remove and replace with backfill material and compact in accordance with Compacting Backfill article below.

C. No payment will be made for backfill required to fill any overexcavation performed by the Contractor

3.04 FOUNDATION INSPECTION

A. The COR will inspect foundation conditions prior to steel pipe installation.

B. Provide a minimum twenty-four (24) hours notice to the COR before a section of foundation surface is ready for inspection.

C. The Government may require up to twenty-four (24) hours to map, inspect, test, and approve a section of foundation.

3.05 REPAIR OF FOUNDATION

A. Repair damage to foundation beyond required excavation lines at Contractor's expense.

3.06 PREPARATION OF PIPE CROSSING FOUNDATION

A. To form firm foundation upon which to place the pipe, prepare foundation and compact the foundation material to density as specified in Compacting Backfill article below before placement of bedding and embedment material.

B. Add water to aid compaction in accordance with Section 02302 – Compacting Earth Materials.

3.07 STOCKPILING

A. Stockpile excavated materials which meet or will be processed to meet material requirements for backfill in steel pipe crossing trench until processed or used as backfill material.

3.08 DISPOSAL

A. Dispose of excess excavated materials in accordance with Section 02324 - Disposal of Excavated Materials.

1. Excess excavated materials: Materials which are not used or processed for use as backfill material and any waste materials from such processing.

3.09 BEDDING AND EMBEDMENT PLACEMENT

A. Place CLSM bedding below bottom of pipe and embedment to 1 foot over top of steel pipe as shown on drawings in accordance with Section 02323 – Controlled Low Strength Materials (CLSM).

B. Place Controlled Low Strength Materials (CLSM) as part of steel pipe embedment.

3.10 BACKFILL PLACEMENT

A. Place backfill in steel pipe crossing trench to lines shown on drawings, or as directed by the COR.

B. Place backfill for overexcavation performed outside specified or directed paylines for excavation for pipe trenches in the same manner as specified for adjacent backfill or embedment.

C. Place backfill carefully and spread in uniform layers so that spaces about rocks and clods will be filled.

3.11 COMPACTING BACKFILL

A. Compact backfill as specified in Section 02302 - Compacting Earth Materials with the following exception:

1. Compact to density, minimum, of 98 percent compaction, or
2. Minimum of 80 percent relative density, or
3. Minimum of 98 percent relative compaction.

B. Use lightweight vibratory rollers (2-5 ton) for compaction, as approved by the COR, to compact the first two feet of soil over the CLSM.

C. Where additional excavation for steel pipe trench is directed by the COR to remove foundation material or other material, compact backfill for this additional excavation.

D. Compacted backfill may be placed after 24 hours, or as directed by COR, or as soon as the final surface of controlled low strength material reaches its set strength.

1. Set strength of final surface of controlled low strength material determined by ASTM D 6024.

E. When tests indicate insufficient density of compacted backfill above pipe:

a. Remove or rework backfill above compacted backfill as directed by the COR.

b. Continue compacting backfill until proper density is obtained..

c. No payment will be made for the removal and reconstruction of defective and nonconforming backfill compacted to an insufficient density.

3.12 PROTECTION

A. To provide adequate protection for compacted backfill in steel pipe trench, the Government reserves the right to direct the Contractor to place a sufficient amount of backfill material over compacted backfill within 72 hours after compacting of backfill has been completed.

B. Place compacted backfill to a minimum depth of 2 foot above top of CLSM located above top of pipe as shown on drawings before allowing construction equipment to travel over pipe.

1. After these minimum earth covers are in place, the maximum equipment loading allowed over the pipe shall be HS-20 loading (16,000-pound wheel load) in accordance with AASHTO Highway Bridges.
2. If construction equipment that exerts a larger wheel load is proposed to be used, submit construction equipment loadings to the COR for analysis and determination of required backfill depths or other protective measures.

END OF SECTION

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SECTION 02317 - CANAL EARTHWORK

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Excavation for Canal:

1. Measurement: Volume to lines, grades, and dimensions shown on drawings, or as directed by COR.
    a. Excavation for canal includes all canal excavation except for that between canal station 342+00 and canal station 354+75.71, which is included in excavation for reservoir.
2. Payment: Cubic yard price offered in the schedule.
    a. Includes cost of hauling from excavation to construct canal embankments.
    b. Includes procuring and applying water to prewet canal excavations as required.
    c. Overexcavation performed beyond specified or directed paylines and embankment and compaction of embankment for such overexcavation shall be at the expense of the Contractor.

B. Compacted Refill for Lining:

1. Measurement: Volume to lines, grades, and dimensions of final cross section shown on drawings.
    a. Required overbuild will not be included.
2. Payment: Cubic yard price offered in the schedule.
    a. Includes excavating, handling, replacing, moistening, and compacting material in place.
    b. No payment will be made for the removal and reconstruction of defective and nonconforming refill compacted to an insufficient density.

C. Trimming Foundation for Concrete Canal Lining:

1. Measurement: Surface area trimmed.
2. Payment: Square yard price offered in the schedule.

D. Constructing Canal Embankments:

1. Measurement: Volume to lines, grades, and dimensions shown on drawings, or as directed by COR.

a. Constructing canal embankments includes construction of all canal embankments except for that between canal station 342+00 and canal station 354+75.71, which is included in reservoir earthwork.

2. Payment: Cubic yard price offered in the schedule.

a. Includes moistening and handling of material from canal excavation.

b. Includes hauling, moistening and handling of necessary material from reservoir excavation.

c. Material from required excavations used for constructing canal embankments will be paid for both as excavation for canal and/or reservoir when removed from original position and as constructing canal embankments when placed.

d. Includes preparing canal embankment foundation surfaces.

E. Compacting Canal Embankments:

1. Measurement: Volume to lines, grades, and dimensions shown on drawings, or as directed by COR.

a. Compacting canal embankments includes compaction of all canal embankments except for that between canal station 342+00 and canal station 354+75.51, which is included in compacting reservoir embankments.

2. Payment: Cubic yard price offered in the schedule.

a. Includes, handling, placing, moistening, and compacting material in place.

b. Includes procuring and applying water for compacting embankments.

c. No payment will be made for the removal and reconstruction of defective and nonconforming embankment compacted to an insufficient density.

1.02 DEFINITIONS

A. Additional Excavation: Excavation beyond specified lines as directed by the COR to remove unsuitable foundation material.

B. Overexcavation: Excavation performed for the convenience, fault, or operation of the Contractor beyond specified or directed additional excavation lines.

C. Tolerances: Allowable variations from specified lines, grades, and dimensions.

D. Variation: Distance between the actual dimension and grade of the canal cross section or alignment and the specified position in plan for the canal cross section or alignment.

1.03 PROJECT CONDITIONS

A. Required excavation for the canal does not provide sufficient materials for construction of canal embankments. Additional material for construction of the canal embankment shall be obtained from required excavation for the reservoir or from approved borrow source.

B. Excavated materials are predominantly fine- to medium-grained, hard sand composed of quartz and feldspar. Laboratory classifications of materials from explorations were predominantly poorly graded sand (SP). These materials shall be used to construct the embankments. Field investigations do not indicate the presence of extensive quantities of clayey or cohesive soils. Clayey or cohesive soils are not to be used in the compacted embankment portion of the canal embankment. Clayey or cohesive soils can be used in the embankment portion of the canal embankment.

C. To facilitate excavation of the predominantly sandy soils, prewetting has been beneficial on the All American Canal lining project. The addition of water increases the firmness of the soil and allows more efficient operation of equipment.

D. The natural moisture content of material from required excavation averages 2 percent. Application of water prior to and during construction is necessary to obtain compaction of the materials.

PART 2 PRODUCTS

2.01 COMPACTED REFILL FOR LINING

A. Obtain material from required excavation or from approved borrow source.

B. Maximum particle size: 3 inches in maximum dimension.

C. Unsuitable materials:

1. Material containing brush, roots, sod, or other organic materials.
2. Clayey or cohesive soils as determined by the COR.
3. Excavated material that has been improperly handled such that contamination and particle breakdown has occurred to a sufficient degree as being deemed unsuitable by the COR

2.02 COMPACTED EMBANKMENT MATERIAL

A. Obtain material from required excavation or from approved borrow source.

B. Maximum particle size: 3 inches in maximum dimension.

C. Unsuitable materials:

1. Material containing brush, roots, sod, or other organic materials.
2. Clayey or cohesive soils as determined by the COR.

2.03 EMBANKMENT MATERIAL

A. Obtain material from required excavation or from approved borrow source.

B. Maximum particle size: 3 inches in maximum dimension.

C. Unsuitable materials:

1. Material containing brush, roots, sod, or other organic materials.
2. Clayey or cohesive soils as determined by the COR.

PART 3 EXECUTION

3.01 PREPARATION FOR EXCAVATION

A. Clear, grub, and strip areas to be excavated including borrow areas and stockpile areas in accordance with Sections 02232 – Clearing and Grubbing and 02236 – Stripping.

B. Remove and control water in accordance with Section 02242 – Removal and Control of Water.

C. Prior to and during excavation of the canal, prewet materials to the depth of excavation to provide moisture content that readily facilitates excavation and material handling.

3.02 PREWETTING CANAL EXCAVATION

A. Apply moisture by sprinkler irrigation.

B. Control application of water, and check depth of water penetration during application so as to avoid over-irrigation.

C. All material shall be dust-free when excavated, loaded, and hauled.

D. If excessive moisture is encountered take measures to reduce moisture by selective excavation to secure drier material; by excavating and placing in temporary stockpiles materials containing excessive moisture; by allowing adequate additional time for drying; or by other approved means.

3.03 CANAL EXCAVATION

A. Excavate canal to lines, grades and dimensions shown on drawings or established by COR.

B. Do not excavate beyond depths shown on drawings unless directed by COR.

C. Handle suitable excavated material to minimize contamination and particle breakdown.

D. Where unsuitable material is encountered, the COR will direct performance of additional excavation to remove unsuitable material.

1. Refill additional excavation with material as directed by the COR.

3.04 ADDITIONAL EXCAVATION

A. Perform additional excavation beyond specified lines as directed by the COR.

3.05 OVEREXCAVATION

A. If foundation material is excavated beyond required lines, fill overexcavation with suitable materials and compact in accordance with Compacting Embankments article below.

B. If foundation material is disturbed or loosened during excavation or otherwise, compact foundation in place or remove and replace it with suitable material and compact in accordance with Compacting Embankments article below.

3.06 FOUNDATION INSPECTION

A. The COR will inspect all foundation surfaces.

B. Provide a minimum twenty-four (24) hours notice to the COR before a section of foundation surface is ready for inspection.

C. The Government may require up to twenty four (24) hours to map, inspect, test, and approve a section of foundation.

3.07 REPAIR OF FOUNDATION

A. Repair damage to foundation beyond required excavation lines at Contractor's expense.

3.08 PREPARATION OF SURFACES UNDER CANAL EMBANKMENTS

A. Perform stripping in accordance with Section 02236 – Stripping.

B. Prior to placement of compacted embankment, compact the embankment foundation with four (4) passes of a vibratory roller as specified in Compacting Canal Embankments article below.

C. Add water to aid compaction in accordance with Section 02302 – Compacting Earth Materials.

3.09 CONSTRUCTING CANAL EMBANKMENTS

A. Construct canal embankments to top widths and side slopes as shown on drawings.

B. Canal embankments may be constructed using excavating and hauling equipment or by excavating equipment depositing the material directly from excavation.

C. Construct in lifts of 12 inches maximum thickness.

D. Route equipment over embankments not to be compacted to distribute wheel loading uniformly over the fill section for uniform coverage by the equipment.

E. Place finer materials from excavation in portion of embankment nearest the water and coarser materials towards outer portions of embankment.

F. In conjunction with canal embankment construction, construct operation and maintenance roads adjacent to the canal and structures as shown on drawings.

1. Grade finished surfaces of operation and maintenance road for placement of gravel surfacing in accordance with Section 02732 – Gravel Surfacing.

3.10 COMPACTING CANAL EMBANKMENTS

A. Add water to aid compaction. The moisture content of compacted embankment material prior to and during compaction shall be in accordance with Section 02302 – Compacting Earth Materials.

B. Compaction equipment: Compact with vibrating pad foot rollers, or vibrating smooth drum rollers, single or dual drum.

1. Drums:

a. Static weight at drum dry: Minimum 20,000 pounds.

b. Centrifugal force per drum: Minimum 45,000 pounds when operating between 1,200 and 2,000 vibrations per minute.

2. Provide a vibratory roller with a Compaction Meter Value (CMV) instrumentation system with operator display, or equivalent as approved by the COR, to assist the operator in monitoring compaction.

a. CMV data will not be used as a basis for acceptance or rejection of degree of compaction as required in this article and Section 02302 – Compacting Earth Materials.

3. Operate at constant frequency and at speeds not to exceed 1-1/2 miles per hour.

4. Do not allow roller to remain stationary with the vibrating mechanism operating.

C. Compact embankments in accordance with Section 02302 – Compacting Earth Materials with the following exceptions:

1. Compact by vibratory roller to obtain an in-place density of:
    a. Minimum of 98 percent compaction, or
    b. Minimum of 80 percent relative density, or
    c. Minimum of 98 percent relative compaction.
2. Minimum number of roller passes: 4.

D. One pass is defined as the number of successive trips with overlap to ensure coverage of the entire surface of each layer by the roller drum. Do not make the second and subsequent passes until the previous pass is complete.

3.11 COMPACTED REFILL FOR LINING

A. Place material over excavated surfaces with low ground pressure (LGP) wide track crawler type dozer.
1. Ground pressure, maximum: 5 lb/in^2.
2. Place material in horizontal lifts.

B. Compact material with vibrating pad foot roller or smooth drum vibratory roller in accordance with Section 02302 - Compacting Earth Materials.

C. Overbuild compacted refill slopes above concrete lining at least 6-inches beyond lines shown on drawings.

D. Trim compacted refill for lining to lines shown on drawings.

3.12 TRIMMING FOUNDATION FOR CONCRETE CANAL LINING

A. Do not trim for lining more than 48 hours before placing concrete canal lining.

B. Dimensions and grades of finished trimmed foundation to be in accordance with the following tolerances.
1. Variation in elevation for invert of canal: Plus or minus 0.05 foot.
2. Variation from specified width of section at any height: Plus or minus 0.25 foot.
3. Departure from established horizontal alignment on tangents along the canal: 0.30 foot.
4. Departure from established horizontal alignment on curves along the canal: Plus or minus 0.50 foot.

C. Plus or minus variations indicate a permitted actual position up or down and in or out from the specified position in plan.

D. Variations not designated as plus or minus indicate the maximum deviation permitted between designated successive points on the complete element of construction.

3.13 MAINTAINING CANAL PRISM

A. During time interval between trimming canal prism and placing concrete canal lining, keep surfaces of canal prism wet by sprinkling with a fine spray.

1. Fine spray to keep canal prism continually moist but not to an extent to cause erosion of the canal prism.

2. Method of applying water to canal prism and amounts of water applied subject to approval by COR.

B. Maintain moisture content of trimmed canal sections to 6 inch depths to prevent sloughing or raveling of the slope.

3.14 DISPOSAL

A. Dispose of unsuitable or excess excavated materials in accordance with Section 02324 - Disposal of Excavated Materials.

END OF SECTION

SECTION 02318 - EARTHWORK FOR STRUCTURES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Excavation for Structures:

1. Measurement: Volume to excavation paylines shown on the drawings or to paylines directed by the COR.

   a. Regardless of quantities removed, measurement for payment will be made to the prescribed paylines.

   b. Overexcavation performed beyond specified or directed paylines and backfill and compaction of backfill for such overexcavation shall be at the expense of the Contractor.

   c. Measurement for payment for excavation for structures will not include materials measured for payment as excavation for other features in accordance with other applicable sections. Where paylines overlap, measurement for payment will be made only once in accordance with this section.

   d. Structures which form a continuation of the canal or pipeline:

      1) Measurement of excavation for structures will include all required excavation for the structure below the original ground surface and between vertical planes at the upstream and downstream ends of the structure. Such measurement will also include any excavation for the structure upstream and downstream of these vertical planes which may be required below the original ground surface and outside of the paylines for canal excavation and pipe excavation.

      2) Measurement of excavation upstream and downstream of the vertical planes will be made to dimensions 1 foot outside of the foundations of the structures and to slopes of 1:1.

   e. Structures within Reservoir and Forebay/Afterbay:

      1) Measurement of excavation for structures will include all required excavation for the structure below the excavation limits shown on the drawings for reservoir excavation and forebay/afterbay excavation.

   f. Includes excavation and hauling of clayey or cohesive soils for geomembrane soil cover.

   g. Where excavating in backfill and embankment previously placed under these specifications, no additional payment will be made.

2. Payment: Cubic yard price offered in the schedule.

   a. Includes cost of labor and materials for work necessary to maintain excavations in good order during construction; removing such temporary construction, where required, and disposing the excavated material except as provided below.

   b. Includes cost of excavation and hauling of clayey or cohesive soils to geomembrane soil cover.

   c. The cost of excavating trenches for buried electrical grounding cables, insulated cables or conductors, and conduit shall be included in the prices offered in the schedule for items for which the excavation is required.

   d. Does not include excavation for control building. Refer to Section 02001 – Control Building.

B. Backfill about Structures:

1. Measurement: Volume to paylines shown on the drawings.

2. Payment: Cubic yard price offered in the schedule.

   a. Includes hauling and handling of necessary material. Material from required excavation used for backfill will be paid for both as excavation when removed from original position and as backfill when placed.

   b. Where additional material is obtained from approved borrow pits and used for backfill about structures, payment will be made for backfill only.

   c. Overexcavation performed outside the established paylines for excavation for structures shall be at the expense of the Contractor.

   d. Include cost of backfilling about guard post footings in lump sum price offered in the schedule for miscellaneous metalwork.

   e. Include cost of backfilling in trenches for buried electrical grounding cables, insulated cables or conductors, and conduit in the applicable prices offered in the schedule for items for which compacting backfill is required.

   f. Does not include backfill for control building. Refer to Section 02001 – Control Building.

   g. No payment will be made for the removal and reconstruction of defective and nonconforming backfill compacted to an insufficient density.

C. Compacting Backfill about Structures:

1. Measurement: Volume in place to the lines shown on the drawings, as prescribed in this section, or as directed by the COR and will be made only for the quantities actually compacted within the limits of the established paylines for backfill about structures.

2. Payment: Cubic yard price offered in the schedule.

   a. Compacting refill for overexcavation outside excavation paylines shall be at the expense of the Contractor.

   b. Include cost of compacting backfill about guard post footings in lump sum price offered in the schedule for miscellaneous metalwork.

   c. Include cost of compacting backfill in trenches for steel pipe, buried electrical grounding cables, insulated cables or conductors, and conduit in the applicable prices offered in the schedule for items for which compacting backfill is required.

   d. Does not include compacting backfill for control building. Refer to Section 02001 – Control Building.

1.02 DEFINITIONS

A. Additional Excavation: Excavation beyond specified lines as directed by the COR to remove unsuitable foundation material.

B. Overexcavation: Excavation performed for the convenience, fault, or operation of the Contractor beyond specified or directed additional excavation lines.

C. Cover: Distance between the top surface of buried cables, conductors, or conduits and the finished grade.

1.03 PROJECT CONDITIONS

A. Excavated materials are predominantly fine- to medium-grained, hard sand composed of quartz and feldspar. Laboratory classifications of materials from explorations were predominantly poorly graded sand (SP). These materials will be used to construct the embankments. Field investigations do not indicate the presence of extensive quantities of clayey or cohesive soils. Clayey or cohesive soils are not to be used for backfill about structures. Clayey or cohesive soils can be used for geomembrane soil cover.

B. To facilitate excavation of the predominantly sandy soils, prewetting has been beneficial on the All American Canal lining project. The addition of water increases the firmness of the soil and allows more efficient operation of equipment.

C. The natural moisture content of material from required excavation averages 2 percent. Application of water prior to and during construction will be necessary to obtain compaction of the materials.

PART 2 PRODUCTS

2.01 EXCAVATED MATERIALS

A. The Contractor's operations in excavations shall be such that excavations will yield as much suitable material for use in permanent construction required under these specifications as practicable.

B. Place excavated materials which are too wet for immediate compaction temporarily in stockpiles until moisture content is reduced sufficiently to permit them to be placed in backfill or embankments.

2.02 MATERIAL FOR BACKFILL

A. Obtain backfill material from material excavated in required excavation for structures. If sufficient suitable material is not available from this source, obtain additional material from required reservoir excavation or from approved borrow pits.

B. Maximum particle size: 3 inches in maximum dimension.

C. Unsuitable materials:

1. Material containing brush, roots, sod, or other organic materials.
2. Clayey or cohesive soils as determined by the COR.

D. Backfill within 2 inches of buried electrical grounding cables, insulated cables, and conduit: Sand or equally fine earth material.

2.03 MATERIAL FOR COMPACTED BACKFILL

A. Obtain from required excavation for the reservoir or from borrow source approved by COR.

B. Maximum particle size: 3 inches in maximum dimension.

C. Unsuitable materials:

1. Material containing brush, roots, sod, or other organic materials.
2. Clayey or cohesive soils as determined by the COR.

PART 3 EXECUTION

3.01 EXCAVATION, GENERAL

A. Excavate structure foundations to elevations shown on the drawings or established by the COR.

B. The Government reserves the right, during progress of work, to vary slopes, grades, and dimensions of excavations from those specified.

C. The Government does not represent that excavation performed under these specifications can be made to or maintained at paylines shown on the drawings or described in these specifications.

D. Perform excavation in the dry, except for pre-wetting.

E. Blasting: Not allowed.

F. Take precautions to preserve material below and beyond established lines of excavation in the soundest possible condition.

1. Damage to foundations due to the Contractor's operations shall be repaired by and at the expense of the Contractor.

2. Material beyond required or prescribed excavation lines which is loosened by the Contractor's operations shall be removed and replaced by and at the expense of the Contractor.

3.02 SURFACES OF EXCAVATION

A. Except for bottom surfaces of trenches and surfaces of excavation that are to be covered with concrete or surfacing materials, sharp points of undisturbed material will be permitted to extend within the prescribed excavation lines not more than 2 inches.

3.03 PREPARATION OF STRUCTURE FOUNDATIONS

A. Prepare foundations at structure sites by methods which will provide firm foundations for structures.

1. Finish bottom and side slopes of excavation, upon or against which the structure is to be placed, to prescribed dimensions.

2. To form firm foundations upon or against which will be placed either the structure or concrete protective coating compact the foundation material to inplace density specified in Compacting Backfill article below.

3. Add water to aid compaction in accordance with Section 02302 – Compacting Earth Materials.

B. Where unsuitable material is encountered in the foundation for a structure, the COR will direct performance of additional excavation to remove unsuitable material.

1. Backfill additional excavation with compacted backfill in accordance with Compacting Backfill article below.

C. Increase depth of minimum excavation lines for concrete structures shown on drawings by 3 inches to allow concrete protective coatings to be applied.

D. Apply concrete protective coatings in accordance with Section 03300 – Cast-In-Place Concrete.

3.04 OVEREXCAVATION

A. If foundation material is excavated beyond lines required to receive the structure, fill overexcavation with suitable materials and compact in accordance with Compacting Backfill article below.

B. If foundation material is disturbed or loosened during excavation or otherwise, compact foundation in place or remove and replace it with suitable material and compact in accordance with Compacting Backfill article below.

3.05 FOUNDATION INSPECTION

A. The Government will inspect all foundation surfaces.

B. Provide a minimum twenty-four (24) hours notice to the COR before a section of foundation surface is ready for inspection.

C. The Government may require up to twenty four (24) hours to map, inspect, test, and approve a section of foundation.

D. Where additional excavation or overexcavation is performed, the COR will inspect and approve the foundation surface before backfill is placed.

3.06 REPAIR OF FOUNDATION

A. Repair damage to foundation beyond required excavation lines at Contractor's expense.

3.07 TRENCHES FOR BURIED ELECTRICAL GROUNDING CABLES, INSULATED CABLES OR CONDUCTORS, AND CONDUIT

A. Excavate trenches to depths to provide a minimum of 24 inches of cover over the cables, conduits, and conductors.

B. Excavate trenches to provide minimum bottom widths sufficient to place 2 inches of sand between the trench sides and the closest cable, conduit, or conductor.

3.08 DISPOSAL OF EXCAVATED MATERIALS

A. Dispose of excavated materials which are unsuitable for or are in excess of embankment, backfill, or other earthwork requirements, as determined by the COR, as provided in Section 02324 - Disposal of Excavated Materials.

3.09 PLACING BACKFILL

A. Place backfill to the lines and grades shown on the drawings, or as directed by the COR.

B. Place backfill in accordance with Section 02302 – Compacting Earth Materials.

C. Do not place backfill against concrete, soil cement, or CLSM until design strength is reached.

D. Backfill trenches to the finished lines of adjacent earthwork.

3.10 COMPACTING BACKFILL

A. Add water to aid compaction in accordance with Section 02302 – Compacting Earth Materials.

B. Compact backfill in accordance with Section 02302 – Compacting Earth Materials with the following exceptions:

1. Compact materials to obtain an in-place density of:
    a. Minimum of 98 percent compaction, or
    b. Minimum of 80 percent relative density, or
    c. Minimum of 98 percent relative compaction.

C. Perform special compaction in accordance with Section 02302 – Compacting Earth Materials at locations shown on drawings.

3.11 PROTECTION

A. To provide adequate protection for compacted backfill about a structure, the Government reserves the right to direct the Contractor to place a sufficient amount of backfill or embankment material over compacted backfill within 72 hours after completion of compacting backfill.

END OF SECTION

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SECTION 02319 – RESERVOIR EARTHWORK

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Excavation for Reservoir:

1. Measurement: Volume to lines, grades, and dimensions shown on drawings, or as directed by COR.
    a. Includes excavation for reservoir and forebay/afterbay.
    b. Includes excavation for Drop 2 inlet canal from canal station 342+00 to canal station 354+75.51 as shown on drawings.
2. Payment: Cubic yard price offered in the schedule.
    a. Includes hauling and handling of material for geomembrane soil cover.
    b. Includes hauling and stockpiling material for soil-cement.
    c. Includes hauling to waste of any excess material.
    d. Overexcavation performed beyond specified or directed paylines and embankment and compaction of embankment for such overexcavation shall be at the expense of the Contractor.
    e. Includes procuring and applying water to prewet reservoir excavations.
    f. Does not include cost of hauling material excavated in the reservoir for use in canal embankment. Include the cost of hauling material excavated in the reservoir for use in canal embankment in the cubic yard price for constructing canal embankments in accordance with Section 02317 – Canal Earthwork.
    g. Does not include cost of hauling material excavated in the reservoir for use in reservoir embankments. Include the cost of hauling material excavated in the reservoir for use in reservoir embankments in the cubic yard price for placing and compacting reservoir embankments.

B. Placing and Compacting Reservoir Embankments:

1. Measurement: Volume to lines, grades, and dimensions shown on drawings, or as directed by COR.
    a. Includes placing, moistening, and compacting embankments for reservoir and forebay/ afterbay.
    b. Includes placing, moistening, and compacting canal embankments between canal stations 342+00 and 354+75.51 as shown on drawings.
2. Payment: Cubic yard price offered in the schedule.

a. Includes hauling from excavation source and handling of necessary material. Material from required excavation for reservoir used for placing and compacting reservoir embankments will be paid for both as excavation for reservoir when removed from original position and as placing and compacting reservoir embankments when placed.

b. Includes procuring and applying water for compacting embankments.

c. No payment will be made for the removal and reconstruction of defective and nonconforming reservoir embankment, forebay/afterbay embankment, or inlet canal embankment compacted to an insufficient density.

1.02 DEFINITIONS

A. Additional Excavation: Excavation beyond specified lines as directed by the COR to remove unsuitable foundation material.

B. Overexcavation: Excavation performed for the convenience, fault, or operation of the Contractor beyond specified or directed additional excavation lines.

C. Embankment: As used in this Section refers to reservoir embankment, forebay/afterbay embankment, and canal embankment between canal stations 342+00 and 354+75.51.

1.03 PROJECT CONDITIONS

A. Excavated materials are predominantly fine- to medium-grained, hard sand composed of quartz and feldspar. Laboratory classifications of materials from explorations were predominantly poorly graded sand (SP). These materials will be used to construct the embankments. Field investigations do not indicate the presence of extensive quantities of clayey or cohesive soils. Clayey or cohesive soils are not to be used for reservoir embankments. Clayey or cohesive soils can be used for geomembrane soil cover in the reservoir.

B. To facilitate excavation of the predominantly sandy soils, prewetting has been beneficial on the All American Canal lining project. The addition of water increases the firmness of the soil and allows more efficient operation of equipment.

C. The natural moisture content of material from required excavation averages 2 percent. Application of water prior to and during construction will be necessary to obtain compaction of the materials.

D. Abandoned wells are present within the footprint of the reservoir and canal. There are steel cased wells and PVC geotechnical investigation wells that shall be abandoned in accordance with Section 02226 – Removing Existing Well Protective Pipes and Grouting Standpipes.

E. An area with soil containing the required range of fines content that is suitable for soil cement has been delineated. The locations are addressed in Sections 00321 – Geologic Investigations and on the drawings.

PART 2 PRODUCTS

2.01 COMPACTED EMBANKMENT MATERIAL

A. Obtain from required excavation for the reservoir or from borrow source approved by COR.

B. Maximum particle size: 3 inches in maximum dimension.

C. Unsuitable materials:

1. Material containing brush, roots, sod, or other organic materials.
2. Clayey or cohesive soils as determined by the COR.

PART 3 EXECUTION

3.01 PREPARATION FOR EXCAVATION

A. Strip areas to be excavated including borrow areas and stockpile areas in accordance with section 02236 – Stripping.

B. Remove and control water in accordance with Section 02242 – Removal and Control of Water.

C. Prior to and during excavation of the reservoir, prewet materials to the depth of excavation to provide moisture content that readily facilitates excavation and material handling.

D. Grout and remove existing wells in accordance with Section 02226 – Removing Existing Well Protective Pipes and Grouting Standpipes.

E. Prepare a stockpile area for soil obtained from reservoir excavation for use in soil cement.

3.02 PREWETTING RESERVOIR EXCAVATIONS

A. Apply moisture by sprinkler irrigation.

B. Control application of water, and check depth of water penetration during application so as to avoid over-irrigation.

C. All material shall be dust-free when excavated, loaded, and hauled.

D. If excessive moisture is encountered take measures to reduce moisture by selective excavation to secure the drier material; by excavating and placing in temporary stockpiles materials containing excessive moisture; by allowing adequate additional time for drying; or by other approved means.

3.03 EXCAVATION

A. Excavate for reservoir to lines and grades shown on drawings or established by COR.

B. Excavate for forebay/afterbay to lines and grades shown on drawings or established by COR.

C. Excavate for Drop 2 inlet canal between canal stations 342+00 and 354+75.51 to lines and grades shown on drawings or established by COR.

D. Stockpile excavated material suitable for soil cement.

E. Do not excavate beyond depths shown on drawings unless directed by COR.

F. Handle suitable excavated material to minimize contamination and particle breakdown.

G. Where unsuitable material is encountered, the COR will direct performance of additional excavation to remove unsuitable material.

1. Refill additional excavation with material as directed by the COR.

H. Maintain access to abandoned wells as approved by the COR. Abandon the wells in accordance with Section 02226 – Removing Existing Well Protective Pipes and Grouting Standpipes.

3.04 OVEREXCAVATION

A. If foundation material is excavated beyond required lines, fill overexcavation with suitable materials and compact in accordance with Compacting Embankments article below.

B. If foundation material is disturbed or loosened during excavation or otherwise, compact foundation in place or remove and replace it with suitable material and compact in accordance with Compacting Embankments article below.

3.05 FOUNDATION INSPECTION

A. The Government will inspect all foundation surfaces.

B. Provide a minimum twenty-four (24) hours notice to the COR before a section of foundation surface is ready for inspection.

C. The Government may require up to twenty four (24) hours to map, inspect, test, and approve a section of foundation.

3.06 REPAIR OF FOUNDATION

A. Repair damage to foundation beyond required excavation lines at Contractor's expense.

3.07 STOCKPILING EXCAVATED MATERIALS

A. Stockpile materials excavated for use in soil-cement at approved locations in accordance with the approved site use plan and Section 02377 – Soil-Cement.

B. Stockpile stripping materials at approved locations in accordance with the approved site use plan and Section 02236 - Stripping.

C. If required, stockpile materials for geomembrane soil cover.

3.08 PREPARATION OF EXCAVATED SURFACES

A. Prior to placement of compacted embankment, and forebay/afterbay embankment, and placement of geomembrane in the reservoir bottom, compact the embankment foundation and reservoir bottom with four (4) passes of a vibratory roller as specified in Compacting Embankments article below.

B. Add water to aid compaction in accordance with Section 02302 – Compacting Earth Materials.

C. Notify COR if any foundations conditions appear unsuitable or unstable for placement of geomembrane or embankments.

3.09 PLACING EMBANKMENTS

A. Construct embankments to top widths and side slopes as shown on drawings.

B. Construct in lift thickness of up to 12 inches in accordance with Section 02302 – Compacting Earth Materials and as demonstrated in test fills for the specific compaction equipment used.

C. In conjunction with embankment construction, construct operation and maintenance roads as shown on the drawings.

1. Grade finished surfaces of operation and maintenance roads for placement of gravel surfacing in accordance with Section 02732 – Gravel Surfacing.

3.10 COMPACTING EMBANKMENTS

A. Add water to aid compaction. The moisture content of compacted embankment material prior to and during compaction shall be in accordance with Section 02302 – Compacting Earth Materials.

B. Compaction equipment: Compact with vibrating pad foot rollers, or vibrating smooth drum rollers, single or dual drum.

1. Drums:

a. Static weight at drum dry: Minimum 20,000 pounds.

b. Centrifugal force per drum: Minimum 45,000 pounds when operating between 1,200 and 2,000 vibrations per minute.

2. Provide a vibratory roller with a Compaction Meter Value (CMV) instrumentation system with operator display, or equivalent as approved by the COR, to assist the operator in monitoring compaction.

a. CMV data will not be used as a basis for acceptance or rejection of degree of compaction as required in this article and Section 02302 – Compacting Earth Materials.

3. Operate at constant frequency and at speeds not to exceed 1-1/2 miles per hour.

4. Do not allow roller to remain stationary with the vibrating mechanism operating.

C. Compact embankments in accordance with Section 02302 – Compacting Earth Materials with the following exceptions:

1. Compact by vibratory roller to obtain an in-place density of:

a. Minimum of 98 percent compaction, or

b. Minimum of 80 percent relative density, or

c. Minimum of 98 percent relative compaction.

2. Minimum number of roller passes: 4.

3. One pass is defined as the number of successive trips with overlap to ensure coverage of the entire surface of each layer by the roller drum. Do not make the second and subsequent passes until the previous pass is complete.

3.11 DISPOSAL

A. Dispose of unsuitable or excess excavated materials in accordance with Section 02324 - Disposal of Excavated Materials.

END OF SECTION

SECTION 02320 – DROP 2 ACCESS ROADWAY EARTHWORK

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Excavation for Access Road to Drop 2 Powerplant:

1. Measurement: Volume to lines, grades, and dimensions shown on drawings, or as directed by COR
2. Payment: Cubic yard price offered in the schedule.
    a. Includes pre-wetting as required and excavation
    b. Overexcavation performed beyond specified or directed paylines and embankment and compaction of embankment for such overexcavation shall be at the expense of the Contractor.

B. Access Road to Drop 2 Powerplant Embankments:

1. Measurement: Volume of compacted roadway embankments measured to lines, grades, and dimensions shown on drawings or as directed by COR.
2. Payment: Cubic yard price offered in the schedule.
    a. Includes preparing roadway embankment foundation surfaces.
    b. Includes moistening Drop 2 powerplant access roadway berm embankment.
    c. No payment will be made for the removal and reconstruction of defective and nonconforming embankment compacted to an insufficient density.

1.02 DEFINITIONS

A. Additional Excavation: Excavation beyond specified lines as directed by the COR to remove unsuitable foundation material.

B. Overexcavation: Excavation performed for the convenience, fault, or operation of the Contractor beyond specified or directed additional excavation lines at Contractor's expense.

1.03 PROJECT CONDITIONS

A. Constructing access roadway embankments includes constructing access roadway berm embankment shown on drawings.

B. To facilitate excavation of the predominantly sandy soils, prewetting has been beneficial on the All American Canal lining project. The addition of water increases the firmness of the soil and allows more efficient operation of equipment.

PART 2 PRODUCTS

2.01 COMPACTED EMBANKMENT MATERIAL

A. Obtain from required excavation or from approved borrow source.

B. Maximum particle size: 3 inches in maximum dimension.

C. Unsuitable materials:

1. Material containing brush, roots, sod, or other organic materials.
2. Clay soils, dry clay, clay clods.

PART 3 EXECUTION

3.01 ACCESS ROADWAY EXCAVATION

A. Excavate access roadway to Drop 2 Powerplant to lines, grades and dimensions shown on drawings or established by COR and for placing compacted embankment.

B. Excavate drainage ditches as shown on drawings.

3.02 ADDITIONAL EXCAVATION

A. Perform additional excavation beyond specified lines as directed by the COR.

3.03 OVEREXCAVATION

A. Replace excavation beyond established grades with additional material from borrow and compact in accordance with Section 02302 - Compacting Earth Materials.

3.04 PREPARATION OF SURFACES UNDER ACCESS ROADWAY EMBANKMENTS

A. Perform stripping in accordance with Section 02236 – Stripping.

B. Scarify entire surfaces of roadway embankment foundations to a depth of at least 6 inches.

C. Compact the embankment foundation with four (4) passes of a vibratory roller as specified in Constructing and Compacting Access Roadway Embankments article below.

D. Add water to aid compaction in accordance with Section 02302 – Compacting Earth Materials.

3.05 CONSTRUCTING AND COMPACTING ACCESS ROADWAY EMBANKMENTS

A. Construct roadway embankments to top widths and side slopes shown on drawings.

B. Construct roadway berm embankment to top widths and side slopes shown on drawings, no compaction is required.

C. Compact embankments as shown on drawing in accordance with Section 02302 – Compacting Earth Materials.

D. Add water to aid compaction in accordance with Section 02302 – Compacting Earth Materials.

E. Compaction equipment: Compact with vibrating pad foot rollers, or vibrating smooth drum rollers, single or dual drum.

1. Drums:

a. Static weight at drum dry: Minimum 20,000 pounds.

b. Centrifugal force per drum: Minimum 45,000 pounds when operating between 1,200 and 2,000 vibrations per minute.

2. Provide a vibratory roller with a Compaction Meter Value (CMV) instrumentation system with operator display, or equivalent as approved by the COR, to assist the operator in monitoring compaction.

a. CMV data will not be used as a basis for acceptance or rejection of degree of compaction as required in this article and Section 02302 – Compacting Earth Materials.

3. Operate at constant frequency and at speeds not to exceed 1-1/2 miles per hour.

4. Do not allow roller to remain stationary with the vibrating mechanism operating.

F. Compact embankments in accordance with Section 02302 – Compacting Earth Materials with the following exceptions:

1. Compact by vibratory roller to obtain an in-place density of:

a. Minimum of 98 percent compaction, or

b. Minimum of 80 percent relative density, or

c. Minimum of 98 percent relative compaction.

2. Minimum number of roller passes: 4.

3.06 DISPOSAL

A. Dispose of unsuitable or excess excavated materials in accordance with Section 02324 - Disposal of Excavated Materials.

END OF SECTION

SECTION 02321 – EXCAVATION FROM BORROW

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in applicable prices offered in the schedule for placement of the materials obtained from borrow.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 02321-1, Borrow Area Use Plan

1. Describe anticipated use, borrow area layout, equipment and operations.

1.03 PROJECT CONDITIONS

A. Based on anticipated materials usages, excavation from borrow should not be required to provide material for embankments. However, should additional embankment material be required, a borrow area has been designated on the drawings.

B. The approximate limits of the borrow areas are shown on the drawings.

C. The exact limits will be approved by the COR.

D. Borrow pits adjacent to the embankment provide the potential for instability. Therefore, borrow should be filled to the original ground surface with material from stripping.

E. Excavated materials are predominantly fine- to medium-grained, hard sand composed of quartz and feldspar. Laboratory classifications of material from explorations were predominantly poorly graded sand (SP). These materials will be used to construct the embankments. Field investigations do not indicate the presence of extensive quantities of clayey or cohesive soils. Any clayey or cohesive soils excavated are to be wasted in areas approved by the COR and not used for compacted embankments or other earthwork requirements.

F. To facilitate excavation of the predominantly sandy soils, prewetting has been beneficial on the All American Canal lining project. The addition of water increases the firmness of the soil and allows more efficient operation of equipment.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 EXCAVATION OPERATIONS

A. Do not operate outside of borrow area boundaries shown on drawings.

B. Perform borrow area operations in accordance with all applicable federal, state, and local regulations.

C. Prior to and during excavation of borrow material, prewet materials to the depth of excavation to provide moisture content that readily facilitates excavation and material handling.

D. Perform clearing, grubbing, and stripping in accordance with Section 02232 - Clearing and Grubbing and Section 02236 - Stripping in such manner to leave sites in a condition for future use.

E. Unless approved by the COR, do not excavate beyond 10 feet depth below the original ground surface.

F. Utilize suitable materials obtained from required excavation before obtaining materials from borrow areas.

G. Excavate sufficient suitable materials from borrow areas to complete required work.

H. Dispose of unsuitable excavated earth materials or selectively excavate and leave unsuitable material in place.

3.02 BORROW PIT COMPLETION

A. Fill with material from stripping.

B. Place in approximately 12 inch lifts.

C. Compact with uniform distribution of equipment travel.

D. Add water as required to facilitate dust abatement and compaction.

END OF SECTION

SECTION 02322 – EXCAVATION OF EXISTING EARTH PLUG

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Excavation of Existing Earth Plug:

1. Measurement: Volume to lines, grades, and dimensions shown on drawings.
2. Payment: Cubic yard price offered in the schedule.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals.

B. RSN 02322-1, Excavation of Existing Earth Plug Plan:

1. Include equipment, loadings, schedule, sequence, and methods to excavate existing earth plug and remove existing geomembrane material.

1.03 PROJECT CONDITIONS

A. Excavation of existing earth plug can be accomplished by common methods.

B. Excavation of existing earth plug needs to occur prior to cessation of dewatering activities.

C. To facilitate excavation of existing earth plug, the Outlet Canal shall be filled to a level such that the water surface is equal in elevation with that in the All American Canal Reach 3.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 COORDINATION

A. Coordinate with COR, Imperial Irrigation District, and approved plan before beginning excavation of existing earth plug.

B. Receive written approval from COR to begin excavation of existing earth plug.

3.02 FILLING

A. Fill Outlet Canal and steel pipes before beginning excavation of existing earth plug.

3.03 EXCAVATION OF EXISTING EARTH PLUG

A. Excavate existing earth plug located at All-American Canal confluence structure in accordance with approved plan.

B. Remove existing geomembrane in accordance with approved plan.

3.04 PROTECTION

A. Protect existing concrete canal lining and canal earthwork remaining in place from damage.

3.05 CANAL LINING INSPECTION

A. The COR will perform inspections of existing concrete canal lining and canal earthwork to remain in place for damage caused by Contractor.

3.06 REPAIR

A. Repair damage to existing concrete canal lining or canal earthwork to COR's approval at Contractor's expense.

3.07 DISPOSAL

A. Waste excavated earth plug material not suitable for use or not necessary for construction, as approved by COR, in accordance with Section 02324 – Disposal of Excavated Material.

B. Dispose of removed geomembrane material in accordance with Section 01740 – Cleaning.

END OF SECTION

SECTION 02323 - CONTROLLED LOW STRENGTH MATERIAL (CLSM)

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Controlled Low Strength Material:

1. Measurement: Volume measured in place to lines, grades, and dimensions shown on drawings or established by the COR.
2. Payment: Cubic yard price offered in the schedule.

B. Cementitious Materials for Controlled Low Strength Material:

1. Measurement: Weight of materials used in controlled low strength material based on batch weights and batch counts at batch plant measured in most practical manner.
2. Payment: Ton price offered in the schedule.
   a. No payment will be made for cementitious materials in wasted controlled low strength material.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM C 33-07	Concrete Aggregates
2.	ASTM C 40-04	Organic Impurities in Fine Aggregates for Concrete
3.	ASTM C 94/C 94M-07	Ready-Mixed Concrete
4.	ASTM C 114-07	Chemical Analysis of Hydraulic Cement
5.	ASTM C 143/C 143M-05a	Slump of Hydraulic-Cement Concrete
6.	ASTM C 150-07	Portland Cement
7.	ASTM C 618-08	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
8.	ASTM C 1602/C 1602M-06	Mixing Water Used in the Production of Hydraulic-Cement Concrete
9.	ASTM D 4832-02	Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinder
10.	ASTM D 6103-04	Flow Consistency of Controlled Low Strength Material (CLSM)

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 02323-1, Approval data:

1. Mix design with test results showing conformance with specified requirements for compressive strength and spread.
2. Method to place CLSM to prevent pipe flotation and lateral pipe movement.
3. Plans to keep CLSM moist for 24 hours.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Furnish batch ticket with each batch of CLSM in accordance with ASTM C 94. Deliver ticket to COR at jobsite during batch delivery.

PART 2 PRODUCTS

2.01 CEMENTITIOUS MATERIALS

A. Cementitious Materials Options:

1. Specified portland cement only.
2. Specified portland cement plus specified pozzolan.
3. Pozzolan only.

B. Portland Cement:

1. ASTM C 150 Type II or V.

C. Pozzolan:

1. ASTM C 618, Class C or Class F.

2.02 WATER

A. ASTM C 1602, including optional requirements of Table 2.

2.03 SOIL AND AGGREGATE

A. Use either soil or aggregate.

B. Soil:

1. Obtain onsite from required excavation for reservoir.
2. Soil producing a color darker than the standard color when tested in accordance with ASTM C 40: Not allowed.

3. Gradation:

   a. Passing U.S. Standard No. 200 sieve, by weight, maximum: 30 percent.

   b. Passing U.S. Standard No. 100 sieve, by weigh, maximum: 50 percent.

   c. Maximum particle size: 1/8 of open distance between pipe and trench wall or 1-1/2 inches, whichever is less.

4. Select or process soil so that particles remain in suspension, i.e. no segregation occurs, when controlled low strength material is placed.

5. Plasticity: Nonplastic.

6. Clay balls:

   a. Maximum percent, by weight of soil: 10 percent.

   b. Maximum size: 1/2 inch.

C. Aggregate:

1. ASTM C 33, fine aggregate.

2.04 MIX

A. Use one of specified cementitious materials options.

B. Water-cementitious materials ratio, maximum: 3.5 to 1, by weight.

C. Water content: Not to exceed that required to provide a mix that will flow without segregation or bleeding and can be pumped.

D. 7-day Compressive strength, ASTM D 4832: Not less than 50 lb/in^2 and not more than 100 lb/in^2.

E. Consistency:

1. Spread, ASTM D 6103: 8 to 9 inches.

2.05 TEMPERATURE

A. Ambient temperature at time of placement: 110 degrees F maximum or as directed by COR.

2.06 TRIAL MIXES

A. Make trial mixes prior to construction to determine mixture adequacy.

1. Determine compressive strength in accordance with ASTM D 4832.

2. Determine spread in accordance with ASTM D 6103.

PART 3 EXECUTION

3.01 BATCHING EQUIPMENT

A. Design and operation of mixers: Controlled low strength material, as discharged, is uniform in composition and consistency throughout each batch.

3.02 PREPARATION

A. Place pipe on soil pads or other approved compressible material such as extruded polystyrene foam insulation as shown on drawings.

B. Weld pipe joints and repair coatings before placing controlled low strength material.

3.03 PLACING

A. Do not place controlled low strength material during rain.

B. Do not mix or place controlled low strength material when ambient temperature is below 40 degrees F. However, when ambient temperature is 35 degrees F or above, controlled low strength material may be placed when ambient temperature is rising.

C. Place controlled low strength material to lines, grade, and dimensions shown on drawings.

1. Initially, place controlled low strength material from one side of pipe. Where necessary, rod or vibrate controlled low strength material so that controlled low strength material flows under pipe and appears on other side.
2. Place controlled low strength material in lifts on both sides of pipe to prevent floatation of pipe. Ballast, weigh, or anchor pipe down if required before placing controlled low strength material as approved by COR. Rod or vibrate until controlled low strength material completely fills space between pipe and trench.
3. Do not disturb pipe trench or allow foreign material to become mixed with controlled low strength material.

D. To prevent uplift, place controlled low strength material in lifts on either side of pipe, allowing sufficient time for initial set before subsequent lifts are placed.

E. Do not place backfill material over controlled low strength material for 24 hours or as directed by COR.

3.04 JOINT PREPARATION

A. When placements between horizontal lifts are delayed, or when a vertical joint is created:

1. Remove standing water prior to placing controlled low strength material.

2. Remove excess sand between placements prior to placing controlled low strength material.

3.05 FIELD QUALITY ASSURANCE

A. The Government will obtain samples and test for compressive strength in accordance with ASTM D 4832 and spread in accordance with ASTM D 6103.

3.06 PROTECTION

A. Keep moist for 24 hours or until backfill is placed over controlled low strength material.

END OF SECTION

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SECTION 02324 - DISPOSAL OF EXCAVATED MATERIALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost in prices offered in the schedule for excavation.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 DISPOSAL OF EXCAVATED MATERIALS

A. Dispose of material from required excavation which is not suitable for backfill or embankment or is in excess of that required for backfill or embankment.

B. Deposit waste excavated material in waste banks in areas as shown on drawings or as directed by COR.

C. Do not waste material by dumping from top of slope.

D. Grade waste banks to reasonably even and uniform surfaces that blend with natural terrain.

1. Minimum slope: 2 percent.
2. Maximum slope: 4:1.

E. Leave surface in a condition that will facilitate natural revegetation.

F. Spread topsoil over disposal areas in accordance with Section 02236 – Stripping.

END OF SECTION

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SECTION 02331 – GRAVEL FILTER MATERIAL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Gravel Filter Material:

1. Measurement: Volume of gravel filter material measured to lines, grades, and dimensions shown on drawings.
2. Payment: Cubic yard price offered in the schedule.

1.02 REFERENCES

A. ASTM International (ASTM)

1. ASTM C 33-07 Concrete Aggregates

PART 2 PRODUCTS

2.01 MATERIALS

A. Gravel filter material: ASTM C 33 coarse aggregate, Size No. 8.

PART 3 EXECUTION

3.01 PREPARATION

A. Install geonet composite, geotextile and geomembrane in accordance with Section 02346 – Geotextile and Geonet Composite and Section 02344 – Geomembrane.

B. Do not place material over geotextile until geotextile has been inspected and approved by COR.

3.02 PLACING AND COMPACTING

A. Place to lines, grades, and dimensions shown on drawings.

B. Drop height of gravel filter material onto geotextile and geomembrane, maximum: 1 foot.

C. Compact gravel filter material using light smooth drum vibratory roller or plate vibrator as approved by COR.

D. Minimize handling of material to prevent particle breakdown.

E. Avoid contamination of gravel filter material.

END OF SECTION

SECTION 02332 - ROCKFILL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Rockfill:

1. Measurement: Volume to lines, grades, and dimensions shown on drawings.
2. Payment: Cubic yard price offered in the schedule.
    a. Includes processing to break oversize material to required dimensions for rock placed in the reservoir and for rock placed in the Coachella Canal temporary bypass channel.
    b. Does not include hauling and placing rock for the Coachella Canal temporary bypass channel. Refer to Section 02261 – Diversion and Care of Coachella Canal During Construction.

PART 2 PRODUCTS

2.01 ROCK

A. Obtain from Government-Furnished stockpile located on west side of reservoir site in accordance with Section 01640 – Government-Furnished Products.

B. The rockfill stockpile may contain material larger than 2-foot maximum size. Processing may be required to either remove oversize material on site or to reduce the maximum size of the material to specified limits.

C. Rockfill material is stockpiled on the reservoir site. The Contractor shall check the stockpile site and determine the extent of processing required to obtain the specified range of material size.

D. Reasonably well graded in accordance with the following:

1. Minimum size: 6 inches.
2. Maximum size: 24 inches.
3. Rock may contain material less than 6 inches in maximum size provided that the quantity shall not exceed an amount which fills the voids in the larger material.

PART 3 EXECUTION

3.01 PROCESSING

A. Process the material using a hoe-ram or other approved mechanical means to break oversize material to the required dimensions.

B. Process a sufficient quantity of material from the Government furnished stockpile to meet the requirements for rockfill in the reservoir and for rock used in the Coachella Canal temporary bypass in accordance with Section 02261 – Diversion and Care of Coachella Canal During construction.

3.02 PLACING

A. Place in continuous, approximately horizontal layers.

B. Place rockfill to the lines, grades, and thickness shown on the drawings.

C. Place rocks so that larger rocks are evenly distributed and small rock fragments fill the spaces.

D. Dump and smooth by moving rocks into position so that material when in place is stable.

E. Placing rockfill on geosynthetics:

1. Drop height, maximum: 1-foot.
2. Before placing rockfill, demonstrate that placing technique will not damage geotextile or underlying geomembrane.
    a. If the demonstration does not show that rockfill can be installed without damaging geosynthetic materials, modify rockfill placing technique.
    b. Possible modifications to placing technique include reducing drop height.

F. Begin rockfill placement at soil cement weir.

G. Do not compact rockfill.

END OF SECTION

SECTION 02333 – GEOMEMBRANE SOIL COVER

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Geomembrane Soil Cover:

1. Measurement: Volume to lines, grades, and dimensions shown on drawings or as directed by COR.

2. Payment: Cubic yard price offered in the schedule.

a. Includes furnishing, placing and compacting geomembrane soil cover.

1.02 SEQUENCING

A. Compact finished reservoir surfaces in accordance with Section 02319 – Reservoir Earthwork.

B. Install geomembrane in accordance with Section 02344 – Geomembrane.

C. Furnish, place and compact geomembrane soil cover in accordance with this section.

PART 2 PRODUCTS

2.01 GEOMEMBRANE SOIL COVER

A. Obtain from required excavation for reservoir or from borrow source approved by COR.

B. Geomembrane soil cover materials are predominantly fine- to medium-grained, hard sand composed of quartz and feldspar. Laboratory classifications of materials from explorations were predominantly Poorly Graded Sand (SP).

C. Clayey and cohesive soils from required excavation may be used for geomembrane soil cover provided that these soils are not placed immediately adjacent to the gravel filter material.

D. The natural moisture content of material from required excavation averages 2 percent. Application of water prior to and during construction shall be necessary to obtain compaction of the materials.

E. Gradation:

1. Maximum particle size: 3 inches in maximum dimension.

F. Unsuitable materials:

1. Material containing brush, roots, sod, or other organic materials.
2. Within the first lift: Material with sharp edges as determined by COR.

PART 3 EXECUTION

3.01 PREPARATION

A. Do not place soil cover material on geomembrane until geomembrane has been inspected and approved by COR.

3.02 MOISTURE CONTROL

A. Moisten or aerate material, as necessary, to provide moisture content that readily facilitates obtaining optimum compaction as specified in Section 02302 – Compacting Earth Materials.

B. Prior to and during compaction, maintain moisture content that obtains maximum practicable compaction without interfering with trafficability of hauling, placing or compacting equipment.

3.03 PLACING

A. Place material to the lines, grades, and thickness shown on the drawings.

B. With the exception of the area adjacent to the soil cement weir, place geomembrane soil cover in two 12-inch lifts. Due to the thickness of the soil cement weir, additional lifts are required to meet the lines and grades shown on the drawings.

C. Place and compact soil cover material in continuous, approximately horizontal layers not to exceed 12 inches in thickness after compaction.

D. Do not operate wheeled or tracked vehicles and equipment directly on the surface of geomembrane.

E. Place first lift of cover material within 14 days after completion of geomembrane installation.

F. Take care to avoid inducing unnecessary stresses and prevent damage to underlying geomembrane.

G. Do not drop material on geomembrane from a height greater than 1 foot above geomembrane.

H. Avoid sharp turns or sudden stops by equipment when placing cover material on geomembrane.

I. Place cover material with low ground pressure (LGP) wide track crawler type dozer.

1. Ground pressure, maximum: 5.5 lb/in^2.

2. Maintain 12 inches of cover material under LGP tracks during placement.

3.04 COMPACTING

A. First lift:

1. Four passes of tracked equipment which applies a ground pressure less than or equal to 5.5 pounds per square inch.

2. Maintain a minimum of 12 inches of soil cover material between the low-ground pressure equipment and the geomembrane at all times.

B. Subsequent 12-inch lifts:

1. Compact as specified in Section 02302 – Compacting Earth Materials.

2. Compact with tamping rollers, vibrating pad foot rollers, or vibrating drum rollers as appropriate for the type of material.

END OF SECTION

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SECTION 02344 – GEOMEMBRANE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Geomembrane:

1. Measurement: Surface area required to be covered including geomembrane placed in anchor trench, except no allowance will be made for seam overlap, repair, or waste.
2. Payment: Square yard price offered in the schedule.
   a. Includes boots, batten attachments, and anchoring accessories.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM D 638-03	Tensile Properties of Plastics
2.	ASTM D 792-00	Density and Specific Gravity (Relative Density) of Plastics by Displacement
3.	ASTM D 1004-07	Tear Resistance (Graves Tear) of Plastic Film and Sheeting
4.	ASTM D 1505-03	Density of Plastics by the Density-Gradient Technique
5.	ASTM D 1603-06	Carbon Black Content in Olefin Plastics
6.	ASTM D 3895-07	Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
7.	ASTM D 4437-99	Integrity of Seams Used in Joining Flexible Polymeric Sheet Geomembranes
8.	ASTM D 4833-07	Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
9.	ASTM D 5199-01(2006)	Measuring the Nominal Thickness of Geosynthetics
10.	ASTM D 5397-07	Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
11.	ASTM D 5596-03	Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
12.	ASTM D 5721-95(2002)	Air-Oven Aging of Polyolefin Geomembranes

13.	ASTM D 5885-06	Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry
14.	ASTM D 7238-06	Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Flouorescent UV Condensation Apparatus

B. Geosynthetics Institute (GSI) – Geosynthetic Research Institute (GRI)

1.	GRI GM 12 - 1998	Asperity Measurement of Textured Geomembranes Using a Depth Gage
2.	GRI GM 13 - 2006	Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
3.	GRI GM 19 - 2005	Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembrane.
4.	GRI GM 24 - 2007	Nondestructive Air Channel Evaluation and Acceptance Criteria of Polyethylene Dual Track Seamed Geomembranes

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 02344-1, Geomembrane Installer Qualifications and Installation Plan.

1. Qualifications of installation company.
    a. Name and address.
    b. Documentation of previous experience with specified geomembrane.
        1) Names of facility owner(s).
        2) Person to contact at facilities who can discuss projects listed.
        3) Project manager, designer, manufacturer, fabricator (if any).
        4) Locations, thicknesses, and area in square feet of geomembrane installed.
        5) Types of seaming and patching equipment used.
        6) Dates of installation.
2. Onsite personnel experience.
    a. Resumes, including dates and duration of employment and pertinent experience.
3. Manufacturer's technical representative(s).

a. Resume(s), including dates and duration of employment and pertinent experience.

4. Manufacturer's instructions for delivery, storage, and handling of geomembrane materials.

5. Geomembrane installation plan.

a. Work schedule.

b. Location, size, orientation, and identification (including whether textured or smooth) of panels and continuous seams.

c. Sequencing of panel installation.

d. Equipment and procedures for handling and installing panels.

e. Equipment and procedures for continuous seaming.

f. Equipment and procedures for geomembrane boots around reservoir penetrations.

g. Equipment and procedures for field testing adequacy of seaming equipment and seams.

h. Details of equipment, products, and procedures for cleaning, protecting, and repairing geomembrane and seams.

i. Equipment and procedures for geomembrane attachment to concrete structures.

j. Number of crews and crew size.

k. Contractors Quality Control (QC) Plan

C. RSN 02344-2, Qualifications of Manufacturer and Fabricator:

1. Name and address of geomembrane manufacturer.

2. Name and address of panel fabricator, if different from manufacturer.

3. Evidence of manufacturer experience

a. Name, location, owner, and purpose of completed facility.

b. Name and telephone number of contact at facility who can discuss project.

c. Geomembrane type and thicknesses, total square footage of installation, installation date, project manager, designer, fabricator (if any), and installer.

4. Descriptive documentation of manufacturer's quality control program.

D. RSN 02344-3, Notice of Start of Production.

E. RSN 02344-4, Certifications:

1. Certified test results of physical properties tests listed in Tables 02344B - HDPE Geomembrane Physical Properties, Submit at frequency specified in GRI GM-13. Identify with production date, roll goods number, and quantity represented
2. Manufacturer's certification that resin used in manufacture of geomembrane being furnished meets requirements of these specifications.
3. Copies of quality control certificates issued by resin supplier.
4. Certification that geomembrane and extrusion welding rod or pellets produced for use under this contract have the same properties and are compatible.

F. RSN 02344-5, Samples:

1. Submit samples from rolls of geomembrane to be furnished.
2. Sample the number of rolls as required in Table 02344A - Geomembrane Sampling Requirements.
3. Take 12-inch long samples from entire roll width.
4. Mark samples with contract name and number, product identification, lot number, roll number, machine direction, and quantity represented.
5. Sampling frequency may be increased if test results show that geomembrane does not meet specifications requirements.

Table 02235A - Geomembrane Sampling Requirements

Number of rolls to be furnished	Number of rolls to be sampled
1 – 2	1
3 – 8	2
9 – 27	3
28 – 64	4
65 – 125	5
126 – 216	6
217 – 343	7
344 – 512	8
513 – 729	9
730 – 1000	10

G. RSN 02344-6, Warranty:

1. The Contractor shall warrant the geomembrane installation workmanship to be free of defects for a period of 2 years.
2. Provide manufacturer's warranty that geomembrane material to be free of defects or failure for a period of 20 years.

H. RSN 02344-7, Surveyed As-Built Drawings.

1. Surveyed panel layout drawings.
2. Locations of patches, repairs, and destructive samples.
3. Deviations from panel layout drawings submitted as part of geomembrane installation plan.

1.04 QUALIFICATIONS

A. Onsite Geomembrane Installation Supervisor:

1. Installed or supervised installation and seaming of a minimum of 2,000,000 square feet of specified geomembrane.

B. Onsite Geomembrane Master Welder (Seamer);

1. Completed within the last 5 years, a minimum of 2,000,000 square feet of specified geomembrane seaming work using type of seaming apparatus proposed for use on this project. The master welder (seamer) may also be the installation supervisor/field engineer.

C. Other Onsite Geomembrane Welders (Seamers):

1. Seamed, within the past 3 years, a minimum of 100,000 square feet of specified geomembrane.

D. Geomembrane Manufacturer:

1. Completed facilities totaling at least 5,000,000 square feet of specified geomembrane.

E. Manufacturer's Technical Representative:

1. Qualified to provide technical advice on materials and procedures for installation.

F. Installer:

1. At least three separate and satisfactory installations totaling at least 2,000,000 square feet of specified geomembrane.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Ship, handle, store, and care for geomembrane in accordance with manufacturer's instructions.

B. Pack geomembrane in snug-fitting containers having smooth, abrasive-free interior to prevent damage to geomembrane during transit and handling.

1. Use containers having structurally sound bottoms designed for lifting with forklift-type trucks or approved cables or slings.

2. Mark each container of geomembrane with name of material, approved roll good numbers, specifications number, quantity contained, name of Contractor, and order or purchase number.

C. Do not stack rolls more than 3 rolls high.

D. Cover rolls of geomembrane with tarp if onsite for more than 30 days.

E. Protect geomembrane from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or cold, direct sunlight or other damage.

1.06 PROJECT ENVIRONMENTAL REQUIREMENTS

A. Do not perform field seaming when geomembrane is wet or when wind is displacing geomembrane panels.

B. Seam only when air temperature is above 35 degrees F and below 104 degrees F.

C. Expect wind and extreme temperature variations.

1.07 SAFETY

A. Take precautions against “snowblindness” of personnel when working on white-colored geomembrane.

PART 2 PRODUCTS

2.01 GEOMEMBRANE

A. HDPE-white geomembrane meeting requirements of GRI GM-13.

1. Virgin HDPE resin with no more than 10 percent rework.

2. Co-extruded, light reflective HDPE geomembrane with a UV-stabilized, white upper surface. White surface 3 to 5 mils thick.

3. Geomembrane boots fabricated from the same HDPE geomembrane. Boots custom fabricated at the HDPE geomembrane factory and shipped to the jobsite for installation

4. Conform to requirements of Table 02344B – HDPE Geomembrane Physical Properties. Unless otherwise indicated, required values are minimum average roll values (MARV) when tested in weaker principle direction.

Table 02344B – HDPE Geomembrane Physical Properties

Property	Test Method	Smooth	Textured
Thickness, minimum average Lowest individual, 8 of 10 Lowest individual of 10 values	ASTM D 5199	60 mils --- 54 mils	57 mils 54 mils 51 mils
Asperity Height	GRI GM-12	---	10 mils
Density (minimum)	ASTM D 1505 ASTM D 792	0.940 g/cc	0.940 g/cc
Tensile properties (MARV) Yield strength Breaking strength Yield Elongation Breaking Elongation	ASTM D 638 Type IV	 126 lbs / inch 228 lbs / inch 12 percent 700 percent	 126 lbs / inch 90 lbs / inch 12 percent 100 percent
Tear strength (MARV)	ASTM D 1004	42 lbs	42 lbs
Stress Crack Resistance	ASTM D 5397 Appendix	300 hours	300 hours
Carbon black content – range	ASTM D 1603	2.0 – 3.0 %	2.0 – 3.0 %
Carbon black dispersion	ASTM D 5596	Category 1 or 2 (9 of 10)	Category 1 or 2 (9 of 10)
Puncture resistance (MARV)	ASTM D 4833	90 lbs	90 lbs
Oxidative Induction Time MARV (a) Standard OIT Or (b) High Pressure OIT	 ASTM D 3895 ASTM D 5885	 100 minutes 400 minutes	 100 minutes 400 minutes
Oven aging @ 85°F Percent retained @ 90 days (a) Standard OIT Or (b) High Pressure OIT	ASTM D 5721 ASTM D 3895 ASTM D 5885	 55 % 80 %	 55 % 80 %
UV Resistance High pressure OIT (MARV) (% retained after 1600 hrs)	ASTM D 7238 ASTM D 5885	 50 %	 50 %

Table 02344B – HDPE Geomembrane Physical Properties

Property	Test Method	Smooth	Textured
Factory and Field Seams	GRI GM 19		
Hot Wedge Seams			
Shear Strength [1]		120 lbs / inch	120 lbs / inch
Shear Elongation		50 percent	50 percent
Peel Strength [1]		91 lbs / inch	91 lbs / inch
Peel Separation		25 percent	25 percent
Extrusion Seams			
Shear Strength [1]		120 lbs / inch	120 lbs / inch
Shear Elongation		50 percent	50 percent
Peel Strength [1]		78 lbs / inch	78 lbs / inch
Peel Separation		25 percent	25 percent

[1]Seam Strengths – 4 of the 5 specimens must meet the listed values. The 5th specimen must demonstrate 80 percent of the listed values.

2.02 ACCESSORIES

A. Batten Strips and Anchors

1. Stainless Steel in accordance with geomembrane manufacturer's recommendations.

2.03 SOURCE QUALITY ASSURANCE

A. The COR reserves the right to inspect and obtain samples for testing during factory manufacture/fabrication at beginning of production and subsequently.

PART 3 EXECUTION

3.01 SUBGRADE PREPARATION

A. Prepare surface upon which geomembrane is to be placed to a firm surface, reasonably even and smooth, and free of abrupt indentations and protruding materials (offsets) greater than 3/4 inch.

B. Remove gravel over 1-inch, vegetative matter, brush, large roots, or other objectionable foreign matter.

C. Obtain COR approval of subgrade before installing geomembrane.

D. Prepare subgrade in accordance with Section 02319 – Reservoir Earthwork.

3.02 INSTALLATION

A. Install geomembrane in accordance with this section, as shown on drawings, and in accordance with approved geomembrane installation plan.

B. Install 60-mil textured HDPE white geomembrane on the sideslopes, and 60-mil smooth HDPE white geomembrane on the invert as shown on the drawings.

C. Install geomembrane with the white surface facing up.

D. Have manufacturer's technical representative(s) onsite during geomembrane installation.

1. Manufacturer's technical representative(s) shall exercise technical control of installation, observe the work, instruct and/or make recommendations to the installers as required, and report unsatisfactory conditions to the COR.

E. Properly protect and maintain any completed geomembrane installations during periods of geomembrane installation inactivity in accordance with approved installation plan.

F. Install geomembrane rolls with the seams running up and down the slopes. Seams perpendicular to the sideslopes are not allowed unless approved by the COR.

G. Anchor geomembrane in anchor trench as shown on drawings. Hold in place by using sandbags or other approved means until ready for backfill.

H. Place lining in a slackened condition so as to conform to subgrade contour without becoming taut when covered with soil cement cover material.

I. Ballast to prevent relocation of compensating slack by wind and to prevent uplift by wind at edges, ends, and other locations as required.

J. Install geomembrane boots as shown on the drawings and in accordance with the approved geomembrane installation plan. Boots shall be watertight.

K. Attach geomembrane to concrete structures using batten strips and anchor bolts as shown on the drawings and in accordance with approved geomembrane installation plan.

L. Wrinkles:

1. Install geomembrane and cover materials so to minimize geomembrane wrinkles.
2. Cut-out and repair wrinkles in geomembrane and geomembrane seams during coolest part of day as determined by COR before covering.
3. Install geomembrane and cover materials to achieve intimate contact (pressed-fit) between subgrade, geomembrane and cover material.
4. Work geomembrane wrinkles upslope into the anchor trench.
5. Install cover material over geomembrane during coolest part of the day.

6. Take special care to prevent wrinkles on south-facing slopes.

3.03 FIELD SEAMS

A. Perform continuous field seaming in strict accordance with the approved geomembrane installation plan and this section.

B. Acceptable processes for field seaming are fusion welding and extrusion welding. Extrusion welding is restricted to repairs and welding applications not possible by fusion welding.

C. Field seams shall form a continuous, homogeneous connection between geomembrane panels.

D. Field seams shall be continuous from the downstream edge of the top geomembrane runout (top) to the upstream edge of the bottom geomembrane runout (bottom).

E. Install and field seam the geomembrane under the direct guidance of the geomembrane manufacturer's technical representative and in the direct presence of the installer's geomembrane installation supervisor/field engineer and/or master welder.

F. Contact surfaces to be field seamed shall be dry and thoroughly cleaned of all dirt, dust, grease, oil, and other foreign materials.

G. Where seaming of geomembrane panels is required to fabricate the connection between separate portions of the geomembrane installation, the Contractor shall remove any protective materials used, such as tape, and shall thoroughly clean the geomembrane surface(s) to be seamed, using appropriate cleaning agents.

H. Joining adjacent panels:

1. Overlap geomembrane according to manufacturer's recommendations.
2. Fusion weld using only approved methods for primary field seaming method.
3. Finished overlap, minimum: 4 inches, provided, that overlap sufficient to allow peel tests to be performed on seam.

I. Fishmouths or Wrinkles

1. Place geomembrane rolls to minimize wrinkles, especially differential wrinkles between adjacent rolls. Place geomembrane rolls to obtain intimate contact between the geomembrane and subgrade.
2. Cut fishmouths or wrinkles along the ridge of the fishmouth (wrinkle) to achieve a flat overlap. Seam the cut fishmouth or wrinkle and patch any portion where the overlap is insufficient.

J. Patching geomembrane:

1. Rounded or Oval patches

2. Finished overlap, minimum: 6 inches, provided, that overlap sufficient to allow peel tests to be performed on seam.

3.04 REPAIRS

A. Repair field seams and other damaged areas according to manufacturer's recommendations and as approved in geomembrane installation plan.

B. Repair geomembrane with oval or rounded patch, which overlaps undamaged geomembrane not less than 6 inches.

C. Test repairs using vacuum method.

D. Repair and retest unbonded areas detected by air pressure testing and by vacuum testing.

3.05 CONTRACTOR FIELD QUALITY TESTING

A. General:

1. Perform all testing in presence of COR.

2. Perform tests at locations and frequencies specified in this section and at other locations and times as determined by the COR.

B. Test equipment:

1. Furnish a portable tensiometer with a load readout device.

2. Vacuum chamber (box): Apparatus manufactured by American Parts and Service Co., 2201 West Commonwealth Avenue, PO Box 702, Alhambra CA 91802, or equal, having the following essential characteristics:

a. Vacuum box assembly consisting of rigid housing, transparent viewing window, soft neoprene gasket attached to the bottom, port hole or valve assembly, and gauge to indicate chamber vacuum.

b. Steel vacuum tank and pump assembly equipped with pressure controller and pipe connections.

c. Rubber pressure/vacuum hose with fittings and connections.

C. Test seams.

1. Prepare test seams using excess geomembrane material to verify that field seaming conditions are satisfactory.

a. Conduct test seams at the beginning of each seaming shift, at a change of weather conditions, and at least once each 4-hour period during operation for each seaming crew.

b. If a test seam fails to meet seam specifications listed in Table 02344B - HDPE Geomembrane Physical Properties, the seaming apparatus and seaming crew shall not be accepted and shall not be used for field seaming

until the deficiencies are corrected and two consecutive successful test seams have been achieved.

2. Test seam:

   a. At least 3 feet in length with the seam centered lengthwise.

   b. Specimens for testing:

      1) Series of 1-inch-wide specimens cut from opposite ends of test seam.

      2) Not obtained from the first or last 6 inches of test seam.

3. Test five specimens in peel and five specimens in shear in accordance with GRI GM-19.

D. Field seams:

1. Remove 12-inch by 24-inch samples at locations selected by the COR, or when conditions indicate concern for integrity of field seams.

   a. Standard testing frequency shall be every 500 feet of seam length. Testing frequency may be decreased at discretion of COR after sufficient and continued history of successful tests.

   b. Testing locations will be selected by COR.

   c. Repair resulting holes in geomembrane with rounded patches and vacuum test.

2. Test 5 shear and 5 peel specimens from each sample per GRI GM-19.

E. Air pressure test – double wedge welds

1. Double wedge welds shall be non-destructively tested, evaluated and approved in accordance with GRI GM-24.

2. Demonstrate procedure for air pressure testing to the COR for approval before testing is begun.

3. Test procedures:

   a. Pressurize channel between the two wedge welds.

   b. Minimum Channel Pressure: 22 psi.

   c. Minimum Dwell Time: 5 minutes

   d. Allowable pressure drop: 4 psi

4. Weld cap-strip over entire length of double wedge welds that fail the air pressure test.

F. Vacuum Testing.

1. Non-destructively test extrusion weld seams by vacuum method in accordance with ASTM D 4437.
2. Demonstrate procedure for vacuum seam testing to the COR for approval before testing is begun.
3. Test procedures:
    a. Perform vacuum test with soapy solution.
    b. Maintain at least 5 psi vacuum for at least 15 seconds, without bubbles appearing from seam.
    c. Overlap 3 inches of seam with vacuum box between tests to ensure that all sections of seam are tested.

G. Recording Results:

1. Record results of test seam and field seam testing and make available to the COR at end of each shift.
2. Identify field seams, by panel and location where applicable, that initially failed seam testing.
3. Include evidence that field seams or welding equipment were repaired and successfully retested.

END OF SECTION

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SECTION 02346 – GEOTEXTILE AND GEONET COMPOSITE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Geotextile:

1. Measurement: Surface area required to be covered including geotextile placed in anchor trench, except no allowance will be made for seam overlap, repairs, or waste.

2. Payment: Square yard price offered in the schedule.

B. Geonet Composite:

1. Measurement: Surface area required to be covered, except no allowance will be made for seam overlap, repairs, or waste.

2. Payment: Square yard price offered in the schedule.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM D 1505-03	Density of Plastics by the Density-Gradient Technique
2.	ASTM D 1603-06	Carbon Black Content of Olefin Plastics
3.	ASTM D 3786-06	Hydraulic Bursting Strength of Textile Fabrics – Diaphragm Bursting Strength Tester Method
4.	ASTM D 4355-07	Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon-Arc Type Apparatus
5.	ASTM D 4491-99a(2004)	Water Permeability of Geotextiles by Permittivity
6.	ASTM D 4533-04	Trapezoid Tearing Strength of Geotextiles
7.	ASTM D 4632-91(2003)	Grab Breaking Load and Elongation of Geotextiles
8.	ASTM D 4716-07	In-Plane Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
9.	ASTM D 4751-04	Determining Apparent Opening Size of a Geotextile
10.	ASTM D 4833-07	Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
11.	ASTM D 5035-06	Breaking Force and Elongation of Textile Fabrics
12.	ASTM D 5199-01(2006)	Nominal Thickness of Geosynthetics

13. ASTM D 5261-92(2003) Measuring Mass per Unit Area of Geotextiles

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals.

B. RSN 02346-1, Manufacturer's certification:

1. Geotextile and Geonet Composite furnished meets specified chemical, physical, and manufacturing requirements.

C. RSN 02346-2, Geotextile Samples:

1. Include manufacturer's certified test results covering properties listed in Table 02346B - Geotextile Physical Properties.
2. Samples: One yard in length from entire roll width.
3. Mark samples:
   a. Project name and contract number.
   b. Product identification.
   c. Lot number.
   d. Roll number.
   e. Machine direction.
   f. Quantity represented.
4. Number of samples: Table 02346A - Geotextile Sampling Requirements. Frequency of sampling may be increased if a geotextile sample does not meet specification requirements.

Table 02346A – Geotextile Sampling Requirements

Number of rolls to be furnished	Number of rolls to be sampled
1 – 2	1
3 – 8	2
9 – 27	3
28 – 64	4
65 – 125	5
126 – 216	6
217 – 343	7
344 – 512	8
513 – 729	9
730 – 1000	10

D. RSN 02346-3, Geonet Composite samples

1. Three 8 inch x 10 inch samples of the Geonet composite to be used on this project

E. RSN 02346-4, Protection method:

1. Method to protect exposed geotextile and geonet composite, when covering is not possible within 14 days.

F. RSN 02346-5, Sewn geotextile seams, if used:

1. Certification stating that polymeric threads to be used for sewing have chemical resistance properties equal to or exceeding those of geotextile.

2. Include data showing that sewn seams have tensile strength of not less than specified percent of parent geotextile material.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Wrap geotextile and geonet composite rolls in relatively impermeable and opaque protective covers.

B. Mark or tag rolls of geotextile and geonet composite with manufacturer's name, product identification, lot number, roll number, and roll dimensions.

C. Protect geotextile and geonet composite from ultraviolet light exposure, temperatures greater than 140 degrees F (60 degrees C), precipitation or other inundation, mud, dirt, dust, puncture, cutting, or other damaging or deleterious conditions.

D. Elevate and cover material stored outside with waterproof membrane.

1.05 SAFETY

A. If white colored geotextile is used, take precautions against “snowblindness” of personnel.

PART 2 PRODUCTS

2.01 GEOTEXTILES

A. Needle-punched, nonwoven geotextile comprised of long-chain polymeric filaments composed of at least 85 percent, by weight, polyolefins or polyesters.

B. Orient filaments into stable network which retains its structure during handling, placement, and long-term service.

C. Stabilizers or inhibitors added to filament base material: Resist deterioration due to ultraviolet or heat exposure.

D. Geotextile edges: Selvaged or otherwise finished to prevent outer material from pulling away.

E. Conform to roll values listed in Table 02346B - Geotextile Physical Properties.

1. Values listed are minimum average roll values (MARVs), unless otherwise noted.

2. Test results for weaker principal direction shall meet or exceed minimum values listed in the table.

3. Mass per unit area is a nominal value and is provided for information purposes only.

F. Direct exposure to sunlight: Withstand fourteen (14) days with no measurable deterioration.

Table 02346B – Geotextile Physical Properties

Property	Test Method	Required Values
Mass per unit area, nominal	ASTM D 5261	16 oz/yd^2
Grab tensile	ASTM D 4632	380 lbs
Elongation at break	ASTM D 4632	50 percent
Trapezoidal tear	ASTM D 4533	140 lbs
Puncture strength	ASTM D 4833	230 lbs
Burst strength	ASTM D 3786	700 lb/in^2
Permittivity	ASTM D 4491	0.5 sec^{-1}
Apparent opening size (minimum US Sieve No./ maximum opening size)	ASTM D 4751	100 US Sieve
UV resistance – tensile strength retained at 500 hours, minimum	ASTM D 4335	70 percent

2.02 GEONET COMPOSITE

A. Consists of a geonet with needle-punched non-woven geotextile bonded to each side.

B. The geotextile shall meet all the requirements of Geotextiles article above, except the physical properties shall conform to the requirements of Table 02346C. – Physical Properties of Geotextile for Geonet Composite. Unless otherwise noted, values are Minimum Average Roll Values (MARV) when tested in weaker principle direction.

Table 02346C – Physical Properties of Geotextile for Geonet Composite

Property	Test Method	Required Values
Mass per unit area, nominal	ASTM D 5261	6 oz/yd^2
Grab tensile	ASTM D 4632	160 lbs
Elongation at break	ASTM D 4632	50 percent
Trapezoidal tear	ASTM D 4533	60 lbs
Puncture strength	ASTM D 4833	85 lbs

Table 02346C – Physical Properties of Geotextile for Geonet Composite

Property	Test Method	Required Values
Permittivity	ASTM D 4491	1.2 sec[1]
Apparent opening size (minimum US Sieve No./ maximum opening size)	ASTM D 4751	70 US Sieve
UV resistance – tensile strength retained at 500 hours, minimum	ASTM D 4335	70 percent

C. Geonet comprised of High Density Polyethylene (HDPE).

D. Geonet manufactured by extruding two or three sets of strands to form a three dimensional structure to provide planar flow.

E. Geonet shall conform to minimum property values shown in Table 02346D – Geonet Physical Properties. Unless otherwise noted, values are Minimum Average Roll Values (MARV) when tested in weaker principle direction.

Table 02346D – Geonet Physical Properties

Property	Test Method	Required Values
Transmissivity (Gradient = 0.1, Pressure = 209 psf	ASTM D 4716	9 gal/min/ft
Thickness	ASTM D 5199	200 mils
Density	ASTM D 1505	0.94
Tensile Strength	ASTM D 5035	45 lbs/inch
Carbon Black	ASTM D 1603	2.0 percent

PART 3 EXECUTION

3.01 SUBGRADE PREPARATION

A. Where geotextile is to be placed on soil, prepare surface upon which geotextile is to be placed to a firm surface, reasonably even and smooth, and free of offsets, abrupt indentations, and protruding materials greater than 1-1/2 inches.

B. Where geotextile or geonet composite is to be placed on geomembrane, remove loose soil.

C. Obtain COR approval of subgrade before installing geotextile and geonet composite.

3.02 INSTALLATION

A. Place geotextile and geonet composite in the manner and at locations shown on drawings.

B. Lay geotextile and geonet composite smoothly, free of tension, stress, folds, wrinkles, or creases so far as is practical and except where required in these specifications.

C. Shingle overlaps on slopes with uphill roll placed over downhill roll.

D. On slopes steeper than 5H:1V, roll out geotextile and geonet composite up or down slope.

E. Do not damage underlying geomembrane.

F. Staking or pinning of geotextile and geonet composite through underlying geomembrane is not allowed.

G. Anchor terminal ends of geotextile with key trenches or aprons at crest of slopes, and with aprons at toe of slopes.

H. In the presence of wind, weight geotextile and geonet composite with sandbags or equivalent until cover material placed.

I. Do not entrap stones, soil, excessive dust, or moisture in geotextile or geonet composite that could damage materials or hamper subsequent seaming.

J. Do not drive or operate equipment directly on geotextile or geonet composite.

1. Cover material depth required for equipment travel over geotextile and geonet composite, minimum: 9 inches.

K. Drop height of cover material on to geotextile and geonet composite, maximum: 1 foot.

L. Cover geotextile and geonet composite within 14 days after placement.

1. If covering with specified material is not possible within 14 days, protect exposed geotextile with suitable cover approved by the COR.

2. Replace geotextile and geonet composite not protected at Contractor's expense.

M. Place soil-cement over geotextile and geonet composite in accordance with Section 02377 – Soil-Cement.

N. After installation, examine entire geotextile surface to ensure that potentially harmful foreign objects (such as needles) are not present.

O. Remove foreign objects or replace geotextile.

3.03 SEAMING

A. Join adjacent sheets of geotextile by overlapping, sewing, or thermal welding.

B. Sewn Seams:

1. Interlocking or sewn twice.

2. Thread:

a. Contrasting color.

b. Chemical resistance: Equal to geotextile.

3. Sew geotextiles continuously. Spot sewing is not allowed.

4. Sewn seam strength: Not less than 70 percent of parent material strength.

C. Overlapped Seams:

1. Overlap minimum: 12 inches.

2. Upstream/upslope roll placed over the downstream/downslope roll.

3. Weight on 3-foot centers to secure the overlap during placement of cover material.

a. Do not use pins when installed over geomembrane.

D. Join adjacent sheets of geonet composite with plastic ties or by sewing or thermal welding the top layer of geotextile.

E. Join geotextile to adjacent geonet composite by overlapping and thermal welding geotextile to top layer of geotextile on the geonet composite.

F. Use additional thermal welding and weighting with sandbags as needed to keep geotextile and geonet composite in place during placement of cover materials.

3.04 REPAIRS

A. At placement, geotextile and geonet composite will be rejected if it has defects, rips, holes, flaws, deterioration, contamination, or damage.

B. Replace or repair geotextile or geonet composite damaged during installation or placement of cover in the following manner:

1. Remove cover from damaged area of geotextile or geonet composite.

2. Remove any soil or other material which may have penetrated torn geotextile or geonet composite.

3. Repair damaged geotextile or geonet composite by placing additional layer of geotextile or geonet composite to cover damaged area and either sew or thermal weld the patch to undamaged geotextile according to requirements stated above or overlap undamaged geotextile by at least 3 feet on all sides.

END OF SECTION

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SECTION 02376 – SOIL-CEMENT TEST SECTION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Soil-Cement Test Section:

1. Payment: Lump sum price offered in the schedule.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 02376-1, Soil-Cement Test Section Placement Plan:

1. Include location; placement sequence, procedures, and details; equipment to be used; mix design; and materials certifications and test reports.

C. RSN 02376-2, Test Section Placement Report:

1. Results of test section.
2. Resubmit RSN 02377-4, Material Handling Process and Equipment, if applicable, due to construction changes based on lessons learned.

1.03 PROJECT CONDITIONS

A. Contractor may use portion of the permanent reservoir embankment for placement of soil-cement test section.

PART 2 PRODUCTS

2.01 MATERIALS

A. Soil-Cement: In accordance with Section 02377 - Soil-Cement.

B. Geomembrane: In accordance with Section 02344 - Geomembrane.

C. Geotextile: In accordance with Section 02346 - Geotextile and Geonet Composite.

D. Geonet Composite: In accordance with Section 02346 - Geotextile and Geonet Composite.

E. Compacted Earthfill: In accordance with Section 02319 - Reservoir Earthwork.

F. Gravel Filter: In accordance with Section 02331 - Gravel Filter Material.

PART 3 EXECUTION

3.01 TEST SECTION

A. Construct soil-cement test section to include toe features including geomembrane, geotextile, geonet composite, and gravel filter material and anchor trench and full height of reservoir side slope and 22-foot minimum width as shown on drawings or three equipment widths, whichever is greater, in an area approved by COR.

B. Use same batching, transportation methods, placement methods, and equipment planned for use in constructing permanent installation.

C. Construct soil-cement test section only in presence of COR.

D. Place soil-cement cover material starting at the bottom of the slope and proceeding upslope.

E. Cast and test 7-day compressive strength specimens in accordance with Section 02377 – Soil-Cement during test section placement. Furnish results to COR.

F. Demonstrate method for jointing seams and vertical soil-cement construction joints at adjacent sections.

G. Complete test section and receive approval from COR at least seven (7) days before beginning placing soil-cement within reservoir for completed installation.

3.02 DESTRUCTIVE TESTING

A. COR will perform destructive testing within completed test section to verify specifications compliance.

B. Contractor shall take 20 full depth cores at multiple locations as determined by COR.

3.03 REPAIR

A. Make test repairs to areas where cores are taken to demonstrate repair methods before removal of test section

3.04 REMOVAL

A. Remove test section when directed by COR.

B. Remove materials from work site in accordance with Section 01740 - Cleaning.

3.05 QUALITY ASSURANCE

A. The Government will observe and approve soil-cement quality and placement procedures, underlying foundation material, geotextile installation, geomembrane installation, and geonet composite installation for the test section.

END OF SECTION

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SECTION 02377 - SOIL-CEMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Soil-Cement:

1. Measurement: Volume of soil-cement furnished, placed, compacted, and cured to the specified lines and grades shown on drawings.
2. Payment: Cubic yard price offered in the schedule.
    a. Includes furnishing, placing, and compacting soil-cement.
    b. Does not include excavation of the foundation for soil-cement. Refer to Section 02319 - Reservoir Earthwork.
    c. Does not include furnishing, placing, and compacting earthfill for the foundation of the soil-cement. Refer to Section 02319 – Reservoir Earthwork.

B. Cementitious Materials for Soil-Cement:

1. Measurement: Weight of materials used in soil-cement based on batch weights and batch counts at batch plant measured in most practical manner.
2. Payment: Ton price offered in the schedule.
    a. No payment will be made for cementitious materials in wasted soil-cement.

1.02 REFERENCES

A. ASTM International (ASTM)

1. ASTM D 558-04 Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures
2. ASTM D 698-07 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
3. ASTM D 1140-00(2006) Amount of Material in Soils Finer Than the No. 200 (75-µm) Sieve
4. ASTM D 1556-07 Density and Unit Weight of Soil in Place by the Sand-Cone Method
5. ASTM D 1633-00 Compressive Strength of Molded Soil-Cement Cylinders (Method A)
6. ASTM D 2216-05 Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

7.	ASTM D 4959-07	Determination of Water (Moisture) Content of Soil By Direct Heating
8.	ASTM D 5080-08	Rapid Determination of Percent Compaction
9.	ASTM D 5982-07	Determining Cement Content of Fresh Soil-Cement (Heat of Neutralization Method)
10.	ASTM D 6236-98(2004)	Coring and Logging Cement - or Lime-Stabilized Soil
11.	ASTM D 6938-08	In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
12.	ASTM D 7382-07	Determination of Maximum Dry Weight and Water Content Range for Effective Compaction of Granular Soils Using a Vibratory Hammer

1.03 DEFINITIONS

A. Stair Step Method: Soil-cement placed in successive horizontal layers adjacent to the slope in a step-like profile.

B. Plating Method: Soil-cement slope protection consisting of one or more layers of soil-cement placed parallel to the slope face.

C. Bonding Agent: Mortar placed between layers of soil-cement to improved bond between lifts when the Stair Step method or more than one layer of Plating is required.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 02377-1, Samples.

1. Submit samples of the stockpiled soil from reservoir excavation and job cement to the Government for determination of a typical moisture-density curve (ASTM D 558) that will be used to make check compression specimens to determine the maximum density and optimum moisture content.

   a. Soil sample: 50 pounds, minimum.

   b. Cement: 50 pounds, minimum.

C. RSN 02377-2, Material Certifications and Supplier Data:

1. Portland cement.

D. RSN 02377-3, Soil-Cement Placement Schedule:

1. Complete, detailed soil-cement placement schedule showing the Contractor’s plan for placement of individual features of soil-cement work.

2. Detail as necessary to show location, sequence, haul ramps, and date of soil-cement placements scheduled for each item of soil-cement work.

E. RSN 02377-4, Equipment Plan

1. Batch Plant Set Up.

a. Detailed proposal of equipment to be used and layout.

b. Plan for monitoring feed and calibrations.

2. Describe materials handling process and equipment to be used.

a. Include equipment for hauling, placing and compacting.

b. Include watering equipment details for wet curing operations.

1.05 QUALIFICATIONS

A. Provide experienced soil-cement construction personnel under supervision and direction personnel with minimum 3 years of construction experience for soil-cement construction similar in nature to that required by this work.

1.06 PROJECT CONDITIONS

A. Stair-step soil cement placement transitions from 8-foot to 2.4-foot widths over a 25-foot length at four locations as shown on the drawings. Specialized equipment may be required to facilitate placing and compaction in transitions and against structures.

B. To prevent damage to the geomembrane, careful operation of rollers used to compact stair-step soil-cement is necessary at the geomembrane/soil-cement interface. Special compaction techniques may be required.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portland cement and water for soil-cement and bonding agent:

1. In accordance with Section 03300 - Cast-in-Place Concrete.

B. Soil:

1. Use on-site material from area designated on drawings with a fines content between 15 and 40 percent. Refer to Section 00321 – Geologic Investigations. Fines content defined as materials passing the minus 200 sieve as determined by ASTM D 1140.

a. As the soil is stockpiled, demonstrate that proper fines content is achieved by testing at a frequency as outlined in the Contractor Quality Testing article of this section.

2. COR reserves right to sample the soil source at any time during the execution of this contract.

3. Blend stockpiled materials to achieve fines distribution and to ensure uniform moisture content and minimize segregation.

4. Maximum size of any clay balls in soil: 1-inch.

5. Maximum percentage of clay balls, by wet weight of the soil, not to exceed 10 percent.

6. Maximum particle size: 3 inches.

2.02 PROPORTIONING

A. General:

1. Measure soil, cement, and water accurately and convey them into the mixer in the proportionate amounts necessary to meet the specified requirements.

2. Mix all ingredients for at least thirty (30) seconds or longer as may be necessary to ensure a thorough, uniform, and intimate mix of the soil, cement, and water.

3. COR will require additional mixing, or require the batch of soil-cement to be wasted if the soil-cement is not homogeneous and uniform in appearance.

B. Soil-Cement Mixture.

1. Cement Content:

a. Minimum cement content of 14 percent by dry weight of soil.

b. The COR reserves the right to adjust mix proportions when need for adjustment is indicated by results of materials testing.

2. Water Content:

a. Determine the initial required moisture content of the soil-cement daily. Initial moisture content at batch plant: between minus 1-percent to plus 2-percent of optimum as related to the maximum density.

b. Adjust the moisture content as required to achieve proper degree of compaction.

3. Compressive Strength:

a. Seven (7) days age: 675 pounds per square inch minimum.

b. Twenty-eight (28) days age: 1,000 pounds per square inch minimum.

C. Bonding Agent:

1. Portland cement and water with a water-cement ratio of 0.70.

2. Mix long enough to suspend all cement and to ensure a uniform and homogenous mixture.

2.03 EQUIPMENT

A. General:

1. Soil-cement may be constructed with any machine or combination of machines that will produce completed soil-cement meeting the requirements for soil pulverization, cement and water application, mixing, transporting, placing, compacting, finishing, and curing, as provided in these specifications.

B. Mixing Plant:

1. Perform mixing in a central mixing plant or other facility in accordance with approved plan.
2. Mixer: Twin-pugmill type or a continuous-mixing type capable of 200 cubic yards per hour capacity and designed for either weight or volume proportioning.
3. Design, coordinate, and operate mixing plant so as to produce a uniform mixture within the limits required by these specifications.
4. Provide facilities for efficiently storing, handling, and proportioning unmixed materials at the plant.
5. Make proportioning checks at various plant operating speeds to cover the range of planned operating speeds.
6. Perform daily proportioning checks at the plant during construction and as required by the COR.
7. Perform all proportioning checks and plant adjustments in the presence of the COR.
8. Provide means to obtain and control the proper amount of cement, soil aggregate, and water introduced into the mix.
9. All measuring devices shall be sensitive to a 2 percent variation above or below the actual weight in pounds required.
10. Proportioning may be on the volume basis; provided, that the sensitivity specified for the weight basis is maintained.
11. Equip plant with a positive, adjustable governor for controlling the mixing time of each batch. The mixing time is considered as the interval between the time the cement contacts the soil and water and the time the mixture leaves the mixing unit.
12. Actual batch weight tickets are required for each soil-cement batch. Submit to the COR at the construction site. Include on the batch weight tickets the time the material leaves the mixing unit and is loaded into/onto the transportation equipment.

PART 3 EXECUTION

3.01 PREPARATION

A. Preparation of Earth Foundation:

1. Before soil-cement processing begins, grade, shape, and compact the area to place the soil-cement to lines and grades shown on the drawings or as directed by the COR.
2. Remove any unstable soil or material as determined by the COR.
    a. Excavate the foundation in accordance with Section 02318 -Earthwork for Structures and Section 02319 – Reservoir Earthwork.
    b. Place any backfill required for soil-cement fill in accordance with Section 02318 – Earthwork for Structures and Section 02319 – Reservoir Earthwork.
3. Prewet compacted earth surfaces that are to receive an overlying layer of soil-cement but not to the extent of eroding soils.
4. Foundation to be firm and able to support, without yielding or subsequent settlement, the construction equipment and the compaction of the soil-cement.
5. Remove soft or yielding material as directed by the COR before placement of soil-cement.
6. If previously compacted and accepted foundation work becomes frozen or overly wet, resulting in a decrease in the dry density of the compacted material as determined by the COR, rework the foundation as directed until approved densities are obtained. Reworking may include removing, rehandling, reconditioning, recompacting, or a combination of these procedures.
7. The Contractor is entitled to no additional allowance above the price offered in the schedule by reason of any additional work required to achieve the in-place densities as specified in this section.

B. Preparation for Placement on Geomembrane or Geotextile and Geonet Composite:

1. Place geomembrane, geotextile, and geonet composite materials prior to soil-cement placing as indicated on the drawings and as specified in Section 02344 – Geomembrane and Section 02346 – Geotextile and Geonet Composite.
2. Do not allow equipment to damage geomembrane, geotextile, and geonet composite materials during soil-cement placement.
3. Prewet geotextile and geonet composite directly prior to soil-cement placement.
4. Remove any loose material from geomembrane, geotextile or geonet composite prior to soil-cement placement.

C. Obtain COR approval before placing soil-cement.

3.02 CONSTRUCTION

A. General:

1. Perform work in accordance with approved Test Section Placement Report required by Section 02376 – Soil-Cement Test Section.
2. A continuous operation including cement application, mixing, spreading, compacting, and finishing to be complete and kept within two (2) hours maximum.
3. The total elapsed time between the addition of water to the soil and cement and the start of compaction not to exceed 60 minutes.
4. Do not leave soil-cement undisturbed for longer than thirty (30) minutes after being placed on the fill and prior to being compacted and finished.
5. Any placement of soil-cement not meeting these requirements shall be removed from the fill and wasted as directed by the COR.
6. Where haul ramps are constructed, protect soil-cement with a minimum 2-foot layer of earth or of sufficient thickness to prevent damage to underlying soil-cement. Haul ramps not permitted over soil-cement plating.
7. The Contractor is entitled to no additional allowance above the price offered in the schedule by any reason of work required to achieve the requirements as specified in this section.

B. Mixing:

1. Do not mix or place soil-cement when the soil aggregate or the foundation contains frost, or when the air temperature is below 45 degrees F.
2. Temperature of soil-cement at placement: 90-degrees F maximum, or as directed by the COR to achieve density and to prevent drying of the soil-cement prior to compaction.
3. Moisture in the soil at the time of cement application to not exceed the quantity that will permit a uniform and intimate mixture of the soil and cement during mixing operations.
4. Mix soil-cement in approved mixer as required above.
5. Mixing time: Sufficient to secure an intimate uniform mixture of the soil, cement, and water and for at least thirty (30) seconds.
6. Monitor moisture and cement content as required to assure proper mixture.

C. Equipment:

1. Transportation Equipment:
   a. Trucks, conveyor systems, or other transport methods shall have tight, clean, and smooth beds or belts, and protective covers.

b. Provide sufficient numbers and types of equipment to ensure continuous operations to transport the soil-cement for placement.

2. Placing Equipment:

a. Conveyor systems, pump trucks, buggies, skid steers, dump trucks or other equipment used to place the soil-cement shall have tight, clean, and smooth beds or belts, and protective covers.

b. Provide sufficient numbers and types of equipment to ensure continuous operations to place the soil-cement into its final position.

3. Compaction Equipment:

a. Compact soil-cement with one or a combination of the following: pneumatic-tire roller, steel-wheel roller, vibratory roller, or vibrating-plate compactor.

b. If using vibratory rollers, they should be equipped with a Compaction Meter Value (CMV) instrumentation system with operator display, or equivalent as approved by the COR, to assist the operator in monitoring compaction.

1) CMV data will not be used as a basis for acceptance or rejection of degree of compaction.

4. Watering Equipment:

a. Watering equipment shall be approved by the COR and shall consist of pumps, water tanks, sprinklers, foggers, or other equipment furnished.

b. Provide adequate equipment available at all times to provide water as required for curing and for moistening compacted surfaces that are to receive an overlying layer of soil-cement.

c. Equip water trucks or sprinklers with fog sprayers for adding water to in-place layers of soil-cement.

D. Transporting:

1. Protect the soil-cement mixture whenever it is transported during unfavorable weather. Any soil-cement wet or dried excessively, whether during transport or after it has been spread, will be rejected by the COR.

2. Haul time, maximum: Thirty (30) minutes.

a. Haul time is the time elapsed from the time the material leaves the mixer until the same material is placed and spreading operations begin. Any load of soil-cement not meeting this time requirement will be rejected by the COR.

3. The Contractor is entitled to no additional allowance above the price offered in the schedule by any reason for rejected soil-cement as specified in this paragraph.

E. Placing:

1. Stair-step method:

   a. Place mixture with equipment that will produce horizontal layers of such widths and thicknesses as are necessary for compaction to the specified dimensions as shown on drawings.

2. Plating method:

   a. Place mixture as shown on drawings.

3. Bonding Agent:

   a. Place bonding agent between successive layers of soil-cement, stair step or plating.

   b. The surface of the soil-cement shall be cleaned off and wetted immediately prior to placement of the bonding agent.

   c. Place the bonding agent immediately ahead of the spreading operation no further than the distance covered by one truck (haul unit) or no more than 30 minutes from the addition of water to the cement.

   d. Place the bonding agent uniformly across the width of the soil-cement lift.

   e. Place the bonding agent at an application rate of 1 pound of dry cement per 1 square yard of surface area.

4. Moisture content shall be no more than 2-percent above the optimum moisture content for the soil-cement mixture at the point of placement.

5. Take all necessary precautions to avoid damage to the underlying geomembrane and geocomposite materials by the equipment.

6. Take all necessary precautions to avoid damage to completed soil-cement by the equipment.

F. Compaction:

1. Special compaction efforts are required overtop or within 3-feet of concrete structures or in confined space.

   a. Use hand held impact tampers, vibrating plate tampers, or small tamping equipment.

2. Start compaction no later than sixty (60) minutes after the addition of water to the soil and cement.

3. Moisture content at the time of compaction:

   a. Less than that quantity that will cause the soil-cement to become unstable during compaction and finishing operations.

   b. Between 1 percentage points below to 2 percentage points above optimum.

4. Uniformly compact soil-cement to a minimum of 97 percent of maximum density.

5. Determine moisture content and density by tests on representative samples of soil-cement obtained from the area being placed. Use test methods listed in Contractor Quality Testing and Government Quality Assurance articles of this section.

6. At start of compaction, soil-cement mixture shall be in a loose condition for its full depth.

7. Compacted lift thickness: 9 inches, plus 1 inch to minus 1/2 inch.

8. Do not leave section uncompacted for longer than thirty (30) minutes during compaction operations.

9. Compaction equipment for plating operations to run vertically up and down the embankments, not horizontally along the slope.

G. Finishing:

1. As compaction nears completion, shape the surface of the soil-cement to the specified lines, grades, and cross sections. During the finishing process keep the surface moist by means of fog sprays.

2. Perform compaction and finishing in such a manner as to produce, in not longer than two (2) hours, a dense surface free of compaction planes, cracks, ridges, or loose material.

H. Curing:

1. After completion of each lift of soil-cement, cure the construction joint surfaces until the next lift is placed by continuously keeping the surfaces moist with a fog water spray that will not erode the surface of the soil-cement.

2. Cure the surfaces at final grade after being shaped to the specified lines and grades with a fog water spray that will not erode the surface of the soil-cement, for a period of seven (7) days after placement.

3. Protective coverings of moist earth may be used for curing at the Contractor's option to protect the soil-cement surface from wind and sun exposure provided:

   a. Minimum thickness of earth cover: 6 inches.

   b. Keep soil-cement moist until protective earth cover is applied.

   c. Earth cover to remain moist for a period of seven (7) days after soil-cement placement.

   d. No damage to the soil-cement is permitted due to the placing or removal of sand.

   e. Remove sand from top surface of soil-cement after maximum 60 days.

3.03 CONSTRUCTION JOINTS AND LIFT LINES

A. At the end of each day's work, or whenever construction operations are interrupted for more than one (1) hour, prepare both horizontal and vertical construction joints, and lift lines between stair stepped placements.

1. Prepare the vertical construction joints to full-depth vertical joints with roughened faces. Roughness to be approved by COR.

2. Prepare the horizontal construction joints by scratching the surface to provide 1/8-inch to 1/4-inch deep grooved surfaces for the next lift of soil-cement.

3. Prior to placement of the next lift, remove all loose material to provide a clean surface.

4. Moisten the grooved, cleaned surface lightly just prior to placing the subsequent lift. However, no ponding or pooling of free water is allowed.

5. Place bonding agent in between successive layers of soil-cement directly ahead of the soil-cement placing operations.

B. The Contractor is entitled to no additional allowance above the price offered in the schedule by reason of work required by this section to prepare and clean construction joints as specified in this section.

3.04 CONTRACTOR QUALITY TESTING

A. The following testing is required during construction of the test section in accordance with Section 02376 – Soil-Cement Test Section and during other soil-cement placements as necessary to ensure proper compaction.

1. In-place density shall be determined by ASTM D 1556 or ASTM D 6938.

   a. Results of in-place density determined by ASTM D 6938 shall be checked with results from ASTM D 1556.

2. Laboratory maximum density shall be determined by ASTM D 1556 and ASTM D 5080.

   a. Compaction site moisture shall be determined by ASTM D 2216 and ASTM D 4959.

   b. ASTM D 6938 will require a moisture correction with ASTM D 2216 as determined by the COR.

B. Stockpiling of soil materials: Test fines content of materials being stockpiled in accordance with ASTM D 1140 every 250 yd^3 or as directed by the COR.

C. Monitor and test materials at the pugmill or batch plant including:

1. Moisture content in accordance with ASTM D 4959 calibrated to ASTM D 2216.

2. Cement content in accordance with ASTM D 5982.

3. Fines content in accordance with ASTM D 1140.

D. Frequency of testing for materials at the pugmill or batch plant.

1. Minimum frequency is daily.
2. Every 500 yd^3 of material produced.
3. If there is any change to the plant equipment.
4. Test if plant operations are stopped and resumed.
5. Test whenever it appears the soil-cement product has changed in soil feed, water, or cement, e.g. any change in material properties.

E. Make test reports available to the COR.

3.05 GOVERNMENT QUALITY ASSURANCE

A. General:

1. The Government or its representative may perform tests to verify that soil gradation, cement type, soil-cement placement, compaction and compressive strength of soil-cement conforms to contract requirements.
2. Notify the COR 24 hours before soil-cement placement begins and 24 hours before significant change in soil-cement operations (major change in equipment or procedure used).
3. Notify the COR immediately of any change in soil-cement operations.

B. Tests:

1. Standard test methods will be used by the COR for testing soil-cement for conformance with specification requirements. Substitution or modification of standards is allowed only with concurrence of all parties.
2. A variety of tests can be used for quality assurance. The appropriate tests will be determined by the COR from both the Contractor Quality Testing and the Government Quality Assurance tests performed on the soil-cement test section (Section 02376 – Soil-Cement Test Section). The COR reserves the right to use the tests that give the highest quality product. Some test methods may be changed for expediency.
3. Degree of Compaction: The degree of compaction will be determined as the ratio of either wet or dry in-place density to laboratory maximum density:
    a. In-place density will be determined by ASTM D 1556 or ASTM D 6938.
        1) Results of in-place density determined by ASTM D 6938 will be checked with results from ASTM D 1556 at a frequency determined by the COR.

4. Laboratory maximum density will be determined by ASTM D 1556, ASTM D 5080, or ASTM D 7382.

5. Moisture content:

   a. Compaction site moisture will be determined by ASTM D 2216, ASTM D 4959 or ASTM D 6938.

      1) ASTM D 6938 will require a moisture correction, which will be developed and periodically checked with ASTM D 2216 as determined by the COR.

      2) ASTM D 5080 will be used to determine the difference between optimum compaction moisture and moisture at the site of compaction.

   b. Batch plant moisture will be determined by ASTM D 4959 calibrated to ASTM D 2216.

6. Compressive strength: ASTM D 1633 (Method A).

   a. COR may elect to use the vibrating hammer to consolidate compression test specimens.

7. The COR may check the required thickness during placement as necessary. Thickness measurements may be performed with a blunt edge ruler or similar as necessary to prevent damage to the underlying geomembrane.

8. Coring (ASTM D 6236) may be used to verify thickness and compressive strength. Core samples will not be taken from areas where the geomembrane, geotextile, or geonet composite is directly under soil-cement. Use extreme caution to prevent puncturing the geomembrane, geotextile, or geonet composite liners.

9. Cement content will be checked using batch tickets or ASTM D 5982.

C. Testing Frequency:

1. Frequency of testing is at discretion of the Government.

2. Greater frequency of testing is normally performed at beginning of new work, new work crew, or new equipment.

3. After a successful work operation pattern is established, testing frequency is normally performed at these minimum guidelines.

   a. At least one test per day or for each shift for each soil-cement placement.

   b. Compacted soil-cement: One test for every 500 yd^3, or once per shift.

   c. Compressive strength: One test for every 500 yd^3, or once per shift.

   d. Additional tests may be performed at sites considered questionable by a COR; such as suspected incomplete compaction, surfaces that may have

become excessively wet or dry since compaction, compacted surfaces torn up by subsequent equipment travel, or other similar circumstances.

D. Contractor Support:

1. Provide timely access to areas for density and compression testing
2. When density is being measured by a sand-cone device (ASTM D 1556), cease construction activity in immediate vicinity of testing.
3. Provide warning lights, flags, or other safety devices as needed by testing personnel.
4. Provide adequate lighting for performing test if required because of darkness.

3.06 MAINTENANCE AND REPAIR

A. Maintain the soil-cement in good condition until all work is completed and accepted at the Contractor's expense.

B. Immediately repair any defects that may occur. If it is necessary to replace any soil-cement, the replacement shall be full depth using either soil-cement or concrete with beveled cuts so that the base is larger than the surface to key in the repair.

C. Minimum repair: 2-foot by 2-foot, or sufficient to encompass the defect, or as directed by COR.

D. No skin patches will be permitted.

END OF SECTION

SECTION 02378 - EROSION CONTROL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for other items of work.

1.02 REFERENCES

A. ASTM International (ASTM)

1. ASTM D 6461-99(2007) Silt Fence Materials
2. ASTM D 6462-03 Silt Fence Installation

1.03 DELIVERY STORAGE AND HANDLING

A. Cover stacks of straw bales at job site with plastic sheeting until use.

PART 2 PRODUCTS

2.01 SILT FENCE

A. Silt fence, posts, and support fence: ASTM D 6461.

2.02 STRAW BALES

A. Average dry weight not less than 50 pounds each.

B. Bind with biodegradable ties.

C. Certified weed free.

PART 3 EXECUTION

3.01 SILT FENCE

A. Erect fence at locations in accordance with approved pollution prevention plan required by Section 01563 – Water Pollution Control.

3.02 STRAW BALES

A. Place straw bales at locations in accordance with approved pollution prevention plan required by Section 01563 – Water Pollution Control.

B. Place straw bales in rows with ends tightly abutting.

C. Anchor each straw bale securely with two wood stakes driven through each bale. Drive stakes a minimum of 18 inches into subgrade.

3.03 MAINTENANCE AND REMOVAL

A. Silt fence:

1. Inspect daily.
2. Repair damaged fence.
3. Remove sediment in accordance with ASTM D 6462.

B. Straw bales:

1. Maintain straw bales during site work.
2. Replace damaged straw bales.

C. Replace damaged silt fence and straw bales.

D. Install additional silt fence and straw bale barriers as directed by the COR.

END OF SECTION

SECTION 02460 – SHEET PILE WALL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Sheet Pile Wall:

1. Measurement: Weight of installed sheet piles as indicated on drawings or directed by COR.
2. Payment: Pound price offered in the schedule.
    a. Includes all materials, equipment and labor to furnish, install, and remove sheet pile wall.

1.02 REFERENCES

A. ASTM International (ASTM)

1. ASTM A 328/A 328M-07 Steel Sheet Piling

1.03 SUMITTALS

A. Submit in accordance with Section 01330 – Submittals.

B. RSN 02460-1, Plan for Constructing Sheet Pile Wall:

1. Sheet pile manufacturer's concurrence with plan, setting, installing, and pulling sheet piling.
2. Describe equipment, materials, and methods to treat interlocks.
3. Sheet pile wall plan and design. Include as a minimum the following:
    a. Plan, pile manufacturer's size and section properties, and equipment and installation method.
    b. Design calculations by registered professional engineer.
4. Installation equipment. Crane, leads, heads, shoes, and caps.
5. Quality Control Representative:
    a. Resume.

C. RSN 02460-2, Quality Control, Construction Records, and Operation Records.

1. Daily records for sheet pile installation.

1.04 DEFINITIONS

A. Aspect Ratio: Length to thickness.

B. Shear Modulus of Elasticity: Ratio of shear stress to shear strain.

1.05 QUALIFICATIONS

A. Employ Quality Control Representative(s) with 5 years minimum experience in sheet piling work similar to requirements of this specification.

B. Have Quality Control Representative present at all times with each crew for the following work activities:

1. Setting sheet piling.
2. Installing sheet piling.
3. Pulling sheet piling.

C. Quality Control Representative is responsible for measurement and preparing and submitting records upon completion of installation, and any other work activity associated with quality control.

1.06 PROJECT CONDITIONS

A. Refer to Section 00322 – Records of Geologic and Subsurface Investigations for soil explorations.

B. The end of the sheet pile wall adjacent to the Coachella turnout structure will need to be field located. To prevent damage to the concrete the Contractor shall excavate to locate the structure prior to driving sheet pile.

PART 2 PRODUCTS

2.01 SHEET PILING

A. Steel Sheet Piling:

1. Hot or cold rolled Z-shaped sections.
2. ASTM A 328.

B. Physical Properties:

1. Section Modulus, minimum: 31 in^3/ft of wall.
2. Thickness, minimum: 3/8-inch.

C. Tolerances:

1. Camber, maximum: 0.8 percent length of pile. Camber is the simple regular curve measured at the midpoint between the ends of a full length sheet pile in the direction parallel to the plane of the web.

2. Replace any installed sheet pile not within tolerances.

2.02 ELASTOMERIC SEALANT

A. Sonolastic 2-part polysulfide sealant manufactured by Sonneborn Building Products, a division of BASF Construction Chemicals – Building Systems, 889 Valley Park Drive, Shakopee, MN 55379, (952) 946-6000, (800) 433-9517; or equal with the following essential characteristics:

1. Two-part, multi-component, medium modulus elastomeric polymer sealant.
2. Gun-grade.
3. Cures to a firm, flexible, resilient, tear-resistant rubber.

PART 3 EXECUTION

3.01 EQUIPMENT

A. Crane:

1. Capacity: Sufficient to maintain proper alignment of leads and piling.
2. Equip crane with rigid leads to support piling to within 2 feet of ground surface.

3.02 CONSTRUCTION

A. Construct sheet pile wall as indicated on drawings.

B. Construct wall into foundation to tip elevations and to unsupported top elevations indicated on drawings.

C. Construct piling in a plumb position with each pile interlocked with adjoining piles for its entire length to form a continuous diaphragm.

D. Installation:

1. Install individual or sets of two-interlocked piles to depth indicated on drawings.
2. Use installation methods to not damage piles and to ensure proper interlocking throughout length of sheet piles.
3. Do not weld or splice pile sections.
4. Water jetting is not allowed.
5. Keep piles in alignment. Do not allow twisting or rotating.
6. Engage interlocks as recommended by manufacturer.
7. When making a socket to socket interlock, engage the interlock with the thumb of the pile gripped by the thumb and finger of the adjacent pile.

8. One-point pickup permitted for sheet piling provided this method does not damage piling.

9. Replace damaged sheet piles at no additional cost.

E. Treatment of Interlocks:

1. Treat interlocks in accordance with approved submittal.

3.03 RECORDS

A. Quality Control, Construction Records and Operation Records:

1. Keep and maintain records of quality control and construction for all construction operations including, but not limited to, the following.

a. Additional materials (including type and strength).

b. Installation line and grade.

c. Interlocks inspection.

d. Placing (include alignment and location).

e. Cutting.

f. Welding.

2. Keep operation records log during installation of each pile at each site.

3.04 REMOVAL

A. Remove entire sheet pile by pulling when no longer required as determined by COR.

B. Removed sheet pile to remain property of the Contractor and be removed from the work site area.

END OF SECTION

SECTION 02514 - STEEL PIPE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Steel Pipe:

1. Measurement: Length along pipe centerline between ends of pipe in place.
   a. Continuous through fittings.
   b. No allowance for lap at joints.
   c. Includes the connections into structure walls as shown on drawings.
2. Payment: Linear foot price offered in the schedule.
   a. Includes cost of furnishing materials; manufacturing and laying pipe; welding joints; furnishing and installing warning tape; inspecting welds; furnishing and placing concrete and concrete reinforcement in vent blocking; and furnishing maintenance warranty bond.
   b. Does not include steel vent pipes. Refer to Section 05635 – Metal Piping.
   c. Does not include electrical conduit. Refer to Section 16130 – Electrical Conduit.

B. Pipe Outlets:

1. Measurement: Number of outlets installed for the Group No.
2. Payment: Outlet price offered in the schedule.
   a. Payment will be made in accordance with the group listing in table 02514A - Steel Pipe Outlets.
   b. Dimensions D_1 and D_2 correspond to dimensions on the drawings.

Table 02514A – Steel Pipe Outlets

Group No.	Group Description	Diameter Dimensions, inches		Number of Outlets Required
		Steel Pipe Size (D_1)	Outlet Size (D_2)	
I	Outlets for vents from steel pipe	108	18	4

3. Payment for pipe outlets includes the following:
   a. Vent: Opening in steel pipe shell for pipe outlet with required steel wrapper plate, steel collar, or single steel cylinder, nozzle, welding flange, lining, and accessories required for the pipe outlet connection.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM A 139/A 139M-04	Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)
2.	ASTM A 283/A 283M-03(2007)	Low and Intermediate Tensile Strength Carbon Steel Plates
3.	ASTM A 1011/A 1011M-07	Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
4.	ASTM A 1018/A 1018M-07	Steel, Sheet and Strip, Heavy Thickness Coils, Hot Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
5.	ASTM E 165-02	Liquid Penetrant Examination

B. American Water Works Association (AWWA)

1.	AWWA C 200-05	Steel Water Pipe - 6 In. (150mm) and Larger
2.	AWWA C 206-03	Field Welding of Steel Water Pipe
3.	AWWA C 207-07	Steel Pipe Flanges for Waterworks Service – Sizes 4 in. Through 155 in. (100 mm Through 3,600 mm)
4.	AWWA C 208-01	Dimensions for Fabricated Steel Water Pipe Fittings

1.03 DEFINITIONS

A. Unless specific reference is made to the outside diameter of pipe, pipe diameters shown on drawings and used in these specifications are inside diameters.

B. Pipe designations shown on drawings and in these specifications establish minimum requirements for pipe allowed under these specifications.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 02514-1, Shop Drawings.

1. Provide checked, detailed drawings showing all dimensions, tolerances, material data, joint details, welding requirements, and lining and coating requirements.

C. RSN 02514-2, Purchase Orders.

1. Copies of purchase orders for steel pipe.

D. RSN 02514-3, Pipelaying Diagrams.

1. Show position and marking of pipe sections.
2. Include centerline and invert stationing and elevations at horizontal and vertical changes in alignment, and subgrade elevation for each pipe fitting.
3. Include field lining and coating repair methods.

E. RSN 02514-4, Pipe Embedment Plans.

1. Show methods used to prevent flotation and movement.
2. Include flotation calculations. Use safety factor of at least 1.1.

F. RSN 02514-5, Welder Qualifications.

1. Resume.

G. RSN 02514-6, Test Reports for Hydrostatic Testing.

H. RSN 02514-7, Test Reports of Field Welds.

1. Test reports for nondestructive testing of field welds.

1.05 WARRANTY

A. Furnish extended warranty for steel pipe in accordance with the clause at FAR 52.246-21 – Warranty of Construction.

1. Extended maintenance warranty period of 3 years after steel pipe commences operation or 5 years after acceptance of the work, whichever comes first.

1.06 QUALIFICATIONS

A. Qualify welding procedures and welders in accordance with the code under which welding is specified to be accomplished.

1.07 DELIVERY, STORAGE, AND HANDLING

A. During loading, transporting, unloading, storing, and laying, prevent damage to steel pipe, linings, and coatings.

B. Maintaining circularity of pipe:

1. After lining operations are completed and prior to handling, shipping, laying, and backfilling pipe sections in trench; furnish and place internal supports to maintain circularity.

2. Supports:

   a. Three members at 60 degrees to each other.

   b. Minimum member cross section: Nominal 4 by 4, with padded ends and wedges.

3. Place supports at 5 feet from ends of each pipe section and at pipe mid-section.

4. Orient support legs in same axis along pipe centerline.

C. Transport coated pipe on padded bolsters curved to fit the outside of the pipe. Use heavy padding under ties.

D. Support and store pipe above ground surface. Do not allow bells and spigots to contact each other or the ground.

E. Tightly close open ends of lined pipe with plastic wrap for protection of lining during shipment.

1. Plastic wrap:

   a. At least two thicknesses of 6-mil sheet polyethylene plastic.

   b. Remain on pipe until installation.

F. Repair damage to lining or coating as directed if, in the opinion of the COR, a satisfactory repair can be made; otherwise, replace damaged section at the expense of the Contractor.

1.08 PROJECT CONDITIONS

A. Steel pipe crossing extends from siphon inlet structure to siphon outlet structure.

B. Groundwater is expected to be encountered during excavation.

C. Provide cathodic protection in accordance with Section 13110 – Buried Impressed Current Cathodic Protection System and Section 13112 – Submerged Galvanic Anode Cathodic Protection System – Pipes.

PART 2 PRODUCTS

2.01 STEEL PIPE

A. Steel pipe:

1. Electric-Fusion- (Arc-) Welded Spiral-Seam Steel Pipe: ASTM A 139, grade B, C, D, or E.

2. Fabricated in accordance with AWWA C 200, except:

a. Steelplate: ASTM A 283, grade C or D.

b. Steel Sheet: ASTM A 1011, designation SS, grade 40, 45, or 50; or ASTM A 1018, designation SS, grade 40.

B. Pipe diameter: To inside of pipe.

C. Minimum steel wall thickness of pipe:

1. As shown in table 02514B - Minimum Steel Wall Thickness for Symbol Pipe, or as otherwise shown on the drawings.

Table 02514B. - Minimum Steel Wall Thickness for Symbol Pipe

Pipe Diameter Inches	Minimum Steel Wall Thickness, Inches
108	0.5

D. Except for structure connections and closure joints, lap joints shall be furnished.

E. Prepare pipe ends for field welding.

F. Furnish butt straps and joints for closure sections.

2.02 FITTINGS

A. Vent Flanges:

1. Flange: AWWA C 207.

a. Class: Working pressure meets or exceeds head class of attached pipe

2. Flange gasket: AWWA C 207

B. Tees:

1. Fabricate tees for vents as shown on drawings.

2. Tee length, minimum: As shown on drawings, or as required for blocking.

3. Ends: Fit type of joint in adjacent pipeline.

C. Bends: In accordance with AWWA C 208.

2.03 COATING AND LINING

A. Notify COR 24 hours before coating and lining steel pipe.

B. Coat and line steel pipe in accordance with Section 09902 – Coatings.

2.04 CONCRETE

A. Concrete in blocking and pads: Section 03300 - Cast-in-Place Concrete.

2.05 PIPE ACCESSORIES

A. Warning Tape:

1. Polyethylene tape.
2. Thickness: 6 mils.
3. Non-detectable.
4. Width, minimum: 6 inches.
5. Color: Purple.
6. Legend repeated at least every 3 feet: BURIED WATERLINE

2.06 ELECTRICAL CONDUIT

A. 4-inch diameter PVC electrical conduit in accordance with Section 16130 – Electrical Conduit.

2.07 CONTRACTOR SOURCE QUALITY TESTING

A. Steel pipe and fittings:

1. Hydrostatic test for pipe: Perform shop hydrostatic test on pipe which stresses steel to 23,000 lb/in^2.
    a. Test sections with formed or welded-on ends after ends have been formed or welded on.
    b. Repair defects and retest section before applying lining and coating.
2. Hydrostatic test for fittings
    a. Test fittings fabricated from steelplate under hydrostatic pressure sufficient to stress the steel to 23,000 lb/in^2
    b. Hold pressure long enough to allow a thorough inspection of welded joints, and repair leaks by rewelding and retest fittings.
    c. Fittings fabricated from tested steel pipe do not require hydrostatic testing if girth butt welds are complete penetration welds.
        1) Perform dye penetrant test on welds in accordance with ASTM E 165.
    d. Chip, flame gouge, or grind to sound metal defects in welds as disclosed by the dye penetrant or hydrostatic tests. Reweld and retest the resulting cavities.

3. Notify Technical Service Center, Attn 86-68140, and COR at least 14 days before hydrostatic testing.

4. Provide test reports of hydrostatic tests for fittings.

B. Joint test:

1. Assemble one joint to check the bell and spigot to check fit prior to coating or lining.

2.08 SOURCE QUALITY ASSURANCE

A. Basis for approval for shipment:

1. Pipe approval will be determined by inspection, during and after manufacture, to determine whether the pipe conforms to these specifications, and ASTM A 139 or AWWA C 200.

2. Notify the Technical Service Center, Attn 86-68140, and COR at least 14 days before manufacturing pipe and 72 hours before shipping pipe.

3. The Government will inspect pipe units and will approve for shipment those which have been manufactured and tested in accordance with these specifications, unless the Contractor is notified in writing by the COR.

4. Further inspection of pipe units will be in accordance with the clause at FAR 52.246-17 "Inspection of Construction."

PART 3 EXECUTION

3.01 LAYING PIPE

A. Keep pipe trench free of water during pipelaying operations.

B. Excavate pipe trench in accordance with Section 02316 – Steel Pipe Earthwork.

1. Grade pipe trench to provide uniform slope along the bottom of pipe.

2. Foundation for pipe trench shall meet minimum foundation requirements prior to laying pipe sections.

3. At joints involving bells or collars, excavate holes at the joint of ample size to prevent bells or collars from coming in contact with the subgrade.

4. Lower the pipe into the trench and place pipe in position such that no soil gets inside the pipe and pipe is not damaged.

5. Joints shall meet minimum requirements in accordance with approved details.

C. Joints for pipe: Field weld in conformance with AWWA C 206.

1. Seal weld outside of pipe joint minimum 3/16-inch fillet weld.

D. Changes in alignment and grade:

1. Where shown on the drawings, make changes in alignment and grade with miter bends.

a. Where miter bends are not required, maximum deflection angle between adjacent pipe sections: 1 degree.

2. Lay ends of each section of steel line pipe on the theoretical centerline of the curve and to the grade shown on the drawings within the laying tolerances prescribed below.

E. Connections at Structures and Encasements.

1. Where steel pipe adjoins a concrete structure or is fully encased in concrete, except at concrete collars and encasements, provide a closure joint at or adjacent to the nearest face of such structure or encasement.

a. Maximum distance from closure joint to concrete face:

1) One-half pipe diameter.

F. Closure Sections.

1. Use closure sections where necessary as determined by the Contractor, subject to the approval of the COR.

2. Cover pipe with controlled low strength material to within 25 feet of closure joint and to at least 1 foot over top of pipe, then allow a minimum of 24 hours before welding.

3. Weld closure sections during coolest time of day and when sun is not directly shining on pipe.

G. Lay pipe on soil pads consisting of any material such as sand bags that is weaker than controlled low strength material.

H. Welding Sequence Requirements:

1. Weld inside and outside of pipe.

2. Repair lining and coating.

3. Complete welding procedures before placing controlled low strength material for embedment and backfill.

I. Repair lining and coating after making welded joints and closures in accordance with Section 09902 – Coatings.

J. After pipelaying and joining operations are completed, clean inside of pipe and remove debris. When pipelaying is not in progress, keep ends of pipeline closed.

3.02 TOLERANCES

A. Lay pipe to lines and grades shown on drawings or established by the COR to the following tolerances:

1. Departure from and return to established alignment and grade, maximum: 1/16-inch per foot of pipe.

2. Total departure from established alignment and grade, maximum: 1-inch.

3.03 EMBEDMENT AND BACKFILL

A. Prevent flooding the pipe trench before embedment and backfilling operations.

B. Embed pipe in accordance with Section 02323 – Controlled Low Strength Materials (CSLM) and backfill pipe in accordance with Section 02316 – Steel Pipe Earthwork.

1. Place embedment and backfill about pipe carefully to avoid lateral displacement of the pipe and damage to joints.

2. In certain pipe reaches, where determined necessary by the COR to prevent the possibility of flotation, do not lay more than 300 linear feet of pipe ahead of controlled low strength materials and backfilling operations.

C. Keep internal supports in place until embedment has been placed above the bottom of the pipe to a minimum height of 1 foot over the top of pipe.

D. Backfill above pipe in accordance with Section 02316 – Steel Pipe Earthwork.

3.04 WARNING TAPE

A. Install warning tape over center of each pipe at least 18 inches below ground and at least 18 inches above each pipe except up to a maximum of 36 inches below finished ground surface.

3.05 ELECTRICAL CONDUIT

A. Install electrical conduit above pipe in accordance with Section 16130 – Electrical Conduit.

3.06 PIPE DEFLECTION

A. Allowable vertical pipe diameter deflection after backfilling is complete:

1. Decrease, maximum: 2 percent of nominal pipe diameter.

2. Elongation, maximum: 3 percent of nominal pipe diameter.

B. Within 2 weeks after backfilling is completed, take measurements of internal diameters.

1. Remove interior bracing before making measurements.

C. Measurement frequency:

1. One pipe unit out of three for the first 30 units laid and one pipe unit out of ten thereafter.

2. In areas of deep burial or where special problems are encountered, the frequency of measurements may be increased at the discretion of the COR.

D. Measurements:

1. Measure vertical and horizontal diameter at approximate midpoint of pipe unit.

2. Record pipe deflections and station where measurements were taken.

3. Mark inside of pipe so that future comparisons can be made.

E. If a pipe unit deflection exceeds the allowable:

1. Take measurements in adjacent pipe units to determine extent of excessive deflection.

2. Provide deflection data to the COR.

3. Additional direction will be provided to the Contractor after deflection data is analyzed.

3.07 CONTRACTOR FIELD QUALITY TESTING

A. Nondestructive testing of field welds:

1. Test welds in accordance with AWWA C206 and this section.

2. Visual inspection: Visually inspect all welds following procedures, techniques, and standards of AWS D1.1.

3. Test all partial penetration joint field welds and fillet field welds by magnetic particle or dye penetrant.

a. Technique and procedure for magnetic particle testing: ASTM E 709.

b. Technique and procedure for dye penetrant: ASTM E 165.

c. Standards of acceptance for both types: AWS D1.1.

4. Complete inspections and tests as work progresses in presence of a COR inspector and in accordance with AWS D1.1.

5. When welds are found to be defective by the standards of AWS, repair welds in accordance with AWS D1.1 and reexamine welds to ensure the adequacy of repairs.

B. Provide test reports for nondestructive testing of field welds.

END OF SECTION

SECTION 02635 - SPLASH BLOCKS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 REFERENCES

A. ASTM International (ASTM)

1. ASTM C 913-07a Precast Concrete Water and Wastewater Structures

PART 2 PRODUCTS

2.01 SPLASH BLOCKS

A. Concrete and Reinforcement Materials: Refer to Section 03300 - Cast-in-Place Concrete and Section 03200 – Concrete Reinforcement.

B. Design and manufacture in accordance with ASTM C 913.

C. Use rigid molds, constructed to maintain precast units uniform in shape, size and finish. Maintain consistent quality during manufacture.

D. Cure units to develop concrete quality, and to minimize appearance blemishes including non-uniformity, staining, or surface cracking.

E. Minor patching in plant is acceptable, providing appearance of units is not impaired.

F. Dimensions:

1. Length: Approximately 30 inches.
2. Width: Approximately 12 inches.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install beneath gutter downspouts at locations indicated on drawings.

B. Install units without damage to shape or finish.

C. Replace or repair damaged units.

END OF SECTION

SECTION 02722 – AGGREGATE BASE COURSE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Aggregate Base Course for Access Road to Drop 2 Powerplant:

1. Measurement: Weight of aggregate materials furnished and placed to lines and grades as shown on the drawings.
    a. Weight will be based on weight tickets from scales certified by State of California. Deliver weight tickets to COR.
2. Payment: Ton price offered in the schedule.
    a. Includes cost of subgrade preparation.
    b. Does not include aggregate base course for Interstate 8 Highway reconstruction. Refer to Section 02052 – Interstate 8 Highway.

1.02 REFERENCES

A. State of California Department of Transportation (CALTRANS)

1.	CALTRANS SS	Standard Specifications, State of California, Business, Transportation, and Housing Agency, Department of Transportation, May 2006
2.	CALTRANS SP	Amendments to May 2006 State Standard Specifications, State of California, Business, Transportation, and Housing Agency, Department of Transportation, April 4, 2008

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 02722-1, Certification:

1. Manufacturer’s certificate of compliance for aggregate grading and quality.
2. In accordance with CALTRANS SS Section 26 “Aggregate Bases” and the Aggregate Bases specifications of Section 02052 – Interstate 8 Highway Work.

PART 2 PRODUCTS

2.01 AGGREGATE BASE COURSE

A. CALTRANS SS, Section 26 “Aggregate Bases” and the Aggregate Bases specifications of Section 02052 – Interstate 8 Highway Work.

1. Class 2 Aggregate Base, 1-1/2-inch maximum size.

B. Free from adobe, vegetable matter, loam, and other deleterious substances.

C. Quality:

1. Capable of being thoroughly compacted when moistened and rolled to form a firm well-bonded base.

2. Conform to quality requirements of CALTRANS SS Section 26 “Aggregate Bases” Section 1.02A and the Aggregate Bases specifications of Section 02052 – Interstate 8 Highway Work.

D. At least 25 percent, by weight, of material retained on the No. 4 mesh screen shall be crushed particles with at least one fractured face.

PART 3 EXECUTION

3.01 PREPARATION

A. Fill depressions and grade to a uniformly smooth profile as determined by COR.

B. Prepare subgrade in accordance with CALTRANS SS, Section 26 “Aggregate Bases” and the Aggregate Bases specifications of Section 02052 – Interstate 8 Highway work.

3.02 SPREADING AND COMPACTING

A. Place at locations and to thickness shown on drawings.

B. Spread and compact in accordance with CALTRANS SS, Section 26 “Aggregate Bases” and the Aggregate Bases specifications of Section 02052 – Interstate 8 Highway Work.

3.03 PROTECTION

A. Protect from damage until final acceptance of work.

END OF SECTION

SECTION 02732 - GRAVEL SURFACING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Gravel Surfacing:

1. Measurement: Weight of material furnished and placed to the lines and grades as shown on the drawings, measured at certified State of California scale. Deliver weight tickets to COR daily.

2. Payment: Ton price offered in the schedule.

B. Recycled Concrete Aggregate:

1. Payment: Lump sum price offered in the schedule.

   a. Includes loading, hauling, and placing material to the lines and grades as shown on the drawings.

1.02 REFERENCES

A. State of California Department of Transportation (CALTRANS)

1.	CALTRANS SS	Standard Specifications, State of California, Business, Transportation, and Housing Agency, Department of Transportation, May 2006

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals.

B. RSN 02732-1, Certification:

1. Manufacturer’s certificate of compliance for aggregate grading and quality.

1.04 PROJECT CONDITIONS

A. Gravel surfacing includes gravel surfacing furnished and placed in accordance with this section and recycled concrete aggregate obtained from Government furnished stockpiles and placed in accordance with this section as shown on drawings.

B. Recycled concrete is stockpiled on the west side of the reservoir site in accordance with Section 01640 – Government Furnished Materials and as shown on the drawings.

PART 2 PRODUCTS

2.01 GRAVEL

A. CALTRANS SS, Section 26-1.02A, Class 2 Aggregate Base, 3/4-inch maximum size.

B. Free from adobe, vegetable matter, loam, and other deleterious substances.

C. Quality:

1. Capable of being thoroughly compacted when moistened and rolled to form a firm well-rounded base.
2. Conform to quality requirements of CALTRANS SS Section 26-1.02A.

2.02 RECYCLED CONCRETE AGGREGATE

A. Obtain from Government furnished stockpiles located on the west side of the reservoir site as shown on drawings.

PART 3 EXECUTION

3.01 PREPARATION

A. Level and prepare subgrade on which gravel or recycled concrete aggregate will be placed to uniform cross sections, free from depressions and soft spots.

B. Obtain Government approval of subgrade before placing surfacing.

3.02 PLACING

A. Place gravel surfacing on access roads and areas to the limits shown on drawings.

B. Place, moisten, and compact gravel surfacing in accordance with CALTRANS SS, Section 26.

C. Provide compacted gravel surfacing to a compacted depth of 4 inches.

D. Place recycled concrete aggregate on access roads and areas to the limits shown on drawings.

E. Place, moisten, and compact recycled concrete aggregate in accordance with CALTRANS SS Section 26.

F. Provide recycled concrete aggregate to a compacted depth of 4 inches.

END OF SECTION

SECTION 02743 - ASPHALTIC CONCRETE PAVEMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Asphaltic Concrete Pavement for Access Road to Drop 2 Powerplant:

1. Measurement: Weight of material placed, measured at certified scale.
   a. Weight will be based on weight tickets from scales certified by State of California. Deliver weight tickets to COR.
   b. Measurement based on combined weight of aggregate and binder.
2. Payment: Ton price offered in the schedule.
   a. Includes cost of tack coat, fog coat, and surface preparation for roadway.

1.02 REFERENCES

A. State of California Department of Transportation (CALTRANS)

1. CALTRANS SS — Standard Specifications, State of California, Business, Transportation, and Housing Agency, Department of Transportation, May 2006
   a. Maintain a copy of CALTRANS SS at jobsite during paving work.
2. CALTRANS SP — Amendments To May 2006 State Standard Specifications, State of California, Business, Transportation, and Housing Agency, Department of Transportation, April 4, 2008

1.03 DEFINITIONS

A. For the purpose of these specifications and use on this work, Asphaltic Concrete Pavement may also be referred to as “Asphalt” or as “Hot Mix Asphalt.” The three terms shall be considered as the same material.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 02743-1, Mix Design Data:

1. Mix design in accordance with Hot Mix Asphalt (HMA) specifications in Section 02052 – Interstate 8 Highway Work.
2. Include percentage for each sieve fraction of aggregate, percentage bitumen, and temperature of mixture when discharged from the mixer.

3. Include test data used to develop mix design.

C. RSN 02743-2, Certifications:

1. Manufacturer's certificate of compliance for aggregate and bituminous materials in accordance with CALTRANS SS Section 6 “Control of Materials”.

1.05 QUALITY CONTROL

A. Perform work and testing in accordance with CALTRANS SS Section 5 “Control of Work” and Section 6 “Control of Materials” and in accordance with Hot Mix Asphalt (HMA) specifications in Section 02052 – Interstate 8 Highway Work.

B. Testing requirements will be at the discretion of the COR.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver asphaltic concrete to placement site in thoroughly blended condition.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Comply with CALTRANS SS Section 39 “Hot Mix Asphalt” for weather limitations for asphaltic concrete placement.

PART 2 PRODUCTS

2.01 ASPHALTIC CONCRETE

A. CALTRANS SS Section 39 “Hot Mix Asphalt” and in accordance with Hot Mix Asphalt (HMA) specifications in Section 02052 – Interstate 8 Highway Work.

1. Type A, using the method process.

2. 3/4-inch maximum, medium grading.

B. Furnish approved mix design, produced at central mixing plant.

C. Asphalt Binder:

1. CALTRANS SS Section 92 “Asphalts” and in accordance with Hot Mix Asphalt (HMA) specifications in Section 02052 – Interstate 8 Highway Work.

a. Type PG 70-10.

2.02 TACK AND FOG COATS

A. CALTRANS SS Section 94 “Asphaltic Emulsion” and in accordance with Hot Mix Asphalt (HMA) specifications in Section 02052 – Interstate 8 Highway Work.

1. Type SS1 or CSS1.

PART 3 EXECUTION

3.01 PREPARATION

A. Aggregate Base Course:

1. Compact and finish in accordance with Section 02722 – Aggregate Base Course.
2. Moisten by sprinkling as directed by COR just prior to placing asphaltic concrete placement.

B. Surfaces of Existing Asphaltic Concrete Pavement:

1. Apply tack coat to saw cut surfaces and other surfaces of existing asphaltic concrete pavement that will be in contact with new asphaltic concrete pavement.
2. Apply tack coat approximately at rate of 0.15 gallon per square yard or as directed by COR.
3. Do not splash on adjacent surfaces.

3.02 PLACING, SPREADING, AND COMPACTING

A. Asphaltic Concrete Paving: Place, spread, and compact asphaltic concrete in accordance with CALTRANS SS Section 39 and in accordance with Hot Mix Asphalt (HMA) specifications in Section 02052 – Interstate 8 Highway Work.

B. Fog Coat: Apply fog coat to finished paving in accordance with CALTRANS SS Section 39 and in accordance with Hot Mix Asphalt (HMA) specifications in Section 02052 – Interstate 8 Highway Work, at approximate rate of 0.10 gallon per square yard.

C. Avoid segregation of materials.

3.03 MAINTENANCE

A. Maintain paved areas of access road to Drop 2 Powerplant until acceptance of work by Government.

END OF SECTION

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SECTION 02763 - PAINTED TRAFFIC LINES AND MARKINGS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Traffic Lines and Markings:

1. Measurement: Length of markings actually made.
2. Payment: Linear foot price offered in the schedule.
   a. Includes painted traffic lines and markings for access road to Drop 2 Powerplant.
   b. Does not include painted traffic lines and markings for Interstate 8 Highway detour or reconstruction work. Refer to Section 02052 - Interstate 8 Highway.

1.02 REFERENCES

A. State of California Department of Transportation (CALTRANS)

1.	CALTRANS SS	Standard Specifications, State of California, Business, Transportation, and Housing Agency, Department of Transportation, May 2006

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 02763-1, Certification:

1. Manufacturer's certification that paint meets specified requirements.

C. RSN 02763-2, Instructions:

1. Paint manufacturer's environmental, surface preparation, and application instructions.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Apply when surface and weather conditions are favorable.

B. Do not apply when air or surface temperature is below 40 degrees F.

C. Comply with paint manufacturer's environmental restrictions.

PART 2 PRODUCTS

2.01 TRAFFIC PAINT

A. In accordance with CALTRANS SS Section 84.

B. Colors: White and yellow.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean and dry surface in accordance with paint manufacturer's instructions.

3.02 APPLICATION

A. Apply standard lines and markings in accordance with CALTRANS SS Sections 84 and 85 as shown on drawings.

B. Apply paint at coverage rate of 100 square feet per gallon, maximum, in accordance with manufacturer's instructions.

C. Apply with clean edges free of overspray and line width within plus or minus 1/4 inch of designated width.

3.03 PROTECTION

A. Protect markings from traffic and damage until dry.

END OF SECTION

SECTION 02845 – W-BEAM GUARDRAIL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. W-Beam Guardrail:

1. Measurement: Length of installed W-Beam Guardrail.
2. Payment: Linear foot price offered in the schedule.
   a. Includes terminal sections, posts, anchor bolt assemblies, and accessories for complete installation.
   b. Does not include pipe guardrails for W-beam guardrails or concrete foundations for W-beam guardrails. Include cost of pipe guardrails for W-beam guardrails in lump-sum price offered in the schedule for miscellaneous metalwork. Refer to Section 05500 – Metal Fabrications. Include cost of concrete foundations for W-beam guardrails in cubic yard price offered in the schedule for concrete structures. Refer to Section 03300 – Cast-In-Place Concrete.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO M 180-00(2004) Corrugated Sheet Steel Beams for Highway Guardrail

1.03 DELIVERY, STORAGE, AND HANDLING

A. Mark each rail element in accordance with AASHTO M 180.

PART 2 PRODUCTS

2.01 MATERIALS

A. Metal Beam Guard Railing:

1. Rail Elements and Backup Plates: AASHTO M 180, Type I, Class A, W-Beam.

B. Terminal Connectors: AASHTO M 180, Type I, Class A, W-Beam.

C. Steel Posts and Baseplates: In accordance with Section 05500 – Metal Fabrications.

D. Bolts, Nuts, and Other Fittings:

1. Bolts, nuts and other fittings for rail elements: AASHTO M 180.

E. Anchor bolt assemblies:

1. Anchor bolts, plates, nuts, and washers: In accordance with Section 05500 – Metal Fabrications.

F. Concrete Foundations: In accordance with Section 03300 – Cast-In-Place Concrete.

2.02 FABRICATION

A. Fabricate steel posts, baseplates, anchor bolt assemblies, pipe guardrails, and accessories in accordance with Section 05500 – Metal Fabrications.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install W-Beam Guardrail at locations shown on drawings.

B. Install steel posts, rail elements, concrete foundations, and anchor bolt assemblies in accordance with the details shown on drawings.

1. Install steel posts plumb and in alignment.
2. Provide shims or nonshrink grout as required to ensure proper alignment and plumbness.

C. Install pipe guardrails in accordance with Section 05500 – Metal Fabrications and the details shown on the drawings.

3.02 REPAIR

A. Repair abraided and damaged galvanized surfaces in accordance with AASHTO M 180.

END OF SECTION

SECTION 02846 – METAL BEAM GUARD RAILING AND CHAIN LINK RAILING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Metal Beam Guard Railing:

1. Measurement: Length installed along the face of the rail element from end post to end post of the completed railing at each installation. The point of measurement at each end post will be the center of the bolt attaching the rail element to the end post.

   a. Includes terminal systems, end treatments, and installation materials.

2. Payment: Linear foot price offered in the schedule.

B. Chain Link Railing:

1. Measurement: Length of installed railing from end to end along the face of the railing, including end and intermediate posts.

2. Payment: Linear foot price offered in the schedule.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO M 180-00(2004) Corrugated Sheet Steel Beams for Highway Guardrail

B. California Department of Transportation (CALTRANS)

1. CALTRANS SS Standard Specifications, State of California, Business, Transportation, and Housing Agency, Department of Transportation, May 2006

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 02846-1, Certifications:

1. Certified grading and treating reports for wood posts and blocks in accordance with CALTRANS SS, Sections 57-1.02A and 58-1.03.

2. Certified copies of mill test reports for galvanized steel rail elements in accordance with CALTRANS SS, Section 83-1.02B.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Mark each rail element in accordance with AASHTO M 180.

PART 2 PRODUCTS

2.01 RAILINGS

A. Metal Beam Guard Railing: CALTRANS SS, Section 83-1.02B, with wood posts and blocks.

B. Chain Link Railing: CALTRANS SS, Section 83-1.02I.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install metal beam guard railing in accordance with CALTRANS SS, Section 83-1.02B.

B. Install chain link railing in accordance with CALTRANS SS, Section 83-1.02I.

3.02 REPAIR

A. Repair abraded and damaged galvanized surfaces in accordance with CALTRANS SS, Section 83-1.02.

END OF SECTION

SECTION 02893 – POST-MOUNTED TRAFFIC SIGNS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Post-Mounted Traffic Signs:

1. Measurement: Number of signs installed as shown on drawings.
2. Payment: Unit price per sign offered in the schedule.
   a. Includes post-mounted traffic signs for access road to Drop 2 Powerplant.
   b. Does not include post-mounted traffic signs for Interstate 8 Highway detour or reconstruction work. Refer to Section 02052 - Interstate 8 Highway Work.

1.02 REFERENCES

A. State of California Department of Transportation (CALTRANS)

1.	CALTRANS SS	Standard Specifications, State of California, Business, Transportation, and Housing Agency, Department of Transportation, May 2006

B. Federal Highway Administration (FHWA)

1.	FHWA MUTCD, Part 6	Manual on Uniform Traffic Control Devices, 2003 Edition, with Revision No. 1, July 21, 2004

C. Maintain a copy of CALTRANS SS and FHWA MUTCD at jobsite during work.

1.03 QUALITY

A. Perform work in accordance with CALTRANS SS.

PART 2 PRODUCTS

2.01 MATERIALS

A. Signs:

1. Conform to FHWA MUTCD.
2. Furnish signs as indicated on drawings.

B. Posts and Hardware:

1. Conform to CALTRANS SS Section 56-2, for wide-flange metal posts set in concrete.
2. Conform to CALTRANS SS Section 56-2.02B for wood posts.

C. Concrete:

1. In accordance with Section 03300 - Cast-In-Place Concrete.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with FHWA MUTCD and CALTRANS SS Section 56-2.

B. Install at locations shown on drawings.

END OF SECTION

SECTION 02918 – PLACING WOOD CHIPS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Placing Wood Chips:

1. Payment: Lump sum price offered in the schedule.

a. Includes loading, hauling and placing.

PART 2 PRODUCTS

2.01 WOOD CHIPS

A. Obtain from Government furnished stockpiles shown on drawings.

B. Wood chips are stockpiled at two locations on the reservoir site.

1. North stockpile contains approximately 650 cubic yards.
2. West stockpile contains approximately 1,950 cubic yards.

PART 3 EXECUTION

3.01 PLACING

A. Place and spread wood chips over finished exterior reservoir and forebay/afterbay slopes as directed by COR.

B. Transport and place wood chips to form uniform layer as directed by COR.

C. Minimize equipment travel over placed wood chip layers

END OF SECTION

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SECTION 03110 - CONCRETE FORMWORK

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost of furnishing and constructing forms in applicable prices offered in schedule for concrete items for which forms are required.

1.02 REFERENCES

A. Bureau of Reclamation (USBR)

1. USBR RSHS Reclamation Safety and Health Standards, 2001 Edition

B. APA – The Engineered Wood Association (APA)

1. APA PS1-07 Construction and Industrial Plywood

C. Western Wood Products Association (WWPA)

1. WWPA G5 Western Lumber Grading Rules ‘05

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 FORM MATERIALS

A. Sheathing or Lining: Conform to Table 03100A - Form Sheathing or Lining Materials, or provide other materials which will produce equivalent results. Refer to Section 03300 – Cast-In-Place Concrete for finishing requirements.

Table 03100A - Form Sheathing or Lining Materials

Finish	Wood sheathing or lining	Steel sheathing or lining
F1	Any grade common board or plywood	Steel sheathing permitted Steel lining permitted
F2	No. 2 common, or better, shiplap or plywood	Steel sheathing permitted Steel lining permitted if approved

Table 03100A - Form Sheathing or Lining Materials

F3	Plywood	Steel sheathing permitted Steel lining not permitted

B. Steel sheathing is steel sheets not supported by wood backing. Steel lining is thin sheets supported by wood backing.

C. Wood Sheathing or Lining: Softwood or plywood of such kind and quality and treated or coated so that deterioration or discoloration of formed concrete surfaces due to chemical action, contamination, or uneven absorption of water from concrete is prevented.

D. Plywood: APA PS 1, Exterior, Grade B-B Concrete Form, Class I, mill oiled and edge sealed.

E. Softwood Lumber:

1. Meet requirements of WWPA G5 for dressed lumber or worked lumber of specified grade.
2. Use common boards surfaced on both edges (S2E) in accordance with WWPA G5.
3. Use 6- or 8-inch wide lumber for shiplap forms.
4. Use same lumber width in forms for F2 finishes.

F. F3 Finish Forms: Use material with basic modular size of 4- by 8-feet.

3.02 DESIGN

A. Design formwork to meet RSHS.

B. Designs and drawings performed by and stamped by a registered professional engineer.

3.03 INSTALLATION

A. Construct forms to confine and shape concrete to required lines and grades so that completed work meets specified structural deviations, surface tolerances, and finish requirements.

B. Construct forms with sufficient strength and safety factors to withstand pressure from placing and vibrating concrete. Maintain in proper position.

C. For concrete containing type 1 or 2 plasticizer chemical admixtures, adjust formwork design and concrete placing rate to compensate for hydraulic pressures exerted on forms by concrete with high fluidity.

D. Where form vibrators are to be used, construct forms with sufficient rigidity to effectively transmit energy from form vibrators to concrete without damaging formwork or altering form position.

E. Seal surfaces and joints of forms to prevent absorption of water into forms or loss of mortar from concrete.

F. Place chamfer strips in corners of forms and at tops of wall placements to bevel edges of permanently exposed concrete surfaces. Do not bevel interior angles of intersecting concrete surfaces and edges of construction joints except as indicated on drawings.

G. Install sufficient plumb and string lines to monitor formwork positions before concrete placement. Monitor plumb and string lines during concrete placement and correct deficiencies in formwork.

H. F2 Finish:

1. Use one type of form sheathing or lining material for exposed F2 surfaces.
2. Construct forms to produce a uniform and consistent texture and pattern on face of concrete. Metal patches on forms are not permitted.
3. Place form sheathing or lining so that horizontal form marks are continuous across entire surface.
4. For forms constructed of plywood form lining or shiplap panels, make vertical form marks continuous for entire height of surface.
5. For forms constructed of shiplap which is not paneled, cut boards square, stagger vertical joints in boards, and place vertical joints at studs.

I. F3 Finish:

1. Use one type of form sheathing or lining material for F3 surfaces. Fabricate filler panels for corners, soffits, and similar offsets from same material as used for forms.
2. Construct forms to produce a uniform and consistent texture and pattern on face of concrete. Metal patches on forms are not permitted.
3. Align sheathing or lining horizontally and vertically and place to minimize joint marks on surfaces.
4. Place form sheathing or lining so that horizontal form marks are continuous across entire surface.
5. Make vertical form marks continuous for entire height of surface.
6. Fill and smooth finish voids at joints in plywood form lining or sheathing.
7. Do not construct forms continuously from lift to lift. Remove forms after concrete in a lift has hardened and reset forms for next lift.
8. Reset forms to overlap hardened concrete in previous lift by 1 inch, maximum.

9. Tighten forms snugly against hardened concrete so that forms will not spread and cause offsets or loss of mortar at construction joints when concrete placement is resumed. Provide additional bolts or form ties required to hold reset forms tight against hardened concrete.

J. Form Ties and Anchors:

1. Embed ties for holding forms.

2. Terminate ties not less than 2 diameters or twice minimum dimension of tie, whichever is greater, from formed surface of concrete, except where F1 finish is permitted.

3. Install ties so ends or end fasteners can be removed without causing spalling at face of concrete.

4. Provide form anchors as required to ensure that concrete surfaces will meet specified tolerances. Replace form anchors embedded in concrete which are loosened before placement of adjoining concrete with other supports firmly embedded in hardened concrete.

K. Cleaning and Oiling Forms:

1. Clean form surfaces of encrustations of mortar, grout, or other foreign material.

2. Coat form surfaces with a form oil which will prevent sticking and will not soften or stain concrete surfaces or cause concrete surface to become chalky or dust producing.

3. Diesel fuel or other products not designated for use on concrete will not be allowed.

4. Do not exceed the volatile organic compound (VOC) content limits permitted by Federal, State, and local air pollution control regulations.

3.04 REMOVAL

A. Remove forms within 24 hours after concrete has hardened sufficiently to prevent damage by form removal and will not result in perceptible cracking, spalling, or breaking of edges or surfaces, or other damage to concrete. Begin required repair and curing immediately after form removal.

B. Do not load or remove forms, falsework, or shoring, or backfill against concrete until concrete has reached its design strength to safely support its weight and imposed loads.

C. Remove forms on upper sloping faces of concrete, such as forms on waterside of warped transitions, as soon as concrete has attained sufficient stiffness to prevent sagging.

D. Loosen wood forms for wall openings as soon as loosening can be accomplished without damage to concrete to prevent excessive stress in concrete from swelling of forms. Construct forms for openings to facilitate loosening.

E. Remove forms in a manner which prevents damage to concrete.

F. Repair damaged concrete in accordance with Section 03300 – Cast-In-Place Concrete.

G. Leave false work in place until concrete has reached design strength.

END OF SECTION

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SECTION 03152 – SPONGE RUBBER JOINT FILLER

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for items of work requiring sponge rubber joint filler.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM D 1752-04a	Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Expansion Fillers for Concrete Paving and Structural Construction

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals.

B. RSN 03152-1, Certification:

1. Manufacturer's certification that sponge rubber filler complies with specified requirements. Identify with materials specifications, quantity being furnished, batch number, and date of manufacture.

C. RSN 03152-2, Instructions:

1. Manufacturer's installation instructions.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's instructions.

B. Do not expose to direct sun.

PART 2 PRODUCTS

2.01 SPONGE RUBBER FILLER

A. ASTM D 1752, Type I, with the following exception:

1. Load required to compress test specimen to 50 percent of its thickness before test shall not be less than 50 pounds per square inch nor greater than 150 pounds per square inch.

2.02 FASTENERS AND ADHESIVE

A. As recommended by sponge rubber filler manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Cut filler to size and shape of joint surface.

B. Install as shown on drawings.

C. Secure to concrete as recommended by manufacturer, with adhesive during or within 7 days of placement.

D. Fit sections of filler tightly.

E. Place filler so that edges are flush with finished surface of concrete, to the bottom edge of chamfers, or as shown on drawings.

END OF SECTION

SECTION 03156 - PVC WATERSTOP

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. PVC Waterstops:

1. Measurement: Length of installed waterstop measured along centerline of waterstop with no allowance for splices and intersections.
2. Payment: Linear foot offered in the schedule.
    a. Does not include PVC strip waterstop for canal lining. Refer to Section 03158 – PVC Strip Waterstop.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM D 638-03	Tensile Properties of Plastics
2.	ASTM D 746-07	Brittleness Temperature of Plastics and Elastomers by Impact
3.	ASTM D 747-02	Apparent Bending Modulus of Plastics by Means of a Cantilever Beam
4.	ASTM D 1203-94(2003)	Volatile Loss From Plastics Using Activated Carbon Methods

B. United States Army Corps of Engineers (COE)

1.	COE CRD-C-572-74	Polyvinylchloride Waterstop

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 03156-1, Purchase Orders:

1. Copies of purchase orders for waterstop.

C. RSN 03156-2, Approval Samples:

1. 2-foot-long sample of each size and type of waterstop to be used in work.

D. RSN 03156-3, Certifications:

1. Manufacturer's certification for PVC compound used to fabricate waterstop.
    a. Include physical property test data on compound from tests performed by manufacturer or other laboratory within 18 months before submittal.

2. Sampling certification that samples are representative of waterstop to be used in work.

E. RSN 03156-4, Instructions:

1. Manufacturer's recommendations for installing and splicing waterstop.

1.04 QUALIFICATIONS

A. Use skilled workmen to make splices.

B. Demonstrate to COR that workmen are sufficiently skilled to fabricate required splices.

PART 2 PRODUCTS

2.01 PVC WATERSTOPS

A. PVC Compound:

1. Domestic virgin PVC with additional resins, plasticizers, stabilizers, or other materials required to meet specified requirements.

2. Do not use reclaimed PVC or manufacturer's scrap.

B. Meet physical characteristic requirements specified in Table 03156A - PVC Waterstop Physical Characteristics.

Table 03156A – PVC Waterstop Physical Characteristics

Property	Test Method	Requirement
Tensile test, minimum	ASTM D 638, speed D, specimen type IV	2,000 lbs/in^2
Ultimate elongation, minimum	ASTM D 638, speed D, specimen type IV	300 percent
Stiffness in flexure, minimum	ASTM D 747	600 lbs/in^2
Low temperature brittleness at -35 degrees F	ASTM D 746	No cracking or chipping
Volatile loss, change in weight, maximum	ASTM D 1203, method A, 0.08-inch-thick specimen	0.50 percent
Tensile strength after accelerated extraction test, percent of tensile strength before extraction test, minimum	COE CRD-C-572	80 percent

Table 03156A – PVC Waterstop Physical Characteristics

Property	Test Method	Requirement
Ultimate elongation after accelerated extraction test, percent of ultimate elongation before extraction test, minimum	COE CRD-C-572	80 percent
Change in weight after effect of alkalies test	COE CRD-C-572	+0.25 percent -0.10 percent
Change in Shore durometer hardness after effect of alkalies test	COE CRD-C-572	± 5 percent

C. Prepare test specimens in accordance with COE CRD-C-572.

2.02 FABRICATION

A. Mold or extrude so that cross section will be dense, homogeneous, and free from porosity and other imperfections.

B. Conform to detail dimensions and tolerances indicated on drawing 40-D-6463.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install waterstops at locations shown on drawings.

B. Install in accordance with manufacturer's recommendations.

C. Embed waterstop so that one-half of waterstop width will be embedded on each side of concrete joint.

D. Position waterstop and secure during installation so that a continuous watertight diaphragm will be formed in joint unless otherwise shown on drawings. Do not nail, puncture, or cut waterstop.

E. Support and protect waterstop during work.

F. Protect waterstop from oil, grease, and curing compound.

G. Remove large pieces of aggregate near waterstop by hand so that complete contact is maintained between waterstop and surrounding concrete.

H. Vibrate concrete surrounding waterstop with additional vibration so that waterstop is uniformly embedded in concrete.

3.02 SPLICING

A. Splice waterstops at joints in waterstop sections and at intersections of waterstops.

B. Make neat splices with waterstop ends joined in true alignment.

C. Use a miter-box guide and portable saw to make cuts so that ends to be joined will be in proper alignment and contact will be maintained between joined surfaces.

D. Splice by heat sealing adjacent surfaces in accordance with manufacturer's recommendations.

1. Use a thermostatically controlled electric heat source.
2. Use correct temperature to melt material.
3. Do not char material.

E. Make splice so that cooled splice when bent by hand to as sharp an angle as possible shows no sign of separation.

END OF SECTION

SECTION 03157 - PVC RETRO-FIT WATERSTOP

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. PVC Retro-Fit Waterstop:

1. Measurement: Length of installed waterstop system measured along centerline of waterstop with no allowance for splices.
2. Payment: Linear foot price offered in the schedule.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM D 638-03	Tensile Properties of Plastics
2.	ASTM D 746-07	Brittleness Temperature of Plastics and Elastomers by Impact
3.	ASTM D 747-02	Apparent Bending Modulus of Plastics by Means of a Cantilever Beam
4.	ASTM D 1203-94(2003)	Volatile Loss From Plastics Using Activated Carbon Methods

B. United States Army Corps of Engineers (COE)

1.	COE CRD-C-572-74	Polyvinylchloride Waterstop

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 03157-1, Approval Data and Instructions:

1. Manufacturer’s product data for approval.
2. Manufacturer’s recommendations for storing materials, preparing concrete surface, applying epoxy gel, installing system, and splicing waterstop.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver epoxy materials in manufacturer’s original unopened packaging with labels and seals intact.

B. Store materials in protected area in accordance with manufacturer’s recommendations.

PART 2 PRODUCTS

2.01 SYSTEM

A. No. 667 PVC Retro-Fit Waterstop System manufactured by Greenstreak, 3400 Tree Court Industrial Blvd., St. Louis, MO 63122; or equal, having following essential characteristics:

1. Waterstop system consisting of T-shaped PVC waterstop, two W-shaped stainless steel batten bars, and stainless steel anchor bolts.

   a. PVC waterstop meeting specified requirements with 1/2-inch thickness, 9-inch width, ribbed stem, and 6-3/8-inch stem length.

   b. Type 304, 16-gauge, stainless steel batten bars predrilled with anchor bolt holes spaced 6 inches on center.

   c. Type 304 stainless steel anchor bolts with 3/8-inch diameter and 3-inch length.

B. PVC Compound:

1. Domestic virgin PVC with additional resins, plasticizers, stabilizers, or other materials required to meet specified requirements.

2. Do not use reclaimed PVC or manufacturer's scrap.

C. Meet physical characteristic requirements specified in Table 03157A - PVC Waterstop Physical Characteristics.

Table 03157A - PVC Waterstop Physical Characteristics

Property	Test Method	Test Value	Units
Tensile test, minimum	ASTM D 638, speed D, specimen type IV	2,000	lbs/in^2
Ultimate elongation, minimum	ASTM D 638, speed D, specimen type IV	300	percent
Stiffness in flexure, minimum	ASTM D 747	600	lbs/in^2
Low temperature brittleness at -35 degrees F	ASTM D 746	No cracking or chipping	
Volatile loss, change in weight, maximum	ASTM D 1203, method A, 0.08-inch-thick specimen	0.50	percent

Table 03157A - PVC Waterstop Physical Characteristics

Property	Test Method	Test Value	Units
Tensile strength after accelerated extraction test, percent of tensile strength before extraction test, minimum	COE CRD-C-572-74	80	percent
Ultimate elongation after accelerated extraction test, percent of ultimate elongation before extraction test, minimum	COE CRD-C-572-74	80	percent
Change in weight after effect of alkalies test	COE CRD-C-572-74	+0.25 -0.10	percent
Change in Shore durometer hardness after effect of alkalies test	COE CRD-C-572-74	± 5	percent

2.02 ACCESSORIES

A. Epoxy Gel: As furnished or recommended by waterstop manufacturer.

2.03 FABRICATION

A. Mold or extrude PVC waterstop so that cross section will be dense, homogeneous, and free from porosity and other imperfections.

B. Factory fabricate corners.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean and prepare concrete contact surface in accordance with manufacturer's recommendations. Obtain approval of prepared surface from COR before proceeding with application of epoxy gel.

B. Apply bed of epoxy gel to concrete contact surface in accordance with manufacturer's recommendations. Comply with manufacturer's environmental restrictions for application of epoxy.

3.02 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Place waterstop before epoxy gel cures.

C. Secure in position with batten bars and anchor bolts.

1. Position and secure waterstop so that a continuous watertight diaphragm will be formed in joint.

2. Prevent air pockets or voids between waterstop and concrete surface.

D. Do not puncture or cut ribbed stem.

E. Support and protect installed waterstop during subsequent work.

F. Protect waterstop from oil, grease, and curing compound.

G. During concrete placement, remove large pieces of aggregate near waterstop by hand so that complete contact is maintained between waterstop and surrounding concrete.

H. Vibrate concrete surrounding waterstop with additional vibration so that waterstop is completely embedded in concrete.

3.03 SPLICING

A. Splice PVC waterstop at joints in waterstop sections.

B. Use skilled workmen to make waterstop splices. Demonstrate to COR that workmen are sufficiently skilled to fabricate required splices.

C. Make neat splices with waterstop ends joined in true alignment.

D. Use a miter-box guide and portable saw to make cuts so that ends to be joined will be in proper alignment and contact will be maintained between joined surfaces.

E. Splice by heat sealing adjacent surfaces in accordance with manufacturer's recommendations.

1. Use a thermostatically controlled electric heat source.

2. Use correct temperature to melt material.

3. Do not char material.

F. Make splice so that cooled splice when bent by hand to as sharp an angle as possible shows no sign of separation.

END OF SECTION

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SECTION 03158 - PVC STRIP WATERSTOP FOR CONCRETE CANAL LINING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in price offered in the schedule for contraction joints in canal lining.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM D 638-03	Tensile Properties of Plastics
2.	ASTM D 746-07	Brittleness Temperature of Plastics and Elastomers by Impact
3.	ASTM D 747-02	Apparent Bending Modulus of Plastics by Means of a Cantilever Beam
4.	ASTM D 1203-94(2003)	Volatile Loss From Plastics Using Activated Carbon Methods

B. United States Army Corps of Engineers (COE)

1.	COE CRD-C-572-74	Polyvinylchloride Waterstop

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 03158-1, Purchase Orders:

1. Copies of purchase orders for strip waterstop.

C. RSN 03158-2, Approval Samples:

1. 2-foot-long sample of each size and type of strip waterstop to be used in work.

D. RSN 03158-3, Certifications:

1. Manufacturer's certification for PVC compound used to fabricate waterstop.
    a. Include physical property test data on compound from tests performed by manufacturer or other laboratory within 18 months before submittal.
2. Certification that samples are representative of waterstop to be used in work.

E. RSN 03158-4, Instructions:

1. Manufacturer's recommendations for installing and splicing strip waterstop.

1.04 QUALIFICATIONS

A. Use skilled workmen to make splices and intersections.

B. Demonstrate to COR that workmen are sufficiently skilled to fabricate required splices and intersections.

PART 2 PRODUCTS

2.01 PVC STRIP WATERSTOP

A. PVC Compound:

1. Domestic virgin PVC with additional resins, plasticizers, stabilizers, or other materials required to meet specified requirements.

2. Do not use reclaimed PVC or manufacturer's scrap.

B. Test sheets, 1/16- to 1/8-inch thick, made from the PVC compound to be used in extruding the finished PVC strip meeting the physical characteristic requirements specified in Table 03158A - PVC Compound Physical Characteristics.

Table 03158A - PVC Compound Physical Characteristics

Property	Test Method	Requirement
Tensile test, minimum	ASTM D 638, speed D, specimen type IV	1,700 lbs/in^2
Ultimate elongation, minimum	ASTM D 638, speed D, specimen type IV	350 percent
Stiffness in flexure, minimum	ASTM D 747	400 lbs/in^2
Low temperature brittleness at -35 degrees F	ASTM D 746	No cracking or chipping
Volatile loss, change in weight, maximum	ASTM D 1203, method A, 0.08-inch-thick specimen	0.50 percent
Tensile strength after accelerated extraction test, percent of tensile strength before extraction test, minimum	COE CRD-C-572	1,500 lbs/in^2
Change in weight after effect of alkalies test	COE CRD-C-572	+0.25 percent -0.10 percent
Change in Shore durometer hardness after effect of alkalies test	COE CRD-C-572	± 5 percent

C. Finished PVC Strip meeting the physical characteristic requirements specified in Table 03158B - PVC Strip Waterstop Physical Characteristics.

Table 03158B - PVC Strip Waterstop Physical Characteristics

Property	Test Method	Requirement
Tensile test, minimum	ASTM D 638, speed D, specimen type IV	1,400 lbs/in^2
Ultimate elongation, minimum	ASTM D 638, speed D, specimen type IV	280 percent
Stiffness in flexure, minimum	ASTM D 747	400 lbs/in^2
Volatile loss, change in weight, maximum	ASTM D 1203, method A, 0.08-inch-thick specimen	0.50 percent

D. Prepare test specimens in accordance with COE CRD-C-572.

2.02 FABRICATION

A. Mold or extrude so that cross section will be dense, homogeneous, and free from porosity and other imperfections.

B. Shape: Conforming to the dimensions shown in the drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install strip waterstops at locations shown on drawings.

B. Install in accordance with manufacturer's recommendations.

C. Install longitudinal strip waterstop before the transverse strip waterstop are installed.

D. Include mechanical vibration to produce thorough consolidation of the concrete around the strip waterstop to provide continuous contact between concrete and all surfaces of the strip.

E. At intersections between longitudinal and transverse strips, remove the top vertical member of the longitudinal strip for 3 inches without pulling the strip from the concrete lining. Place the transverse strip within the 3-inch notch. Depression of the longitudianal strip below specified positions in the concrete is allowed at intersections only to the extent necessary to place the transverse strip to the specified depth. Tolerances and concrete consolidation requirements will apply at intersections

F. Make intersections in a manner to produce a reasonably close fit between transverse and longitudinal strips and to provide a nearly continuous weakened plane normal to the lining surface in both directions through the intersections.

G. Protect strip waterstop from oil, grease, and curing compound.

H. Remove large pieces of aggregate near waterstop by hand so that complete contact is maintained between waterstop and surrounding concrete.

I. Vibrate concrete surrounding waterstop with additional vibration so that waterstop is completely embedded in concrete.

3.02 FIELD SPLICING

A. Splice waterstops at end of rolls.

B. Make neat splices with waterstop ends joined in true alignment.

C. Use a miter-box guide and portable saw to make cuts so that ends to be joined will be in proper alignment and contact will be maintained between joined surfaces.

D. Splice by heat sealing adjacent surfaces in accordance with manufacturer's recommendations.

1. Use a thermostatically controlled electric heat source.
2. Use correct temperature to melt material.
3. Do not char material.

E. Make splice so that cooled splice when bent by hand to as sharp an angle as possible shows no sign of separation.

END OF SECTION

SECTION 03200 – CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Concrete Reinforcement:

1. Measurement: Weight of reinforcement placed as shown on approved shop drawings or directed by COR.
2. Payment: Pound price offered in the schedule.

B. Cost:

1. Include concrete reinforcement for concrete foundation, concrete floor slab, and concrete aprons for control building in lumps sum price offered in the schedule for control building. Refer to Section 02001 – Control Building.
2. Include concrete reinforcement for steel pipe vent blocking in lump sum price offered in the schedule for metal piping for air vents. Refer to Section 05635 – Metal Piping.
3. Include concrete reinforcement for electrical equipment supports in cubic yard price offered in the schedule for concrete structures. Refer to Section 03300 – Cast-In-Place Concrete.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM A 185/A 185M-07	Steel Welded Wire Reinforcement, Plain, for Concrete
2.	ASTM A 497/A 497M-07	Steel Welded Wire Reinforcement, Deformed, for Concrete
3.	ASTM A 615/A 615M-08	Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
4.	ASTM A 996/A 996M-06a	Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 03200-1, Reinforcement Diagrams and Lists:

1. Bar-placing diagrams, bar lists, and bar-bending diagrams required for reinforcement fabrication and placement.

a. Prepare bar-placing diagrams, bar lists, splice locations, and bar-bending diagrams in accordance with drawings.

C. RSN 03200-2, Shop Drawings:

1. Shop drawings showing reinforcement layout, construction placement details, and bar size lists.

D. RSN 03200-3, Mill Certifications.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store reinforcement of different sizes and shapes in individually marked, organized piles or racks raised above the ground to avoid rusting.

B. Protect from contaminants such as grease, oil, and dirt.

C. Provide for identification after bundles are broken and tags removed.

PART 2 PRODUCTS

2.01 STEEL REINFORCEMENT

A. Reinforcing Bars:

1. ASTM A 615, Grade 60; or ASTM A 996, Type A, Grade 60.
2. Deformed steel bar.

B. Reinforcing Fabric: ASTM A 185 or ASTM A 497, electrically-welded wire fabric.

PART 3 EXECUTION

3.01 INSTALLATION

A. Clean reinforcement surfaces of heavy, flaky rust; loose mill scale; dirt; grease; and other foreign substances before placement.

B. Accurately place and secure in position so that reinforcement will not be displaced during concrete placement.

C. Field bending not allowed unless approved by COR.

D. Do not weld or tack weld reinforcing bars.

E. Place reinforcement with a clear distance of 1 inch, minimum, between reinforcement and anchor bolts, form ties, or other embedded metalwork unless otherwise shown on drawings.

F. Tolerances:

1. Maintain concrete cover over reinforcement within 1/2 inch of specified cover where specified cover is greater than 2-1/2 inches.

2. Maintain concrete cover over reinforcement within 1/4 inch of specified cover where specified cover is 2-1/2 inches or less.

3. Maintain spacing of reinforcing bars within 1 inch of required spacing.

END OF SECTION

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SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Concrete for Structures:

1. Measurement: Volume of concrete measured to structure neatlines shown on drawings.
    a. Volume of openings, recesses, embedded pipes, and metalwork larger than 100 square inches in cross section will be deducted.
2. Payment: Cubic yard price offered in the schedule. Includes cost of work and materials for concrete except as specified.

B. Concrete for Protective Coatings:

1. Measurement: Volume of concrete measured to structure neatlines shown on drawings.
    a. Where concrete is placed on or against excavated surfaces, measurement will be made to lines for which payment for excavation is made.
2. Payment: Cubic yard price offered in the schedule. Includes cost of work and materials for concrete for protective coatings except as specified.

C. Cementitious Materials for Cast-In-Place Concrete:

1. Measurement: Weight of materials used in concrete based on batch weights and batch counts at batch plant measured in most practical manner.
2. Payment: Ton price offered in the schedule.
    a. No payment will be made for cementitious materials in wasted concrete for structures or concrete for protective coatings.

D. Cost:

1. Include cost of cast-in-place concrete for foundation, floor slab, and aprons for control building in lump-sum price offered in the schedule for control building. Refer to Section 02001 – Control Building.
2. Include cost of cast-in-place concrete for steel pipe vent blocking in lump-sum price offered in the schedule for metal piping for air vents. Refer to Section 05635 – Metal Piping.
3. Include cost of cast-in-place concrete for electrical equipment supports in lump-sum price offered in the schedule for complete electrical system. Refer to Section 16050 – Basic Electrical Materials and Methods.

4. Include cost of cementitious materials for cast-in-place concrete for foundation, floor slab, and aprons for control building in lump-sum price offered in the schedule for control building. Refer to Section 02001 – Control Building.

5. Include cost of cementitious materials for cast-in-place concrete for steel pipe vent blocking in lump-sum price offered in the schedule for metal piping for air vents. Refer to Section 05635 – Metal Piping.

6. Include cost of cementitious material for cast-in-place concrete for electrical equipment supports in lump-sum price offered in the schedule for complete electrical system. Refer to Section 16050 – Basic Electrical Materials and Methods.

1.02 REFERENCES

A. American Concrete Institute (ACI)

1.	ACI 305R-99	Hot Weather Concreting

B. ASTM International (ASTM)

1.	ASTM C 31/C 31M-08	Making and Curing Concrete Test Specimens in the Field
2.	ASTM C 33-07	Concrete Aggregates
3.	ASTM C 39/C 39M-05	Compressive Strength of Cylindrical Concrete Specimens
4.	ASTM C 42/C 42M-04	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
5.	ASTM C 94/C 94M-07	Ready-Mixed Concrete
6.	ASTM C 114-07	Chemical Analysis of Hydraulic Cement
7.	ASTM C 117-04	Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing
8.	ASTM C 136-06	Sieve Analysis of Fine and Coarse Aggregates
9.	ASTM C 138/C 138M-08	Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
10.	ASTM C 143/C 143M-05a	Slump of Hydraulic-Cement Concrete
11.	ASTM C 150-07	Portland Cement
12.	ASTM C 171-07	Sheet Materials for Curing Concrete
13.	ASTM C 231-08	Air Content of Freshly Mixed Concrete by the Pressure Method
14.	ASTM C 260-06	Air-Entraining Admixtures for Concrete

15.	ASTM C 494/C 494M-08	Chemical Admixtures for Concrete
16.	ASTM C 566-97(2004)	Total Evaporable Moisture Content of Aggregate by Drying
17.	ASTM C 618-08	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
18.	ASTM C 1017/C 1017M-07	Chemical Admixtures for Use in Producing Flowing Concrete
19.	ASTM C 1064/C 1064M-05	Temperature of Freshly Mixed Hydraulic-Cement Concrete
20.	ASTM C 1315-07	Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
21.	ASTM C 1602/C 1602M-06	Mixing Water Used in the Production of Hydraulic Cement Concrete
22.	ASTM D 1751-04	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

C. Bureau of Reclamation (USBR)

1.	USBR M-47	Standard Specifications for Repair of Concrete, August 1996
2.	USBR Concrete Manual	Concrete Manual, Eighth Edition, Revised Reprint, 1981

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 03300-1, Material Approval Data:

1. Mix Design. For each concrete mix design:
    a. Mixture proportions, materials sources, and physical properties.
    b. Compressive strength results from trial batches.
        1) Trial mix test results, three six-inch diameter cylinders at 7 and 28 days each.
        2) Average 28 day compressive strength of trial batch cylinders: Design strength plus 1200 lbs/in^2.
    c. Re-submittal of mix design is required for any change in material source or type.

2. Name and manufacturer of each cementitious material, aggregate source, admixture, curing compound, and joint filler.

    a. The Government reserves the right to require submission of manufacturer's test data and certification of compliance with specifications.

    b. The Government reserves the right to require submission of samples of concrete materials for testing before or during use in concrete.

3. Cementitious materials and aggregate certifications and test reports:

    a. Manufacturer’s certification and test reports for each lot from which cementitious materials shipments are drawn.

        1) Certify materials were tested during production or transfer in accordance with specified reference specification.

    b. Aggregate certification:

        1) Producer’s physical property and gradation testing reports for each aggregate source, less than 6 months old.

        2) Certification that aggregate is from an approved USBR source.

        3) Material that is not from USBR approved source, send 100 pounds of each material size to USBR, Technical Service Center, Denver CO, Attn. 86-68180.

    c. Submittal of certification and test reports shall not relieve Contractor of responsibility for furnishing materials meeting specified requirements.

4. Joint filler adhesive manufacturer’s data and certification.

C. RSN 03300-2, Concrete Placement Drawings:

1. For approval.

2. Drawings for each individual concrete placement. An individual concrete placement is defined as a portion of concrete work placed in one continuous operation between specified lines or joints.

3. Show locations, dimensions, blockouts, openings, recesses, waterstops, and finishes.

4. Show details of items embedded in or associated with placement except reinforcing steel.

5. Include a separate drawing showing placement sequence.

6. Place a title block with Contractor’s name, contract title and number, placement identification, and identifying drawing number in lower right hand corner of each drawing.

7. List reference drawings from which details shown on placement drawing were obtained on each drawing.

8. Reference related steel reinforcement drawings associated with placement on each drawing.

D. RSN 03300-3, Concrete Placement Schedule:

1. Complete, detailed concrete placement schedule showing the Contractor's plan for placement of individual features, units, and other elements of concrete work.

2. Detail as necessary to show location, sequence, and date of concrete placements scheduled for each item of concrete work.

3. Show submittal of detail drawings and placement of reinforcement and embedded items.

E. RSN 03300-4, Concrete Check Out Cards:

1. A concrete placement check out card listing all the various work items, for example, "Cleanup" and "Embedded Items" required prior to placement of concrete.

2. Include signature lines for the Contractor and COR.

F. Concrete Repair: In accordance with USBR M-47.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Furnish batch ticket with each batch of concrete in accordance with ASTM C 94. Deliver ticket to COR at jobsite during batch delivery.

PART 2 PRODUCTS

2.01 CEMENTITIOUS MATERIALS

A. Cementitious Materials Options:

1. Specified portland cement and 20 percent plus or minus 5 percent of specified pozzolan, by weight of cementitious materials.

B. Portland Cement:

1. ASTM C 150, Type V.

2. Meet equivalent alkalies requirements of ASTM C 150 - Table 2.

3. Meet false-set requirements of ASTM C 150 - Table 4.

C. Pozzolan:

1. ASTM C 618, Class F, except,

a. Sulfur trioxide, maximum: 4.0 percent.

b. Loss on ignition, maximum: 2.5 percent.

c. Test for effectiveness in controlling alkali-silica reaction under optional physical requirements in Table 2 of ASTM C 618. Use low-alkali cement for test.

d. Does not decrease sulfate resistance of concrete by use of pozzolan.

1) Demonstrate pozzolan will have an "R" factor less than 2.5.

2) R = (C-5)/F

3) C: Calcium oxide content of pozzolan in percent determined in accordance with ASTM C 114.

4) F: Ferric oxide content of pozzolan in percent determined in accordance with ASTM C 114.

2.02 WATER

A. ASTM C 1602, including optional requirements of Table 2.

2.03 AGGREGATE MATERIALS

A. Fine aggregate: ASTM C 33.

B. Coarse Aggregate for Structures: ASTM C 33, Size No. 57 except allowable fines content (material passing No. 200 sieve) less than 3 percent.

C. Coarse Aggregate for Protective Coatings: ASTM C 33, Size No. 57 or Size No. 67.

2.04 ADMIXTURES

A. Air-Entraining Admixture:

1. ASTM C 260.

2. Use a neutralized vinsol resin formulation for air-entraining admixture used with ASTM C 494, Type F or G; and ASTM C 1017, Type I or II chemical admixtures.

B. Chemical Admixtures:

1. Allowable Chemical Admixtures:

a. ASTM C 494, Type A, D, F, or G.

b. ASTM C 1017, Type I or II.

2. Do not use chemical admixtures which contain more than 0.1 percent chloride, by weight.

2.05 CURING MATERIALS

A. Water: ASTM C 1602, including optional requirements of Table 2.

B. Curing Compound: ASTM C 1315, type II (white pigmented).

C. Polyethylene Film: ASTM C 171, white opaque.

2.06 ACCESSORIES

A. Bituminous Joint Filler: ASTM D 1751.

B. Joint Filler Adhesive: Nonbituminous adhesive recommended by filler manufacturer.

2.07 MIX

A. The Contractor shall design the concrete mix.

1. The COR reserves the right to adjust mix proportions when need for adjustment is indicated by results of materials testing.

a. Adjustment of mix proportions by the Government will be in accordance with USBR Concrete Manual.

B. Use specified cementitious materials option.

C. Net water-cementitious materials ratio for structural concrete: 0.45, maximum, by weight.

D. Net water-cementitious materials ratio for concrete protective coatings: 0.70, maximum by weight.

E. Minimum cementitious materials content for structural concrete: 564 lbs per cubic yard.

F. Slump: In accordance with ASTM C 143.

1. Concrete in Slabs: 1 to 3 inches at placement, except as specified.

2. Other Concrete: 2 to 4 inches at placement, except as specified.

3. When first mixed at the plant, maximum: 5 inches.

4. Concrete with ASTM C 1017, Type I or II chemical admixtures: Use slump appropriate for placing conditions.

G. Compressive Strength:

1. Concrete in structures:

a. At 28 days, minimum: 4,000 lb/in^2.

1) Acceptance criteria:

a) In accordance with ASTM C 94, plus the following

i. 90 Percent of test cylinders exceed specified compressive strength at 28 days.

ii. Average compressive strength of any six consecutive test cylinders exceeds specified compressive strength at 28 days.

iii. No individual strength test falls below specified compressive strength by more than 500 lb/in^2.

2. Concrete in protective coatings:

a. At 28 days, minimum: 3,000 lb/in^2.

1) Acceptance criteria:

a) In accordance with ASTM C 94, plus the following

i. 90 Percent of test cylinders exceed specified compressive strength at 28 days.

ii. Average compressive strength of any six consecutive test cylinders exceeds specified compressive strength at 28 days.

iii. No individual strength test falls below specified compressive strength by more than 500 lb/in^2.

H. Air Entrainment: 4 to 6 percent air by volume of concrete as discharged at placement, in accordance with ASTM C 231.

2.08 BATCHING, MIXING, AND TRANSPORTING

A. Manufacture and deliver in accordance with ASTM C 94.

B. Deposit concrete at its final destination within 90 minutes from the introduction of cement to water or aggregates, or as directed by COR.

C. Prevent appreciable segregation of ingredients, or slump loss exceeding 2 inches in concrete delivered to work.

D. Condition aggregate to ensure consistency in mixture proportions.

E. The Contractor will only be allowed to add water to the batched concrete once at the site if the specified water to cement ratio is not exceeded and addition of water is approved by the COR.

2.09 CONCRETE TEMPERATURE

A. Concrete temperature at placing: 50 to 90 degrees F (10 to 31 degrees C).

B. Reference ACI 305R for hot weather concreting practices.

2.10 SOURCE CONTRACTOR QUALITY TESTING

A. Perform the following checks at batch plant:

1. Slump: ASTM C 143
2. Air content: ASTM C 231
3. Unit weight: ASTM C 138
4. Concrete temperature: ASTM C 1064
5. Frequency: at least once per shift per mix or when consistency of the mix changes.

B. Perform the following tests to maintain concrete consistency and workability:

1. Gradation and fines content: ASTM C 117 and ASTM C 136
2. Moisture contents of concrete aggregates: ASTM C 566

C. Make test reports available to the COR.

PART 3 EXECUTION

3.01 PREPARATION

A. Remove standing water, mud, and debris from foundation surfaces to be covered by concrete.

B. Prepare earth foundations free from frost.

C. Thoroughly moisten surfaces of absorptive foundations to be covered with concrete so that moisture will not be drawn from fresh concrete.

D. Clean, roughen, and surface dry surfaces of existing concrete and construction joints to be covered with fresh concrete.

1. Remove laitance, loose or defective concrete, coatings, sand, curing compound, and other foreign material.
2. Wet sandblast or water blast or chip surface, wash thoroughly, and surface dry immediately before placement of adjoining concrete.
3. Do not use a mortar layer on construction joints.

E. Wash coarse aggregate to ensure fines content less than allowable maximum.

F. Exposed surfaces of concrete protective coatings are not considered as a construction joint, however these surfaces shall be pressure washed to remove curing compound and be free of mud, standing water and debris.

G. Complete and sign approved concrete check out cards for each placement signifying completion of work. Notify the COR after completion of each phase of preparation and obtain approval, by signature, on the concrete placement check out card. The COR may waive the use of placement check out cards.

1. Make the completed concrete placement check our cards available to the COR.

3.02 PLACING

A. Do not use aluminum pipes and chutes for placing or pumping concrete.

B. Do not retemper concrete.

C. Do not use concrete which has become so stiff that concrete cannot be properly placed.

D. Place formed concrete in continuous, approximately horizontal layers. Do not exceed 20 inches in depth of layers.

E. Vibrate concrete until concrete has been consolidated to maximum practical density, is free from pockets of coarse aggregate, and closes snugly against surfaces of forms and embedded materials.

F. Provide required access and samples for quality assurance inspection and testing.

G. Do not place concrete directly on foundation surfaces without written approval of the COR that the foundation surface has been suitably prepared for concrete placement.

H. Place concrete protective coatings to contact surfaces such that surfaces are covered to a 3 inch minimum depth.

3.03 FIELD QUALITY ASSURANCE

A. The Government may use the Contractor submitted approved Concrete Placement Check Out Cards to record placement and pre-placement conditions.

B. The Government will perform tests to verify properties of concrete. Frequency is at the discretion of the COR. Greater frequency testing is normally performed at the beginning of new work, new crew, or new equipment.

C. In addition to the Contractors quality testing program, the Government will test compressive strength in accordance with ASTM C 31 and ASTM C 39 for 6- by 12-inch cast cylinders.

D. Compressive strength may also be determined by COR in accordance with ASTM C 42 for concrete cores.

1. Concrete in an area represented by core tests will be considered structurally adequate when average compressive strength of three cores is equal to at least 3,400 lb/in^2 and no single core has a compressive strength of less than 3,000 lb/in^2.

2. COR will determine locations of cores used for acceptance.

E. The Government will prepare one set of five concrete test cylinders for the first 50 or less cubic yards or at least one set of five concrete cylinders for each day of concrete placement, and one set of five concrete cylinders for each additional 100 cubic yards of concrete placement.

1. Test cylinders will be 6- by 12-inches cast in accordance with ASTM C 31 and tested in accordance with ASTM C 39.

2. The Government will test 2 cylinders from each set at 7 days, and 2 cylinders from each set at 28 days. Maintain the last cylinder from each set for testing in the event the 28-day tests fall below the required strength.

F. Two additional test cylinders may be taken during placement in adverse weather and cured on jobsite under the same conditions as the concrete the cylinders represent.

G. The Government will perform the following tests for each set of test cylinders taken:

1. Slump: ASTM C 143

2. Air content: ASTM C 231

3. Unit weight: ASTM C 138

4. Temperature: ASTM C 1064

H. Additional slump tests may be taken for each truck or as determined by the COR.

I. Slump of concrete will be determined at point of placement or as determined by the COR.

3.04 FINISHING

A. Where finishes are not specified or shown on drawings for a particular surface, finish concrete as specified for similar work.

B. Finish concrete in presence of Government inspector unless inspection is waived in each specific case.

C. Formed Surfaces:

1. Finish class is designated by symbols F1, F2, and F3.

2. Finish F1:

   a. Applies to formed surfaces to be covered by fill material, grout, or concrete, and construction joint surfaces as specified in Table 03300D – Formed Surfaces.

   b. Protect form tie rod ends on surfaces in contact with fill material from moisture where they will be below the water table or waterline.

      1) Recess tie rod ends and fill recess with dry pack or other material approved by COR.

   c. Cut off flush with formed surface form tie rod ends on surfaces in contact with concrete or fill material and above maximum water table or waterline elevation.

3. Finish F2:

   a. Applies to exposed formed surfaces not permanently concealed by fill material, grout, or concrete, and not required to receive finish F3, and to contraction joint surfaces and expansion joint surfaces as specified in Table 03300D – Formed Surfaces.

      1) Recess tie rod ends and fill recess with dry pack or other material approved by COR.

4. Finish F3:

   a. Applies to formed surfaces with special appearance requirements, such as surfaces exposed to view, as specified in schedule below.

   b. After required patching and correction of imperfections has been completed, sack rub surface as follows:

      1) Thoroughly wet surface and sack rub while surface is still damp.

      2) Use mortar consisting of 1 part cement; 2 parts, by volume, of sand passing a No. 16 screen; and enough water so that mortar has consistency of thick cream. Blend standard cement with white cement as necessary to obtain a color which will match surrounding concrete surface.

      3) Thoroughly rub mortar over area with clean burlap or a sponge rubber float to fill pits, bugholes, and other defects.

      4) While mortar in pits is still plastic, rub surface with a dry mix of above proportions and material to remove excess plastic material and place enough dry material in the pits to stiffen and solidify mortar so that filling will be flush with surface. Remove material remaining on surface except material within pits.

      5) Continue curing surface as specified.

D. Unformed Surfaces:

1. Finish class is designated by symbols U1, U2, and U3.
2. Do not add water to surface during finishing.
3. Finish U1 (Screeded Finish):
    a. Applies to unformed surfaces to be covered by fill material, grout, or concrete as specified in schedule below.
    b. Use as first stage of finish U2 and U3.
    c. Level and screed concrete to produce even uniform surfaces.
4. Finish U2 (Floated Finish):
    a. Applies to unformed surfaces not permanently concealed by fill material, grout, or concrete, and not required to receive finish U3, as specified in Table 03300D – Unformed Surfaces.
    b. Use hand- or power-driven equipment.
    c. Begin floating as soon as screeded surface has sufficiently stiffened and before bleed water forms.
    d. Finish surface with minimum floating necessary to produce a surface that is free of screed marks and is uniform in texture.
    e. Use as second stage of finish U3.
5. Finish U3 (troweled finish):
    a. Applies to unformed surfaces where appearance and porosity is considered by Government to be of special importance as specified in Table 03300D – Unformed Surfaces.
    b. Begin steel troweling after bleed water has disappeared and floated surface has sufficiently hardened to prevent an excess of fine material from being drawn to surface.
    c. Trowel with firm pressure to flatten sandy texture of floated surface.
    d. Trowel to a dense uniform surface free from blemishes and trowel marks.

3.05 JOINTS AND EDGES

A. Construction Joints:

1. Construction joints are joints which are purposely placed in concrete to facilitate construction, reduce initial shrinkage stresses and cracks, allow time for installation of embedded metalwork, or allow for subsequent placing of other concrete.
2. Bond is required at construction joints regardless of whether or not reinforcement is continuous across joint.
3. Locate construction joints where shown on drawings or approved by COR.

4. Relocation, addition, or elimination of construction joints will be subject to approval by COR.

B. Contraction Joints:

1. Contraction joints are joints placed in concrete to provide for volumetric shrinkage of a monolithic unit or movement between monolithic units.

2. Construct contraction joints so no bond exists between concrete surfaces forming the joint.

a. Construct contraction joints by placing concrete on one side of joint and allowing it to set before concrete is placed on other side of joint.

b. Coat surface of concrete first placed at contraction joint with curing compound before placing concrete on other side of joint.

3. Except as provided for dowels, reinforcement is never continuous across a contraction joint.

C. Control Joints:

1. Control joints are joints placed in concrete to provide for control of initial shrinkage stresses and cracks of monolithic units.

2. Construct control joints same as contraction joints above, except make reinforcement continuous across control joints.

D. Expansion Joints:

1. Cut sponge rubber joint filler to size and shape of joint surface to receive filler.

2. Adhere filler to concrete in accordance with adhesive manufacturer's recommendations.

3. Butt sections of filler with tight-fitting butt joints to prevent mortar from seeping through joint.

E. Tooled Edges: Tool exposed edges of slabs and top edges of curbs to a radius of 1/4 inch.

3.06 STRUCTURAL DEVIATIONS AND SURFACE TOLERANCES

A. Structural deviations are defined as allowable variations from specified lines, grades, and dimensions.

B. Surface tolerances are defined as maximum allowable magnitude of surface irregularities.

C. Specified structural deviations and surface tolerances are consistent with modern construction practice and governed by effect that permissible variations may have upon a structure. COR reserves the right to diminish specified structural deviations and surface

tolerances where such variations impair structural action, operational function, or architectural appearance of a structure or portion of structure.

D. Construct concrete within stated variations even though more than one may be specified.

1. Specified variation for one element of a structure will not apply when it will permit another element of same structure to exceed its allowable variation.

2. Where variations are not specified or shown on drawings for a particular structure, variations shall be those specified for similar work. As an exception to clause at FAR 52.236-21 "Specifications and Drawings for Construction," specific tolerances shown on drawings in connection with any dimension shall govern.

E. Structural Deviations:

1. Check variations from specified lines, grades, and dimensions in hardened concrete to determine that structures are within tolerances specified in Table 03300A - Deviations from Specified Lines, Grades, and Dimensions.

2. Variation is distance between actual position of structure or any element of structure and specified position in plan for structure or particular element.

a. Plus or minus variations, shown as (±), indicate a permitted actual position up or down and in or out from specified position in plan.

b. Variations not designated as (+) or (-) indicate maximum deviation permitted between designated successive points on completed element of construction.

3. Specified position in plan is defined as lines, grades, and dimensions described in these specifications, shown on drawings, or prescribed by COR.

Table 03300A - Deviations from specified lines, grades, and dimensions

A. STRUCTURES

Table 03300A - Deviations from specified lines, grades, and dimensions

1.	Footings:	
	(a) Variation of length and width dimensions from those specified	-1/2 inch +2 inches
	(b) Misplacement or eccentricity:	2 percent of footing width in direction of misplacement, but not more than 2 inches
	(c) Reduction in thickness from that specified	5 percent of specified thickness not to exceed 1 inch
2.	Drops, turnouts, inlets, outlets, chutes, and similar structures:	
	(a) Departure from established alignment	±1 inch
	(b) Departure from established grade	±1 inch
	(c) Variation from plumb or specified batter for lines and surfaces of columns, piers, walls, and for arrises:	
	(1) When overall length of line or surface is:	
	Less than 10 feet	Exposed: ±3/8 inch Buried: ±3/4 inch
	10 feet or more	Exposed: ±1/2 inch Buried: ±1 inch
	(2) For any two successive intermediate points on the line or surface separated by:	
	10 to 20 feet, inclusive	Exposed: 3/8 inch Buried: 3/4 inch
	More than 20 feet	Exposed: 1/2 inch Buried: 1 inch

Table 03300A - Deviations from specified lines, grades, and dimensions

3.	Variations from level or specified grades for slabs, beams, and horizontal grooves:	
	(a) When overall length of line or surface is:	
	Less than 10 feet	Exposed: ±3/8 inch Buried: ±3/4 inch
	10 feet or more	Exposed: ±1/2 inch Buried: ±1 inch
	(b) For any two successive intermediate points on the line or surface separated by:	
	10 to 20 feet, inclusive	Exposed: 3/8 inch Buried: 3/4 inch
	More than 20 feet	Exposed: 1/2 inch Buried: 1 inch
4.	Variation in cross-sectional dimensions of columns, piers, slabs, walls, beams, and similar parts of the structure in A.3 above from those specified	-1/4 inch +1/2 inch
5.	Variation in sizes and locations from those specified for slab and wall openings	±1/2 inch
6.	**Variation from plumb or level for sills and sidewalls for gates and similar watertight joints	Not greater than a rate of 1/8 inch in 10 feet
	** Dimensions between sidewalls for gates: Not more than shown on drawings at sills and not less than shown on drawings at top of walls.	
7.	Variation from plumb of pipe erected vertically in any length of 10 feet	±1/2 inch
B. BRIDGES		
1.	Departure from established alignment	±1 inch

Table 03300A - Deviations from specified lines, grades, and dimensions

2.	Footings:	
	(a) Variation in length and width dimensions from those specified	-1/2 inch +2 inches
	(b) Horizontal misplacement or eccentricity	2 percent of footing width in direction of misplacement, but not more than 2 inches
	(c) Reduction in thickness	5 percent of specified thickness, not to exceed 1 inch
3.	Variation from plumb or specified batter for lines and surfaces of piers and walls and for arrises:	
	(a) Exposed construction:	
	(1) When overall height of line or surface is:	
	Less than 10 feet	±3/8 inch
	10 feet or more	±1/2 inch
	(2) For any two successive intermediate points on the line or surface separated by:	
	10 to 20 feet, inclusive	3/8 inch
	More than 20 feet	1/2 inch
	(b) Buried construction:	
	(1) When overall height of line or surface is:	
	Less than 10 feet	±3/4 inch
	10 feet or more	±1 inch
	(2) For any two successive intermediate points on the line or surface separated by:	
	10 to 20 feet, inclusive	3/4 inch
	More than 20 feet	1 inch

Table 03300A - Deviations from specified lines, grades, and dimensions

4.	Variation from level or specified grades for slabs, other than bridge deck; beams; horizontal grooves; railing offsets; and diaphragms:	
	(a) Exposed construction:	
	(1) When overall length of line or surface is:	
	Less than 10 feet	±3/8 inch
	10 feet or more	±1/2 inch
	(2) For any two successive intermediate points on the line or surface separated by:	
	10 to 20 feet, inclusive	3/8 inch
	More than 20 feet	1/2 inch
	(b) Buried construction:	
	(1) When overall length of line or surface is:	
	Less than 10 feet	±3/4 inch
	10 feet or more	±1 inch
	(2) For any two successive intermediate points on the line or surface separated by:	
	10 to 20 feet, inclusive	3/4 inch
	More than 20 feet	1 inch
5.	Departure of bridge deck and rails from specified grades	±1/4 inch
6.	Variation in cross-sectional dimensions from those specified for piers; slabs, other than bridge deck; walls; beams; and similar parts of bridge structures	-1/4 inch +1/2 inch
7.	Variation from that specified in the thickness of bridge slabs	-1/8 inch +1/2 inch

F. Surface Irregularities:

1. Bulges, depressions, and offsets are defined as surface irregularities or roughness.

2. Surface irregularities are classified as "abrupt" or "gradual" and allowable tolerances are specified in Table 03300B - Surface Tolerances.

a. A surface tolerance is designated by a capital "T" followed by a number 1 through 5.

b. Surface tolerance designations are separate from surface finishes and structural deviations.

3. Abrupt Surface Irregularities:

a. Abrupt surface irregularities are defined as offsets such as those caused by misplaced or loose forms in which maximum dimension of irregularity perpendicular to surface is greater than maximum dimension of irregularity in plane of surface.

b. Abrupt surface irregularities include all incidences of isolated surface irregularities which exceed specified gradual irregularities.

4. Gradual Surface Irregularities:

a. Gradual surface irregularities are defined as bulges and depressions resulting in gradual changes on surface.

b. Gradual surface irregularities are further defined as isolated undulations on surface. Maximum dimension of undulation perpendicular to surface is small relative to maximum dimension of undulation in plane of surface.

5. Check magnitude of surface irregularities of formwork and finished surfaces to ensure that surfaces are within specified tolerances.

G. Surface Tolerances:

Table 03300B - Surface Tolerances

Concrete surface	Maximum allowable surface irregularity tolerance	
	Abrupt	Gradual
T1	1 inch	1/4 inch/inch
T2	1/2 inch	1/8 inch/inch
T3	1/4 inch	1/16 inch/inch
T4	1/8 inch	1/32 inch/inch
T5	1/32 inch	1/120 inch/inch

H. Repair of Hardened Concrete Not Within Specified Tolerances:

1. Repair hardened concrete which is not within specified tolerances to bring it within those tolerances.

2. Perform repair after consultation with a Government inspector regarding method of repair. Notify COR as to time when repair will be performed.

3. Repair concrete which will be exposed to view in a manner which will result in a concrete surface with uniform appearance.

    a. When grinding surfaces exposed to view, limit depth of grinding such that no aggregate particles are exposed more than 1/16 inch in cross section at finished surface.

    b. Where grinding has caused or will cause exposure of aggregate particles greater than 1/16 inch in cross section at finished surface, repair concrete by excavating and replacing concrete.

I. Field Verification of Surface Tolerances:

1. Determine compliance of a surface with specified surface tolerances.

2. Evaluate surface roughness.

    a. Measure roughness height or depth and check for compliance with values specified in Table 03300B - Surface Tolerances and Table 03300A - Deviations from Specified Lines, Grades, and Dimensions.

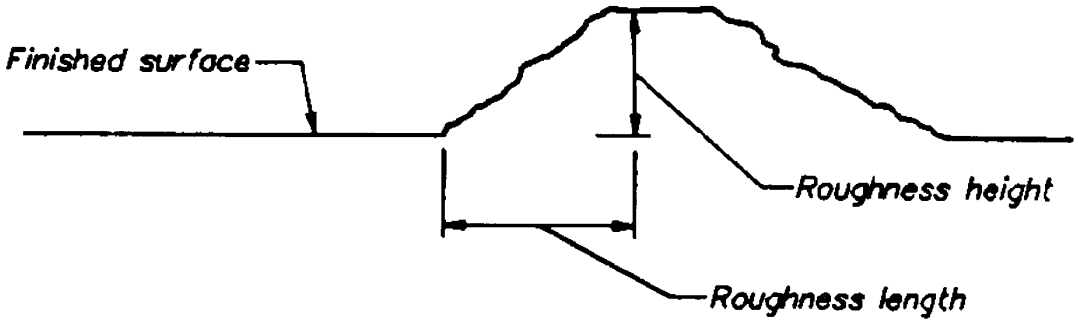
    b. When measured height or depth of roughness is less than value in abrupt tolerance specification and height or depth of roughness does not cause structure to exceed any applicable value specified in Table 03300B - Deviations from Specified Lines, Grades, and Dimensions, surface roughness is acceptable.

    c. When roughness height or depth exceeds abrupt tolerance specification, determine roughness slope for comparison to gradual tolerance specification.

        1) Measure roughness length and determine roughness slope by dividing roughness height or depth by roughness length (see Figure 1).

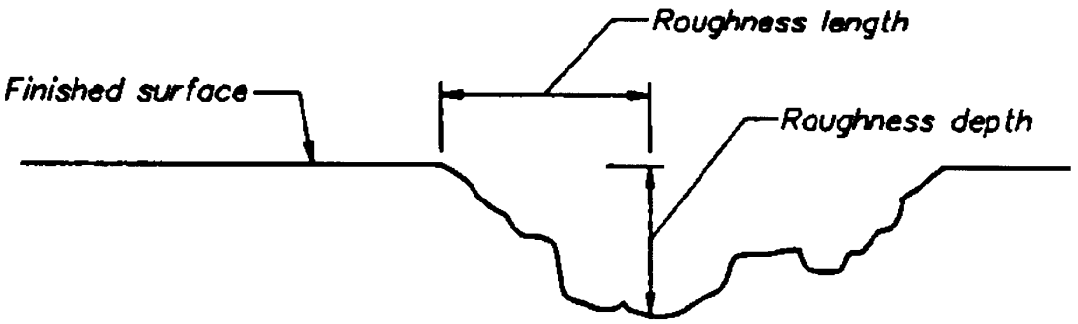
        2) When roughness slope is greater than slope specified by gradual tolerance specification, surface roughness is unacceptable.

        3) When roughness slope is less than gradual slope specified and gradual roughness does not cause structure to exceed allowable structural deviations, surface roughness is acceptable.



$$\text{Roughness slope ratio} = \frac{\text{Roughness height}}{\text{Roughness length}}$$

CASE 1 = Offset on the Surface



$$\text{Roughness slope ratio} = \frac{\text{Roughness depth}}{\text{Roughness length}}$$

CASE 2 = Offset into the Surface

FIGURE 1

J. Measuring Surface Roughness:

1. Examples below illustrate how to make necessary surface measurements for typical roughness.

2. Case 1 - Roughness Protruding above Surface:

   a. A roughness protruding above the surface should be measured with a straightedge that is at least 20 times longer than the roughness height being measured.

   b. Position the straightedge with one end resting on top of the roughness, as shown in Figure 2 (case 1).

   c. Determine the roughness height by measuring the maximum gap that occurs normal to the straight edge.

   d. Also, note the position on the straightedge from which the normal distance is measured.

   e. To determine the roughness length, measure the distance along the straightedge from the point where the height was measured to the point of contact between the straightedge and the top of the roughness.

   f. The roughness slope is defined as the ratio of the roughness height to the roughness length.

   g. As roughness is seldom symmetric, moving the position of the straightedge about the roughness may be necessary to locate the point where the maximum height and slope exists.

3. Case 2 - Roughness Extending below the Surface:

   a. A roughness occurring as an indentation to the surface is measured by placing the straightedge across the indentation, as shown in Figure 2 (case 2).

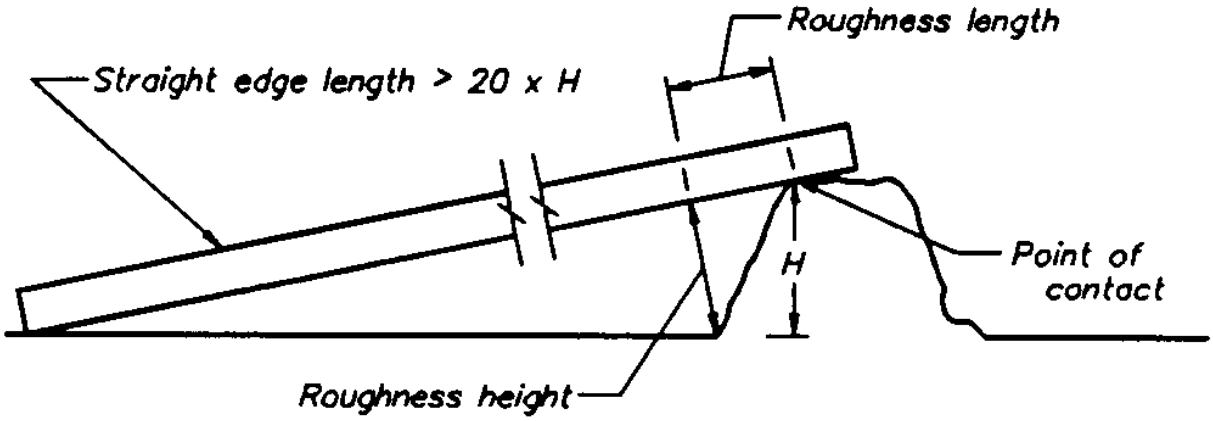
   b. Measure the maximum gap between the straightedge and the surface and note the location of the measurement on the straightedge.

   c. From the point of the depth measurement, measure along the straightedge in both directions to the point of contact with the surface.

   d. The shortest length measured is used as the roughness length.

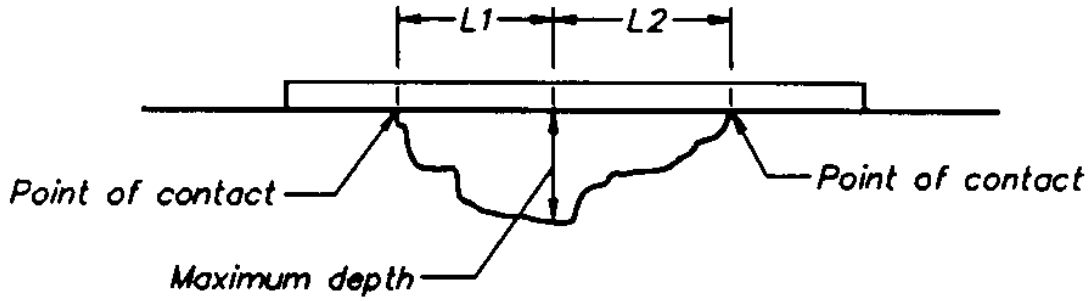
   e. Divide the roughness depth by the roughness length to determine the roughness slope.

4. A simple measuring device can be constructed to perform surface tolerance measurements and evaluation process directly and quickly. Information concerning concrete tolerance measuring devices can be obtained from Bureau of Reclamation, Attn 86-68180, PO Box 25007, Denver CO 80225-0007, telephone (303) 445-2386.



CASE 1

$$\text{Roughness slope} = \frac{\text{Roughness depth}}{\text{The shortest distance L1 or L2}}$$



CASE 2

FIGURE 2

K. Prevention of Repeated Failure to Meet Tolerances:

1. When concrete placements result in hardened concrete which does not meet specified tolerances, submit to COR an outline of preventive actions such as modifications to forms, modified procedure for setting screeds, and different finishing techniques to be implemented to avoid repeated failures. Submit when requested by COR.

2. Government reserves the right to delay concrete placements until preventive actions which have been approved by COR are implemented.

3.07 CURING

A. Water Curing:

1. Keep concrete surface wet for 14 days, minimum, from time concrete has attained sufficient set to prevent detrimental effects to surface.

2. Cure methods:

a. Water-saturated material.

b. System of perforated pipes, mechanical sprinklers, or porous hose.

c. Other methods which will keep surfaces wet.

d. Subject to approval by COR.

B. Curing with Curing Compound:

1. Apply to concrete surface to provide a water-retaining film. Reapply as necessary to maintain a continuous, water-retaining film on surface for 28 days.

2. Thoroughly mix compound and spray apply in one coat to provide a continuous, uniform film over surface.

3. Do not exceed coverage rate of 150 square feet per gallon. Decrease coverage rate on rough surfaces as necessary to obtain required continuous film.

4. Ensure ample coverage on edges, corners, and rough surfaces.

5. Spray equipment and equipment performance shall be subject to approval by COR. Repair or replace equipment when directed by COR.

6. Use personnel qualified in using specified spray technique, as determined by COR, to perform application.

C. Polyethylene Film Curing:

1. Thoroughly moisten concrete surface by lightly spraying with water as soon as concrete has hardened sufficiently to prevent damage.

2. Completely cover concrete surface with polyethylene film to provide an airtight, water-retaining film over entire surface.

3. Lap edges of polyethylene sheets to seal adjacent sheets.

4. Place tightly against concrete surface at extreme edge of curing area.

5. Secure film to withstand wind and prevent circulation of air inside curing film.

6. Keep surface covered for 14 days, minimum.

3.08 PROTECTION

A. Protect concrete from damage until final acceptance by Government.

1. Do not load, remove forms, falsework or shoring, or backfill against concrete until concrete has reached its design strength to safely support its weight and imposed loads.

2. Protect fresh concrete against erosion from rain, hail, or sleet; contamination from foreign materials; and damage from foot traffic until the concrete has hardened.

3. Protect concrete from heavy foot traffic and other construction activities by covering with plywood or other suitable material. Remove and dispose of temporary covering when no longer required.

3.09 REPAIR

A. Repair concrete in accordance with USBR M-47.

B. Use repair or replacement method directed by COR.

3.10 FINISH, SURFACE TOLERANCES, AND CURING SCHEDULES

Table 03300C - Formed surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Surfaces upon or against which fill material will be placed	F1	T1	Water White wax-base, or white water-emulsified resin-base curing compound
Surfaces not permanently concealed by fill material or concrete where appearance is not critical	F2	T2 and T3	Water White wax-base, or white water-emulsified resin-base curing compound

Table 03300C - Formed surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Canal structures	F2	T3	Water White wax-base, or white water-emulsified resin-base curing compound
Inside surfaces of culverts	F2	T3	Water White wax-base, or white water-emulsified resin-base curing compound
Bridges; superstructure (not including roadway surface) and exposed portion of retaining walls	F2	T3	Water White wax-base, or white water-emulsified resin-base curing compound
Surfaces exposed prominently to view or where appearance is important	F3	T4	Clear curing compounds, water-emulsified resin-base if outdoors
Surfaces of trapezoidal road crossings	F3	T4	Clear curing compounds, water-emulsified resin-base if outdoors
Underwater structures with mechanical features such as gates and trashracks	F3	T3	Water White wax-base or white water-emulsified resin-base curing compound
Interior walls and ceilings of vaults, sumps, pullboxes, and entry boxes	F2	T4	Water White wax-base or white water-emulsified resin-base curing compound
Outdoor curbs	F2	T4	Clear water-emulsified resin-base curing compound
Pedestals and equipment foundations	F2	T4	Clear water-emulsified resin-base curing compound
Construction joints and surfaces to be covered by grout	F1	T2	Water White wax-base curing compound

Table 03300C - Formed surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Expansion joints	F2	T2	Water White wax-base or white water-emulsified resin-base curing compound
Contraction joints	F2	T2	White wax-base curing compound

Table 03300D - Unformed surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Surfaces to be covered by concrete, except surfaces of concrete protective coatings	U1	T1	Water White wax-base or white water-emulsified resin-base curing compound
Surfaces of concrete protective coatings	Screed plus roller tamp finish	T1	Water Dissipating curing compound
Surfaces to be covered by grout	U1	T3	Water White wax-base or white water-emulsified resin-base curing compound
Canal structures	U2	T2	Water White wax-base or white water-emulsified resin-base curing compound
Surfaces of operating platforms for canal structures	U2 plus broom finish	T2	Water White wax-base or white water-emulsified resin-base curing compound
Control building slab	U2	T4	Water Polyethylene film

Table 03300D - Unformed surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Outdoor entrance slabs, walks, and stoops	U2	T4	Water White wax-base or white water-emulsified resin-base curing compound
Outdoor curbs and gutters	U2	T4	Water White wax-base or white water-emulsified resin-base curing compound
Outdoor decks and roofs	U2	T4	Water White wax-base or white water-emulsified resin-base curing compound
Outdoor equipment slabs and foundations	U2	T4	Water White wax-base or white water-emulsified resin-base curing compound
Tops of walls not prominently exposed to public view	U2	T4	Water White wax-base or white water-emulsified resin-base curing compound
Tops of walls prominently exposed to public view	U2	T4	Clear water-emulsified, resin-base curing compound
Roadway slabs and concrete bridges not to be covered by sealant	U2 plus broom finish	T4	Water White wax-base or white water-emulsified resin-base curing compound
Floors of vaults, sumps, pullboxes, and entry boxes	U2	T4	Water White wax-base or white water-emulsified resin-base curing compound
Interior floors	U3	T4	Water Polyethylene film
Indoor curbs	U2	T4	Water White wax-base or white water-emulsified resin-base curing compound

END OF SECTION

SECTION 03305 - CONCRETE REMOVAL

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Saw Cutting Existing Concrete:

1. Measurement: Length of saw cuts made as shown on the drawings or directed by the COR for removal.
    a. Saw cuts made in concrete placed under this contract will not be included in measurement.
2. Payment: Linear foot price offered in the schedule.
    a. Includes saw cutting Interstate 8 Highway for pipe trench, Evan Hewes Highway for pipe trench, and Drop 2 Inlet canal for wasteway construction.

B. Concrete Removal:

1. Measurement: Volume of concrete removed.
2. Payment: Cubic yard price offered in the schedule.
    a. Includes concrete removal for Interstate 8 Highway for pipe trench, Evan Hewes Highway for pipe trench, and Drop 2 Inlet canal for wasteway construction.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 03305-1, Concrete removal plan:

1. Describe methods and equipment to be used to locate embedded metalwork and reinforcement within concrete to be removed.
2. Describe methods, equipment, and sequence to be used for cutting and removing concrete.

1.03 PROJECT CONDITIONS

A. Concrete to be removed consists of cement, sand, and broken rock or gravel.

1. Maximum aggregate size: 1-1/2-inch.
2. Design compressive strength: 4,000 lb/in^2 at 28 days.
3. Actual compressive strength of existing concrete may be in excess of 2 times the original design compressive strength.

B. Information drawings provide general locations of embedded reinforcement, pipe, conduit, and metalwork. Actual locations of these items may vary from what is shown on the drawings.

C. Cease operations immediately if concrete removal operations come in contact with electrical conduit containing energized circuits and notify the COR. Do not resume operations until directed by the COR.

D. Cease operations immediately if concrete removal operations cause cracking of remaining concrete structure and notify COR. Do not resume operations until directed by COR.

E. Coordinate performance of noisy, malodorous, or dusty work with the COR.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 EXAMINATION

A. Locate and mark exact locations of embedded reinforcement, pipe, conduit, and metalwork within concrete removal areas before beginning concrete removal.

3.02 REMOVAL

A. Produce surfaces and edges suitable for required construction.

B. Clean loose concrete from surfaces on which new concrete or grout will be placed.

C. Use methods which will not damage concrete or reinforcement to remain in place.

D. Do not line drill perimeters of large openings.

E. Blasting not permitted.

F. Where more than 1/3 of the diameter of a reinforcing bar is exposed by removal of concrete to required depth, remove additional concrete to minimum depth of the maximum size of aggregate of the replacement concrete plus 1/4-inch below the bar.

G. When removing concrete in and around reinforcing steel that will remain in place, use 15-pound or smaller chipping hammers, or high or ultra-high pressure water jetting.

H. All damaged, deteriorated, loosened, or unbonded portions of existing concrete shall initially be removed by:

1. High and ultra-high pressure water jetting, jack hammering, or any other approved method, with approved equipment.

    a. Bush hammering will not be permitted.

I. The remaining concrete surfaces shall then be prepared by:

1. Contained shotblasting, wet sandblasting, or low pressure water cleaning to remove any weakened or damaged concrete surfaces resulting from the initial removal process.

2. If low pressure water cleaning is used, pressures sufficiently high to prepare the surface shall be used. Pressures up to 5,000 psi may be needed, depending on the condition of the concrete surface.

J. Clean and allow surfaces to dry thoroughly, unless the specific repair technique requires application of materials to a saturated surface.

K. Concrete removal processes involving the use of jack hammers in excess of 30 pounds, dry sandblasting, or scabblers shall not be used without approval by the COR.

L. The use of acids for cleaning or preparing concrete surfaces for repair will not be permitted.

3.03 REPAIR

A. Repair concrete and reinforcement outside of prescribed removal lines which is damaged or loosened during cutting and removal operations.

1. Repair or replace as directed by COR.

2. Repair or replace in accordance with applicable sections of these specifications.

3.04 DISPOSAL

A. Dispose of removed concrete materials as directed by COR at approved waste area.

END OF SECTION

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SECTION 03306 – REMOVING EXISTING COACHELLA CANAL CONCRETE LINING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Saw Cutting Existing Coachella Canal Concrete Lining:

1. Measurement: Length of saw cuts made as shown on the drawings or directed by the COR for concrete canal lining removal.

    a. Saw cuts made in concrete canal lining placed under this contract will not be measured and paid for.

2. Payment: Linear foot price offered in the schedule.

B. Removing Existing Coachella Canal Concrete Lining:

1. Payment: Lump sum price offered in the schedule.

    a. Includes removal of all disturbed Coachella Canal concrete lining.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 03306-1, Concrete canal lining removal plan:

1. Describe methods, equipment, and sequence to be used for cutting and removing concrete canal lining.

C. RSN 03306-2, Concrete canal lining repair plan:

1. Describe methods, equipment, sequence, and materials to be used to repair existing concrete lining in Coachella Canal.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 SAW CUTTING

A. Saw cut concrete canal lining at limits of concrete canal lining removal.

B. Saw cut to produce clean, sharp edges.

C. Saw cut depth, minimum: 3–inches

1. Saw cut full depth at joints in existing concrete canal lining to completely cut embedded PVC waterstop strips.

D. Saw cut concrete canal lining using diamond blade.

E. Make cuts normal to exposed concrete canal lining surfaces.

3.02 REMOVAL

A. Produce surfaces and edges suitable for required construction.

B. Clean loose concrete from surfaces on which new concrete canal lining will be placed.

C. Use methods which will not damage concrete canal lining to remain in place.

D. Blasting not permitted.

3.03 REPAIR

A. Repair concrete canal lining outside of prescribed removal lines which is damaged or loosened during cutting and removal operations.

1. Repair or replace in accordance with approved plan or as directed by COR.

2. Repair or replace in accordance with applicable sections of these specifications.

3.04 DISPOSAL

A. Dispose of removed concrete canal lining as directed by COR at approved waste area.

END OF SECTION

SECTION 03309 – CONCRETE IN CANAL LINING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Concrete in Canal Lining:

1. Measurement: Surface area covered.
2. Payment: Square yard price offered in the schedule.
   a. Includes concrete, sponge rubber joint filler, and elastomeric sealant.

B. Cementitious Materials for Concrete in Canal Lining:

1. Measurement: Weight of materials used in concrete based on batch weights and batch counts at batch plant measured in most practical manner. One bag of cement will be measured as 0.047 ton.
2. Payment: Ton price offered in the schedule.
   a. No payment will be made for cementitious materials in wasted concrete in canal lining.

C. Contraction Joints in Canal Lining:

1. Measurement: Length along constructed joints.
2. Payment: Linear foot price offered in the schedule.
   a. Includes PVC strip waterstop.

1.02 REFERENCES

A. American Concrete Institute (ACI)

1.	ACI 305R-99	Hot Weather Concreting

B. ASTM International (ASTM)

1.	ASTM C 31/C 31M-08	Making and Curing Concrete Test Specimens in the Field
2.	ASTM C 33-07	Concrete Aggregates
3.	ASTM C 39/C 39M-05	Compressive Strength of Cylindrical Concrete Specimens
4.	ASTM C 42/C 42M-04	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
5.	ASTM C 94/C 94M-07	Ready-Mixed Concrete

6.	ASTM C 114-07	Chemical Analysis of Hydraulic Cement
7.	ASTM C 138/C 138M-08	Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
8.	ASTM C 143/C 143M-05a	Slump of Hydraulic-Cement Concrete
9.	ASTM C 150-07	Portland Cement
10.	ASTM C 231-08	Air Content of Freshly Mixed Concrete by the Pressure Method
11.	ASTM C 260-06	Air-Entraining Admixtures for Concrete
12.	ASTM C 494/C 494M-08	Chemical Admixtures for Concrete
13.	ASTM C 618-08	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
14.	ASTM C 920-05	Elastomeric Joint Sealants
15.	ASTM C 1017/C 1017M-07	Chemical Admixtures for Use in Producing Flowing Concrete
16.	ASTM C 1064/C 1064M-05	Temperature of Freshly Mixed Hydraulic Cement Concrete
17.	ASTM C 1315-07	Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
18.	ASTM C 1330-02(2007)	Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants
19.	ASTM C 1602/C 1602M-06	Mixing Water Used in the Production of Hydraulic Cement Concrete

C. Bureau of Reclamation (USBR)

1.	USBR M-41	Standard Specifications for Elastomeric Canal Joint Sealant, March 9, 1998
2.	USBR M-47	Standard Specifications for Repair of Concrete, August 1996
3.	USBR Concrete Manual	Concrete Manual, Eighth Edition, Revised Reprint, 1981

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 03309-1, Concrete material approval data:

1. Mix Design. For each concrete mix design:

a. Mixture proportions, materials sources, and physical properties.

b. Compressive strength results from trial batches.

1) Trial mix test results, three six-inch diameter cylinders at 7 and 28 days each.

2) Average 28 day compressive strength of trial batch cylinders: Design strength plus 1200 lbs/in^2.

c. Re-submittal of mix design is required for any change in material source and type.

2. Name and manufacturer of each cementitious material, aggregate source, admixture, curing compound, and joint filler.

a. The Government reserves the right to require submission of manufacturer's test data and certification of compliance with specifications.

b. The Government reserves the right to require submission of samples of concrete materials for testing before or during use in concrete.

3. Cementitious materials and aggregate certifications and test reports:

a. Manufacturer's certification and test reports for each lot from which cementitious materials shipments are drawn.

1) Certify materials were tested during production or transfer in accordance with specified reference specification.

b. Aggregate certification:

1) Producer’s physical property and gradation testing reports for each aggregate source, less than 6 months old

2) Certification that aggregate is from an approved USBR source.

3) Material that is not from USBR approved source, send 100 pounds of each material size to USBR, Technical Service Center, Denver CO, Attn. 86-68180.

c. Submittal of certification and test reports shall not relieve Contractor of responsibility for furnishing materials meeting specified requirements.

C. RSN 03309-2, Elastomeric sealant certification:

1. Manufacturer’s certification that elastomeric sealant meets specifications.

D. RSN 03309-3, Lining placement procedures:

1. Equipment, methods, details for placing concrete lining.

E. Concrete Repair: In accordance with USBR M-47.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Furnish batch ticket with each batch of concrete in accordance with ASTM C 94. Deliver ticket to COR at jobsite during batch delivery.

1.05 TEST SECTION

A. Construct 500 linear feet of concrete in canal lining within the permanent canal alignment in a location approved by the COR.

1. Construct the concrete in canal lining to the full prism as required for the permanent work.

B. Purpose of construction of first 500 linear feet of concrete in canal lining is to have the Contractor demonstrate placement of acceptable concrete canal lining, thickness tolerances, PVC strip waterstop placement in contraction joints, contraction and expansion joints, and concrete which is free of cracking, defects, or other objectionable surface irregularities as determined by the COR.

C. Upon demonstrating the ability to consistently place concrete canal lining meeting the specifications, the Contractor shall receive written approval from COR before proceeding with remaining concrete in canal lining construction.

D. Use equipment in accordance with approved lining placement procedures plan.

E. The COR has the authority to limit the application of water to concrete in canal lining finishing operations.

F. The COR will observe concrete in canal lining construction procedures and perform the following testing.

1. Concrete core sampling and testing, including within waterstop.

G. Remove concrete in canal lining determined objectionable by the COR at the Contractor’s expense.

PART 2 PRODUCTS

2.01 CEMENTITIOUS MATERIALS

A. Cementitious Materials Option:

1. Specified portland cement and 20 percent plus or minus 5 percent of specified pozzolan, by weight of total cementitious materials.

B. Portland Cement:

1. ASTM C 150, Type V.

2. Meet equivalent alkalies requirements of ASTM C 150 - Table 2.

3. Meet false-set requirements of ASTM C 150 - Table 4.

C. Pozzolan:

1. ASTM C 618, Class F, except,

a. Sulfur trioxide, maximum: 4.0 percent.

b. Loss on ignition, maximum: 2.5 percent.

c. Test for effectiveness in controlling alkali-silica reaction under optional physical requirements in Table 2 of ASTM C 618. Use low-alkali cement for test.

d. Does not decrease sulfate resistance of concrete by use of pozzolan.

1) Demonstrate pozzolan will have an "R" factor less than 2.5.

2) R = (C-5)/F

3) C: Calcium oxide content of pozzolan in percent determined in accordance with ASTM C 114.

4) F: Ferric oxide content of pozzolan in percent determined in accordance with ASTM C 114.

2.02 WATER

A. ASTM C 1602, including optional requirements of Table 2.

2.03 AGGREGATE MATERIALS

A. Fine aggregate: ASTM C 33.

B. Coarse Aggregate: ASTM C 33, Size No. 57 except allowable fines content (material passing No. 200 sieve) less than 3 percent..

2.04 ADMIXTURES

A. Air-Entraining Admixture:

1. ASTM C 260.

2. Use a neutralized vinsol resin formulation for air-entraining admixture used with ASTM C 494, Type F or G; and ASTM C 1017, Type I or II chemical admixtures.

B. Chemical Admixtures:

1. Allowable Chemical Admixtures:

a. ASTM C 494, Type A, D, F, or G.

b. ASTM C 1017, Type I or II.

2. Do not use chemical admixtures which contain more than 0.1 percent chloride, by weight.

2.05 CURING MATERIALS

A. Curing Compound: ASTM C 1315, Type II (white pigmented).

B. Water: ASTM C 1602, including optional requirements of Table 2.

2.06 ACCESSORIES

A. Backer Rod:

1. Closed cell polyurethane foam.
2. Meets ASTM C 1330, Type C.
3. Furnish in required sizes to conform to the joint sizes with sufficient compression to seal against the sides of the joints and support the elastomeric sealant.

B. Elastomeric sealant: Sikaflex 2C, manufactured by Sika Corporation, 201 Polito Ave., Lyndhurst NJ 07071, (800) 933-7452; or equal, with the following essential characteristics:

1. Two component.
2. Meets ASTM C 920, Type S or M, Grade NS, Class 25, Use T, NT, I.
3. Conforms to USBR M-41.
4. Polyurethane based.
5. Cures to a homogeneous rubber-like mass.

C. Sponge Rubber Joint Filler: In accordance with Section 03152 – Sponge Rubber Joint Filler.

D. PVC Strip Waterstop: In accordance with Section 03158 – PVC Strip Waterstop.

2.07 FORMS

A. Forms: Any grade common board or plywood. Steel sheathing or steel lining permitted.

2.08 MIX

A. The Contractor shall design the concrete mix.

1. The Government reserves the right to adjust mix proportions when need for adjustment is indicated by results of materials testing, or by the failure of meeting specifications requirements.

a. Adjustment of mix proportions by the Government will be in accordance with USBR Concrete Manual.

b. Mixtures will be proportioned or adjusted to meet strength and durability requirements.

B. Use specified cementitious materials option.

C. Net water-cementitious materials ratio: 0.45 maximum, by weight.

D. Minimum cementitious materials content: 564 pounds per cubic yard.

E. Slump: In accordance with ASTM C 143.

1. Concrete in Canal Lining: 1 to 3 inches at placement, except as specified.

2. Concrete with ASTM C 1017, Type I or II chemical admixtures: Use slump appropriate for placing conditions.

F. Compressive Strength:

1. At 28 days, minimum: 3,000 lb/in^2.

a. Acceptance criteria:

1) In accordance with ASTM C 94, plus the following

a) 90 Percent of test cylinders exceed specified compressive strength at 28 days.

b) Average compressive strength of any six consecutive test cylinders exceeds specified compressive strength at 28 days.

c) No individual strength test falls below specified compressive strength by more than 500 lb/in^2.

G. Air Entrainment: 5 to 7 percent air by volume of concrete as discharged at placement, in accordance with ASTM C 231.

2.09 BATCHING, MIXING, AND TRANSPORTING

A. Manufacture and deliver in accordance with ASTM C 94.

B. Deposit concrete at its final destination within 90 minutes from the introduction of cement to water or aggregates, or as directed by COR.

C. Prevent appreciable segregation of ingredients, or slump loss exceeding 2 inches in concrete delivered to work.

D. Condition aggregate to ensure consistency in mixture proportions.

E. Transport concrete in covered equipment only. When non-agitating equipment is used for transporting concrete to the delivery point, complete discharge within 45 minutes after the addition of water to the cement.

2.10 CONCRETE TEMPERATURE

A. Concrete temperature at placing: 50 to 90 degrees F.

B. Reference ACI 305R for hot weather concreting practices.

2.11 SOURCE CONTRACTOR QUALITY TESTING

A. Perform the following checks at batch plant:

1. Slump: ASTM C 143
2. Air content: ASTM C 231
3. Unit weight: ASTM C 138
4. Concrete temperature: ASTM C 1064
5. Frequency: At least once per shift per mix or when consistency of the mix changes.

B. Perform the following tests to maintain concrete consistency and workability:

1. Gradation and fines content: ASTM C 117 and ASTM C 136
2. Moisture contents of concrete aggregates: ASTM C 566

C. Make test reports available to the COR.

PART 3 EXECUTION

3.01 PREPARATION

A. Remove standing water, mud, and debris from foundation surfaces to be covered by concrete.

B. Prepare rock surfaces free from oil, objectionable coatings, and loose, semidetached, and unsound fragments. Immediately before placement of concrete, wash rock surfaces with an air-water jet and dry to a uniform surface-dry condition.

C. Prepare earth foundations free from frost.

D. Thoroughly moisten surfaces of absorptive foundations to be covered with concrete so that moisture will not be drawn from fresh concrete.

E. Keep trimmed canal prism wet by sprinkling prior to placing concrete canal lining as required by Section 02317 – Canal Earthwork.

F. Moisten subgrade in front of concrete placing operations to a depth of approximately 6 inches. Do not place over ponded water.

G. Clean, roughen, and surface dry surfaces of sponge rubber filled expansion joints to be covered with fresh concrete.

1. Remove laitance, loose or defective concrete, coatings, sand, curing compound, and other foreign material.

2. Wet sandblast surface, wash thoroughly, and surface dry immediately before placement of adjoining concrete.

3. Do not use a mortar layer on expansion joints.

4. Secure sponge rubber with adhesive as recommended by manufacturer. Refer to Section 03152 – Sponge Rubber Joint Filler.

H. Complete and sign approved concrete check out cards (reference Section 03300 – Cast-In-Place Concrete) for each placement signifying completion of work. Notify the COR after completion of each phase of preparation and obtain approval, by signature, on the concrete placement check out card. The COR may waive the use of placement check out cards.

1. Make the completed concrete placement check our cards available to the COR.

3.02 FORMING

A. Construct forms to confine concrete in accordance with Section 03110 – Concrete Formwork.

3.03 PLACING

A. Do not use aluminum pipes and chutes for placing or pumping concrete.

B. Do not retemper concrete.

C. Do not use concrete which has become so stiff that concrete cannot be properly placed.

D. Do not place concrete directly on foundation surfaces without written approval of the COR that the foundation surface has been suitably prepared for concrete placement.

E. Vibrate concrete until concrete has been consolidated to maximum practical density, is free from pockets of coarse aggregate, and closes snugly against surfaces of forms.

F. Provide concrete in canal lining to a minimum thickness of 3-1/2 inches.

G. Provide required access and samples for quality assurance inspection and testing. .

3.04 CONTRACTOR QUALITY TESTING

A. Test thickness of concrete canal lining continuously during placement.

B. Take concrete cores (ASTM C 42) of hardened concrete as directed by COR.

1. A minimum of 75 cores is anticipated.

C. Make test reports available to the COR.

3.05 FIELD QUALITY ASSURANCE

A. The Government may use the Contractor submitted approved Concrete Placement Check Out Cards to record placement and pre-placement conditions.

B. The Government will perform tests to verify properties of concrete. Frequency is at the discretion of the COR. Greater frequency testing is normally performed at the beginning of new work, new crew, or new equipment.

C. In addition to the Contractors quality testing program, the Government will test compressive strength in accordance with ASTM C 31 and ASTM C 39 for 6- by 12-inch cast cylinders.

D. Compressive strength may also be determined by COR in accordance with ASTM C 42 for concrete cores.

1. Concrete in an area represented by core tests will be considered structurally adequate when average compressive strength of three cores is equal to at least 3,400 lb/in^2 and no single core has a compressive strength of less than 3,000 lb/in^2.

2. COR will determine locations of cores used for acceptance.

E. The Government will prepare one set of five concrete test cylinders for the first 50 or less cubic yards or at least one set of five concrete cylinders for each day of concrete placement, and one set of five concrete cylinders for each additional 100 cubic yards of concrete placement.

1. Test cylinders will be 6- by 12-inches cast in accordance with ASTM C 31 and tested in accordance with ASTM C 39.

2. The Government will test 2 cylinders from each set at 7 days, and 2 cylinders from each set at 28 days. Maintain the last cylinder from each set for testing in the event the 28-day tests fall below the required strength.

F. Two additional test cylinders may be taken during placement in adverse weather and cured on jobsite under the same conditions as the concrete the cylinders represent.

G. The Government will perform the following test for each set of test cylinders taken:

1. Slump: ASTM C 143
2. Air content: ASTM C 231
3. Unit weight: ASTM C 138
4. Temperature: ASTM C 1064

H. Additional slump tests may be taken for each truck or as determined by the COR.

I. Slump of concrete will be determined at point of placement or as determined by the COR.

3.06 FINISHING

A. Where finishes are not specified or shown on drawings for a particular surface, finish concrete as specified for similar work.

B. Finish concrete in presence of Government inspector unless inspection is waived in each specific case.

1. Do not add water to finish surface.
2. Separate placing machine and finishing machine enough so that bleed water evaporates before being worked into finished concrete.

C. Unformed Surfaces:

1. Finish class is designated by symbol U4.
2. Finish U4 (Canal Lining Finish):
    a. Equal in evenness and smoothness to that obtained by use of a long-handled steel trowel. Free of rock pockets and surface voids.
    b. Light surface pitting and light trowel marks are not considered objectionable.
    c. Provide a nonskid longitudinal brush finish as approved by COR to the top portion of the side slopes of the canal lining extending 5 feet vertically below the top of the lining.

3.07 JOINTS AND EDGES

A. Expansion Joints:

1. Place 1 inch expansion joints at nearest transverse joint to every PC and PT and when paving operation stops for the placement or as directed by COR. The maximum distance between expansion joints shall be 500 feet. Contraction joints are replaced with expansion joints at these locations.
2. Install joints in canal lining within 24 hours of placement.
3. Place canal expansion joints in accordance with detail shown on drawings.

4. Cut sponge rubber joint filler to size and shape of joint to receive filler.

5. Adhere sponge rubber joint filler to concrete in accordance with adhesive manufacturer's recommendations.

6. Butt sections of filler with tight-fitting butt joints to prevent mortar from seeping through joint.

B. Contraction Joints:

1. Construct as shown on drawings.

2. Place strip waterstop in accordance with Section 03158 – PVC Strip Waterstop.

C. Contraction Joints for Equipment Breakdown:

1. Contraction joints are joints placed in concrete to provide for volumetric shrinkage of a monolithic unit or movement between monolithic units.

2. Construct contraction joints so no bond exists between concrete surfaces forming the joint.

   a. Construct contraction joints by placing concrete on one side of joint and allowing it to set before concrete is placed on other side of joint.

   b. Coat surface of concrete first placed at contraction joint with curing compound before placing concrete on other side of joint.

3. Construct contraction joints in unreinforced concrete canal lining as shown on drawings.

4. Construct contraction joints along straight lines to detailed dimensions shown on drawings.

5. Maintain required shape and dimensions during subsequent finishing operations until concrete has hardened.

6. Make joints continuous across and along canal section.

7. End transverse contraction joints at top of canal side slopes.

8. Tool a groove as shown on drawings across the concrete curb from end of each transverse joint.

9. Install backer rod and sealant in groove as shown on drawings.

10. Where concrete lining placing operations are stopped for the day, interrupted or delayed, transverse contraction joints may be placed at spacings that vary from spacing shown on drawings as approved by COR. Make spacings not less than one-half the spacing shown on drawings.

11. Drill 6-inch-diameter cores in accordance with the Contractor Quality Testing section at times and locations designated by COR for inspection to determine effectiveness of contraction joint installation procedures.

12. Repair core holes immediately following completion of inspection of the holes by COR. Method and manner of repair shall be approved by COR.

13. If inspection reveals contraction joint does not meet specifications, modify equipment and installation procedures to ensure specifications compliance, and remove and repair defective work at Contractor's expense.

3.08 DEVIATIONS AND SURFACE TOLERANCES

A. Canal Lining deviations are defined as allowable variations from specified lines, grades, and dimensions.

B. Surface tolerances are defined as maximum allowable magnitude of surface irregularities.

C. Specified canal lining deviations and surface tolerances are consistent with modern construction practice and governed by effect that permissible variations may have upon the lining. COR reserves the right to diminish specified deviations and surface tolerances where such variations impair canal operational function.

D. Construct concrete within stated variations even though more than one may be specified.

1. Specified variation for one element of the lining will not apply when it will permit another element of the lining to exceed its allowable variation.

2. Where variations are not specified or shown on drawings for a portion of the lining, variations shall be those specified for similar work. As an exception to clause at FAR 52.236-21 "Specifications and Drawings for Construction," specific tolerances shown on drawings in connection with any dimension shall govern.

E. Canal Deviations:

1. Check variations from specified lines, grades, and dimensions in hardened concrete to determine that the lining is within tolerances specified in Table 03309A - Deviations from Specified Lines, Grades, and Dimensions.

2. Variation is distance between actual position of canal or any element of lining and specified position in plan for lining or particular element.

a. Plus or minus variations, shown as (±), indicate a permitted actual position up or down and in or out from specified position in plan.

b. Variations not designated as (+) or (-) indicate maximum deviation permitted between designated successive points on completed element of construction.

3. Specified position in plan is defined as lines, grades, and dimensions described in these specifications, shown on drawings, or prescribed by COR.

Table 03309A - Deviations from specified lines, grades, and dimensions

A. CANAL LINING		
1.	*Departure from established alignment (centerline)	±2 inches
2.	*Departure from established profile grade	±1 inch
	_____ * Departure from alignment or grade shall be uniform. No departure and no correction in alignment or grade shall be made in less than 20 feet.	
3.	Reduction in lining thickness	0 percent of specified thickness
4.	Variation from specified width of section at any height.....	± (0.25 percent of specified width plus 1 inch)
5.	Variation from established lining height	± (0.50 percent of established height plus 1 inch)

F. Canal Surface Irregularities:

1. Bulges, depressions, and offsets are defined as surface irregularities or roughness.

2. Surface irregularities are classified as "abrupt" or "gradual" and allowable tolerances are specified in Table 03309B - Surface Tolerances.

   a. A surface tolerance is designated by a capital "T" followed by a number 1 through 3.

   b. Surface tolerance designations are separate from surface finishes and structural deviations.

3. Abrupt Surface Irregularities:

   a. Abrupt surface irregularities are defined as offsets such as those caused by misplaced or loose forms in which maximum dimension of irregularity perpendicular to surface is greater than maximum dimension of irregularity in plane of surface.

   b. Abrupt surface irregularities include all incidences of isolated surface irregularities which exceed specified gradual irregularities.

4. Gradual Surface Irregularities:

   a. Gradual surface irregularities are defined as bulges and depressions resulting in gradual changes on surface.

b. Gradual surface irregularities are further defined as isolated undulations on surface. Maximum dimension of undulation perpendicular to surface is small relative to maximum dimension of undulation in plane of surface.

5. Check magnitude of surface irregularities of formwork and finished surfaces to ensure that surfaces are within specified tolerances.

G. Canal Surface Tolerances:

Table 03309B - Surface Tolerances

Concrete surface	Maximum allowable surface irregularity tolerance	
	Abrupt	Gradual
T1	1 inch	1/4 inch/inch
T2	1/2 inch	1/8 inch/inch
T3	1/8 inch	1/16 inch/inch

H. Field Verification of Surface Tolerances:

1. Determine compliance of a surface with specified surface tolerances.

2. Evaluate surface roughness.

a. Measure roughness height or depth and check for compliance with values specified in Table 03309B - Surface Tolerances and Table 03309A - Deviations from Specified Lines, Grades, and Dimensions.

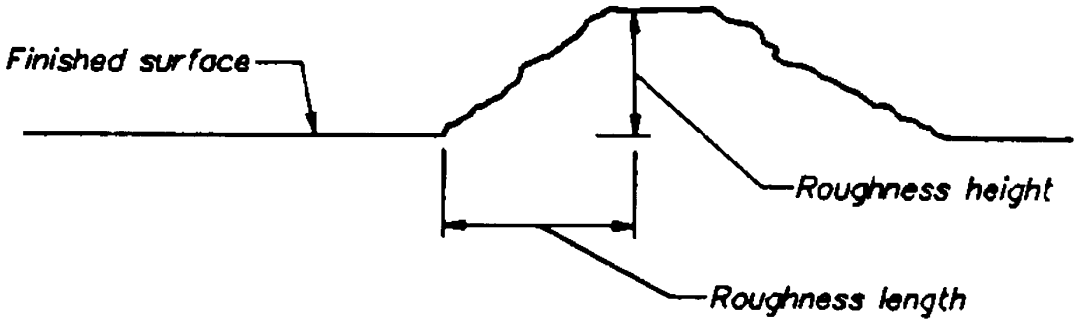
b. When measured height or depth of roughness is less than value in abrupt tolerance specification and height or depth of roughness does not cause the lining to exceed any applicable value specified in Table 03309A - Deviations from Specified Lines, Grades, and Dimensions, surface roughness is acceptable.

c. When roughness height or depth exceeds abrupt tolerance specification, determine roughness slope for comparison to gradual tolerance specification.

1) Measure roughness length and determine roughness slope by dividing roughness height or depth by roughness length (see Figure 1).

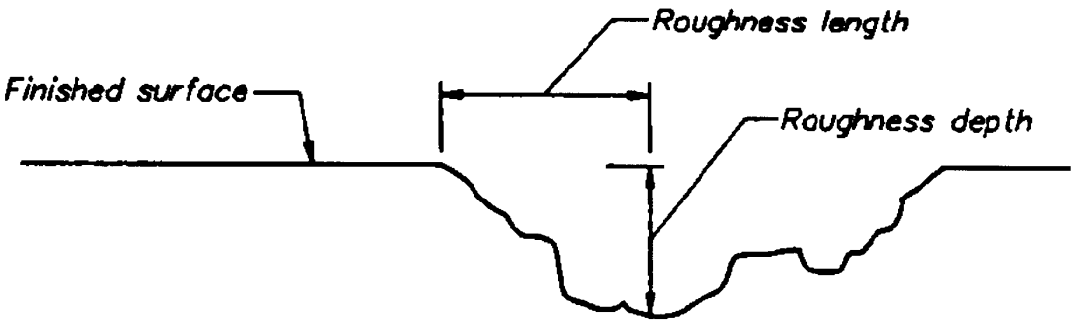
2) When roughness slope is greater than slope specified by gradual tolerance specification, surface roughness is unacceptable.

3) When roughness slope is less than gradual slope specified and gradual roughness does not cause the lining to exceed allowable deviations, surface roughness is acceptable.



$$\text{Roughness slope ratio} = \frac{\text{Roughness height}}{\text{Roughness length}}$$

CASE 1 = Offset on the Surface



$$\text{Roughness slope ratio} = \frac{\text{Roughness depth}}{\text{Roughness length}}$$

CASE 2 = Offset into the Surface

FIGURE 1

I. Measuring Surface Roughness:

1. Examples below illustrate how to make necessary surface measurements for typical roughness.

2. Case 1 - Roughness Protruding above Surface:

   a. A roughness protruding above the surface should be measured with a straightedge that is at least 20 times longer than the roughness height being measured.

   b. Position the straightedge with one end resting on top of the roughness, as shown in Figure 2 (case 1).

   c. Determine the roughness height by measuring the maximum gap that occurs normal to the straight edge.

   d. Also, note the position on the straightedge from which the normal distance is measured.

   e. To determine the roughness length, measure the distance along the straightedge from the point where the height was measured to the point of contact between the straightedge and the top of the roughness.

   f. The roughness slope is defined as the ratio of the roughness height to the roughness length.

   g. As roughness is seldom symmetric, moving the position of the straightedge about the roughness may be necessary to locate the point where the maximum height and slope exists.

3. Case 2 - Roughness Extending below the Surface:

   a. A roughness occurring as an indentation to the surface is measured by placing the straightedge across the indentation, as shown in Figure 2 (case 2).

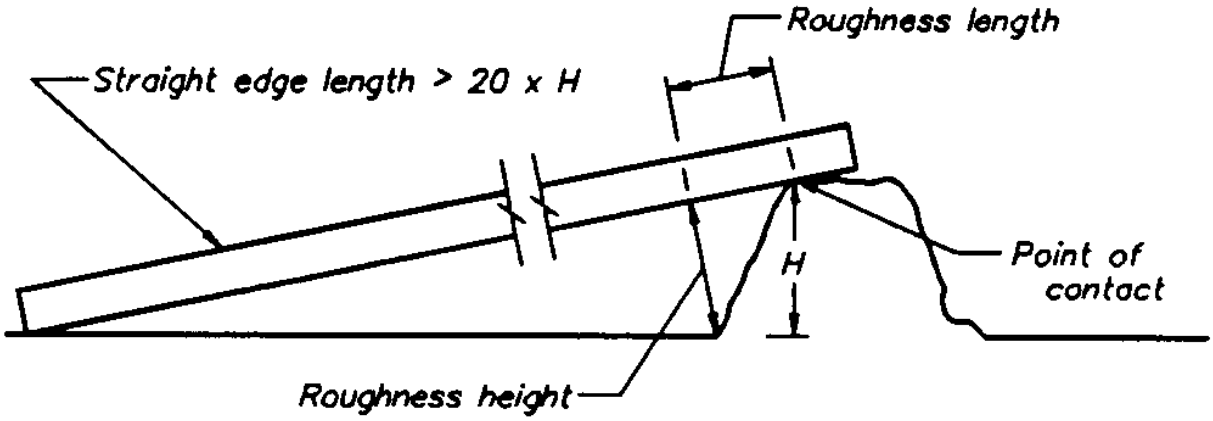
   b. Measure the maximum gap between the straightedge and the surface and note the location of the measurement on the straightedge.

   c. From the point of the depth measurement, measure along the straightedge in both directions to the point of contact with the surface.

   d. The shortest length measured is used as the roughness length.

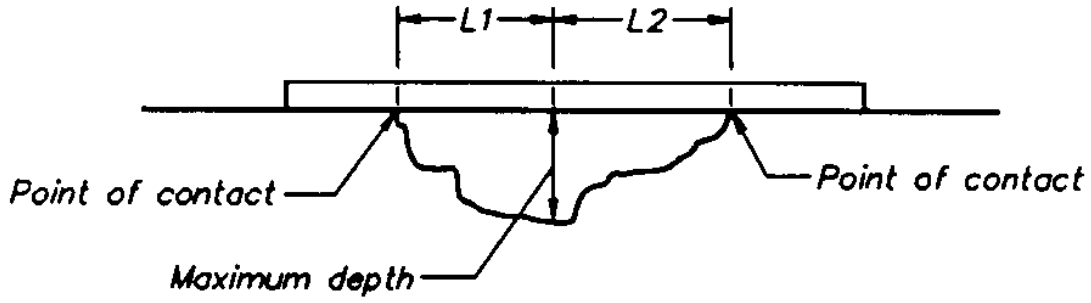
   e. Divide the roughness depth by the roughness length to determine the roughness slope.

4. A simple measuring device can be constructed to perform surface tolerance measurements and evaluation process directly and quickly. Information concerning concrete tolerance measuring devices can be obtained from Bureau of Reclamation, Attn 86-68180, PO Box 25007, Denver CO 80225-0007, telephone (303) 445-2386.



CASE 1

$$\text{Roughness slope} = \frac{\text{Roughness depth}}{\text{The shortest distance L1 or L2}}$$



CASE 2

FIGURE 2

J. Prevention of Repeated Failure to Meet Tolerances:

1. When concrete placements result in hardened concrete which does not meet specified tolerances, submit to COR an outline of preventive actions such as modifications to forms, modified procedure for setting screeds, and different finishing techniques to be implemented to avoid repeated failures. Submit when requested by COR.

2. Government reserves the right to delay concrete placements until preventive actions which have been approved by COR are implemented.

3.09 CURING

A. Curing with Curing Compound:

1. Apply to concrete surface to provide a water-retaining film. Reapply as necessary to maintain a continuous, water-retaining film on surface for 28 days.

2. Thoroughly mix compound and spray apply in one coat to provide a continuous, uniform film over surface.

3. Follow manufacturer's coverage rate recommendations or do not exceed coverage rate of 150 square feet per gallon, whichever is the least coverage rate. Decrease coverage rate on rough surfaces as necessary to obtain required continuous film.

4. Ensure ample coverage on edges, corners, and rough surfaces.

5. Spray equipment and equipment performance will be subject to approval by COR. Repair or replace equipment when directed by COR.

6. Use personnel qualified in using specified spray technique, as determined by COR, to perform application.

B. Curing with Water:

1. Keep concrete surface wet for 14 days, minimum, from time concrete has attained sufficient set to prevent detrimental effects to surface.

2. Cure methods:

a. Water-saturated material.

b. System of perforated pipes, mechanical sprinklers, or porous hose.

c. Other methods which will keep surfaces wet.

d. Subject to approval by COR.

3.10 PROTECTION

A. Protect concrete from damage until final acceptance by Government.

1. Do not load, remove forms or shoring, or backfill against concrete until concrete has gained sufficient strength to safely support its weight and imposed loads.

2. Protect fresh concrete against erosion from rain, hail, sleet, or snow; contamination from foreign materials; and damage from foot traffic, vehicles, or lining machinery until the concrete has hardened.

3. Protect concrete from heavy foot traffic and other construction activities by covering with plywood or other suitable material. Remove and dispose of temporary covering when no longer required.

B. Protect concrete from excess evaporation.

1. Use wind breaks, shades, or foggers during and immediately after placement if evaporation rates exceed 0.2 lb/ft^2/hr as determined by ACI 305R.

3.11 REPAIR

A. Repair concrete in accordance with USBR M-47 and provisions listed below:

1. Panels with cracks with offset or displaced edges, or panels with cracks larger than 0.20-inches: Replace panel or part of panel as directed by the COR.

2. Repair any crack extending full depth.

3. Cracks less than 0.04-inch in width and not full depth: Monitor crack or repair using the Cap Seal as shown on drawings as directed by the COR.

4. Cracks between 0.04-inch and 0.20-inch: Repair using routing and sealing.

a. Route minimum 0.25-inches wide and 0.50-inches deep with chamfered edges.

b. Use a Non-Sag Polyurethane Sealant as specified in Section 07920 – Joint Sealants.

c. Completely fill the routed groove with sealant.

B. Use repair or replacement method directed by COR.

3.12 FINISH, SURFACE TOLERANCES, AND CURING SCHEDULES

Table 03309C - Formed surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Contraction joints and surfaces to be covered by concrete	F1	T2	White wax-base curing compound
Expansion joints	F1	T2	White wax-base curing compound

Table 03309C - Formed surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods

Table 03309D - Unformed surfaces

Surface	Finish	Maximum Allowable Tolerances	Acceptable Curing Methods
Canal lining	U4	T3	Water or White wax-base curing compound

END OF SECTION

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SECTION 03362 - CONCRETE FLOOR HARDENER

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 03362-1, Manufacturer's instructions.

1. Rate of coverage and application procedures.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete floor hardener options:

1. Fluosilicate crystals: Magnesium fluosilicate or zinc fluosilicate, or a combination of both.
    a. Mix proportions:
        1) First coat: 1/2 pound of fluosilicate crystals per gallon of water.
        2) Second and third coats: 2 pounds fluosicate per gallon of water.
2. Commercial mixtures:
    a. Combination of magnesium fluosilicates and zinc fluosilicates with a wetting agent
    b. Equal to Lithoplate liquid floor hardener manufactured by Protex Industries, Inc., 1331 West Evans Avenue, Denver CO 80223; Saniseal 50 chemical floor hardener manufactured by Martin Marietta Corp., Master Builders Division, 23700 Chagrin Boulevard, Cleveland OH 44122; or Lapidolith chemical floor hardener manufactured by Contech, Inc., Sonneborn Division, 7711 Computer Avenue, Minneapolis MN 55435.

PART 3 EXECUTION

3.01 PREPARATION

A. After concrete floors have thoroughly cured and at such time as approved by the COR, clean concrete surfaces thoroughly of curing compound, dirt, grease, laitance, or other foreign matter.

3.02 APPLICATION

A. Apply concrete floor hardener to the following areas:

1. Interior concrete floor of Control Building except as provided below.

B. Apply three coats of floor hardener immediately after floors are dry from cleaning.

1. If fluosilicate crystals are used:

a. Apply hardener solution by using floor mops at a maximum coverage of 100-square-feet-per-gallon per coat.

2. If a commercial mixture of liquid floor hardener is used:

a. Coverage rate and application procedures: As recommended by manufacturer of liquid floor hardener.

C. Do not apply concrete floor hardener where equipment grout pads are to be placed.

D. Spread each coat of floor hardener uniformly.

E. Prevent pools of hardener solution from appearing.

F. Allow each coat to dry thoroughly before next coat is applied.

G. After last coat has dried, brush floors and wash with water to remove crystals which may have formed on surface.

END OF SECTION

SECTION 03622 - GROUTING MORTAR FOR EQUIPMENT AND METALWORK

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for items of work requiring nonshrink grout.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM C 150-07	Portland Cement
2.	ASTM C 1107/C 1107M-07a	Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 03622-1, Packaged Nonshrink Grout Data:

1. Manufacturer's product data for approval for nonshrink grout.
2. Manufacturer's certification that product meets specifications.
3. Manufacturer's surface preparation, mixing, installation, and curing instructions.

PART 2 PRODUCTS

2.01 PACKAGED NONSHRINK GROUT

A. Pre-mixed commercial grout mixture:

1. ASTM C 1107.
2. Cement in mixture: ASTM C 150, Type V.

B. Water:

1. Clean.
2. Free of detrimental quantities of silt, organic matters, salts, or other impurities.
3. As recommended by grout manufacturer.

C. Mix: In accordance with manufacturer's instructions to consistency recommended by manufacturer for application.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean and prepare base concrete surface to which nonshrink grout or grouting mortar will be bonded in accordance with manufacturer's instructions or as directed by COR:

1. Roughen surface.
2. Remove dirt, laitance, loose or defective concrete, curing compound, coatings, and other foreign material.
3. Wash with water.

B. Lubricate concrete surface by washing with water immediately before placing nonshrink grout or grouting mortar when delay occurs between washing and placing nonshrink grout or grouting mortar.

3.02 PLACING

A. Place nonshrink grout in accordance with manufacturer's instructions to completely fill space to be grouted.

B. Place grouting mortar to completely fill spaces adjacent to equipment and metalwork as shown on drawings.

C. Use forms, where required, to confine nonshrink grout.

3.03 CURING

A. Cure exposed surface of packaged nonshrink grout by method recommended by manufacturer.

B. Cure exposed surface of grouting mortar for 72 hours with burlap, damp sand, or other means approved by the COR

C. Do not apply loads sooner than 72 hours after placement and only after mortar has attained compressive strength of at least 3,000 lb/in^2.

END OF SECTION

SECTION 04822 - REINFORCED CONCRETE UNIT MASONRY ASSEMBLIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM A 82/A 82M-07	Steel Wire, Plain, for Concrete Reinforcement
2.	ASTM A 153/A 153M-05	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
3.	ASTM A 615/A 615M-08	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
4.	ASTM A 951-/A 951M-06	Masonry Joint Reinforcement
5.	ASTM C 90-06b	Loadbearing Concrete Masonry Units
6.	ASTM C 140-07a	Sampling and Testing Concrete Masonry Units and Related Units
7.	ASTM C 144-04	Aggregate for Masonry Mortar
8.	ASTM C 150-07	Portland Cement
9.	ASTM C 207-06	Hydrated Lime for Masonry Purposes
10.	ASTM C 270-07a	Mortar for Unit Masonry
11.	ASTM C 404-07	Aggregates for Masonry Grout
12.	ASTM C 426-07	Linear Drying Shrinkage of Concrete Masonry Units
13.	ASTM C 476-07	Grout for Masonry

B. Masonry Industry Council (MIC)

1.	MIC Manual	Hot and Cold Weather Masonry Construction Manual, 1999

C. National Concrete Masonry Association (NCMA)

1.	NCMA CM 260CD	Concrete Masonry Shapes and Sizes Manual

D. Maintain a copy of MIC Manual at jobsite during work.

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 04822-1, Approval Data:

1. Manufacturer's product data for each masonry unit, joint reinforcement, and accessory material.

a. Include test results which show minimum compressive strength and maximum water absorption for masonry units.

b. Color sample kit for masonry units and for mortar.

C. RSN 04822-2, Certifications and Instructions:

1. Manufacturer's certification that masonry units meet specified requirements. Attach results from specified source sampling and testing to each certification.

2. Manufacturer's certification that Portland cement and lime meet specified requirements.

3. Manufacturer's instructions for cleaning masonry units.

D. RSN 04822-3, Mix Designs:

1. Mortar mix design indicating type and proportions of ingredients in compliance with the proportion specification of ASTM C 270.

2. Grout mix design indicating type and proportions of ingredients in compliance with the proportions specification of ASTM C 476.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store materials off ground and under cover to prevent contact with moisture.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Comply with recommended practices of MIC Manual for hot and cold weather masonry.

PART 2 PRODUCTS

2.01 REGULAR MASONRY UNITS

A. ASTM C 90, lightweight, hollow units.

B. Finish: NCMA CM 260A, 00 REG.

C. Nominal Size: NCMA CM 260A, 080816.

D. Color: Government will select color based on color sample kit submitted.

2.02 SPLIT FACE MASONRY UNITS

A. ASTM C 90, lightweight, hollow units.

B. Finishes: NCMA CM 260A, 00 SPF on exterior face and exposed end surfaces and NCMA CM 260A, 01 SPF on exterior face and exposed end surfaces.

C. Nominal Size: NCMA CM 260A, 080816.

D. Color: Government will select color based on color sample kit submitted.

2.03 MORTAR MATERIALS

A. Portland Cement: ASTM C 150; Type I, II, or III.

B. Hydrated Lime: ASTM C 207, Type M.

C. Aggregate: ASTM C 144.

D. Water: Clean water free of detrimental amounts of silt, organic matter, alkali, salts, and other impurities.

E. Color: Government will select color based on color sample kit submitted.

2.04 GROUT MATERIALS

A. Portland Cement: ASTM C 150; Type I, II, or III.

B. Aggregate: ASTM C 404.

C. Water: Clean water free of detrimental amounts of silt, organic matter, alkali, salts, and other impurities.

2.05 REINFORCEMENTS

A. Joint Reinforcements:

1. ASTM A 951, Truss Type, with deformed longitudinal wires butt welded to continuous diagonal cross wire at 16-inch intervals.
2. Material: ASTM A 82 steel wire.
3. Wire Size: No. 9 gauge longitudinal and cross wires.
4. Finish: ASTM A 153, Class B-2, hot-dipped zinc coating applied after fabrication.
5. Width: 2 inches less than nominal wall thickness.
6. Provide prefabricated corner at wall corners.

B. Reinforcing Bars: ASTM A 615, Grade 60, deformed steel bar, uncoated.

2.06 SOURCE QUALITY TESTING

A. Sample and test masonry units in accordance with ASTM C 140 and ASTM C 426 before shipment to jobsite.

2.07 MORTAR MIX

A. Type: ASTM C 270, Type M, proportion specification using specified materials.

B. Do not add calcium chloride or anti-freeze compounds.

C. Re-temper mortar in accordance with ASTM C 270 except use and place mortar within 1-1/2 hours after mixing.

2.08 GROUT MIX

A. Coarse Grout: ASTM C 476, proportion specification using specified materials.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean and roughen concrete substrate surfaces to be in contact with mortar or grout. Remove curing compounds, laitance, efflorescence, loose or defective concrete, sand, dirt, and foreign material.

B. Clean top of unfinished masonry of loose mortar and foreign material before resuming work.

C. Lay concrete masonry units dry. Do not prewet.

D. Clean excess concrete and loose rust from dowel bars to be embedded in masonry.

E. Clean loose rust and coatings from reinforcing bars, joint reinforcements, and metal items to be embedded in masonry.

3.02 COURSING

A. Place masonry plumb, level, and true to required lines.

B. Maintain masonry courses to uniform width.

C. Make vertical and horizontal joints equal and of uniform thickness.

D. Lay units in running bond except as indicated on drawings. Course one unit and one mortar joint to equal nominal unit dimension.

E. Form concave mortar joints.

3.03 PLACING AND BONDING

A. Lay masonry with completely filled mortar joints. Buttering corners of joints and deep or excessive furrowing of mortar joints are not permitted.

B. Do not shift or tap units after mortar has taken initial set. Remove and replace with fresh mortar where adjustment must be made.

C. Keep concrete foundation surfaces to be in contact with grout free of mortar.

D. Keep cells to be grouted free of mortar.

E. Keep wall cavities free of mortar.

F. Remove excess mortar.

G. Saw cut to form straight unchipped edges where jobsite cutting is required. Cut units dry.

3.04 TOLERANCES

A. Variation From Unit to Adjacent Unit: 1/32 inch, maximum.

B. Variation From Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.

C. Variation From Plumb: 1/4 inch per story non-cumulative, 1/2 inch in two stories or more.

D. Variation From Level Coursing: 1/8 inch in 3 feet; 1/4 inch in 10 feet; 1/2 inch, maximum.

E. Variation of Joint Thickness: 1/8 inch in 3 feet.

F. Maximum Variation From Cross Sectional Thickness of Walls: Plus or minus 1/4 inch.

3.05 REINFORCEMENT INSTALLATION

A. Joint Reinforcements:

1. Place so that longitudinal wires are fully embedded in mortar with minimum 5/8-inch cover.
2. Lap ends 6 inches, minimum, at joints between reinforcement sections.

B. Reinforcing Bars:

1. Place reinforcing bars supported and secured against displacement.
2. Maintain position within 1/2 inch of true dimension.
3. Lap bar splices 48 bar diameters, minimum.

3.06 GROUTING

A. Place and consolidate grout fill without disturbing reinforcements.

B. Maintain grout thickness of 1/2 inch, minimum, between bar and masonry units.

C. Place grout in lifts of 4 feet, maximum, as wall is built.

D. Stop grout 1-1/2 inches below top of masonry when grouting is stopped for 1 hour or more.

E. Agitate to consolidate grout and fill space.

F. Grout full all masonry cells.

3.07 BUILT-IN WORK

A. Build in steel doorframes and other built-in items.

B. Build in items plumb and level.

C. Bed doorframe anchors in mortar joints.

D. Fill doorframes solid with mortar.

E. Rake joint between doorframes and masonry to 1/4 inch depth for sealant installation.

3.08 CUTTING AND FITTING

A. Cut and fit for pipes, conduits, sleeves, and similar items. Provide correct size, shape, and location.

3.09 POINTING AND CLEANING

A. Cut out and replace defective mortar. Match adjacent work.

B. Remove excess mortar and mortar and grout smears.

C. Clean soiled surfaces.

D. Clean masonry in accordance with manufacturer's instructions. Do not mottle, discolor, stain, damage, or acid burn masonry.

E. Obtain approval of each cleaning method from COR at jobsite before using method on work.

3.10 PROTECTION

A. Provide temporary bracing during erection to support finished work and withstand wind loads. Maintain bracing until structure provides permanent support.

B. At workday's end, cover unfinished work with secure waterproof covers to prevent moisture infiltration. Keep unfinished work covered during work shutdown.

3.11 QUALITY ASSURANCE

A. Facilitate access and materials necessary for the Government's Quality Assurance program.

B. Special Inspection. - Government will complete a Level 2 special inspection of the construction of the masonry walls that is in compliance with the 2006 International Building Code Sections 1704 through 1708.

C. Mortar Mix. – Government will verify that the actual mortar mix used in the construction of the masonry walls agrees with the approved mix design and that it is in compliance with ASTM C 270.

D. Grout Mix. – Government will verify that the actual grout used in the construction of the masonry walls agrees with the approved mix design and that it is in compliance with ASTM C 476.

E. Concrete Masonry Units. - Government will verify that the concrete masonry units used in the construction of the masonry walls are in compliance with ASTM C 90. In addition, the Government will randomly select 3 concrete masonry units to determine their compressive strengths are in compliance with ASTM C 90.

END OF SECTION

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SECTION 05315 - METAL ROOF DECK

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost

1. Include in lump sum price offered in the schedule for control building.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM A 653/A 653M-07	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process
2.	ASTM A 780-01(2006)	Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
3.	ASTM A 1008/A 1008M-7a	Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

B. American Welding Society, Inc. (AWS)

1.	AWS D1.1/D1.1M-06	Structural Welding Code - Steel
2.	AWS D1.3-98	Structural Welding Code - Sheet Steel

C. Steel Deck Institute (SDI)

1.	SDI 31-2007	Design Manual for Composite Decks, Form Decks and Roof Decks
2.	SDI DDM03-2004	Diaphragm Design Manual, 3rd Edition

1.03 PERFORMANCE REQUIREMENTS

A. Steel Deck Institute Design Manuals: Design metal roof deck according to SDI 31-2007 "Design Manual for Composite Decks, Form Decks and Roof Decks" and SDI DDM03-2004 "Diaphragm Design Manual, 3rd Edition".

B. Structural Performance: Design, fabricate, and erect metal roof deck to withstand specified design loads within and under conditions required.

1. Design Loads: As specified on control building structural engineering drawings.

2. Deflections: Live load deflection less than or equal to Length/240.

3. Design connections to roof trusses to provide for movement of roof decking without damage or overstressing, sheathing (roof panel) failure, connection failure, or other detrimental effects when subject to a maximum temperature change (range) of 120 deg F (50 deg C).

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 05315-1, Approval Data:

1. Submit metal deck manufacturer's product data for approval.
2. Submit detailed shop and erection drawings for approval.
    a. Show deck section layout and attachment to the steel roof trusses, including unit dimensions and sections.
    b. Show type and number of deck units and the type, location and method of attachment.
    c. Show all accessories and details required for proper installation of metal roof decks.

C. RSN 05315-2, Approval Drawings:

1. Submit individual metal deck drawings, sealed and signed by a qualified registered Professional Engineer, verifying compliance with local building code and design requirements. Include:
    a. Description of design criteria.
    b. Engineering analysis depicting member stresses and deflection.
    c. Member sizes and thickness and connections at joints.
    d. Support reactions.

D. RSN 05315-3, Welder Qualifications:

1. Submit welder's and tacker's identification and qualifications.

1.05 QUALIFICATIONS

A. Manufacturer Qualification: Member of Steel Deck Institute.

B. Welder qualification: Qualify in accordance with AWS D1.1. Maintain permanent records of all pertinent information.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle metal roof deck in a manner to protect it from corrosion, deformation, and other types of damage.

B. Do not bend metal roof decking. Exercise care not to damage the material or overload the decking during the construction period.

C. Maximum uniform distributed storage load shall not exceed the design live load of 20 pounds per square feet.

D. Stack decking on platforms or pallets and cover with watertight ventilated covering. Elevate one end during storage to provide for drainage. Maintain deck finish at all times to prevent the formation of rust.

E. Replace damaged material.

PART 2 PRODUCTS

2.01 METAL ROOF DECK.

A. Metal Deck manufactured by Vulcraft, 1875 West Highway 13 South, Brigham City, Utah, 84302, telephone no. 435-734-9433; or equal, having the following essential characteristics:

1. Nominal depth: As determined by designer.
2. Thickness before coating: As determined by designer.
3. Section modulus: As determined by designer.
4. Moment of inertia: As determined by designer.
5. ASTM A 1008, Grades C and D, or ASTM A 653, Structural Quality
   a. Yield Strength: 33,000 lb/in^2, minimum.
6. Metal deck shall be galvanized.
7. Panel Length: To span from end support to end support.

2.02 ACCESSORIES

A. Provide plates and closures as necessary to complete the work.

B. Provide accessories required for a finished installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Prior to installation of decking units and accessories

1. Examine worksite to verify that as-built structure will permit installation of decking system without modification and supporting members are in correct layout and alignment.

3.02 PREPARATION

A. Check surfaces to receive the decking and assure they are free of debris.

3.03 INSTALLATION

A. Install steel deck units in accordance with approved shop drawings.

B. Install deck units and accessories in accordance with manufacturer's recommendations.

C. Place units on structural supports, properly adjusted, leveled, aligned side laps, and aligned at right angles to supports.

D. Align steel deck units before permanently anchoring. Locate deck ends over supports only.

E. Bearing Length: 2-1/2 inches, minimum

F. Attachment: Immediately after placement and alignment, and after correcting inaccuracies, permanently fasten metal deck units to structural supports and to adjacent deck units as shown on shop drawings.

1. Clamp or weight deck units to provide firm contact between deck units and structural supports while performing welding.
2. Attachment of adjacent deck units by button-punching is prohibited.
3. Location, size, and spacing of fastening shall be as indicated on the drawings.

G. Welding: Perform welding in accordance with AWS D1.3 using methods and electrodes recommended by the manufacturer of the base metal alloys being used.

1. Ensure only operators previously qualified by tests prescribed in AWS D1.1 and AWS D1.3 make welds.
2. Immediately clean welds by chipping and wire brushing.
3. Heavily coat welds, cut edges and damaged portions of coated finish with zinc-dust paint conforming to ASTM A 780.

H. Cutting and fitting: Cut and fit deck units and accessories around projections through roof with neat, square, and trim cuts. Do not use cutting torches where a neat appearance is required.

3.04 REPAIRS

A. Repair damage as directed by COR.

END OF SECTION

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SECTION 05425 - PRE-ENGINEERED, PRE-FABRICATED COLD-FORMED STEEL ROOF TRUSSES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 REFERENCES

A. American Iron and Steel Institute (AISI)

1.	AISI SG02-2001	North American Specification for the Design of Cold-Formed Steel Structural Members
2.	American Iron and Steel Institute Standard for Cold-Formed Steel Framing – Truss Design, 2001	

B. American Society of Civil Engineers (ASCE)

1.	ASCE 7-05	Minimum Design Loads for Buildings and Other Structures (2005)

C. ASTM International (ASTM)

1.	ASTM A 653/A 653M-07	Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot Dip Process
2.	ASTM A 780-01(2006)	Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

D. American Welding Society (AWS)

1.	AWS D1.1/D1.1M-06	Structural Welding Code – Steel
2.	AWS D1.3/D1.3M-08	Structural Welding Code - Sheet Steel

E. International Code Council (ICC)

1.	ICC IBC-2006	International Building Code

F. Light Gauge Steel Engineers Association (LGSEA)

1.	LGSEA Field Installation Guide	Light Gauge Steel Engineers Association Field Installation Guide

1.03 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Calculate structural characteristics of cold-formed steel truss members according to AISI SG02.

B. Structural Performance: Design, fabricate, and erect cold-formed steel trusses to withstand specified design loads within limits and under conditions required.

1. Design Loads: As specified on control building structural engineering drawings.
2. Deflections: Live load deflection meeting the following (unless otherwise specified):
    a. Roof Trusses: Vertical deflection less than or equal to Length/240.
3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 120 deg F (50 deg C).
4. Design embedded wall connection to transfer all roof loads to masonry walls without damage or overstressing steel roof trusses and masonry walls.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals.

B. RSN 05425 - 1, Approval Data:

1. Manufacturer’s product data and installation instructions for each type of cold-formed steel framing and accessory required.

C. RSN 05425 - 2, Approval Drawings:

1. Detailed roof truss layouts indicating placement of trusses.
2. Individual truss drawings, sealed and signed by a qualified registered Professional Engineer, verifying compliance with local building code and design requirements. Include:
    a. Description of design criteria.
    b. Engineering analysis depicting member stresses and truss deflection.
    c. Truss member sizes and thickness and connections at truss joints.
    d. Truss support reactions.
    e. Top chord, bottom chord and web bracing requirements.
3. Final roof plan drawings sealed and signed by a qualified registered Professional Engineer depicting final installed truss assembly. Include:
    a. All truss to truss connections

b. All truss to structure (bearing and uplift) embedded connections. Connections to be embedded in top course of masonry walls.

c. Plan and details for the location of all permanent lateral and diagonal bracing and/or blocking required in the top chord, web, and bottom chord planes. (Diaphragms excluded)

1.05 QUALIFICATIONS

A. Fabricator Qualifications: Fabrication shall be performed in a quality controlled manufacturing environment by a cold-formed steel truss fabricator with experience fabricating Cold-Formed Steel trusses equal in material, design, and scope to the trusses required for this project.

B. Manufacturer's Qualifications:

1. Manufacturer experience in the cold-formed light gauge steel manufacturing and fabrication of roof trusses.

2. Installation of Cold-Formed Steel truss roof assembly shall be performed by an installer with experience installing Cold-Formed Steel trusses equal in material, design and scope to the trusses required for this project.

C. Welding Standards: Comply with applicable provisions of AWS D1.1 and AWS D1.3.

1. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure."

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's unopened containers or bundles, fully identified by name, brand, type and grade. Exercise care to avoid damage during unloading, storing and erection.

B. Store trusses on blocking, pallets, platforms or other supports off the ground and in an upright position sufficiently braced to avoid damage from excessive bending.

C. Protect trusses and accessories from corrosion, deformation, damage and deterioration when stored at job site. Keep trusses free of dirt and other foreign matter.

1.07 PROJECT CONDITIONS

A. During construction, adequately distribute all loads applied to trusses so as not to exceed the carrying capacity of any one truss.

PART 2 PRODUCTS

2.01 STEEL ROOF TRUSSES

A. Components

1. Provide manufacturer's standard steel truss members, bracing, bridging, blocking, reinforcements, fasteners and accessories with each type of steel framing required, as recommended by the manufacturer for the applications indicated and as needed to provide a complete cold-formed steel truss roof assembly.

B. Materials

1. Materials:
   a. For all chord and web members: Fabricate components of structural quality steel sheet per ASTM A 653 with a minimum yield strength of 50,000 psi.
   b. Bracing, bridging and blocking members: Fabricate components of commercial quality steel sheet per ASTM A 653 with a minimum yield strength of 33,000 psi.
2. Components: For steel truss components provide sizes, shapes and gauges indicated.
   a. Design Uncoated-Steel Thickness: 0.0350 inch (0.89 mm) (nominal 20 ga)
   b. Design Uncoated-Steel Thickness: 0.0460 inch (1.17 mm) (nominal 18 ga)
   c. Design Uncoated-Steel Thickness: 0.0570 inch (1.45 mm) (nominal 16 ga)
   d. Design Uncoated-Steel Thickness: 0.0730 inch (1.85 mm) (nominal 14 ga)
   e. Design Uncoated-Steel Thickness: 0.0970 inch (2.46 mm) (nominal 12 ga)
3. Finish: Provide components with protective zinc coating complying with ASTM A 653, minimum G60 coating.
4. Fastenings:
   a. Manufacturer recommended self-drilling screws with corrosion-resistant plated finish. Fasteners shall be of sufficient size and number to ensure the strength of the connection.
   b. Welding: Comply with AWS D1.1 when applicable and AWS D1.3 for welding base metals less than 1/8" thick.
   c. Other fasteners as accepted by truss engineer.

C. Fabrication

1. Factory fabricate cold-formed steel trusses plumb, square, true to line, and with connections securely fastened, according to manufacturer's recommendations and the requirements of this Section.
   a. Fabricate truss assemblies in jig templates.

b. Cut truss members by sawing or shearing or plasma cutting.

c. Fasten cold-formed steel truss members by screw fastening, or other methods as standard with fabricator.

d. Locate mechanical fasteners and install according to cold-formed steel truss component manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.

2. Care shall be taken during handling, delivery and erection. Brace, block, or reinforce truss as necessary to minimize member and connection stresses. Refer to LGSEA "Field Installation Guide".

3. Fabricate trusses to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet (1:960) and as follows:

a. Spacing: Space individual trusses no more than plus or minus 1/8 inch (3mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

b. Squareness: Fabricate each cold-formed steel truss to a maximum out-of-square tolerance of 1/8 inch (3mm).

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine structure, substrates and installation conditions. Do not proceed with cold-formed steel truss installation until unsatisfactory conditions have been corrected.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 INSTALLATION, GENERAL

A. General:

1. Erection of trusses, including proper handling, safety precautions, installation bracing and other safeguards or procedures is the responsibility of the Contractor and Contractor's installer. Refer to LGSEA "Field Installation Guide".

2. Exercise care and provide installation bracing required to prevent toppling of trusses during erection. Provide framing for lateral bracing.

B. Erect trusses with plane of truss webs vertical and parallel to each other, accurately located at design spacing indicated.

C. Provide proper lifting equipment, including spreader bar, suited to sizes and types of trusses required, applied at lift points recommended by truss fabricator. Exercise care to avoid damage to truss members during erection and to keep horizontal bending of the trusses to a minimum.

D. Provide framing anchors as indicated or accepted on the engineering design drawing or erection drawings. Anchor trusses securely at bearing points.

E. Install trusses plumb, square, true to line, and with connections securely fastened, according to manufacturer's recommendations.

1. Do not cut truss members without prior approval of truss engineer.

2. Fasten cold-formed steel trusses by screw fastening, welding or other methods, as standard with fabricator.

a. Comply with AWS requirements and procedures for welding, appearance and

F. quality of welds, and methods used in correcting welding work.

a. Locate mechanical fasteners and install according to cold-formed truss

G. manufacturer's instructions with screw penetrating joined members by not less

H. than 3 exposed screw threads.

1. Fasten cold-formed steel trusses by screw fastening, welding or other methods, as standard with fabricator.

2. Install trusses in one-piece lengths, unless splice connections are indicated.

3. Provide installation bracing and leave in place until trusses are permanently stabilized.

I. Erection Tolerances: Install trusses to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual trusses no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

2. Limit out-of-plane bow and plumb per LGSEA "Field Installation Guide".

3.03 ROOF TRUSS INSTALLATION

A. Install trusses per approved installation documents.

B. Space trusses per sealed truss drawings.

C. Do not alter, cut, or remove truss members or connections of truss members.

D. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacing indicated.

E. Erect trusses without damaging truss members or connections.

F. Anchor trusses securely at all points of support, per approved installation documents.

G. Install all continuous bridging and permanent truss bracing per approved installation.

H. Perform all truss-to-truss connections per approved installation.

3.04 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanizing repair paint according to ASTM A 780 and the manufacturer's instructions.

END OF SECTION

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SECTION 05500 - METAL FABRICATIONS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Miscellaneous metalwork:

1. Payment: Lump-sum price offered in the schedule.
2. Does not include miscellaneous concrete slabs and concrete foundations for mounting poles and electrical equipment supports. Include cost of miscellaneous concrete slabs and concrete foundations for mounting poles and electrical equipment supports in cubic yard price offered in the schedule for concrete structures. Refer to Section 03300 – Cast-In-Place Concrete.
3. Does not include safety ladders for concrete-lined canals. Refer to Section 05518 – Safety Ladders for Concrete-Lined Canals.

1.02 REFERENCES

A. American Institute of Steel Construction (AISC)

1.	AISC 316-89	Manual of Steel Construction - Allowable Stress Design - 9th Edition

B. American Society of Mechanical Engineers (ASME)

1.	ASME B18.2.1-1996(2005)	Square and Hex Bolts and Screws (Inch Series)

C. ASTM International (ASTM)

1.	ASTM A 36/A 36M-05	Carbon Structural Steel
2.	ASTM A 53/A 53M-07	Pipe, Steel, Black and Hot-dipped, Zinc-Coated Welded and Seamless
3.	ASTM A 108-07	Steel Bar, Carbon and Alloy, Cold-Finished
4.	ASTM A 123/A 123M-02	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
5.	ASTM A 153/A 153M-05	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
6.	ASTM A 193/A 193M-05	Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
7.	ASTM A 307-07b	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
8.	ASTM A 385-05	Providing High-Quality Zinc Coatings (Hot-Dip)

9.	ASTM A 500/A 500M-07	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
10.	ASTM A 501-07	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
11.	ASTM A 563-07a	Carbon and Alloy Steel Nuts
12.	ASTM A 992/A 992M-06a	Structural Steel Shapes
13.	ASTM F 436-04	Hardened Steel Washers
14.	ASTM F 844-07a	Washers, Steel, Plain (Flat), Unhardened for General Use

D. American Welding Society, Inc. (AWS)

1.	AWS D1.1/D1.1M-06	Structural Welding Code - Steel

E. Commercial Item Description (CID)

1.	CID A-A-1923A	Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)

F. International Code Council (ICC)

1.	IBC – 2006	International Building Code
2.	AC308 – 2008	Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements

G. Military Specifications (MIL)

1.	MIL-DTL-24441C/19B	Paint, Epoxy-Polyamide, Zinc Primer, Formula 159, Type III

H. National Association of Architectural Metal Mfrs. (NAAMM)

1.	NAAMM 531-00	Metal Bar Grating Manual

1.03 DEFINITIONS

A. Miscellaneous metalwork: Where either shown on the drawings or specified elsewhere in this section or these specifications, “miscellaneous metalwork” means metal fabrications as used in this section.

1.04 QUALIFICATION OF WELDERS

A. Qualify welders in accordance with AWS D1.1 using procedures, materials, and equipment of the type required for the work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect from corrosion, deformation, and other types of damage.

B. Store items in an enclosed area free from contact with soil and weather.

C. Remove and replace damaged items with new items.

1.06 PROJECT CONDITIONS

A. Metal fabrications covered by this section include:

1. Grated walkways.
2. Embedded angles.
3. Pipe guardrails.
4. Mounting poles and anchor bolts for water level sensors.
5. Electrical equipment supports.
6. Ladders.
7. Guard posts, metal frames, and grille frames for the control building.

PART 2 PRODUCTS

2.01 MATERIALS

A. Arc-Welding Electrodes:

1. Use filler metal and shielding gases suitable for base materials, positions, and other conditions.
2. Filler metal and required shielding gases or fluxes: AWS D1.1.
3. Use filler metal with a minimum tensile strength of 70,000 pounds per square inch for steel.

B. Bolts, Nuts, Washers, and Lockwashers.

1. Nuts: ASTM A 563.
2. Washers:
   a. Unhardened for general use: ASTM F 844.
3. Bolts:
   a. ASTM A 307, except anchor bolts and studbolts.
   b. Anchor bolts as shown on drawings.
   c. ASTM A 36 steel.

d. Length of bolt threads: ASME B18.2.1.

e. Thread class: 2 free-fit, American National coarse-thread series.

4. Studbolts:

a. Suitable for end welding to steel with automatically timed stud-welding equipment.

5. Anchor bolts:

a. ASTM A 36 steel, galvanized.

C. Grating: NAAMM MBG 531 galvanized steel.

1. Banding bar: Same size as bearing bars, where required.

D. Steel Pipe: ASTM A 53, type E or S, grade B.

1. Unless otherwise shown on drawings, provide standard-weight, black, steel pipe.

2. Government inspection at the mill and hydrostatic tests will not be required.

E. Structural steel:

1. Shapes except wide flange sections: ASTM A 36.

2. Wide flange sections: ASTM A 992/A 992 M.

F. Square or Rectangular Hollow Structural Shapes (HSS):

1. HSS 2 inches and larger: ASTM A 500 or A 501, Grade B.

G. Metal Safety Steps for Ladders:

1. "Tread-Grip" No. 11-gauge sheet steel ladder rungs as manufactured by Morton Manufacturing Co., PO Box 640, Libertyville IL 60048; "One Diamond Ladder Rung" as manufactured by GS Metals Corp., PO Box 7, Pinckneyville IL 62274; 1-inch-square "Mebac" solid ladder rungs as manufactured by IKG Industries, 270 Terminal Avenue, Clark NJ 07066; or equal, having the following essential characteristics:

a. Concentrated design load at center of rung: 200 pound.

b. Raised button, serrated-edge, or metal bonded encapsulated grit surface.

H. Safety Rail:

1. Design:

a. Working load: 250 pounds.

b. Permit user to ascend or descend hands free.

c. Maximum possible fall length: 6 inches.

2. Main support rail:

a. Continuous.

b. Notched.

c. Mount permanently to ladder.

d. Provide stop for rail at top.

3. Slide or safety sleeve: Equipped with locking mechanism for making connection between rail and safety belt.

4. Components: Non-corrosive, i.e. fiberglass, aluminum, or stainless steel.

I. Splice Locks:

1. Model No. 923, as manufactured by Julius Blum Co., PO Box 816, Carlstadt NJ 07072; TFCO splice lock No. SL-1 as manufactured by Thompson Fabrication Co., PO Box 170160, Birmingham AL 35217; splice locks as manufactured by Tri Tech, Inc., 5710 Harrison Avenue, Austell GA 30001; or equal, having the following essential characteristics:

a. Weldless end-to-end connection of pipe guardrail.

b. Internal expansion-type lock expanded by use of a set screw.

J. Anchors:

1. Seismic qualified per ICC IBC and ICC AC308 for seismic design category A through F and cracked concrete conditions.

a. Adhesive: HIT-RE 500-SD epoxy adhesive manufactured by HILTI, PO Box 21148, Tulsa OK 74121; or equal having the following essential characteristics:

1) Injectable two-component epoxy adhesive.

2) Dual packaging system designed for automatic mixing during injection.

3) Weathering resistant.

4) Resistant against high temperatures.

5) Suitable for use in diamond cored or pneumatic drilled holes.

6) Extended temperature range from 41 degrees F to 120 degrees F.

b. Threaded carbon steel anchor rod: HAS Super rod manufactured by HILTI, PO Box 21148, Tulsa OK 74121; or equal having the following essential characteristics:

1) Rod material: ASTM A 193, Grade B7.

2) Thread: ASME B1.1, continuously threaded (all-thread).

3) Fabricate with 45-degree chisel point on one end to facilitate insertion into adhesive-filled hole.

4) Hot-dip galvanized.

c. Standard steel nuts: ASTM F 563, Grade DH.

1) Hot-dip galvanized.

d. Standard steel washers: ASTM F 436, Type 1.

1) Hot-dip galvanized.

2. Expansion anchors: CID A-A-1923, Type 4, galvanized steel, except stainless steel anchors when submerged in water.

a. Bolt length: As shown on drawings. If not shown, provide bolt length with 3-1/2 inch minimum embedment.

3. Headed Concrete Anchors: ASTM A 108.

a. Flux-filled ends suitable for end welding to steel with automatically timed stud-welding equipment.

K. Electrical equipment supports:

1. Combination channels as manufactured by Globe Strut, United Gypsum Corp., 101 South Wacker Drive, Chicago IL 60606; Unistrut Corp, 35660 Clinton Street, Wayne MI 48184; B-Line Systems Inc., 509 West Monroe Street, Highland IL 62249; or equal, having the following items and essential characteristics:

a. Combination channels: Globe Strut No. G7612A; B-Line Systems B12A; Unistrut P5501, or equal, having the following essential characteristics:

1) No. 12 gauge steel.

2) Channel: 1-5/8-inch wide by 4-7/8-inch deep with 7/8-inch opening.

b. Connection plates: Globe Strut G2057; B-Line Systems B532; Unistrut P1726, or equal and Globe Strut G2068; B-Line Systems B568; Unistrut P1950 or equal.

c. Bolts, nuts, and washers with electro-galvanized finish.

2. Plates:

a. ASTM A 36 steel, galvanized.

3. Concrete footings:

a. In accordance with the applicable requirements of Section 03300 – Cast-In-Place Concrete.

b. Maximum size aggregate: 3/4-inch.

c. Minimum compressive strength: 2,500 pounds-per-square-inch at 28 days.

L. Guard posts:

1. Steel Pipe: ASTM A 53, type E or S, grade B.
    a. Unless otherwise shown on drawings, provide standard-weight, black, steel pipe.
    b. Government inspection at the mill and hydrostatic tests will not be required.
2. Concrete:
    a. In accordance with the applicable requirements of Section 03300 – Cast-In-Place Concrete.
    b. Maximum size aggregate: 3/4-inch.
    c. Minimum compressive strength: 2,500 pounds-per-square-inch at 28 days.
3. Painting: In accordance with Section 09902 – Coatings.

2.02 FABRICATION

A. Fabricate metalwork in accordance with AISC 316 and these specifications.

1. Perform welding and related work in accordance with AWS D1.1.
2. Grind all welds on ladders and pipe guardrails smooth.

B. If straightening is necessary, use methods that will not injure the metal.

C. After shop work completion and before galvanizing, if required, clean material of rust, loose scale, dirt, oil, grease, slag from welded areas, and other foreign substances.

D. Fabricate ladders and pipe guardrails from standard weight pipe with diameter shown on drawings.

E. Galvanizing:

1. Galvanize items of metalwork as specified or shown on drawings. Use hot-dip galvanizing, where required after fabrication, in accordance with ASTM A 123 and A 385.
2. Galvanize bolts, nuts, washers, and locknuts in accordance with ASTM A 153. Remove excess spelter by centrifugal spinning.
3. Fabricator’s Galvanizing Repair:
    a. Redip material with damaged galvanizing unless damage is local and can be repaired by zinc primer.
    b. If the galvanized coating becomes damaged after being dipped twice, material will be rejected.

c. Repair procedure where local paint repair is authorized:

1) Clean damaged areas by wiping with clean rags saturated with mineral spirits or xylene, followed by wire brushing.

2) Reclean areas with solvent to remove residue.

3) Apply two or more coats of zinc primer:

a) Total minimum dry-film thickness: 4 mils.

b) Zinc primer: MIL-DTL-24441/19.

PART 3 EXECUTION

3.01 PREPARATION

A. Where locations and dimensions of miscellaneous metalwork shown on drawings are tentative or subject to change dependent upon equipment furnished, confirm locations and dimensions prior to fabrication of miscellaneous metalwork.

3.02 INSTALLATION

A. Embedded Metalwork:

1. Accurately locate metalwork to be embedded in concrete. Hold metalwork in correct position and alignment and protect metalwork from damage and displacement during placing and setting of concrete.

2. Unless otherwise specified, use only metal braces, supports, and other items to position and align embedded metalwork, which will be embedded in concrete. Do not use wooden braces, supports, or other items to position and align embedded metalwork if they will also be embedded in concrete.

B. Anchors:

1. Drill holes for anchors straight and true and of diameter recommended by anchor manufacturer.

2. Install anchors in accordance with manufacturer's recommendations.

3. Follow manufacturer’s recommendations when embedded steel or reinforcement is encountered during drilling for anchors.

4. When drilling water is used, clean surfaces of concrete to remain exposed immediately to prevent discoloration.

5. Following drilling, clean holes with water to remove cuttings, followed by air to ensure holes are dry.

C. Galvanizing Repair:

1. Repair in accordance with Section 09902 – Coatings.

D. Grout:

1. Where shown on drawings, fill spaces under metalwork completely as required with nonshrink grout in accordance with Section 03622 - Grouting Mortar for Equipment and Metalwork.

2. Clean surfaces of metalwork to be in contact with or embedded in concrete or grouting mortar in accordance with method B of Section 09902 - Coatings.

E. Holes in Metalwork:

1. Drill, or drill and tap as required, holes in metalwork required for installation.

F. Painting:

1. Paint surfaces of miscellaneous metalwork exposed after installation; except galvanized steel; in accordance with Section 09902 - Coatings.

END OF SECTION

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SECTION 05518 - SAFETY LADDERS FOR CONCRETE-LINED CANALS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Safety Ladders for Concrete-Lined Canal:

1. Measurement: Number of safety ladders installed.
    a. Each location where a safety ladder is required will be considered one ladder, regardless of the number of sections installed.
2. Payment: Ladder price offered in the schedule.
    a. Includes installing ladders.
    b. Includes painting concrete canal lining surface at safety ladders.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM A 276-06	Stainless Steel Bars and Shapes
2.	ASTM B 211-03	Aluminum and Aluminum-Alloy Bar, Rod, and Wire

B. American Welding Society (AWS)

1.	AWS D1.2/D1.2M-06	Structural Welding Code - Aluminum
2.	AWS D1.6-07	Structural Welding Code - Stainless Steel

C. Commercial Item Description (CID)

1.	CID A-A-1923A	Shield Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)

PART 2 PRODUCTS

2.01 MATERIALS

A. Bars and shapes for ladders:

1. Stainless steel: ASTM 276, Type 304L.
2. Aluminum: ASTM B 211, Alloy 6061, T6.

B. Expansion anchors: CID A-A-1923; Type 4; stainless steel, type 304.

1. Diameter: 3/8-inch.

2. Bolt length: 3-inches.

C. PVC sleeves and washers:

1. Sleeves: 1/2-inch inside diameter, 0.06-inch wall thickness, 3/8-inch long.

2. Washers: 3/8-inch inside diameter, 1-inch outside diameter, 1/16-inch thick.

2.02 FABRICATION

A. Fabricate ladders from one of the specified materials.

B. Welding:

1. Stainless steel: AWS D1.6

2. Aluminum: AWS D1.2

PART 3 EXECUTION

3.01 INSTALLATION

A. Install safety ladders along both sides of canal as shown on drawings with the following exceptions:

1. Staggered spacing so no more than 350 feet between alternating safety ladders.

2. Install safety ladders on both sides of canal at safety cable location as shown on drawings.

B. Drill holes for anchors straight and true and of diameter recommended by anchor manufacturer.

1. Do not drill hole deeper than required for embedment.

C. Install anchors in accordance with manufacturer's recommendations.

D. If aluminum, attach safety ladders using PVC sleeves and washers to ensure electrical isolation between the ladder components and the stainless steel fasteners, and to ensure aluminum ladder components are not in contact with concrete.

E. If aluminum, verify isolation between ladder components and each stainless steel fastener using a radio frequency skin-effect instrument such as the Gas Electronics model 601 or equal.

F. Paint concrete surface at safety ladders in accordance with Section 09980 - Coatings for Concrete and Masonry.

END OF SECTION

SECTION 05612 - TRASHRACKS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Trashracks:

1. Payment: Lump sum price offered in the schedule.

1.02 REFERENCES

A. American Institute of Steel Construction (AISC)

1.	AISC S335-1989	Specifications for Structural Steel Buildings Allowable Stress Design and Plastic Design with Commentary, Part of M016 - Manual of Steel Construction Allowable Stress Design, Ninth Edition

B. ASTM International (ASTM)

1.	ASTM A 36/A 36M-05	Carbon Structural Steel
2.	ASTM A 108-07	Steel Bar, Carbon and Alloy, Cold-Finished
3.	ASTM F 593-02	Stainless Steel Bolts, Hex Cap Screws, and Studs

1.03 DELIVERY, STORAGE, AND HANDLING

A. Protect from corrosion, deformation, and other types of damage.

PART 2 PRODUCTS

2.01 MATERIALS

A. Structural Steel: ASTM A 36.

B. Headed Anchors:

1. ASTM A 108.
2. Flux-filled stud anchors suitable for end welding to steel with automatic end welding guns or equivalent manually welded anchors.

C. Epoxy/Adhesive Anchors:

1. All-thread anchor rod, nut, washer, and HVA Adhesive Anchor System as manufactured by Hilti, PO Box 21148, Tulsa OK 74121; HS-200 or WIL-Bond 200 Epoxy Paste Anchor System as manufactured by Williams Form Engineering

Corporation, PO Box 7389, Grand Rapids MI 49510; or equal, having the following salient characteristics:

1) The anchor and adhesive system shall be furnished by the same manufacturer and sold exclusively for installing metal anchors.

2) Stainless steel all-thread rod: ASTM F 593, Type 304 or 316.

3) For epoxy paste type system:

a) Epoxy paste provided in two cartridges.

b) Hand dispenser tool mixes the two components.

c) Minimum working time (gel time after installation in the hole before epoxy becomes unsuitable for installing anchor): 12 minutes at 110 degree F.

4) For capsule type adhesive system:

a) The capsule contains premeasured amounts of resin and hardener.

b) One end of the threaded rod provided with 45-degree chisel point to provide proper mixing of the adhesive components.

5) Temperature application range: 35 to 120 degrees F.

6) Minimum cured tensile strength: 4000 lbs/in^2.

2. The minimum anchor embedment to be as shown on the drawings or in accordance with the anchor manufacturer's recommendations, whichever is greater.

2.02 FABRICATION

A. Provide trashracks and embedded seat as specified below and in accordance with drawing 423-D-788.

B. Details of fabrication are per AISC-S335 for structural steel.

2.03 FINISHES

A. Coat trashracks and embedded seat in accordance with Section 09902 - Coatings.

2.04 CONTRACTOR SOURCE QUALITY TESTING

A. After fabrication, inspect the trashracks in the shop to ensure that the required dimensions and tolerances have been obtained.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the trashracks and the embedded seat in the trashrack/gate structure as shown on drawing 423-D-788.

B. The surfaces of all metalwork to be embedded in concrete shall be thoroughly cleaned of all dirt, grease, loose scale, grout, mortar, loose rust, and other foreign substances immediately before concrete is placed.

C. All embedded metalwork to be set accurately in position and supported rigidly to prevent displacement during placing of concrete.

D. Epoxy/Adhesive Anchors:

1. Drill holes in concrete for installation of anchors. Drill holes straight and true to the diameter and depth recommended by the anchor manufacturer to provide the minimum embedment shown on the drawings. If embedded steel or reinforcement is encountered during drilling, use core drilling in accordance with the anchor manufacturer's recommendations.

2. If drilling water is used, clean the exposed concrete surfaces immediately after drilling to prevent discoloration.

E. Make any required changes or adjustments to the trashracks to the satisfaction of the COR.

F. After final installation, repair any damage to coatings.

END OF SECTION

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SECTION 05635 - METAL PIPING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Metal Piping for Air Vents:

1. Payment: Lump sum price offered in the schedule.
    a. Includes air vent installations.

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME)

1.	ASME B16.5-2003	Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24
2.	ASME B16.9-2007	Factory-made Wrought Steel Buttwelding Fittings

B. ASTM International (ASTM)

1.	ASTM A 36/A 36M-05	Carbon Structural Steel
2.	ASTM A 53/A 53M-07	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
3.	ASTM A 139/A 139M-04	Electric-Fusion (Arc) - Welded Steel Pipe (Sizes 4 in. and over)
4.	ASTM A 283/A 283M-03(2007)	Low and Intermediate Tensile Strength Carbon Steel
5.	ASTM E 165-02	Liquid Penetrant Examination
6.	ASTM E 709-01	Magnetic Particle Examination

C. American Water Works Association (AWWA)

1.	AWWA C200-05	Steel Water Pipe - 6 In (150 mm) and Larger
2.	AWWA C206-03	Field Welding of Steel Water Pipe
3.	AWWA C207-07	Steel Pipe Flanges for Waterworks Service – Sizes 4 In. Through 144 In.
4.	AWWA C606-06	Grooved and Shouldered Joints

D. American Welding Society

1.	AWS D1.1/D1.1M-06	Structural Welding Code

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 05635-1, Shop Drawings:

1. As soon as practicable after date of award and before proceeding with fabrication of material, submit, for approval, the required copies of checked drawings and data.
2. Use dimensions in feet and inches.
3. Provide checked, detailed shop drawings which include all dimensions and tolerances, material data, joint details, welding requirements; and all painting, lining, and coating requirements.
4. Include an installation procedure that details the proposed method for the installation of the equipment.
5. When revised drawings and data are resubmitted, clearly identify changes from previous submittals.

C. RSN 05635-2, Drawings of Vent Tee Fittings.

1. Show fittings and fabrication details including field verified height.

D. RSN 05635-3, Final Drawings.

1. Submit as-built drawings after the equipment is fabricated and is accepted by the COR.
2. Provide detailed drawings which clearly show steel pipe sections exactly as they exist after completion, including all dimensions and tolerances, material data, joint details, painting, and welding.
3. If a section of piping has been modified in the field, resubmit a drawing of the field modified pipe section.
4. Clearly mark drawings to show all field modifications.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Transport and handle in accordance with fabricator’s instructions.

B. Prevent damage during loading, transporting, unloading, and at final storage location.

1. Provide padded bolsters curved to fit under the outside of the pipe.
2. Provide heavy padding under ties during transportation and storage.

C. Unload pipe and move to storage area as approved by the COR.

D. Do not store directly on the ground.

E. Store so that lifting straps can be passed beneath pipe sections.

F. Provide space to allow personnel to move between pipe sections.

G. Cover with tarps and tie tarps down securely.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Steel Plate: ASTM A 283, grade C or D, or ASTM A 36.

B. Standard and Schedule Steel Pipe: ASTM A 53, grade B.

C. Electric-Fusion- (Arc-) Welded, Spiral-Seam Steel Pipe: ASTM A 139, grade B or C.

D. Flanges: Slip-on ring type: AWWA C207, Class D or F as shown on the drawings.

E. Flange Gaskets: AWWA C207, flat, ring type.

F. Flange Bolts: AWWA C207.

G. Steel Fittings: ASME B16.9.

2.02 FABRICATION

A. Fabricate the metal pipe in accordance with these specifications, as indicated on drawings, and in accordance with ASTM A 53 and AWWA C200.

B. No rubber gasketed bell-and-spigot joints are allowed.

C. Longitudinal, girth, and spiral joints, other than field welds:

1. Double-welded butt joints with complete penetration.
2. Stagger longitudinal joints.
3. Longitudinal, girth, and spiral joints shall not intersect at outlet connections.

D. Cut the plates accurately to size and shape.

E. Bend or roll plates to true circular sections with curvature continuous from the edges of the plates.

F. Properly form the edges to be joined by welding to suit the type of welding and to allow complete penetration.

G. Tolerances, inside surface of the pipe:

1. Inside surface of pipe: It shall not be possible to insert at any point a feeler gauge greater than 3/8-inch thickness between a template made to the nominal curvature of the inside surface extending over an arc of 30 degrees and the inside surface of the pipe.

2. Ends of straight pipe sections shall lie in a plane normal to the longitudinal axis of the section with a maximum deviation of 1/8-inch on either side of the plane.

H. Complete all welding with a process that protects the molten metal from the atmosphere.

1. Where practicable, use automatic machines.

2. Where weld metal is deposited in successive layers, clean each layer thoroughly before the subsequent layer is deposited.

3. Take particular care in aligning and separating the edges of plates to be joined by butt welding so that complete penetration and fusion of the welds will be ensured.

4. After welding is completed, remove all weld spatter.

I. Protect the work and the operator from the wind, rain, and snow during welding operations.

1. Welding of any kind is not permitted on wet surfaces or when the temperature of the steel is lower than 0 degrees F.

2. At temperatures between 0 and 32 degrees F, heat the surface of all areas within 3 inches of the point where a weld is to be started to at least 60 degrees F.

J. Flanges and Flanged Connections:

1. During the attachment of all flanges to their associated steel piping, take adequate steps to ensure that the face of the flanges remains flat and perpendicular to the centerline of the attached piping.

2. Limit any and all irregularities or warping in the face of all flanges to 0.0015 of an inch measured from (1) a high point on the face of the flange at an inside diameter to a corresponding low point on the face of the flange at an outside diameter, along any radial line, (concave orientation of the flange is not permissible) and (2) a high point on the face of the flange along a circumferential line at the centerline of the flange bolt holes, to a low point on the face of the flange along the same circumferential line, within a distance equal to the circumferential distance between every third bolt hole.

3. Remove by machining, all initial, residual, or latent irregularities or warping that remain in the face of the flange after its attachment to the steel piping that exceeds the above.

4. After machining, the flange thickness shall not be reduced below the minimum thickness specified in AWWA C207, ASME B 16.5, or as shown on drawings.

5. Weld all pipe flanges to the piping so that the bolt holes straddle the vertical centerline when in the installed position.

K. Maintain the circularity of the pipe sections during coating, lining, transporting, and installing operations.

L. Continuously weld all joints of flange supports and pipe supports.

2.03 CONTRACTOR SOURCE QUALITY TESTING

A. Hydrostatic Pressure Testing:

1. Straight sections of pipe that will not have nozzle outlet connections and are manufactured and hydrostatically tested in accordance with ASTM A 53.

2. If a flange is attached to a piping section after the piping section has been hydrostatically tested, the piping section will not require retesting.

3. Test the flange welds by the magnetic particle or liquid penetrant method in accordance with AWS D1.1. Any defects shall be repaired, and the weld retested.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the steel piping to line and grade as shown on drawings.

B. Furnish and install supports and bracing as may be required to hold the steel piping in place and prevent distortion during erection, placing of concrete; however, the embedment of timber supports will not be permitted.

C. Contact between pipe and rebar will not be allowed.

D. Welded field joints: In accordance with AWWA C206 and this section.

E. Allowable Field Joints for the Piping:

1. Threaded couplings for pipe less than 4 inches in diameter.

2. Flanged for pipe from 4 to 27 inches in diameter, inclusive. Flanges shall be suitable for the working pressure of the adjacent pipe.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Nondestructive Testing of Field Welds:

1. Test welds in accordance with AWWA C206 and this paragraph.

2. Complete inspections and tests as work progresses in presence of a Government inspector and in accordance with AWS D1.1.

3. When welds are found to be defective by the standards of AWS, repair welds in accordance with AWS D1.1 and reexamine welds to ensure the adequacy of repairs.

4. Visual Inspection: Visually inspect all welds following procedures, techniques, and standards of AWS D1.1.

5. Testing of full penetration butt welded field joints:

   a. Ultrasonic examination of field welds shall conform to the requirements of AWS D1.1.

6. Test partial penetration joint field welds and fillet field welds by magnetic particle or dye penetrant.

   a. Technique and procedure for magnetic particle testing: ASTM E 709.

   b. Technique and procedure for dye penetrant: ASTM E 165.

   c. Standards of acceptance for both types: AWS D1.1.

3.03 PAINTING

A. Paint metal piping in accordance with Section 09902 - Coatings.

END OF SECTION

SECTION 07192 - SILANE WATER REPELLENT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM D 5095-91(2007)	Determination of the Nonvolatile Content in Silanes, Siloxanes, Silane-Siloxane Blends Used in Masonry Water Repellent Treatments

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 07192-1, Approval Data:

1. Manufacturer’s product data.

C. RSN 07192-2, Instructions and Documentation:

1. Manufacturer’s storage, surface preparation, and application instructions.
2. Evidence of applicator’s qualifications.
3. Include signed statement from water repellent manufacturer attesting to manufacturer’s approval of applicator.

1.04 QUALIFICATIONS

A. Applicator Qualifications: Experienced applicator approved by water repellent manufacturer.

1.05 FIELD SAMPLE

A. Field Sample: Apply water repellent to 2- by 2-foot area of building wall designated by the COR.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to jobsite in manufacturer's original unopened packaging with labels and seals intact.

B. Store materials in protected area in accordance with manufacturer's instructions.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not apply when air or substrate temperature is below 45 degrees F.

B. Comply with manufacturer's environmental restrictions.

PART 2 PRODUCTS

2.01 SILANE WATER REPELLENT

A. Clear water-based silane water repellent.

B. Nonvolatile Content: 98.7 percent, minimum, when tested in accordance with ASTM D 5095.

C. Deep penetrating, non-film forming solution.

D. Does not contain silicone or urethane.

PART 3 EXECUTION

3.01 PREPARATION

A. Allow masonry to cure for 30 days, minimum, before application of water repellent.

B. Prepare clean, dry substrate surface in accordance with manufacturer's instructions. Remove dirt, efflorescence, and foreign materials.

3.02 APPLICATION

A. Apply to exterior concrete masonry surfaces.

B. Mix and apply in accordance with manufacturer’s instructions.

C. Apply at coverage rate recommended by manufacturer for new masonry.

3.03 CLEANING

A. Remove drips, runs, and overspray residue by methods recommended by manufacturer.

END OF SECTION

SECTION 07213 - BATT AND BLANKET INSULATION

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM C 665-06	Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 07213-1, Approval Data:

1. Manufacturer’s product data for approval.

C. RSN 07213-2, Instructions:

1. Manufacturer’s storage and installation instructions.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Package and mark materials in accordance with ASTM C 665.

B. Deliver materials to jobsite in manufacturer’s original unopened packaging with labels intact.

C. Store materials in protected area in accordance with manufacturer’s instructions.

1.05 SEQUENCING

A. Do not install insulation until building is fully enclosed.

PART 2 PRODUCTS

2.01 INSULATION

A. Kraft-Faced Thermal Blankets:

1. ASTM C 665, Type II, Class C, Category 1, kraft-faced fiberglass blanket with facing flanges.
2. Width: Match frame spacing.

2.02 ACCESSORIES

A. Facing Repair Tape: Tape recommended by insulation manufacturer for matching insulation facing.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Place to completely fill space to be insulated.

C. Butt insulation tightly together and to intersecting surfaces.

D. Friction fit insulation between framing without edge or end gaps.

E. Place faced insulation with facing towards heated room space.

F. Place facing flanges between support framing and gypsum board.

G. Repair rips or tears in facing with tape.

H. Provide galvanized wire stringers or galvanized hexagonal mesh to support insulation in locations where additional back support is required. Securely attach to framing.

END OF SECTION

SECTION 07430 – PRE-INSULATED METAL ROOF AND WALL PANELS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM A 653/A 653M-07	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
2.	ASTM C 1363-05	Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus

B. Metal Building Manufacturers Association (MBMA)

1.	MBMA Manual-2006	Metal Building Manufacturers Association Manual

C. Underwriters Laboratories Inc. (UL)

1.	UL 580-06	Tests for Uplift Resistance of Roof Assemblies

1.03 SYSTEM DESCRIPTION

A. Wall and Roof Systems: Preformed factory-insulated metal panels and accessory components.

1.04 PERFORMANCE REQUIREMENTS

A. Roof Uplift Rating: Class 90 when tested in accordance with UL 580.

1.05 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 07430-1, Approval Drawings, Data, and Sample Kit:

1. Manufacturer’s data sheets on each product to be used, including:
    a. Complete descriptions of and specifications for roof and wall panels and materials. Including material type, metal thickness and finish.
    b. Preparation instructions and recommendations.

c. Storage and handling requirements and recommendations.

d. Installation methods.

e. Instructions for field “touch-up” of finishes.

2. Shop drawings.

a. Show roof and wall panel layout and dimensions; sections through roof and walls; gutters and downspouts; installation details; ridge, eave, corner, sill, and trim details; and type, grade, size, and thickness of materials.

b. Manufacturer’s standard or typical drawings may be included to show details. Mark standard or typical drawings to indicate relevant details.

3. Color sample kit.

a. Manufacturer’s color sample kit representing the full range of available colors and patterns for roof and wall panels.

C. RSN 07430-2, Documentation:

1. Written evidence that panel manufacturer meets the qualifications as specified in the Article Qualifications below.

2. Written evidence that panel installer meets the qualifications as specified in the Article Qualifications below.

3. Manufacturer’s warranty that meets warranty requirements as specified in the Warranty Article below.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing factory foamed-in-place insulated metal panels.

B. Installer: Company specializing in installation of the products specified for projects of similar size and scope.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver and store panels and other manufactured items in manufacturer’s unopened packaging so they will not be damaged or deformed.

B. Store products off the ground, with panels sloped for drainage and covered with opaque tarpaulins or other approved weather-resistant ventilated covering to protect factory finishes from damage. Do not store panels in contact with other materials which might cause staining.

C. Damaged materials must be reported to determine if replacement is required.

D. Inspect panels to prevent moisture between panels and secure as required.

1.08 WARRANTY

A. Manufacturer's Warranty:

1. Manufacturer's two (2) year limited warranty that panels are free from defects in materials and workmanship, beginning from date of shipment of panels.

2. Manufacturer's written five (5) year limited warranty providing panels to be free from gas blister formation of the foam core to the exterior panel facing, beginning from date of shipment of panels.

PART 2 PRODUCTS

2.01 ROOF SYSTEM

A. Metl-Span III CFR Metal Roof Panel system manufactured by Metl-Span Corporation, 1497 North Kealy, Lewisville, Texas, 75057; or equal, having the following essential characteristics:

1. Steel-faced, pre-finished factory-insulated 30-inch wide panel units.

2. Designed and manufactured to prevent through metal-to-metal contact between exterior and interior faces of installed system.

3. Exterior Face Sheet:

   a. Sheet Steel Stock: ASTM A 653, Coating Designation G90.

   b. Thickness: 24 gauge, minimum.

   c. Profile: 2-inch standing seam with Mesa pattern between seams.

   d. Finish: Manufacturer's exterior grade, factory-applied, oven-cured, 70-percent polyvinylidene-fluoride finish system.

   e. Color: To be determined by Government based on color sample kit submitted.

4. Interior Face Sheet:

   a. Sheet Steel Stock: ASTM A 653, Coating Designation G90.

   b. Thickness: 26 gauge, minimum.

   c. Profile: Mesa pattern.

   d. Finish: Manufacturer's interior grade, factory-applied, oven-cured polyester finish system.

   e. Color: White.

5. Insulation:

   a. Polyurethane insulation factory foamed between face sheets.

b. Foamed-in-place, blister free, without the use of hydrochloroflourocarbon (HCFC) blowing agents.

6. Thermal Resistance Value: R value of R-32 or greater when tested in accordance with ASTM C 1363.

2.02 WALL SYSTEM

A. Metl-Span Tuff-Wall Panel system manufactured by Metl-Span Corporation, 1497 North Kealy, Lewisville, Texas, 75057; or equal, having the following essential characteristics:

1. Steel-faced, factory-insulated, panel units.

2. Designed and manufactured to prevent through metal-to-metal contact between exterior and interior faces of installed system.

3. Exterior Face Sheet:

a. Sheet Steel Stock: ASTM A 653, Coating Designation G90.

b. Thickness: 26 gauge, minimum.

c. Profile: Off-set double tongue and groove with extended metal shelf. Non-profiled stucco embossed between joints.

d. Finish: Manufacturer's exterior grade, factory-applied, finish system with hard aggregated fiber reinforced polymer coating.

e. Color: To be determined by Government based on color sample kit submitted.

4. Interior Face Sheet:

a. Sheet Steel Stock: ASTM A 653, Coating Designation G90.

b. Thickness: 26 gauge, minimum.

c. Profile: Mesa pattern.

d. Finish: Manufacturer's interior grade, factory-applied, oven-cured polyester finish system.

e. Color: White.

5. Insulation:

a. Polyurethane insulation factory foamed between face sheets.

b. Foamed-in-place, blister free, without the use of hydrochloroflourocarbon (HCFC) blowing agents.

6. Thermal Resistance Value: R value of R-19 or greater when tested in accordance with ASTM C 1363.

2.03 ACCESSORIES

A. Metal Trim, Flashings, Closures, and Similar Items:

1. Same material, finish, and color as panel system.
2. Preformed to required profile.

B. Gutters and Downspouts:

1. Material: ASTM A 653, Coating Designation G90, or ASTM A 792, Coating Designation AZ55, coated steel sheet.
2. Thickness: 24 gauge, minimum, core steel.
3. Gutter Finish: Pre-finish to match exterior finish and color of building roof.
4. Downspout Finish: Pre-finish to match exterior finish and color of building walls.

C. Gutter Supports:

1. Material: Zinc-coated steel.
2. Type and size recommended by gutter manufacturer.
3. Pre-finish to match gutter.

D. Downspout Anchors:

1. Same material, thickness, finish, and color as downspouts.
2. Type and size recommended by building manufacturer.

E. Fasteners:

1. Manufacturer's standard fasteners.
2. Finish exposed fasteners to match building surface.

F. Loose Fill Insulation: Fiberglass insulation recommended by building manufacturer.

G. Building Sealants, Gaskets, and Sealing Materials: As furnished or recommended by building manufacturer.

H. Sealant for Gutters and Downspouts: Clear commercial elastomeric gutter sealant formulated for sealing narrow metal seams and joints.

2.04 FABRICATION

A. Panel Systems:

1. Fabricate panel units in continuous vertical lengths to match building dimensions. Horizontal laps or seams in installed roof and wall systems are not permitted.
2. Provide for thermal expansion and contraction in panel systems without causing buckling, opening of joints, or other damage.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with approved drawings, manufacturer's installation instructions, and MBMA Manual.

B. Install components in correct position and alignment.

C. Install wall system with fasteners concealed in panel seams.

D. Prevent through metal-to-metal contact between exterior and interior faces of installed roof and wall systems.

E. Install loose fill insulation in eaves, corners, and ridge of building to maintain thermal continuity in building system.

F. Gutter and Downspout Installation:

1. Join lengths with lap seams sealed watertight.
2. Slope gutters 1/16-inch per foot, minimum.
3. Connect gutters to downspouts and seal watertight.
4. Clean and prepare contact surfaces in accordance with sealant manufacturer's recommendations. Allow surfaces to dry.
5. Apply and tool sealant in accordance with manufacturer's recommendations.

G. Trim, close, and seal building weather tight.

3.02 CLEANING

A. Remove grease, finger marks, and stains in accordance with manufacturer's instructions.

3.03 REPAIR

A. Pre-finished Materials:

1. Touch-up paint minor scratches and abrasions to finish in accordance with manufacturer's instructions. Use matching paint furnished by manufacturer.
2. Replace materials with damaged finish detrimental to appearance.

END OF SECTION

SECTION 07612 - METAL SOFFIT PANELS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in the lump sum price offered in the schedule for control building.

1.02 REFERENCES

A. American Architectural Manufacturers Association (AAMA)

1.	AAMA 2604-05	High Performance Organic Coatings on Aluminum Extrusions and Panels

B. ASTM International (ASTM)

1.	ASTM B 117-07a	Operating Salt Spray (Fog) Apparatus
2.	ASTM D 522-93a(2008)	Mandrel Bend Test of Attached Organic Coatings
3.	ASTM D 523-89(1999)	Specular Gloss
4.	ASTM D 714-02	Evaluating Degree of Blistering of Paint
5.	ASTM D 968-05	Abrasion Resistance of Organic Coatings by Falling Abrasive
6.	ASTM D 1654-05	Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
7.	ASTM D 2244-07	Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
8.	ASTM D 2247-02	Testing Water Resistance of Coatings in 100% Relative Humidity
9.	ASTM D 2794-93(2004)	Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
10.	ASTM D 3363-05	Film Hardness by Pencil Test
11.	ASTM D 4214-07	Evaluating the Degree of Chalking of Exterior Paint Films

1.03 PERFORMANCE REQUIREMENTS

A. Exterior Finish Performance Requirements:

Table 07612A - Exterior Finish Performance Requirements

Test	Method	Requirements
60-degree gloss	ASTM D 523	10-35
Pencil hardness	ASTM D 3363	F-H
Adhesion – impact	ASTM D 2794	No removal
Abrasion resistance	ASTM D 968	100 liters of falling sand per mil of coating, minimum, or a minimum abrasion coefficient value of 20 per AAMA 2604
Post formability	ASTM D 522 (method B)	180 degree bend around 1/8-inch mandrel; flexible to point of metal rupture without rupture of coating
Humidity resistance	ASTM D 2247	100 percent Relative Humidity at 100 degrees F for 4000 hours of exposure; less than 5 percent of No. 8 size blisters
Salt spray resistance	ASTM B 117 ASTM D 714 ASTM D 1654	4000 hours exposure, 5 percent salt solution, 95 degrees F minimum 7 rating for scribe and edges; less than 5 percent of No. 8 size blisters
Exterior chalk resistance	ASTM D 4214	45 degrees South Florida exposure, 10 years; maximum 8 rating-colors, 6 rating-whites
Color	ASTM D 2244	45 degrees South Florida exposure, 10 years; maximum. Less than or equal to 10 percent difference in color
Acid, alkali, mortar, and detergent resistance	AAMA 2604	Minimums required by AAMA 2604

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 07612-1, Approval Drawings, Data, and Sample Kit:

1. Manufacturer's shop drawings.

a. Show soffit layout, dimensions, and spacings; flashing, closure, trim, and penetration details; and other fabrication and installation details.

2. Manufacturer's product data for panel system components, sealants, and sealing materials.

a. Include certified test data which demonstrates panel finish meets specified performance requirements.

3. Color sample kit.

a. Manufacturer's kit of finished metal chips showing complete range of available panel colors.

C. RSN 07612-2, Instructions:

1. Manufacturer's environmental, storage, handling, and installation instructions.

a. Include instructions for field touch-up of finish.

D. RSN 07612-3, Documentation:

1. Written evidence of installer's qualifications.

a. Include signed statement from manufacturer attesting to manufacturer's approval of installer.

E. RSN 07612-4, Warranties:

1. Installer's 2-year weathertightness guarantee.

2. Manufacturer's 20-year finish guarantee.

1.05 QUALIFICATIONS

A. Installer Qualifications: Experienced installer approved by system manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store and handle materials in accordance with manufacturer's instructions.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Comply with manufacturer's environmental restrictions for installation of panel system, sealants, and sealing materials.

PART 2 PRODUCTS

2.01 PANEL SYSTEM

A. PAC-850 Soffit Panel system manufactured by Petersen Aluminum Corporation, 1005 Tonne Road, Elk Grove Village IL 60007; or equal, having following essential characteristics:

1. Prefinished, preformed aluminum panels.
2. Panel width of 12 inches center-to-center of seams.
3. Hook and grab interlock design.
4. Vee groove pattern at 6 inches center-to-center.
5. Meets specified system component requirements.

B. Solid panels except where half and full vent panels are indicated on drawings. Provide manufacturer's standard perforated panels for half and fully vented panels.

C. Includes flashings, closures, trim, and accessories required for complete, weathertight installation.

2.02 PANEL SYSTEM COMPONENTS

A. Panels:

1. Sheet Metal Stock: Aluminum alloy sheet.
2. Thickness: 0.032 inch, minimum.
3. Texture: Stucco embossed.
4. Exterior Finish: Factory-applied, oven-cured, 70-percent polyvinylidene fluoride paint system on exposed surfaces with a minimum coating thickness of 0.20 mils for primer coat and 0.80 mils for topcoat.
5. Interior Finish: Manufacturer's standard factory-applied backer coating.

B. Flashings, Closures, Trim, and Similar Items: Same material, gauge, texture, finish, and color as panels.

C. Fasteners:

1. Corrosion-resistant fasteners recommended by system manufacturer for application.
2. Provide pop rivets colored to match system finish where exposed pop rivets are permitted in prefinished materials.

D. Sealants and Sealing Materials: Materials suitable for application furnished or recommended by system manufacturer.

2.03 FABRICATION

A. Fabricate in accordance with approved shop drawings.

B. Fabricate panels in continuous lengths to match soffit dimensions. Do not make horizontal laps or seams in installed system.

C. Fabricate flashings, closures, trim, and similar items in longest possible lengths.

D. Provide for thermal expansion and contraction in system.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with approved shop drawings and manufacturer's instructions.

B. Install straight and true with building lines and adjacent work.

C. Install components with concealed fastening except as permitted. Exposed pop rivets are permitted in flashings, closures, trim, and similar items.

D. Make installation weathertight.

3.02 CLEANING

A. Remove grease, finger marks, and stains in accordance with manufacturer's instructions.

3.03 REPAIR

A. Touch-up paint minor scratches and abrasions to finish in accordance with manufacturer's instructions. Use matching paint furnished by manufacturer.

B. Replace materials with damaged finish detrimental to appearance.

END OF SECTION

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SECTION 07840 - FIRESTOPPING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 REFERENCES

A. ASTM International (ASTM)

1. ASTM E 84-08 Surface Burning Characteristics of Building Materials
2. ASTM E 814-06 Fire Tests of Through-Penetration Fire Stops

B. Factory Mutual Global (FM)

1. FM P7825-2002 Approval Guide

C. Underwriters Laboratories Inc. (UL)

1. UL FRD-06 Fire Resistance Directory
2. UL 723-03 Surface Burning Characteristics of Building Materials
3. UL 1479-03 Fire Tests of Through-Penetration Firestops

1.03 PERFORMANCE CRITERIA

A. Fire Resistance Criteria:

1. Provide firestopping systems or designs listed in UL FRD or approved by FM P7825 for use with required fire-rated assembly design and type of penetration.
2. Provide systems or designs with "F" and "T" ratings equal to or better than fire resistance rating of penetrated assembly when tested in accordance with UL 1479 or ASTM E 814.

B. Fire Hazard Criteria:

1. Provide materials with flame spread rating of 25 or less, smoke development rating of 50 or less, and fuel contribution of 50 or less when tested in accordance with UL 723 or ASTM E 84.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300 - Submittals.

B. RSN 07840-1, Approval Data:

1. Firestopping schedule which lists fire-rated assemblies, penetrations, and firestopping system or design to be used for each type of penetration and joint.
2. Manufacturer's drawings for each firestopping system or design.
    a. Show construction compliance with UL FRD or FM P7825.
    b. Reference UL system or FM design number.
3. Manufacturer's product data for each material.
    a. Include evidence of UL classification or FM approval for systems or designs to be used.
    b. Include evidence of compliance with specified fire hazard criteria.

C. RSN 07840-2, Instructions:

1. Manufacturer's storage, surface preparation, and installation instructions for each firestopping material.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to jobsite in manufacturer's original unopened packaging with labels and seals intact.

B. Store materials in protected area in accordance with manufacturer's instructions.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Comply with manufacturer's environmental restrictions.

PART 2 PRODUCTS

2.01 FIRESTOPPING MATERIALS

A. Provide materials having following characteristics:

1. Capable of maintaining an effective barrier against flame, smoke, gases, and temperature rise during required fire resistance period.
2. In compliance with UL FRD or FM P7825.
3. Do not contain asbestos.
4. Do not emit toxic gases during installation or fire conditions.

2.02 ACCESSORIES

A. Materials furnished or recommended by firestopping manufacturer.

PART 3 EXECUTION

3.01 LOCATIONS

A. Provide firestopping at following locations:

1. Penetrations through fire-rated wall assemblies by pipes, ducts, cables, conduit, and other systems.

2. Joints at intersection of fire-rated wall assemblies and roof, walls, and floor.

3.02 PREPARATION

A. Prepare clean, dry contact surfaces in accordance with manufacturer's instructions.

B. Remove dirt, petroleum products, rust, corrosion, and loose materials.

C. Remove other substances which could affect proper installation or adhesion of materials or could affect required fire resistance.

3.03 INSTALLATION

A. Install in accordance with approved system or design and manufacturer's instructions.

3.04 CONTRACTOR FIELD QUALITY TESTING

A. After completion of firestopping, perform mutual inspection of firestopping installations with COR.

B. Correct defects identified by inspection.

3.05 CLEANING

A. Remove excess materials protruding from penetrations.

B. Remove excess materials from adjacent surfaces by methods recommended by manufacturer.

END OF SECTION

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SECTION 07920 - JOINT SEALANTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for items of work requiring joint sealants.

1.02 REFERENCES

A. ASTM International (ASTM)

1. ASTM C 920-05 Elastomeric Joint Sealants

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 07920-1, Approval Data:

1. Manufacturer's product data for each sealant and backing material.

C. RSN 07920-2, Color Sample Kit:

1. Manufacturer's color sample kit.

D. RSN 07920-3, Certification and Instructions:

1. Manufacturer's certification that sealant meets specified requirements.
2. Manufacturer's environmental, storage, surface preparation, mixing, installation, and cleanup instructions for each sealant and primer material.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to jobsite in manufacturer's original unopened packaging with labels and seals intact.

B. Store materials in accordance with manufacturer's instructions.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not install sealant when ambient air temperature is below 40 degrees Fahrenheit or above 90 degrees Fahrenheit.

B. Comply with sealant manufacturer's environmental restrictions.

PART 2 PRODUCTS

2.01 SEALANTS

A. Two component products:

1. Sikaflex 2c NS EZ Mix, available from Sika Corporation, at www.sikaconstruction.com
2. Sonolastic NP2, available from BASF Chemical Company, at www.basf-ugc.com.
3. Dynatrol II, available from Pecora Corporation at 800-523-6688.
4. Essential Characteristics:
   a. Conforms to ASTM C 920, Type M, Grade NS, Class 25, Use M.
   b. Two-part, non-sag, polyurethane elastomeric sealant.
   c. Concrete gray in color; add color pack if needed.

B. Type B – Silicone Sealant:

1. ASTM C 920, Type S, Grade NS, Class 50, A.
2. Silicone rubber base sealing compound.
3. Use for control building only.

2.02 ACCESSORIES

A. Primers: As recommended by sealant manufacturer for joint surface materials.

B. Joint Cleaners: Noncorrosive and nonstaining products recommended by sealant manufacturer for application.

C. Joint Backing:

1. Closed-cell round polyethylene foam rod compatible with sealant.
2. Recommended by sealant manufacturer for application.

PART 3 EXECUTION

3.01 PREPARATION

A. Allow concrete and masonry to cure for twenty-eight (28) days, minimum, before installation of sealant against these materials.

B. Preparation of Joint Surfaces:

1. Clean and prepare joint in accordance with sealant manufacturer’s instructions.

2. Remove mortar, laitance, dust, coatings, curing compounds, petroleum products, corrosion, and other foreign material.
3. Allow joint to dry.
4. Prime joint surfaces as recommended by sealant manufacturer for joint materials.

C. Backing Installation:

1. Install backing materials in accordance with sealant manufacturer's instructions.
2. Use backing material to achieve required sealant depth.
3. Use backing rod with diameter 25 percent greater than joint width.

D. Obtain approval of joint preparation and backing installation from COR before installation of sealant in joint.

3.02 INSTALLATION

A. Mix and install in accordance with manufacturer's instructions.

B. Place sealant to depth specified in Table 07920A - Depth of Sealant in Joints.

Table 07920A - Depth of Sealant in Joints

Type of Joint	Joint Width	Sealant Depth
Joints in porous materials (concrete masonry, stone, etc.) and between porous materials and nonporous materials	1/4 to 3/8 inch	Equal to joint width
	3/8 to 3/4 inch	3/8 inch
	¾ inch or greater	1/2 inch
Other joints	All widths	50 percent of joint width or 1/4 inch, whichever is greater, not to exceed 1/2 inch.

C. Place and tool to smooth joints free of air pockets, embedded foreign material, ridges, and sags.

3.03 REPAIR

A. Remove defective or contaminated sealant. Reclean joint and replace sealant.

3.04 CLEANING

A. Remove excess sealant and soiling from adjacent surfaces.

END OF SECTION

SECTION 08115 - BULLET-RESISTANT STEEL DOORS AND FRAMES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 REFERENCES

A. Underwriters Laboratories Inc. (UL)

1. UL 752-05 Bullet-Resisting Equipment, Tenth Edition

1.03 PERFORMANCE REQUIREMENTS

A. Bullet-Resisting Rating: Provide door and frame assemblies capable of resisting Level 2 ballistics test when tested in accordance with UL 752.

1.04 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals.

B. RSN 08115-1, Approval Drawings and Data:

1. Shop drawings for approval.
    a. Show dimensions, material gauges, reinforcements, hardware preparation and locations, anchorage details, frame grouting access, door swing, and other fabrication and installation details.
2. Manufacturer's product data for approval.
    a. Include complete descriptions and specifications for materials, construction, finish, door hardware, lock cylinders, weatherstripping, and thresholds.

C. RSN 08115-2, Instructions:

1. Manufacturer's storage, handling, and installation instructions for doors and frames.
2. Manufacturer's installation instructions for door hardware, weatherstripping, and thresholds.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store and handle at jobsite in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 DOORS AND FRAMES

A. DR Door/Frame assembly, UL Level 2, manufactured by Chicago Bullet Proof Systems, 12 E. Old Mill Lane, Burr Ridge IL 60527; or equal, having following essential characteristics:

1. 1-3/4-inch-thick steel door.
2. Steel frame.
3. Welded door and frame construction with corners mitered, welded, and ground smooth.
4. Each door shall bear UL label.

B. Provide door and frame assemblies listed and labeled by UL for specified bullet-resisting rating. Label assembly with permanent UL label attesting to required rating.

2.02 ACCESSORIES

A. Frame Anchors: Masonry “Tee” anchors with zinc-coated finish.

2.03 DOOR HARDWARE

A. In accordance with Section 08710 – Door Hardware.

2.04 LOCK CYLINDERS AND KEYING

A. Refer to Section 08710 – Door Hardware.

2.05 FABRICATION

A. Fabricate in accordance with approved shop drawings.

B. Grind exposed welds smooth.

C. Fill doors with fiberglass batt insulation.

D. Factory mortise, reinforce, drill, and tap for lockset.

E. Use hardware manufacturer's templates for hardware preparation.

F. Provide single grouting access opening in frames.

1. Center opening in inside face of head.
2. Provide flush-mounted plate cover attached with countersunk flathead screws to cover opening.

G. Omit silencer holes in frames.

2.06 FINISH

A. Clean, degrease, and factory paint with rust-inhibiting primer. Use lead- and chromate-free priming paint compatible with finish paint to be field applied.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with approved shop drawings and manufacturer's instructions.

B. Install plumb, level, and in alignment with adjacent work.

C. Fill frames with grouting mortar in accordance with Section 03622 - Grouting Mortar for Equipment and Metalwork.

D. Rake joint between frame and concrete to minimum depth of 1/4 inch and caulk joint with non-sag polyurethane elastomeric sealant in accordance with Section 07920 - Joint Sealants.

E. Install surface-mounted hardware after doors and frames have been painted.

F. Use manufacturer's templates for field mounting of hardware.

G. Fit threshold to doorframe, set in full bed of grouting mortar.

H. Attach door frame to masonry wall with masonry “Tee” anchors.

I. After doors and frames have been painted, install weatherstripping at head and jambs.

1. Install in full-length pieces without joints.
2. Butt corners tight.
3. Provide positive door seal.

J. Test and adjust door operation for proper operation.

3.02 PAINTING

A. Paint installed doors and frames in accordance with Section 09902 - Coatings.

END OF SECTION

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SECTION 08710 - DOOR HARDWARE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 REFERENCES

A. Builder Hardware Manufacturers Association (BHMA)

1.	BHMA A156.4-2000	Door Controls - Closers
2.	BHMA A156.13-2005	Mortise Locks and Latches
3.	BHMA A156.16-2002	Auxiliary Hardware
4.	BHMA A156.22-2005	Door Gasketing Systems

B. Underwriters Laboratories (UL)

1.	UL 10C-98	Positive Pressure Fire Test of Door Assemblies
2.	UL 752-05	Bullet-Resisting Equipment

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 08710-1, Hardware schedule.

1. Include complete hardware group, door, handing, hardware, accessories, and finish identification.
2. Use Government designations to identify doors and hardware groups.

C. RSN 08710-2, Approval Data:

1. Manufacturer’s product data.

D. RSN 08710-3, Instructions:

1. Manufacturer’s installation instructions.

1.04 SEQUENCING

A. Do not install surface-mounted hardware, gasketing systems, or weather-stripping on steel doors and frames until doors and frames have been painted.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Label each hardware container with item number in approved hardware schedule.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide matching products from single manufacturer for each type of hardware.

B. Provide manufacturers' templates for door and frame preparation.

2.02 HINGES

A. Bullet-Resistant Continuous Piano-Type Hinges: UL752, Level 2, stainless steel, satin finish, factory drilled and tapped.

2.03 BULLET-RESISTIVE LOCKSETS AND LATCHES

A. Type, Series, and Grade: ANSI A156.13, Series 1000, Grade 1, mortise locksets and latches.

B. ANSI Dormitory lock function.

C. Front: Armored.

D. Latch Bolt: 3/4-inch-throw, anti-friction, deadlocking stainless steel latchbolt.

E. Deadbolt: 1-inch-throw, solid stainless steel deadbolt with two enclosed hardened steel roller pins.

F. Trim Installation: Self-aligning installation secured with thru-bolts from inside trim.

G. Trim:

1. Round rose and lever handle with end return on inside and outside.
2. US32D Finish.

2.04 DOOR CLOSERS

A. Heavy-Duty Closers: Yale 440 heavy duty manufactured by Yale Commercial Locks and Hardware, 1902 Airport Road, Monroe, NC 28110; or equal having the following salient characteristics:

1. ANSI A156.4, Grade 1 UL10C compliant.
2. Surface mounted, non-handed arm, full rack-and-pinion type.
3. 1-1/2-inch diameter piston, staked valves, cast aluminum alloy shell.

4. Separate and independent, latch, sweep and backcheck intensity valves.

2.05 FLUSH BOLTS

A. Lever Extension Flush Bolts:

1. ANSI A156.16, L14081, with flat front and 12-inch length rod.

2.06 AUXILIARY HARDWARE

A. Kick Down Holders: ANSI A156.16, L51391, stainless steel holder with 3-inch or less floor clearance.

B. Astragal: ANSI A156.16, ROY636, heavy duty, full length.

2.07 GASKETING SYSTEMS

A. Door Shoes with Drip Cap: 216DV Door shoe manufactured by Pemko Manufacturing Co., PO Box 3780, Venture CA 93006; or equal, having the following salient characteristics:

1. ANSI A156.22, R3D535.
2. One-piece, channel-type, extruded aluminum housing with integral rain drip.
3. One-piece, removable, fingered vinyl insert seal.
4. 1-3/4-inch, width.
5. 1/2-inch seal height.

2.08 WEATHER-STRIPPING AND THRESHOLDS

A. Weather-stripping: S88D Silicon seal manufactured by Pemko Manufacturing Co., PO Box 3780, Venture CA 93006; or equal, having the following essential characteristics:

1. Compression bulb-type weather-stripping.
2. Silicone-rubber material.
3. Self-adhesive backing.

B. Thresholds: Pemko – 271D Saddle threshold manufactured by Pemko Manufacturing Co., PO Box 3780, Venture CA 93006; or equal, having the following essential characteristics:

1. Extruded aluminum threshold with fluted top.
2. 1/4-inch height.
3. 5-inch width.
4. Mill finish.

C. Threshold Fasteners: Machine screws and expansion anchors furnished by threshold manufacturer.

2.09 ACCESSORIES

A. Strikes and Accessories: Provide matching strikes and accessories required for installation or operation of hardware.

B. Fasteners: Matching fasteners suitable for application furnished by product manufacturer.

2.10 LOCK CYLINDERS AND KEYING

A. Furnish locks with seven-pin, interchangeable-core, lock cylinders.

1. Furnish lock cylinders with temporary construction core system which can be voided after contract completion.

2. Key locks alike.

B. Government will furnish permanent core system after contract completion.

C. Stamp construction keys with "U.S. Property - Do Not Duplicate" and appropriate key numbers.

D. Furnish a total of six construction keys to COR for Government’s use during construction.

E. Deliver all construction keys to COR at jobsite after completion of work when directed by COR.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Mount hardware in accordance with approved shop drawings for doors and frames.

C. Use manufacturer’s templates for field mounting of hardware.

D. Closers: Adjust for door size, weight, and jobsite conditions in accordance with manufacturer’s recommendations.

E. Thresholds: Fit threshold to doorframe, set in full bed of grouting mortar, and attach to concrete with machine screws in expansion anchors.

F. Gasketing and Weather-stripping:

1. Apply in continuous lengths without joints.
2. Butt corners tight.
3. Provide effective door seal.

G. Test door operation and correct defects in operation.

3.02 HARDWARE SCHEDULE

Table 08710A - Door Hardware Schedule

Hardware Group No.	Door Numbers	Required Hardware for Each Door
1	100 & 101	Bullet-resisting continuous piano-type hinges - US32D finish. Mortise lockset, F13 dormitory, US32D finish. Heavy-duty closer with non hold-open regular arm – sprayed aluminum finish. Saddle threshold. Weather-stripping - Install at head and jambs. Door shoe with drip cap - mill finish.
2	102	Bullet-resisting continuous piano-type hinges - US32D finish. Mortise lockset, F13 dormitory, US32D finish. Heavy-duty closer with non hold-open regular arm – sprayed aluminum finish, active leaf only. Lever extension flush bolts - pair for top and bottom of inactive leaf - provide with standard top strike and suitable dustproof bottom strike - US32D finish. Astragal - heavy duty, full length, active leaf only. Kick down door holder - each leaf - US32D finish. Door shoe with drip cap - each leaf - mill finish. Saddle threshold - mill finish. Weather-stripping - Install at head and jambs.

END OF SECTION

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SECTION 09260 - GYPSUM BOARD WALL ASSEMBLY

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.
    a. Includes cost of constructing fire rated wall assemblies in accordance with this Section.
    b. Includes cost of firestopping floor/wall, wall/wall, and head of wall joints.
    c. Firestopping around wall penetrations.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM C 475/C 475M-02(2007)	Joint Compound and Joint Tape for Finishing Gypsum Board
2.	ASTM C 645-08	Nonstructural Steel Framing Members
3.	ASTM C 1002-07	Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
4.	ASTM C 1396/C 1396M-06a	Gypsum Board

B. Gypsum Association (GA)

1.	GA-214-07	Levels of Gypsum Board Finish
2.	GA-216-07	Application and Finishing of Gypsum Panel Products

C. Underwriters Laboratories (UL)

1.	UL 263-05	Fire Resistance Ratings

D. Maintain copies of ASTM C 475, GA-214, and GA-216 at jobsite during work.

1.03 SUBMITTALS

A. Submit in accordance with Section 01330 – Submittals.

B. RSN 09260-1, Approval Data:

1. Product data for gypsum boards, studs, runners, screws.

2. Certification that system will be constructed in conformance with specified UL Design Number U411.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials in accordance with GA-216 and manufacturer's recommendations.

1.05 SEQUENCING

A. Do not install board materials until work to be concealed by board has been completed.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Maintain environmental conditions in accordance with GA-216.

PART 2 PRODUCTS

2.01 FRAMING

A. Studs and Runners: ASTM C 645, zinc-coated steel, sizes and gauges indicated on drawings.

B. Screws and Fasteners: Corrosion-resistant screws and fasteners recommended by framing manufacturer.

C. Powder-Actuated Fasteners:

1. Low-velocity, powder-actuated fasteners with zinc-plated finish.
2. Type and size suitable for required construction.

2.02 GYPSUM BOARD MATERIALS

A. ASTM C 1396, Type X, with tapered edges, plain face, and plain back, bearing UL classification mark.

B. Thickness: As indicated on Drawings.

2.03 ACCESSORIES

A. Drywall Screws:

1. Type S: ASTM C 1002, Type S.
   a. Length: In accordance with UL 263 (UL Design No. U411).

B. Joint Compound:

1. ASTM C 475, vinyl or case in, dry or premixed.
2. Materials recommended by gypsum board manufacturer for application and jobsite conditions.

C. Joint Tape:

1. ASTM C 475, paper, 2 inches wide nominal.
2. Materials recommended by gypsum board manufacturer for application and jobsite conditions.

PART 3 EXECUTION

3.01 LOCATION

A. Construct Control Building fire rated wall assemblies as indicated on drawings.

3.02 INSTALLATION

A. Fasten studs to top and bottom runners by screwing both flanges to the runner.

B. Gypsum Board:

1. Install and finish in accordance with UL 263 (UL Design No. U411) and GA-216.
2. Offset vertical joints in adjacent layers one stud cavity.
3. Offset horizontal joints in adjacent layers.
4. Tape joints of outer layer.
5. Finish surfaces with GA-214 Level 4 finish.

3.03 FIRESTOPPING

A. Firestop wall and ceiling penetrations, wall/floor joints, wall/wall joints, and head of wall joints

B. Firestop in accordance with Section 07840 – Firestopping.

3.04 PAINTING

A. Paint in accordance with Section 09980 – Coatings for Concrete and Masonry.

END OF SECTION

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SECTION 09902 - COATINGS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include cost in prices offered schedule for items of work requiring coatings.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM A 780-01(2006)	Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
2.	ASTM B117-07a	Operating Salt Spray (Fog) Apparatus
3.	ASTM D 522-93a(2001)	Mandrel Bend Test of Attached Organic Coatings
4.	ASTM D 870-02	Testing Water Resistance of Coatings Using Water Immersion
5.	ASTM D 1141-99(2003)	Preparation of Substitute Ocean Water
6.	ASTM D-2240-05	Rubber Property – Durometer Hardness
7.	ASTM D 2244-07	Calculation of Color Differences From Instrumentally Measured Color Coordinates
8.	ASTM D 3359-08	Measuring Adhesion by Tape Test
9.	ASTM D 3363-05	Film Hardness by Pencil Test
10.	ASTM D 4060-07	Abrasion Resistance of Organic Coatings by the Taber Abraser
11.	ASTM D 4214-07	Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
12.	ASTM D 4285-83(2006)	Indicating Oil or Water in Compressed Air
13.	ASTM D 4541-02	Pull-Off Strength of Coatings Using Portable Adhesion Testers
14.	ASTM D 4587-05	Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light- and Water-Exposure Apparatus
15.	ASTM G 8-96(2003)	Cathodic Disbonding of Pipeline Coatings

16.	ASTM G 154-06	Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

B. American Water Works Association (AWWA)

1.	AWWA C 203-02	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines, Enamel and Tape, Hot-Applied
2.	AWWA C 222-99	Polyurethane Coatings for the Interior and Exterior of Steel Pipe and Fittings

C. National Association of Pipe Fabricators (NAPF)

1.	NAPF 500-03-05-06	Abrasive Blast Cleaning of Cast Ductile Iron Fittings

D. The Society for Protective Coatings (SSPC)/NACE International (NACE)

1.	SSPC-AB1-04	Mineral and Slag Abrasives
2.	SSPC-AB2-04	Cleanliness of Recycled Ferrous Metallic Abrasives
3.	SSPC-AB3-04	Newly Manufactured or Re-Manufactured Steel Abrasives
4.	SSPC-PA2-04	Measurement of Dry Paint Thickness with Magnetic Gages
5.	SSPC-QP1-04	Evaluating Painting Contractors (Field Application to Complex Industrial Structures)
6.	SSPC-QP3-04	Evaluating the Qualifications of Shop Painting Contractors
7.	SSPC-SP1-04	Solvent Cleaning
8.	SSPC-SP3-04	Power Tool Cleaning
9.	SSPC-SP11-04	Power Tool Cleaning to Bare Metal
10.	SSPC-SP6/NACE 3-04	Commercial Blast Cleaning
11.	SSPC-SP7/NACE 4-04	Brush-Off Blast Cleaning
12.	SSPC-SP10/NACE 2-04	Near-White Blast Cleaning
13.	SSPC-VIS1-02	Guide and Reference Photographs for Steel Surfaces Prepared by Abrasive Blast Cleaning
14.	SSPC-VIS3-04	Visual Standard for Power- and Hand-Tool Cleaned Steel
15.	NACE SP 0188-06	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

16.	NACE RP 0287-02	Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape
17.	NACE TM 0174-02	Laboratory Methods for the Evaluation of Protective Coatings and Lining Materials on Metallic Substrates in Immersion Service

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

1. Include following information with each set of data or certification:

a. Applicable tabulation number from Coating Tabulations.

b. Identification of “Items to be coated” including sub-letter and sub-number listed in Coating Tabulations.

B. RSN 09902-1, Approval Data:

1. For each coating material:

a. Manufacturer’s product data and application sheets.

b. Purchase orders. Include:

1) Supplier’s name, address, and phone number.

2) Purchase order number and date.

3) Manufacturer’s designated product name.

4) Batch number(s) for each material, except thinners.

5) Quantities ordered for each material, except thinners.

C. RSN 09902-2, Documentation:

1. Written evidence of applicator’s qualifications.

D. RSN 09902-3, Certifications:

1. Current SSPC-QP1 certification for field application to complex industrial structures.

2. Current SSPC-QP3 certification for shop application.

E. RSN 09902-4, Contractor quality testing data

1. Date of work

2. Description of areas and work performed

3. Surface preparation

4. Surface cleanliness

5. Ambient conditions

6. Dry film thickness

F. "Equal" Products:

1. For coating materials proposed as "equal" products to specified brand name products in Coating Categories, submit following with specified approval data:

a. List of projects (not less than three) where material has been successfully used in applications similar to this project. Include:

1) Project name and location.

2) Type of structure and service environment.

3) Owner's name, address, and telephone number.

4) Application dates.

b. Manufacturer's certification substitute coating material meets specified requirements. Include:

1) Manufacturer's name, address, and phone number.

2) Batch number(s) for each material, except thinners.

3) Signature of manufacturer's technical representative and date of signature.

c. Certified test reports that demonstrates substitute material meets or exceeds specified coating category requirements for physical and performance characteristics from each of following:

1) Coating manufacturer.

2) Independent laboratory.

1.04 QUALIFICATIONS

A. Coating Applicators Qualifications:

1. Qualified to apply specified coating materials by one of following:

a. Successfully completed training in use of coating material on applications similar to those specified in these specifications. List as a minimum, three completed projects using specified materials.

b. Skilled and experienced in application of coating materials similar to materials specified in these specifications under conditions similar to conditions of this project. List as a minimum, three completed projects using specified materials.

B. Compliance Criteria for Coating Materials:

1. Material is of same composition and formulation to meet physical and performance test results for one of following:
    a. Submitted batch or previously tested batch materials complies with these specifications.
    b. Submitted batch materials are unchanged from previously tested batch materials that comply with manufacturer's quality control (QC) and quality assurance (QA) programs.
    c. Submitted batch materials complies with manufacturer's quality control (QC) and quality assurance (QA) programs as listed on product data and application sheets.

1.05 DELIVERY, STORAGE, HANDLING

A. Deliver materials to jobsite in original, undamaged, unopened containers labeled with manufacturer's name, designated product name, batch number, date of manufacture, and any special instructions.

B. Deliver materials in containers not larger than 5 gallons as packaged by manufacturer unless suitable equipment is provided at jobsite to handle and thoroughly mix materials in larger containers.

C. Store materials in well ventilated area.

D. Do not expose to direct sunlight during storage.

E. Comply with manufacturer's storage instructions.

F. Do not use coating material which has exceeded manufacturer's specified storage stability period (shelf life).

1.06 ENVIRONMENTAL REQUIREMENTS

A. Comply with coating manufacturer's environmental restrictions. Comply with most restrictive requirements of coating manufacturer's restrictions and these specifications when coating manufacturer's restrictions conflict with these specifications.

B. Do not apply coatings under following environmental conditions:
    1. Substrate surface temperature less than 5 degrees Fahrenheit above dewpoint.
    2. Air and substrate surface temperature less than 50 degrees Fahrenheit and not to exceed manufacturer's recommended maximum temperature limit.
    3. Humidity outside of manufacturer's recommended range.

C. Do not perform surface preparation or apply coatings when environmental conditions are not expected to meet specified requirements during surface preparation, coating application, and curing period.

D. Maintain environmental temperature and humidity conditions to meet specified requirements during, surface preparation, coating application, and curing period by use of indirect fired heater and dehumidification equipment.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. Materials required by these specifications and not listed in Coating Categories are subject to certification and testing in accordance with this section.
2. Provide compatible products of same manufacturer for coating system components.

B. Abrasives:

1. Mineral and slag abrasives: Meets SSPC-AB1 for type I (natural minerals) and type II (slags), class A, except following are not permitted:
   a. Flint minerals.
   b. Nickel slags.
2. Mineral abrasives: Meets SSPC-AB1 for type I, natural minerals, class A, except flint minerals are not permitted.
3. Ferrous metallic abrasives: Meets following requirements:
   a. SSPC-AB2 for recycled cleanliness.
   b. SSPC-AB3 class I (steel) or II (iron) for angular shaped grit.
4. Do not exceed toxicity threshold limit for hazardous materials.

C. Coatings:

1. Specified in Coating Categories.
2. Apply only one coating category per option in Coating Tabulations.
3. Volatile organic compounds (VOC):
   a. Do not exceed maximum permitted by Federal, State, and local air pollution control regulations.
   b. Do not exceed maximum permitted content as supplied in container or by addition of thinner material.

4. Factory color or tint. Do not color or tint at jobsite.
5. Use thinners recommended by manufacturer for each coating material.
6. Following chemical products are not permitted unless approved by Contracting Officer:
    a. Accelerators.
    b. Corrosion inhibitors.

PART 3 EXECUTION

3.01 PROTECTION OF ADJACENT SURFACES, EQUIPMENT AND NEWLY COATED SURFACES

A. Protect items or surfaces not to be coated and adjacent to surfaces to be cleaned and coated from contamination and damage during cleaning and coating operations.
    1. Includes surfaces and equipment in physical contact with areas being cleaned or coated. Examples include: mechanical and electrical equipment (open or enclosed); instruction and similar plates; and wet and newly coated surfaces.
    2. Protect from abrasive blast particles and airborne coating particles.

B. Do not move newly coated items until coating is thoroughly dry as determined by one of following:
    1. Coating manufacturer’s instructions for handling.
    2. Coating film cannot be distorted or removed by exerting substantial, but less than maximum, pressure with thumb and turning thumb through 90 degrees in plane of film.

3.02 REPAIR OF CONTRACTOR-DAMAGED SURFACES

A. Repair items, equipment, or surfaces which are damaged or contaminated as determined by Contracting Officer.
    1. Repair damaged items or restore manufacturer-coated equipment to original condition and appearance.
    2. Before coating any damaged coated surfaces, re-clean exposed surface and apply coating materials in accordance with these specifications.

3.03 COATING OF METALWORK EMBEDDED IN CONCRETE

A. Extend primer coat 6 inches, minimum, into concrete embedment measured from face of concrete and along surface of embedded. Examples include: concrete vaults, floors, and walls.

B. Extend primer coat continuously through solid concrete structure with burial or immersion service exposure on either side of concrete faces. Examples include: thrust or anchor blocks.

3.04 SURFACE PREPARATION

A. Remove or repair weld spatter, slag burrs, porosity, sharp edges, pits, laminations, crevices, or other objectionable surface irregularities before specific surface preparation.

B. Specific Surface Preparation:

1. See Coating Tabulations.
    a. Method A: SSPC-SP1.
    b. Method B (steel): SSPC-SP6/NACE 3.
    c. Method B-1 (steel): Repair of defective or damaged coated areas.
        1) To metal substrate:
            a) SSPC-SP6/NACE 3.
            b) SSPC-SP11 where abrasive blasting is impractical.
        2) To prime or intermediate coat:
            a) Method A.
            b) Feather abrupt edges and around repair area by hand or power tool with non-woven pad.
            c) Roughen or abraded surface in accordance with manufacturer’s recommendations.
            d) Achieve matted or lusterless finish.
    d. Method C (steel): SSPC-SP10/NACE 2.
    e. Method C-1 (steel): Repair of defective or damaged coated areas.
        1) To metal substrate:
            a) SSPC-SP10/NACE 2.
            b) SSPC-SP11 where abrasive blasting is impractical.
        2) To prime or intermediate coat:
            a) Method A.
            b) Feather abrupt edges and around repair area by hand or power tool with non-woven pad.
            c) Roughen or abraded surface in accordance with manufacturer’s recommendations.
            d) Achieve matted or lusterless finish.

f. Method F (cast iron): NAPF 500-03-05, Blast Clean No. 4.

g. Method I (galvanized): Repair of defective or damaged galvanized surface. Use following:

1) To steel substrate:

a) SSPC-SP7/NACE 4.

b) SSPC-SP3, where abrasive blast cleaning is impractical.

2) Galvanized surface:

a) Method A and treat with conditioner specific for galvanized substrate in accordance with manufacturer's instructions. Rinse surface with potable water.

b) Sweep blast.

C. Surface Profile:

1. Prepare in accordance with manufacturer's instructions for metallic or existing coating surfaces and service environment, unless specified in Coating Tabulations.

2. Where manufacturer's instruction do not specify a surface profile, prepare blasted surfaces to following profile:

a. Atmospheric service environments: 1 mil or greater angular profile and less than specified dry film thickness of first applied coat.

b. Burial and immersion service environments: Angular profile between 2 and 3-mils minimum and less than specified dry film thickness of first applied coat.

3. Perform tests in accordance with surface profile inspection procedures specified.

D. Re-clean or perform additional surface preparation of completed metallic or coated surfaces that become contaminated before coating application.

E. Prepare surface free of moisture, frost, and ice. Heat substrate surface which is not thoroughly dry to remove moisture before coating application.

3.05 APPLICATION EQUIPMENT

A. Air Compressor and Spray Application Equipment:

1. Provide appropriate type equipment, adequately sized, and in proper operating order.

2. Equip with pressure gauges and pressure regulators.

3. Equip with air supply lines free from oil and moisture. Keep lines free of oil and moisture during work.

4. Perform tests in accordance with oil and moisture inspection procedures specified.

3.06 COATING APPLICATION

A. Apply in accordance with manufacturer's instructions.

B. Apply coatings so that surfaces exposed to public view display a uniform texture and color matched appearance.

C. Apply an even film of uniform thickness which tightly bonds to substrate or previous coat.

1. Fill crevices and cover irregularities.

2. Apply free of runs, pinholes, sags, laps, brush marks, voids, and other defects.

D. Primer Coats:

1. Cover peaks of surface profile by specified dry film thickness.

2. Apply stripe coats to edges, boltheads, welds seams, corners, and similar surfaces.

E. Intermediate and Topcoats:

1. Apply number of coats and coating thickness specified in Coating Tabulations.

2. Apply within re-coat window at referenced humidity and temperature recommended by manufacturer.

3. Tint intermediate coats with manufacturer's standard color to differentiate between coats.

3.07 SHOP FABRICATOR COATING INSPECTION

A. Allow 14 days notice to COR for factory inspection of surface preparation and coating application.

3.08 CONTRACTOR FIELD QUALITY TESTING

A. Equipment: Inspect air supply lines on air compressors for oil and moisture in accordance with ASTM D 4285. Remove oil or water before proceeding with work.

B. Surface Profile: Inspect surface profile in accordance with NACE RP 0287 for compliance with specified requirements.

1. Use replica tape suitable for surface profile depth range.

C. Visual Comparison of Prepared Surfaces:

1. Compare prepared steel surfaces to following visual reference photographs for allowable visible contaminants and stains:

a. SSPC-VIS1 for abrasive blast cleaning.

b. SSPC-VIS3 for power and hand tool cleaning.

D. Completed Coating System:

1. Dry film thickness (DFT):

a. Inspect hardened coating system before re-recoating interval has been exceeded for DFT compliance in accordance with SSPC-PA2 with following modifications:

1) Section 4.3.1: Minimum thickness of 90 percent of specified minimum thickness.

2) Section 4.3.2: Maximum thickness of 150 percent of specified maximum thickness.

b. Acceptance criteria: No single spot measurement in any 100 square foot area less than 90 percent of minimum specified thickness or greater than 150 percent of maximum specified thickness.

2. Discontinuity (holiday) testing:

a. Burial and immersion exposure:

1) Inspect nonconductive coating applied to conductive base metals in accordance with NACE SP 0188.

a) Use maximum test voltage for any DFT as recommended by coating manufacturer to prevent coating damage.

b) Use of detergent wetting solution is not permitted.

c) Subtract thickness of zinc-rich primer from applied coating systems to determine test voltage.

2) Perform test in presence of COR.

3.09 REPAIR OF DEFECTIVE COATED SURFACES

A. Repair within minimum and maximum recoat window time in accordance with coating manufacturer's recommendations and applicable Coating Tabulation under which coating was applied.

B. Repair pinholes, holidays, laps, voids, and other defects.

C. Inspect repaired areas for compliance with specifications.

3.10 COATING TABULATIONS

A.

Tabulation No. 01		
Items to be coated: a. Slide gate motor-operators, ultraviolet UV-stable material required. b. Engine generator set c. Fuel tank d. HVAC control equipment, chiller, and cabinets e. Wall mounted fan f. Hydraulic trash rake g. Hydraulic trash rake conveyor h. Automatic transfer switch i. Stationary louvers		
Coating materials	Number and thickness of coats	Surface preparation method
Factory's coating system: 1. Factory's standard surface preparation and permanent coating system. 2. Color and gloss: Factory's standard color unless a specific color is otherwise specified in the color schedule. 3. Unless otherwise specified, unexposed surfaces that require coatings, such as interior of cabinets, enclosures, and equipment, are be given the factory's standard permanent coated finish. Field Repair: Repair damaged areas of coated surfaces with compatible materials to equal thickness and color match of undamaged areas, unless otherwise tabulated herein. All repair coating materials shall meet Local or State Air Quality VOC Regulations.		

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Tabulation No. 02

Items to be coated:

a. Guard posts (manufacturer's standard safety yellow).
b. Control building bullet resistant doors and frames.

Coating materials Epoxy/polyurethane	Number and thickness of coats	Surface preparation method
For ferrous surfaces: Base coats: Category options: IE-1A1 IE-1G	2 or more base coats. Apply at 3 to 4 mils DFT, per coat, plus stripe coats.	B Uncoated surfaces
Finish coats: Category options: AE-1ATV over IE-1A1 AE-1GTV over IE-1G Color and gloss: To be determined by COR	1 or more compatible manufacturer's finish coats. Apply at 4 mils DFT, minimum, per coat. Total system, excluding stripe coats: 10-mil DFT, minimum 12-mil DFT, maximum	B Uncoated surfaces B-1 Damaged coated surfaces Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

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Tabulation No. 03		
Items to be coated: a. Stem guides b. Motor operator support pedestals c. Supports for cast iron slide gates. d. Instrument deployment bars e. Trashracks and seats. f. Stoplogs. g. Stoplog guides. h. Stoplog lifting beams. i. Water level sensor equipment and mounting poles. j. Ladders.		
Coating materials Epoxy/polyurethane	Number and thickness of coats	Surface preparation method
For ferrous surfaces: Base coats: Category options: IE-1A1 IE-1G	2 or more base coats. Apply at 6 to 8 mils DFT, per coat, plus stripe coats.	C
Finish coats: Category options: IE-1ATV over IE-1A1 AE-1GTV over IE-1G Color and gloss: To be determined by COR	1or more compatible manufacturer's finish coats. Apply at 3 to 4 mils DFT, per coat. Total system, excluding stripe coats: 15-mil DFT, minimum 20-mil DFT, maximum	Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

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Tabulation No. 04		
Items to be coated: a. Cast iron slide gates. b. Wall thimbles		
Note: 1. Do not coat stainless steel, nonmetallic, or valve and gate seat bearing surfaces. 2. At contractor's option, above items may be coated with fusion bonded epoxy in accordance with Coating Tabulation No. 31.		
Coating materials – Option 1 Epoxy	Number and thickness of coats	Surface preparation method
For ferrous surfaces: Base coats: Category options: IE-1A1 IE-1G Color: manufacturer's standard white	2 or more base coats. Apply at 6 to 10 mils DFT, per coat, plus stripe coats. Total system, excluding stripe coats: 12-mil DFT, minimum 20-mil DFT, maximum	F
Coating materials – Option 2 Fusion-bonded epoxy	Number and thickness of coats	Surface preparation method
For ferrous surfaces: Fluidize bed method using: Scotchkote 206N* or Scotchkote 6233 or equal Color: (a) 206N; manufacturer's standard blue-green (b) 6233: manufacturer's standard green	Apply 1 coat only, redipping is not permitted. System range: 12 to 30 mil DFT	F For ferrous surfaces Round sharp corners and edges to 1/8-inch radius, minimum For aluminum surfaces follow manufacturer's surface preparation instructions
Field repair: Repair material: Scotchkote 323* or equal Ambient temperature cured, two component, 100 percent solids, liquid thermosetting epoxy.	1 or more coats as required for repair of small defects or damaged areas of coating. Repair of thin areas is not permitted. Match DFT of undamaged coating.	Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

Tabulation No. 04		
Coating materials – Option 3 Fusion-bonded epoxy	Number and thickness of coats	Surface preparation method
For ferrous surfaces: Electrostatic hot flock spray method using: Scotchkote 134* or equal Color: manufacturer's standard blue-green	Apply 1 or more coats. System range: 12 to 30 mil DFT	F For ferrous surfaces Round sharp corners and edges to 1/8-inch radius, minimum For aluminum surfaces follow manufacturer's surface preparation instructions
Field repair: Repair material: Scotchkote 314* or equal Ambient temperature cured, two component, 80 percent solids minimum, liquid thermosetting epoxy.	1 or more coats as required for repair of small defects or damaged areas of coating. Repair of thin areas is not permitted. Match DFT of undamaged coating.	Follow manufacturer's surface preparation and application instructions to apply subsequent coats.
*As manufactured by 3M Company, Corrosion Protection Division, Electrical Specialties Division, 6801 River Place Boulevard, Austin TX 78726, (512) 984-5670, www.3m.com		

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Tabulation No. 05		
Items to be coated: a. Buried exterior surfaces of 108-inch steel pipe. b. Buried exterior surfaces of 108-inch steel pipe field welded joints. c. Buried exterior surfaces of ferrous piping not tabulated herein. d. Exterior of vent piping.		
Coating materials – Option 1 Coal-Tar Epoxy	Number and thickness of coats	Surface preparation method
For ferrous surfaces: Base coats: Category options: IE-2AA IE-2AB Color: Manufacturer's standard black	2 or more base coats. Apply at 8 to 10 mils DFT per coat, plus stripe coats. Total system, excluding stripe coats: 16-mil DFT, minimum 20-mil DFT, maximum	C Follow manufacturer's surface preparation and application instructions to apply subsequent coats.
Repair of field joints, weld hold back areas, or damaged areas in the field: Base coats: 2-component, polymer epoxy Category: IE-1E Use either hand applied kits or hot spray applied product types. Color: Manufacturer's standard brown	2 or more base coats, apply at 18 to 20 mils per coat, plus stripe coats. Total system measured to steel substrate: 36-mil DFT, minimum 40-mil DFT, maximum	C-1 Repair of damaged coated surfaces and field joints, weld holdback areas. Follow manufacturer's surface preparation and application instructions to apply subsequent coats.
Coating materials – Option 2 Coal-Tar Enamel	Number and thickness of coats	Surface preparation method

<table>
<tr><td colspan="3">Tabulation No. 05</td></tr>
<tr><td colspan="2">For ferrous surfaces:

Coal-tar enamel: Meets AWWA C 203 and following:
1. Materials:
a. Primer: Type B (fast-drying synthetic) liquid adhesion.
b. Coal-tar enamel: Type II.
c. Embedded woven glass outerwrap: Type II.
d. Whitewash: Water-emulsion latex paint.
2. System thickness: 3/32-inch, plus or minus 1/32-inch plus outerwrap excluding whitewash thickness.</td><td>C
For uncoated surfaces</td></tr>
<tr><td>Repair of field joints, weld hold back areas:

Base coats: 2-component, polymer epoxy

Category: IE-1E
Use either hand applied kits or hot spray applied product types.

Color: Manufacturer’s standard brown</td><td>2 or more base coats over beveled coal-tar enamel system and bare substrate, apply at 18 to 20 mils per coat, plus stripe coats.

Total system measured to steel substrate:
36-mil DFT, minimum
40-mil DFT, maximum</td><td>C-1
Repair of damaged coated surfaces and field joints, weld holdback areas.

Follow manufacturer’s surface preparation and application instructions to apply subsequent coats.</td></tr>
<tr><td>Coating materials – Option 3
Polyurethane</td><td>Number and thickness of coats</td><td>Surface preparation method</td></tr>
<tr><td colspan="2">For ferrous surfaces:

Material: Coating category BE-5A

Standard: Meets or exceeds requirements of AWWA C 222

Thickness: 25-mil DFT, minimum

Color: Manufacturer’s standard {black}{blue}{green}{off-white}{red}{tan}]</td><td>C
For uncoated surfaces

Achieve 4-mil surface profile, minimum</td></tr>
</table>

Tabulation No. 05	
For repair of damaged and defective polyurethane areas: Category: BE-5AR Material option: Areas 1-inch square or less, use of polyethylene melt stick is permitted. Thickness: Achieve thickness equal to surrounding undamaged polyurethane in 1 or more coats.	C-1 Follow manufacturer's surface preparation and application instructions to apply subsequent coats.
Repair of field joints, weld hold back areas: Base coats: 2-component, polymer epoxy Category: IE-1E Use either hand applied kits or hot spray applied product types. Color: Manufacturer's standard brown	2 or more base coats, apply at 18 to 20 mils per coat, plus stripe coats. Total system measured to steel substrate: 36-mil DFT, minimum 40-mil DFT, maximum

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Tabulation No. 06
Items to be coated: a. Gratings, beams, and supports. b. Pipe guardrails. c. Embedded angles. d. W-beam guardrails and posts. e. Metal frames and grille frames for the control building. f. Electrical equipment supports. g. Damaged galvanized surfaces not otherwise tabulated.
Note: Repair damaged galvanized surface areas for above listed items.
Repair damaged galvanized surfaces in accordance with ASTM A 780, except repair materials containing cadmium and lead are not permitted.

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Tabulation No. 07		
Items to be coated: a. Buried interior surfaces of 108-inch steel pipe. b. Buried interior surfaces of 108-inch steel pipe field welded joints. c. Interior surfaces of vent piping. d. Buried interior surfaces of ferrous piping not tabulated herein.		
Coating materials – Option 1 High Solids Epoxy	Number and thickness of coats	Surface preparation method
For ferrous surfaces: Base coats: Category options: IE-1A1 IE-1G Color and gloss: manufacturer's standard beige, gray, off-white, or other light color	3 or more base coats. Apply at 8 to 10 mils DFT, per coat, plus stripe coats. Total system, excluding stripe coats: 24-mil DFT, minimum 30-mil DFT, maximum	C For uncoated surfaces C-1 For repair of damaged coated surfaces Follow manufacturer's surface preparation and application instructions to apply subsequent coats.
Coating materials- Option 2 100% Solids epoxy	Number and thickness of coats	Surface preparation method
For ferrous surfaces: Base coats: Category: IES-6D2(pw) Color: manufacturer's standard white	1 or more primer coats, apply at 4 to 8 mils DFT, per coat, plus stripe coats. 1 or more topcoats, apply at 10 to 12 mils DFT, per coat. Total system, excluding stripe coats: 14-mil DFT, minimum 20-mil DFT, maximum	C For uncoated surfaces C-1 For repair of damaged coated surfaces Follow manufacturer's surface preparation and application instructions to apply subsequent coats
Coating materials- Option 2 100% Solids epoxy	Number and thickness of coats	Surface preparation method

Tabulation No. 07		
For ferrous surfaces: Base coats: Category: IES-6D3(pw) Color: manufacturer's standard white	1 or more primer coats, apply at 16 to 20 mils DFT, per coat, plus stripe coats. Total system, excluding stripe coats: 16-mil DFT, minimum 20-mil DFT, maximum	C For uncoated surfaces C-1 For repair of damaged coated surfaces Material amine blushes, multiply coat systems need to be prepared in accordance with manufacturers' instructions to apply subsequent coats

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3.11 COATING CATEGORIES

Category IE-1A1	
Amerlock 400 or Amerlock 400/2; as manufactured by: Ameron International, 13010 Morris Road, Suite 400, Alpharetta GA 30004 (678) 393-0653, www.ameroncoatings.com	
or equal, having following essential characteristics:	
COMPOSITION:	
Self-priming, two component, polyamide epoxy Lead and chromate free.	
PHYSICAL CHARACTERISTICS:	
Solids by volume:	80 percent, minimum
VOC (as supplied):	1.4 pounds per gallon (168 grams per liter), maximum
Mix ratio (resin:hardener):	1:1
Mixed usable pot life at 70 degrees F:	2.5 hours, minimum
Ambient application temperature:	50 degrees F, minimum 120 degree F, maximum
Surface application temperature above dew point:	5 degrees F, minimum
Maximum DFT per coat:	10 mils
Recoat time at 70 degrees F and 50 percent humidity:	3 months, maximum
Full cure time before immersion at 70 degrees F and 50 percent humidity:	7 days, minimum
Application methods:	Brush, roller, or spray
Color/finish:	Variety of colors/semigloss
PERFORMANCE REQUIREMENTS:	
Fresh/deionized water immersion test (ASTM D 870):	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Salt water immersion test (ASTM D 870; ASTM D 1141 formula A with no heavy metals):	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Abrasion resistance (ASTM D 4060, CS-17 wheel, 1,000 cycles, 1-kg load):	100 milligram loss or less
Flexibility (ASTM D 522, 180 degree bend over 1-inch mandrel):	passes
Pencil hardness (ASTM D 3363):	2B, minimum

Category IE-1A1

Pulloff adhesion (ASTM D 4541, annex A2, type II tester):	500 psi or greater
Pulloff tape (ASTM D 3359):	4A or better
Cathodic disbondment (ASTM G 8):	passes 90 day test

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Category AE-1ATV

Amershield VOC; as manufactured by:

Ameron International, 13010 Morris Road, Suite 400, Alpharetta GA 30004
678-393-0653, www.ameroncoatings.com

or equal, having following essential characteristics:

COMPOSITION:

Topcoat – Two-component, aliphatic polyurethane

Lead and chromate free.

PHYSICAL CHARACTERISTICS, PRIMER:

Solids by volume:	79 percent, minimum
VOC, as supplied:	1.5 pounds per gallon (185 grams per liter), maximum
Mix ratio - resin: hardener:	4:1
Mixed usable pot life at 50 degrees F:	5 hours, minimum
Ambient application temperature:	50 degrees F, minimum 120 degree F, maximum
Surface application temperature above dew point:	5 degrees F, minimum
Maximum DFT per coat:	5 mils
Recoat time at 50 degrees F and 50 percent humidity:	48 hours, minimum
Application methods:	Brush, roller, or spray
Color/finish:	Variety of colors/gloss

PERFORMANCE REQUIREMENTS:

QUV accelerated weathering test, ASTM D 4587, ASTM G 154:	Passes 3,000 hour test with no blisters evident on either scribed or unscribed sides, minimal chalking ASTM D 4214 or color difference ASTM D 2244.
Flexibility, ASTM D 522, 180 degree bend over 1-inch mandrel:	Passes
Pencil hardness, ASTM D 3363:	2B, minimum
Pulloff adhesion, ASTM D 4541, annex A2, type II tester:	500 psi or greater
Pulloff tape, ASTM D 3359:	equal to 4A or better

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Category IE-1G

Carboguard 691; as manufactured by:

Carboline, 350 Hanley Industrial Court, St. Louis, MO 63144-1599, 314/644-1000, www.carboline.com

or equal, having following essential characteristics:

COMPOSITION:

Self-priming, two component, phenalkamine epoxy

Lead and chromate free.

PHYSICAL CHARACTERISTICS:

Solids by volume:	80 percent, minimum
VOC, as supplied:	1.42 pounds per gallon (170 grams per liter) mixed, maximum
Mix ratio - resin: hardener:	1:4
Mixed usable pot life at 75 degrees F:	1.5 hours, maximum
Ambient application temperature:	50 degrees F, minimum 100 degrees F, maximum
Surface application temperature above dew point:	5 degrees F, minimum
Maximum DFT per coat:	8 to 20 mils
Recoat time at 60 degrees F:	14 days, maximum
Full cure time before immersion at 60 degrees F and 50 percent humidity:	14 days, minimum
Application methods:	Brush, roller, or spray
Color/finish:	Beige (0200), Red (0500) and Gray (0700) in a Semi-gloss.

PERFORMANCE REQUIREMENTS:

Immersion Test, NACE mod TM-01-74:	
75 degree F:	Grade: 99/100
130 degree F	Grade: 97/100
Salt Spray Test, ASTM B117	1400 hour test single coat, NE in plane, VSL undercutting @scribe, #2, MD blisters @scribe
Abrasion resistance, ASTM D 4060, CS-17 wheel, 1,000 cycles, 1-kg load:	249 milligram loss or less
Flexibility, ASTM D 522, 180 degree bend over ¼-inch mandrel:	Passes

Category IE-1G

Pencil hardness, ASTM D 3363:	2B, minimum
Pulloff adhesion, ASTM D 4541, annex A2, type II tester:	1700 psi or greater
Pulloff tape, ASTM D 3359:	4A or better
Cathodic disbondment, ASTM G 8:	passes 90 day test

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Category AE-1GTV

Carbothane 134 VOC; as manufactured by:

Carboline, 350 Hanley Industrial Court, St. Louis, MO 63144-1599, 314/644-1000, www.carboline.com

or equal, having following essential characteristics:

COMPOSITION:

Topcoat – Two-component, aliphatic acrylic polyurethane

Lead and chromate free.

PHYSICAL CHARACTERISTICS, PRIMER:

Solids by volume:	70 percent, minimum
VOC, as supplied:	1.58 pounds per gallon (190 grams per liter), maximum
Mix ratio - resin: hardener:	4:1
Mixed usable pot life at 75 degrees F:	4 hours, maximum
Ambient application temperature:	50 degrees F, minimum 95 degrees F, maximum
Surface application temperature above dew point:	5 degrees F, minimum
Maximum DFT per coat:	2 to 2.5 mils
Recoat time at 50 degrees F and 50 percent humidity:	16 hours, minimum
Application methods:	Brush, roller, or spray
Color/finish:	Variety of colors/gloss

PERFORMANCE REQUIREMENTS:

QUV accelerated weathering test, ASTM D 4587, ASTM G 154:	Passes 3,000 hour test with no blisters evident on either scribed or unscribed sides, minimal chalking ASTM D 4214 or color difference ASTM D 2244.
Flexibility, ASTM D 522, 180 degree bend over 1-inch mandrel:	Passes
Pencil hardness, ASTM D 3363:	2B, minimum
Pulloff adhesion, ASTM D 4541, annex A2, type II tester:	2500 psi or greater
Pulloff tape, ASTM D 3359:	equal to 4A or better

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Category IE-1E

Powercrete J; as manufactured by:

Covalence Corrosion Protection Group, 11010 Wallisville Road, Houston TX 77013
713-676-0085, www.covalencecpg.com

or equal, having following essential characteristics:

COMPOSITION:

Self-priming, two component, polymer epoxy

Lead and chromate free.

PHYSICAL CHARACTERISTICS:

Solids by volume:	100 percent, minimum
VOC, as supplied:	Zero
Mix ratio - resin: hardener:	4.8:1
Mixed usable pot life at 73 degrees F:	20 minutes, minimum
Ambient application temperature:	50 degrees F, minimum 140 degrees F, maximum
Surface application temperature above dew point:	5 degrees F, minimum
Maximum DFT per coat:	20 mils
Recoat time at 70 degrees F:	50 minutes, maximum; see manufacturer's recoat and curing chart
Full cure time before burial or immersion at 70 degrees F:	24 hours, minimum
Application methods:	Trowel or hot airless spray
Color:	Brown

PERFORMANCE REQUIREMENTS:

Fresh/deionized water immersion test, ASTM D 870:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Salt water immersion test, ASTM D 870; ASTM D 1141 formula A with no heavy metals:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Abrasion resistance, ASTM D 4060, CS-17 wheel, 1,000 cycles, 1-kg load:	1 mil loss per 1250 cycles

Category IE-1E

Flexibility, ASTM D 522, 180 degree bend over 1-inch mandrel:	Passes
Pencil hardness, ASTM D 3363:	2B, minimum
Pulloff adhesion from ferrous substrate, ASTM D 4541, annex A2, type II tester:	500 psi or greater
Pulloff adhesion from coal-tar enamel substrate, ASTM D 4541, annex A2, type II tester:	320 psi or greater
Pulloff tape, ASTM D 3359:	4A or better
Cathodic disbondment, ASTM G 8:	passes 90 day test

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Category IES-6D2(pw)

Dura-Plate UHS Epoxy Primer; Dura-Plate UHS Epoxy, intermediate coat and topcoat; as manufactured by:

Sherwin-Williams, 101 Prospect Avenue NW, Cleveland OH 44115
216-566-2000, www.sherwin-williams.com

or equal, having following essential characteristics:

COMPOSITION:

Primer – Two-component, ultra high solids, amine, epoxy

Intermediate coat and topcoat – Two-component, ultra high solids, amine, epoxy

Lead and chromate free.

PHYSICAL CHARACTERISTICS, PRIMER:

Solids by volume:	96 percent, minimum
Solids by weight:	96 percent, minimum
Weight per gallon:	10.5 pounds per gallon, minimum
VOC, as supplied:	0.66 pounds per gallon (80 grams per liter), maximum
Mix ratio – resin:hardener:	4:1
Pot life at 55 degrees F	45 minutes, maximum
Ambient application temperature:	50 degrees F, minimum 110 degrees F, maximum
Maximum DFT per coat:	8 mils
Recoat time at 55 degrees F:	48 hours, minimum
Application methods:	Brush, roller, spray
Color:	Gold

PHYSICAL CHARACTERISTICS, INTERMEDIATE COAT AND TOPCOAT:

Solids by volume:	96 percent, minimum
Solids by weight:	96 percent, minimum
VOC, as supplied:	0.66 pounds per gallon (80 grams per liter), maximum
Mix ratio – resin:hardener:	4:1
Pot life at 55 degrees F:	45 minutes, maximum
Maximum DFT per coat:	12 mils for 2-coat system
Recoat time at 55 degrees F:	21 days, maximum
Full cure before immersion service at 55 degrees F and 50 percent humidity:	14 days, minimum

Category IES-6D2(pw)

Application methods:	Brush, roller, spray
Color/finish:	Gray-green and white/gloss
PERFORMANCE REQUIREMENTS:	
Fresh/deionized water immersion test, ASTM D 870:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Salt water immersion test, ASTM D 870; ASTM D 1141 formula A with no heavy metals:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Abrasion resistance, ASTM D 4060, CS-17 wheel, 1,000 cycles, 1-kg load:	21 milligram loss or less
Flexibility, ASTM D 522, 180 degree bend over 1/2-inch mandrel:	passes
Pencil hardness, ASTM D 3363:	3H, minimum
Pulloff adhesion, ASTM D 4541, annex A2, type II tester:	500 psi or greater
Cathodic disbondment, ASTM G 8:	Passes 90 day test

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Category IES-6D3(pw)

Plasite 4500 S; as manufactured by:

Carboline, 350 Hanley Industrial Court, St. Louis MO, 63144
314-644-1000, www.carboline.com

or equal, having following essential characteristics:

COMPOSITION:

Primer – Two-component, 100% solids, amine, epoxy

Intermediate coat and topcoat – Two-component, ultra high solids, amine, epoxy

Lead and chromate free.

PHYSICAL CHARACTERISTICS, PRIMER:

Solids by volume:	100 percent, minimum
Solids by weight:	100 percent, minimum
VOC, as supplied:	0.04 pounds per gallon (18 grams per liter), maximum
Mix ratio – resin:hardener:	4:1
Pot life at 75 degrees F	45 minutes
Ambient application temperature:	50 degrees F, minimum 90 degrees F, maximum
DFT per coat:	20-60 mils
Application methods:	Brush, roller, spray
Color:	Light gray, tile red, or white

PERFORMANCE REQUIREMENTS:

Fresh/deionized water immersion test, ASTM D 870:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Salt water immersion test, ASTM D 870; ASTM D 1141 formula A with no heavy metals:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Abrasion resistance, ASTM D 4060, CS-17 wheel, 1,000 cycles, 1-kg load:	100 milligram loss or less
Flexibility, ASTM D 522, 180 degree bend over 1/2-inch mandrel:	passes
Pencil hardness, ASTM D 3363:	3H, minimum

Category IES-6D3(pw)

Pulloff adhesion, ASTM D 4541, annex A2, type II tester:	500 psi or greater
Cathodic disbondment, ASTM G 8:	Passes 90 day test

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Category IE-2AA

Amercoat 78HB; as manufactured by:

Ameron International, 13010 Morris Road, Suite 400, Alpharetta GA 30004, 678-393-0653, www.ameroncoatings.com

or equal, having following essential characteristics:

COMPOSITION:

Self-priming, two component, amine-cured, coal-tar epoxy

Lead and chromate free.

PHYSICAL CHARACTERISTICS:

Solids by volume:	75 percent, minimum
VOC, as supplied:	1.9 pounds per gallon (228 grams per liter), maximum
Mix ratio - resin:hardener:	19:1
Mixed usable pot life at 50 degrees F:	8 hours, minimum
Ambient application temperature:	50 degrees F, minimum 120 degrees F, maximum
Surface application temperature above dew point:	5 degrees F, minimum
Maximum DFT per coat:	16 mils
Recoat time at 50 degrees F:	72 hours, maximum
Full cure time before immersion at 50 degrees F and 50 percent humidity:	14 days, minimum
Application methods:	Brush, roller, or spray
Color/finish:	Black or dark red/flat

PERFORMANCE REQUIREMENTS:

Fresh/deionized water immersion test, ASTM D 870:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.

Category IE-2AA

Salt water immersion test, ASTM D 870; ASTM D 1141 formula A with no heavy metals:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Abrasion resistance, ASTM D 4060, CS-17 wheel, 1,000 cycles, 1-kg load:	120 milligram loss or less
Flexibility, ASTM D 522, 180 degree bend over 1-inch mandrel:	passes
Pencil hardness, ASTM D 3363:	2B, minimum
Pulloff adhesion, ASTM D 4541, annex A2, type II tester:	500 psi or greater
Pulloff tape, ASTM D 3359:	4A or better
Cathodic disbondment, ASTM G 8:	passes 90 day test

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Category IE-2AB

Use one of following:

Bitumastic 300M; as manufactured by: Carboline, 350 Hanley Industrial Court, St. Louis MO, 314-644-1000, www.carboline.com

Targuard; as manufactured by: Sherwin-Williams, 101 Prospect Avenue NW, Cleveland OH 44115, 216-566-2000, www.sherwin-williams.com

Hi-Build Tnemec-Tar, Series 46H-413; as manufactured by: Tnemec Company, 6800 Corporate Drive, Kansas City MO 64141, 800-863-6321, www.tnemec.com

or equal, having following essential characteristics:

COMPOSITION:

Self-priming, two component, polyamide, coal-tar epoxy

Lead and chromate free.

PHYSICAL CHARACTERISTICS:

Solids by volume:	72 percent, minimum
VOC, as supplied:	1.88 pounds per gallon (225 grams per liter), maximum
Mix ratio - resin:hardener:	Varies by manufacturer
Mixed usable pot life at 75 degrees F:	2 hours, minimum
Ambient application temperature:	50 degrees F, minimum 100 degrees F, maximum
Substrate temperature above dew point:	5 degrees F, minimum
Maximum DFT per coat:	16 to20 mils, varies by manufacturer
Recoat time:	Varies by manufacturer
Full cure time before immersion at 70 degrees F and 50 percent humidity:	14 days, minimum
Application methods:	Brush, roller, or spray
Color/finish:	Black or dark red/flat, gloss, or semigloss; varies by manufacturer

PERFORMANCE REQUIREMENTS:

Fresh/deionized water immersion test, ASTM D 870:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Salt water immersion test, ASTM D 870; ASTM D 1141 formula A with no heavy metals:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or

Category IE-2AB

	unscribed sides.
Abrasion resistance, ASTM D 4060, CS-17 wheel, 1,000 cycles, 1-kg load:	120 milligram loss or less
Flexibility, ASTM D 522, 180 degree bend over 1-inch mandrel:	passes
Pencil hardness, ASTM D 3363:	2B, minimum
Pulloff adhesion, ASTM D 4541, annex A2, type II tester:	500 psi or greater
Pulloff tape, ASTM D 3359:	4A or better
Cathodic disbondment, ASTM G 8:	passes 90 day test

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Category BE-5A

Corropipe II Omni; as manufactured by:

Madison Chemical Industries Inc., 490 McGeachie Drive, Milton, Ontario, Canada L9T 3Y5, 905-878-8863, www.madisonchemical.com

or equal, having following essential characteristics:

COMPOSITION:

Self-priming, two component, aromatic polyether urethane

PHYSICAL CHARACTERISTICS:

Solids by volume:	98 percent, minimum
VOC, as supplied:	13.25 grams per liter, maximum
Mix ratio:	1:1
Ambient application temperature:	40 degrees F, minimum 150 degrees F, maximum
Surface application temperature above dew point:	5 degrees F, minimum
Initial set time:	Between 30 seconds and 15 minutes
Recoat time at 70 degrees F:	45 minutes, maximum
Full cure time at 70 degrees F:	7 days, minimum
Application method:	Heated plural-component airless spray
Color:	Limited colors

PERFORMANCE REQUIREMENTS:

Fresh/deionized water immersion test, ASTM D 870:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident.
Salt water immersion test, ASTM D 870; ASTM D 1141 formula A with no heavy metals:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident.
Abrasion resistance, ASTM D 4060, CS-17 wheel, 1,000 cycles, 1-kg load:	75 milligram loss or less
Flexibility, ASTM D 522, 180 degree bend over 1-inch mandrel at 20-mil DFT:	passes
Hardness, ASTM D 2240 Shore D::	70 plus/minus 5
Pulloff adhesion, ASTM D 4541:	1,800 psi or greater
Cathodic disbondment, ASTM G 8:	passes 90 day test

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Category BE-5AR

GP II (E) Touch-Up; as manufactured by:

Madison Chemical Industries Inc., 490 McGeachie Drive, Milton, Ontario, Canada L9T 3Y5, 905-878-8863, www.madisonchemical.com

or equal, having following essential characteristics:

COMPOSITION:

Self-priming, two component, aromatic, pyrolysis, epoxy

PHYSICAL CHARACTERISTICS:

Solids by volume:	100 percent
VOC, as supplied:	zero
Mix ratio, resin-to-hardener:	1:1
Mixed useable pot life at 70 degrees F:	30 minutes, maximum
Ambient application temperature:	50 degrees F, minimum 150 degrees F, maximum
Surface application temperature above dew point:	5 degrees F, minimum
Recoat time at 50 degrees F:	2 days, maximum
Full cure time at 50 degrees F:	7 days, minimum
Application method:	Brush, spatula, or double barrel caulking gun, if tube packaged
Color:	Limited colors

PERFORMANCE REQUIREMENTS:

Fresh/deionized water immersion test, ASTM D 870:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident.
Salt water immersion test, ASTM D 870; ASTM D 1141 formula A with no heavy metals:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident.
Abrasion resistance, ASTM D 4060, CS-17 wheel, 1,000 cycles, 1-kg load:	200 milligram loss or less
Hardness, ASTM D 2240 Shore D::	65 plus/minus 5
Pulloff adhesion, ASTM D 4541:	1,300 psi or greater
Cathodic disbondment, ASTM G 8:	passes 90 day test

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END OF SECTION

SECTION 09980 – COATINGS FOR CONCRETE, MASONRY, AND GYPSUM BOARD

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in prices offered in the schedule for items of work requiring coatings.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM D 522-93a(2008)	Mandrel Bend Test of Attached Organic Coatings
2.	ASTM D 870-02	Testing Water Resistance of Coatings Using Water Immersion
3.	ASTM D 1141-98(2003)	Preparation of Substitute Ocean Water
4.	ASTM D 2244-07	Calculation of Color Differences From Instrumentally Measured Color Coordinates
5.	ASTM D 3359-08	Measuring Adhesion by Tape Test
6.	ASTM D 3363-05	Film Hardness by Pencil Test
7.	ASTM D 4060-07	Abrasion Resistance of Organic Coatings by the Taber Abraser
8.	ASTM D 4138-07	Measurement of Dry Film Thickness of Protective Coating Systems by Destructive Means
9.	ASTM D 4259-88(2006)	Abrading Concrete
10.	ASTM D 4263-83(2005)	Indicting Moisture in Concrete by the Plastic Sheet Method
11.	ASTM D 4285-83(2006)	Indicating Oil and Moisture in Compressed Air
12.	ASTM D 4414-95(2007)	Measurement of Wet Film Thickness by Notch Gages
13.	ASTM D 4541-02	Pull-Off Strength of Coating Using Portable Adhesion Testers
14.	ASTM D 4587-05	Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light- and Water-Exposure Apparatus

15.	ASTM D 6132-04	Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Over Concrete Using an Ultrasonic Gage
16.	ASTM F 1869-04	Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
17.	ASTM G 8-96(2003)	Cathodic Disbonding of Pipeline Coatings
18.	ASTM G 154-06	Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

B. The Society for Protective Coatings (SSPC)/NACE International (NACE)

1.	SSPC-AB1-04	Mineral and Slag Abrasives
2.	SSPC-PA2-04	Measurement of Dry Paint Thickness with Magnetic Gages
3.	SSPC-SP13/NACE 6-03	Surface Preparation of Concrete

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

1. Include following information with each set of data or certification:
   a. Applicable tabulation number from Coating Tabulations.
   b. Identification of “Items to be coated” including sub-letter and sub-number listed in Coating Tabulations.

B. RSN 09980-1, Approval Data:

1. For each coating material:
   a. Manufacturer’s product data and application sheets
   b. Purchase orders. Include supplier’s name, address, and phone number; purchase order number; purchase order date; manufacturer’s designated product name; batch number(s) for each material, except thinners; and quantities ordered for each material, except thinners.

C. RSN 09980-2, Documentation: Submit written evidence of applicator’s qualifications.

D. “Equal” Products:

1. For coating materials proposed as “equal” products to specified brand name products in Coating Categories, submit following with specified approval data:
   a. List of projects (not less than three) where material has been successfully used in applications similar to this project. Include:

1) Project name and location.

2) Type of structure.

3) Owner's name, address, and telephone number.

4) Application dates.

2. Manufacturer’s certification substitute coating material meets specified requirements. Include:

1) Manufacturer’s name, address, and phone number.

2) Batch number(s) for each material, except thinners.

3) Signature of manufacturer’s technical representative and date of signature.

b. Certified test reports that demonstrates substitute material meets or exceeds specified coating category requirements for physical and performance characteristics from each of following:

1) Coating manufacturer.

2) Independent laboratory.

1.04 QUALIFICATIONS

A. Coating Applicators Qualifications:

1. Qualified to apply specified coating materials by one of following:

a. Successfully completed training in use of coating material on applications similar to those specified in these specifications.

b. Skilled and experienced in application of coating materials similar to materials specified in these specifications under conditions similar to conditions of this project.

B. Compliance Criteria for Coating Materials:

1. Material is of same composition and formulation to meet physical and performance test results for one of following:

a. Submitted batch or previously tested batch materials complies with these specifications.

b. Submitted batch materials are unchanged from previously tested batch materials that complies with manufacturer’s quality control (QC) and quality assurance (QA) programs.

c. Submitted batch materials complies with manufacturer’s quality control (QC) and quality assurance (QA) programs as listed on product data and application sheets.

1.05 DELIVERY, STORAGE, HANDLING

A. Deliver materials to jobsite in original, undamaged, unopened containers labeled with manufacturer's name, designated product name, batch number, date of manufacture, and any special instructions.

B. Deliver materials in containers not larger than 5 gallons as packaged by manufacturer unless suitable equipment is provided at jobsite to handle and thoroughly mix materials in larger containers.

C. Store materials in well ventilated area.

D. Do not expose to direct sunlight during storage.

E. Comply with manufacturer's storage instructions.

F. Do not use coating material which has exceeded manufacturer's specified storage stability period (shelf life).

1.06 ENVIRONMENTAL REQUIREMENTS

A. Comply with coating manufacturer's environmental restrictions. Comply with most restrictive requirements of coating manufacturer's restrictions and these specifications when coating manufacturer's restrictions conflict with these specifications.

B. Do not apply coatings under following environmental conditions:

1. Substrate surface temperature less than 5 degrees Fahrenheit above dewpoint.
2. Air and substrate surface temperature less than 50 degrees Fahrenheit and not to exceed manufacturer's recommended maximum temperature limit.
3. Humidity outside of manufacturer's recommended range.

C. Do not apply coatings when environmental conditions are not expected to meet specified requirements during coating application and curing period.

D. Maintain environmental conditions to meet specified requirements during coating application and curing period. Provide heat and dehumidification required to maintain temperature and humidity conditions.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. Materials required by these specifications and not listed in Coating Categories are subject to certification and testing in accordance with this section.
2. Provide compatible products of same manufacturer for coating system components.

B. Abrasives:

1. Meets requirements of SSPC-AB 1, type I or II, class A, except as specified.
2. Do not exceed toxicity threshold limit for hazardous materials.

C. Coatings:

1. Specified in Coating Categories.
2. Apply only one coating category per option in Coating Tabulations.
3. Volatile Organic Compounds (VOC):
   a. Do not to exceed maximum permitted by Federal, State, and local air pollution control regulations.
   b. Do not exceed maximum content as supplied in container or by addition of thinner material.
4. Factory color or tint. Do not color or tint at jobsite.
5. Use thinners recommended by manufacturer for each coating material.
6. Use of accelerator products is not permitted unless approved by Contracting Officer.

PART 3 EXECUTION

3.01 PROTECTION OF ADJACENT SURFACES, EQUIPMENT AND NEWLY COATED SURFACES

A. Protect items or surfaces not to be coated and adjacent to surfaces to be cleaned and coated from contamination and damage during cleaning and coating operations.

1. Includes surfaces and equipment in physical contact with areas being cleaned or coated. Examples include: mechanical and electrical equipment (open or enclosed); instruction and similar plates; and wet and newly coated surfaces.
2. Protect from abrasive blast particles and airborne coating particles.
3. Prevent damage from bumping or striking with foreign objects.

B. Protect newly coated surfaces until coating is thoroughly dry or as determined by coating manufacturer’s instructions.

3.02 REPAIR OF CONTRACTOR-DAMAGED SURFACES

A. Repair surfaces which are damaged or contaminated as determined by Contracting Officer.

1. Repair damaged surfaces to original condition and appearance.

2. Before coating any damaged coated surfaces, re-clean exposed surface and apply coating materials in accordance with these specifications.

3.03 SURFACE PREPARATION

A. Before surface preparation and coating application, cure cementitious materials for 28 days, minimum.

B. Before coating application, repair cementitious defects greater than 3/4-inch in depth by one of following:

1. In accordance with manufacturer's product instructions.

C. Remove fungus, mold, and mildew on concrete or masonry surfaces before coating by one of following:

1. Wash brush affected area with solution of 5 ounces of trisodium phosphate, 3 ounces of household detergent, 1.25 percent sodium hypochlorite, and 3 quarts of warm potable water. After 24 hours, thoroughly flush with potable water. Repeat process if growth returns.

2. Use commercial products formulated and suitable for removal. Follow manufacturer's instructions.

D. Specific surface preparation:

1. See Coating Tabulations:

2. Method T (concrete and masonry): SSPC-SP13/NACE 6, except as specified:

a. Section 4.3.3: Fractures and microcracks caused by impact tools are to repaired in accordance with ASTM D 4259.

b. Following methods are not permitted:

1) Section 4.3.3: Scabbling impact tool.

2) Section 4.4: Chemical surface preparation.

3) Section 4.5: Flame (Thermal) cleaning and blasting.

3. Method U (gypsum board):

a. Repair cracks and other surface imperfections with joint finishing compound in accordance manufacturer's instructions.

b. Remove all dirt, dust, and foreign matter with clean, lint-free, wiping material before coating application.

4. Manufacturer's instructions.

E. Surface profile for concrete:

1. Prepare in accordance with manufacturer's instructions for cementitious materials and service environment.

2. Where manufacturer's instructions do not specify a surface profile, prepare surfaces to appearance of medium (100) abrasive paper, minimum.

F. Surface irregularities for concrete: After surface preparation, repair following surface irregularities:

1. Air pockets (bugholes): Repair bugholes greater than 1/8-inch in diameter by adhesive epoxy or manufacturer's repair compound filler.

2. Protrusions, fins, or bulges: Grind down by SSPC-SP13/NACE 6 surface preparation methods to 1/16-inch or less of surrounding surface.

3. Cracks: Repair cracks with material compatible with manufacturer's coating material listed in Coating Tabulations.

G. Surface cleanliness: Free of dirt, dust, grease, oil, laitance, efflorescence, form oil, and curing compounds.

H. Moisture content for concrete:

1. Test substrate surface for moisture content before applying coating.

2. Perform one test per 1,000 square feet, minimum.

3. Perform tests in accordance with moisture content inspection procedures specified.

I. Re-clean or perform additional surface preparation of completed surfaces that become contaminated before coating application.

J. Prepare surface free of moisture, frost, and ice before coating application.

3.04 APPLICATION EQUIPMENT

A. Air compressor and spray application equipment:

1. Provide appropriate type equipment, adequately sized, and in proper operating order.

2. Equip with pressure gauges and pressure regulators.

3. Equip with air supply lines free from oil and moisture. Keep lines free of oil and moisture during work.

4. Perform tests in accordance with oil and moisture inspection procedures specified.

3.05 COATING APPLICATION

A. Apply in accordance with manufacturer's instructions.

B. Apply coatings so that surfaces exposed to public view display a uniform texture and color matched appearance.

C. Apply an even film of uniform thickness which tightly bonds to substrate or previous coat.

1. Fill crevices and cover irregularities.

2. Apply free of runs, pinholes, sags, laps, brush marks, voids, and other defects.

D. Primer Coats:

1. Cover peaks of surface profile by specified dry film thickness.

2. Apply stripe coats to edges, corners, and similar surfaces.

E. Intermediate and Topcoats:

1. Apply number of coats and coating thickness specified in Coating Tabulations.

2. Apply within re-coat window recommended by manufacturer.

3. Tint intermediate coats with manufacturer's standard color to differentiate between coats.

3.06 CONTRACTOR FIELD QUALITY TESTING

A. Equipment: Inspect air supply lines on air compressors for oil and moisture in accordance with ASTM D 4285. Remove oil or water before proceeding with work.

B. Measure moisture content of cementitious material on substrate surface by one of following methods:

1. Method 1:

a. ASTM D 4263.

b. Acceptance Criteria: No visible moisture.

2. Method 2:

a. ASTM F 1869.

b. Acceptance Criteria: Not to exceed 3 pounds of water per 1,000 square feet per 24 hours.

3. Method 3:

a. Moisture meter calibrated to manufacturer's recommendation.

b. Acceptance Criteria: Not to exceed coating manufacturer's maximum recommendation for moisture content.

C. Wet Film Thickness (WFT) Testing:

1. Inspect wet film thickness immediately after application in accordance with ASTM D 4414.

2. Compensate for reduced thickness to achieve specified thickness in Coating Tabulations.

D. Dry Film Thickness (DFT) Testing and Acceptance:

1. Inspect hardened coating system before re-coating interval has been exceeded for DFT compliance by one of following:

a. ASTM D 4138.

b. ASTM D 6132.

2. Number of tests and numerical averaging to meet corresponding ASTM inspection method used above:

a. ASTM D 4138: Average of 3 tests per 1,000 square feet.

b. ASTM D 6132: In accordance with Section 4 of SSPC-PA2.

3. Acceptance Criteria:

a. 80 percent of minimum specified thickness.

b. 150 percent of maximum specified thickness.

4. Repair areas tested by destructive method.

3.07 REPAIR OF DEFECTIVE COATED SURFACES

A. Repair within minimum and maximum re-coat window time in accordance with coating manufacturer's recommendations and applicable Coating Tabulation.

B. Repair pinholes, holidays, laps, voids, and other defects.

C. Inspect repaired areas for compliance with specifications.

3.08 COATING TABULATIONS

Tabulation No. 01		
Items to be coated: a. Concrete surfaces at canal safety ladders.		
Coating materials Epoxy	Number and thickness of coats	Surface preparation method
Base coats: Category options: IE-1A1	2 or more base coats. Apply at 8 to 10 mils DFT, per coat. Total system: 16-mil DFT, minimum	T Follow manufacturer's surface preparation and application instructions to apply subsequent coats.
Finish coats: Category options: AE-1ATV over IE-1A1 Color and gloss: Safety Yellow	1or more compatible manufacturer's finish coats. Apply at 3 to 4 mils DFT, per coat. Total system: 19-mil DFT, minimum	Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

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Tabulation No. 2

Items to be coated:

a. Gypsum board systems.

Coating materials Latex	Number and thickness of coats	Surface preparation method
Primer/sealer for gypsum board substrate, use: No. 50, Interior Latex Primer Sealer	Follow manufacturer's instructions for number of coats and thickness per coat.	U
Finish coats: Interior High Performance Latex for specified gloss, use: No. 138, velvet No. 139, eggshell No. 140, satin No. 141, semigloss Color and gloss: see color schedule	2 or more compatible manufacturer's finish coats. Follow manufacturer's instructions for thickness per coat. Total system, excluding blockfiller: 3-mil DFT, minimum	Follow manufacturer's surface preparation and application instructions to apply subsequent coats.

Approved Materials: Materials from Master Painters Institute (MPI) Approved Products List (APL).

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COATING CATEGORIES

Category IE-1A1

Amerlock 400 or Amerlock 2; as manufactured by:

Ameron International, 13010 Morris Road, Suite 400, Alpharetta GA 30004, 678-393-0653, www.ameroncoatings.com

or equal, having following essential characteristics:

COMPOSITION:

Self-priming, two component, polyamide epoxy

Lead and chromate free.

PHYSICAL CHARACTERISTICS:

Solids by volume:	80 percent, minimum
VOC, as supplied:	Amerlock 400: 1.4 pounds per gallon (168 grams per liter), maximum Amerlock 2: 1.5 pounds per gallon (180 grams per liter), maximum
Mix ratio - resin:hardener:	1:1
Mixed usable pot life at 50 degrees F:	2 hours, minimum
Ambient application temperature:	50 degrees F, minimum
Surface application temperature above dew point:	5 degrees F, minimum
Maximum DFT per coat:	10 mils
Recoat time at 50 degrees F:	Amerlock 400: 3 months, maximum Amerlock 2: 1 month, maximum
Full cure time before immersion at 50 degrees F and 50 percent humidity:	14 days, minimum
Application methods:	Brush, roller, or spray
Color/finish:	Variety of colors/semigloss

PERFORMANCE REQUIREMENTS:

Fresh/deionized water immersion test, ASTM D 870:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.
Salt water immersion test, ASTM D 870; ASTM D 1141 formula A with no heavy metals:	passes, 3,000 hour test with aerated water held at ambient temperature with no blisters evident on either scribed or unscribed sides.

Category IE-1A1

Abrasion resistance, ASTM D 4060, CS-17 wheel, 1,000 cycles, 1-kg load:	100 milligram loss or less
Flexibility, ASTM D 522, 180 degree bend over ¼-inch mandrel:	passes
Pencil hardness, ASTM D 3363:	2B, minimum
Pulloff adhesion, ASTM D 4541, annex A2, type II tester:	500 psi or greater
Pulloff tape, ASTM D 3359:	4A or better
Cathodic disbondment, ASTM G 8:	passes 90 day test

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Category AE-1ATV

Amershield VOC; as manufactured by:	
Ameron International, 13010 Morris Road, Suite 400, Alpharetta GA 30004 678-393-0653, www.ameroncoatings.com	
or equal, having following essential characteristics:	
COMPOSITION:	
Topcoat – Two-component, aliphatic polyurethane	
Lead and chromate free.	
PHYSICAL CHARACTERISTICS, PRIMER:	
Solids by volume:	79 percent, minimum
VOC, as supplied:	1.5 pounds per gallon (185 grams per liter), maximum
Mix ratio - resin: hardener:	4:1
Mixed usable pot life at 50 degrees F:	5 hours, minimum
Ambient application temperature:	50 degrees F, minimum
Surface application temperature above dew point:	5 degrees F, minimum
Maximum DFT per coat:	5 mils
Recoat time at 50 degrees F and 50 percent humidity:	48 hours, minimum
Application methods:	Brush, roller, or spray
Color/finish:	Variety of colors/gloss
PERFORMANCE REQUIREMENTS:	
QUV accelerated weathering test, ASTM D 4587, ASTM G 154:	Passes 3,000 hour test with no blisters evident on either scribed or unscribed sides, color difference ASTM D 2244.
Flexibility, ASTM D 522, 180 degree bend over 1-inch mandrel:	Passes
Pencil hardness, ASTM D 3363:	2B, minimum
Pulloff adhesion, ASTM D 4541, annex A2, type II tester:	500 psi or greater
Pulloff tape, ASTM D 3359:	equal to 4A or better

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END OF SECTION

SECTION 10522 - FIRE EXTINGUISHERS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 REFERENCES

A. National Fire Protection Association (NFPA)

1. NFPA 10-2007 Portable Fire Extinguishers

1.03 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals.

B. RSN 10522-1, Approval Data:

1. Commercial products data.

PART 2 PRODUCTS

2.01 FIRE EXTINGUISHERS

A. Hand-Held Portable Extinguishers: 20-pound agent capacity, minimum U.L. rating 20A: 120 B.C., multi-purpose pressurized dry chemical, red glossy coated steel shell, minimum12 year hydrostatic test requirement, waterproof pressure gauge, wall mounted, hand-operated, minimum 15 foot stream, UL listed for class A, B, and C fires, manufacture’s rated temperature range above 32 degrees F and below 120 degrees F.

B. Fasteners: Corrosion resistant stainless steel mounting hardware.

1. All bolts, screws, expansion anchors, and mounting brackets required for installation of extinguishers.

2.02 COATINGS

A. Provide coatings for fire extinguishers in accordance with Section 09902 - Coatings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install a total of three (3) hand-held portable extinguishers on interior walls of building in accordance with NFPA 10. Locate extinguishers inside building, adjacent to each exterior doorway.

B. Install wall stickers to indicate location of extinguishers from across room.

END OF SECTION

SECTION 11285 – STOPLOGS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Stoplogs:

1. Payment: Lump sum price offered in the schedule.

1.02 REFERENCES

A. American Institute of Steel Construction (AISC)

1.	AISC-S335-1989	Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design with Commentary, Part of M016 - Manual of Steel Construction-Allowable Stress Design, Ninth Edition

B. ASTM International (ASTM)

1.	ASTM A 36/A36M-05	Carbon Structural Steel
2.	ASTM 108-07	Steel Bar, Carbon and Alloy, Cold-Finished
3.	ASTM D 395-03	Rubber Property – Compression Set
4.	ASTM D 412-06a	Vulcanized Rubber and Thermoplastic Elastomers - Tension
5.	ASTM D 471-06	Rubber Property – Effect of Liquids
6.	ASTM D 572-04	Rubber- Deterioration by Heat and Oxygen
7.	ASTM D 2240-05	Rubber Property – Durometer Hardness

1.03 SHIPPING

A. The stoplogs may be shipped assembled or partially disassembled. If shipped assembled, care shall be taken to ensure that no damage occurs to the seals. If partially disassembled, individual components shall be match marked for ease of field assembly. Crate all loose items in a container with a packing list to assist in field inventory and inspection.

PART 2 PRODUCTS

2.01 COMMERCIAL PRODUCTS

A. Seals:

1. The seals are to be fabricated as detailed on the drawings and per these following specifications.

2. Fabricate seals from neoprene, compounded and cured to provide the physical properties listed in Table 11285A - Physical Properties of Seals.

Table 11285A – Physical Properties of Seals

Property	Test Method ASTM	Value
Shore "A" durometer hardness, range	D 2240	60 to 70
Minimum ultimate tensile strength, lbs/in^2	D 412, Method A	2,500
Minimum tensile strength after accelerated aging, (48 hours in oxygen at 70^o C), percent of actual ultimate tensile strength before aging	D 572	80
Minimum elongation at break	D 412	400 percent
Maximum compression set (22 hours at 70^o C, constant deflection), percent of original deflection	D 395, Method B	30
Maximum change in weight (7 days in water at 100^o C), percent	D 471	10

3. All seals are to be inspected to comply with the following requirements:
   a. All cross sections are to be dense, homogeneous, and free from porosity and other imperfections
   b. Exterior surfaces of the seals are to be free of pits, blisters, and other imperfections that could impair sealing.
   c. Variations in cross sectional dimensions of continuous seal strips not to exceed a rate of change of 1/16 inch in 24 inches of seal length.

4. Mold the seal strips using heat and pressure. Provide excess length for cutting and fitting, and to provide specimens for adhesion tests.

5. All splicing must be performed by the seal manufacturer. The thickness of splice gaps may not exceed 1/4 inch. Filler material must completely fill splice gaps and be flush with the exterior seal surfaces. Wrapped or cold cemented splices will not be acceptable.

6. Match profiles of seals to be joined at vulcanized splices to avoid pronounced offsets that could result in leakage. Buff any offsets at spliced joints flush with a transition slope not exceeding 1/16 inch in 24 inches of seal length.

7. Exterior surfaces of the seals shall be free of adhering and bonded seal material.

2.02 MATERIALS

A. Structural Steel: ASTM A 572 Grade 50, unless otherwise noted on the drawings.

B. Headed Anchors:

1. ASTM A 108.

2. Flux-filled stud anchors suitable for end welding to steel with automatic end welding guns or equivalent manually welded anchors.

2.03 FABRICATION

A. Fabricate the stoplog seats and guides, stoplogs, stoplog lifting beams and stoplog storage racks in accordance with these specifications and as detailed on drawings 423-D-789 through 423-D-794, and 423-D-796 through 423-D-801.

B. Details of design and fabrication are per AISC-S335.

2.04 FINISHES

A. Coat the stoplogs, stoplog seats and guides, stoplog lifting beam and all associated equipment in accordance with Section 09902 - Coatings.

B. Remove seals before applying the coating.

2.05 CONTRACTOR SOURCE QUALITY TESTING

A. After fabrication, completely assemble each stoplog in the shop to ensure that all parts fit properly and that the required dimensions and tolerances have been obtained.

B. Drill holes in seals to match holes in seal clamps. Drill holes 1/8 inch oversize for ease of assembly and adjustment.

C. While assembled check for proper seal projection all around.

D. After fabrication, completely assemble stoplog seats and guides in the shop and inspect to ensure that the required dimensions and tolerance have been obtained.

E. Inspection of the stoplogs, lifting beams and guides during fabrication and testing, by a government representative, at the discretion of the COR.

1. Notify the COR at least 21 days in advance of when the inspections are to be performed.

PART 3 EXECUTION

3.01 INSTALLATION AND TESTING

A. Embed the stoplog seats and guides as shown on drawings 423-D-792, 423-D-793, 423-D-799 and in accordance with the installation tolerances. Properly support metalwork during embedment.

B. Embedded Metalwork:

1. Before placing concrete, clean surfaces of metalwork to be in contact with or embedded in concrete in accordance with Section 09902 – Coatings.
2. Accurately locate metalwork to be embedded in concrete. Hold metalwork in correct position and alignment and protect metalwork from damage and displacement during placing and setting of concrete.
3. If they are to be embedded in concrete, use only metal braces, supports, and other items to position and align embedded metalwork, unless otherwise specified. If they are to be embedded in concrete, do not use wooden braces, supports, or other items to position and align embedded metalwork.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Fully assemble and test install each stoplog in each of the stoplog guides using the lifting beam.

B. Testing:

1. While lowering each stoplog in the guides, check for proper clearances and that there is no binding through out its travel.
2. In the fully lowered position or seated position, check each stoplog to ensure that it mates properly with the seats, and that proper clearances are maintained for the guide shoes. Seals shall have continuous contact with the seats.

C. Make any required changes or adjustments to the stoplogs to the satisfaction of the COR.

D. After final testing and adjustments, repair any damage to the coatings.

3.03 STORAGE

A. After all testing, store the stoplogs and lifting beams at a location directed by the COR.

1. The contractor will place the reservoir stoplogs and lifting beam in the Stoplog Storage Facility shown on drawing 423-D-771.
2. The contractor will place the turnout stoplogs in the Coachella Canal Turnout guides as directed by the COR and in accordance with Section 02261 – Diversion and Care of Coachella Canal During Construction.

B. The stoplogs, not stored in the Stoplog Storage Facility, are to be stored with the skinplate up so not to collect moisture in the cavities.

C. Provide timber blocking for elevating the stoplogs above the ground during storage.

END OF SECTION

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SECTION 11288 - SLIDE GATES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Slide Gates:

1. Payment: Lump sum price offered in the schedule.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM A 276-06	Stainless Steel Bars and Shapes

B. American Water Works Association (AWWA)

1.	AWWA C540-02	Power-Actuating Devices For Valves And Slide Gates
2.	AWWA C560-00	Cast-Iron Slide Gates

C. National Electrical Manufacturers Association (NEMA)

1.	NEMA MG 1-2006	Motors and Generators
2.	NEMA 250-2003	Enclosures for Electrical Equipment (1000 Volts Maximum)

D. National Fire Protection Association (NFPA)®

1.	NFPA 70 – 2008	National Electrical Code (NEC)®

1.03 DEFINITIONS

A. Face and back pressure heads: Head at vertical distance from center of gate to maximum water surface.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

1. Electrical Schematic and Wiring Diagrams: In accordance with Division 16 – Electrical.

B. RSN 11288-1, Approval Drawings and Data:

1. Drawings and data showing assembly, type, size, and detail dimensions of slide gate and lift installation including stem guide location, stem nut size, and stem size including material designation. Include lift capacity and drawing showing bellows assembly and installation.

2. Schematic and wiring diagrams for motor and motor operator.

3. Product Data: Gate motor operator.

4. Motor data:

   a. Completed drawing 40-D-6032.

   b. Locked-rotor torque: foot-pounds.

   c. Full-load torque: foot-pounds.

   d. Time rating: minutes.

5. Design and drawings of stem and detailed lubrication instructions and type of lubricant. Stem nut assembly showing size and length.

C. RSN 11288-2, Purchase Orders:

1. Copies of purchase orders for slide gates.

D. RSN 11288-3, Installation Procedures:

1. Describe equipment, methods, materials, and details to install slide gates.

2. Include installation equipment make and model numbers, total weight, distributions of weight to the axles or tracks and outriggers, distance between axles or tracks and outriggers, general equipment dimensions, and proposed working locations relative to concrete structures and canal.

3. This information will be used by Government to determine if loads generated by equipment, including cranes, on concrete structures are acceptable.

E. RSN 11288-4, Final Data:

1. Service manuals, including schematic and wiring diagrams for each motor and motor operator.

1.05 PROJECT CONDITIONS

A. Ambient Temperature Range: 0 to 122 degrees F.

B. Supply Power: 480 volts, 3-phase, 60 hertz.

PART 2 PRODUCTS

2.01 SLIDE GATES

A. Design and manufacture in accordance with AWWA C560, except:

1. Gate frame and slide: Steel.

2. Seating faces: Bronze.

3. Cap-screws, studs, assembly bolts, and anchor bolts: Stainless steel conforming to any 300 series.
4. Stem: Stainless steel conforming to Type 410.
5. Nuts: Bronze.
6. Wall thimble cross section shape: Letter “F".

B. Seating and unseating heads: Design to be suitable for heads indicated on drawings.

C. Closure type: Standard

D. Flat-back type.

E. Frame and slide:
1. Slide: Square bottom type.
2. Frame: Self-Contained.
3. Raised surfaces: Only as necessary for attaching seats and wedges.

2.02 STEM AND STEM GUIDES

A. Design and manufacture in accordance with AWWA C560, except:
1. Stem material: ASTM A 276, Type 410
2. Threaded upper section of the stem connected to the lower stem section by means of a coupling:
   a. Designed to withstand tension, compression, and torsion in the steel as required.
   b. De-couples with a minimum of effort and no special tools.
   c. Releases the upper stem so that the bellows can be removed and reinstalled.
3. No portion of stem shall have cross-sectional area smaller than root area of threaded portion of stem.
4. Stem may have upset end or stem block.
5. Stem block:
   a. Thread or screw onto bottom end of stem, or designed for an upset stem end.
   b. Rigidly pin or key to stem.
6. Stem guides: Fully adjustable.

2.03 BELLOWS ASSEMBLY

A. Design or select a commercially available stem bellows assembly to prevent contamination of threads by dirt or debris.

1. Bellows material: Reinforced rubber accordion style manufactured in one piece.
2. Flanged to seal against the deck or underside of the lift pedestal.
3. Lower end designed to clamp tightly to the stem.
4. Sufficient length and flexibility to allow full gate travel without overstressing the bellows.
5. Resistant to damage by ultraviolet light.

2.04 MOTOR-OPERATED GATE LIFT

A. Design and manufacture in accordance with AWWA C540, except:

1. Hand-wheel and declutching mechanism:
   a. Provide hand-wheel for manual operation.
      1) Manual operation not prevented by fused motor.
      2) Hand-wheel pull, maximum: 40 pounds when raising or lowering gate under maximum load.
   b. Declutching lever:
      1) Place operator in manual operation by mechanically disconnecting motor drive from gear train.
      2) Provide positive indication for remote use when hand-wheel is engaged for manual operation.
      3) Automatically return to electric drive position after manual operation.
2. Enclose gears in a housing.
   a. Waterproof, dust proof, vandal proof.
3. Lifting nut: Bronze, extra-long threaded section length at least 2-1/2 times the nominal stem diameter.
4. Provide for lubrication of sliding and rolling surfaces.
5. Counter or dial type position indicator:
   a. Positive mechanical drive to show gate opening in feet.
   b. Measurement divisions: Manufacturer's option.
6. Stem cover: Steel.

a. Access opening along the entire length of the cover to allow full inspection of the stem threads on one side and cleaning and greasing of the threads.

b. Fully-secured hinged and lockable cover(s). Locks will be provided by others.

c. Cover is sealed against entry of wind-driven dirt and water.

B. Seating and unseating heads: Design to be suitable for seating and unseating heads shown on drawings: seating head of 20 feet.

C. Operating speed: 12 inches per minute plus or minus 10 percent.

D. Actuator Control Compartment:

1. Watertight, dustproof, and O-ring sealed to meet NEMA Type 4 requirements of NEMA 250.

2. Provide thermostatically controlled, anti-condensation heater in compartment.

3. Compartment to house motor contactor, torque and position switches, and communication modules.

E. Actuator Termination Compartment:

1. separate, sealed termination compartment.

2. Terminals: Allow installation of conductors with crimped ring connectors.

3. Terminal Identification: Integral part of terminal strip.

F. Conduit entry: Tapped for threaded conduit termination. One 1-1/2-inch NPT and two 1-inch NPT, minimum.

G. Motor:

1. Squirrel-cage induction specifically designed for gate actuator service.

2. 460 volt, 3-phase, 60 Hz.

3. Insulation Class: F or H.

4. Time rating: 15 minutes at 50 degrees C.

5. Winding Protection: Integral armature winding thermostats.

6. Enclosure: Totally enclosed, nonventilated (TENV), vandal proof.

7. Conform to NEMA MG 1.

H. Motor Contactor: Full-voltage, electro-mechanical, reversing type.

I. Actuator Electrical Disconnect:

1. Disconnect switch or circuit breaker supplied by actuator manufacturer. Electrical ratings in accordance with NFPA 70.
2. Designed to simultaneously interrupt all phases of power between actuator and incoming electrical power supply.
3. Mounted in separate weather proof, watertight compartment. A disconnect switch or circuit breaker mounted integral to the actuator is acceptable.

J. Torque switch mechanism:

1. Integral part of motor operator.
2. Adjustable settings and independent adjustment for opening and closing directions.

K. Position Limit Switches:

1. Mechanically geared to actuator drive mechanism.
2. Contact rating: 5 amperes, 250 volts, 60 Hz., minimum.
3. Adjustable to operate at any opening.
4. Provide enough independent limit switches for internal control functions and for external functions as shown or as described elsewhere in these specifications.
5. Provide limit switch contact that closes when gate is fully open for each gate on trashrake structure. Contact to be used for trashrake interlocks.

L. Position Potentiometer:

1. Mechanically geared to actuator drive mechanism.
2. Suitable for use with digital control module.

M. Local Controls:

1. Pushbuttons for RAISE, LOWER, and STOP. Use of control knob or switch in lieu of pushbuttons is acceptable.
2. Control knob or switch for LOCAL and REMOTE operation.
3. LED type pilot lights to indicate gate OPEN, gate CLOSED, and gate stopped in mid-travel, minimum.

N. Digital Control Module (DCM):

1. Provide each gate actuator with DCM to allow for remote monitoring and control of the actuator from a host PLC.
2. Microprocessor based electronics with control software stored in non-volatile EEPROM memory.
3. Watchdog timer to disconnect actuator from network and disable all outputs upon microprocessor failure.

4. Two serial communication ports, minimum.
5. Built in transient and lighting protection.
6. Perform self-diagnostics and report to host PLC.
7. Provide gate position feedback to host PLC in the form of 0 to 100 percent of gate opening.
8. Provide following status and alarms when requested by host PLC:
    a. Gate in fully open position.
    b. Gate in fully closed position.
    c. Gate is moving in open direction in both electric and handwheel mode.
    d. Gate is moving in closed direction in both electric and handwheel mode.
    e. Selector switch in LOCAL position.
    f. Selector switch in REMOTE position.
    g. Torque switch tripped in the OPEN direction.
    h. Torque switch tripped in the CLOSE direction.
    i. Gate is not moving on command.
    j. Loss of internal control voltage.
    k. Actuator failed self-diagnostics or general alarm.

O. Communication:
1. Communication protocol: Modbus RTU.
2. Communication method: Single RS-485 twisted pair, shielded wire network to host PLC.
3. Communication topology: Redundant loop.

P. Corrosion Protection:
1. All external and internal fasteners and brackets used in actuator are 316 stainless steel.
2. Printed circuit card interconnects have gold-plated connectors.

2.05 PAINTING

A. Paint in accordance with Section 09902 - Coatings.

B. Gate Actuator: Manufacturer’s standard coating for outdoor, desert environment.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install slide gate in accordance with AWWA C560 and as shown on drawings.

1. Install gates in manner to prevent leakage past seats.
2. Leakage between wall thimble and concrete: None allowed.
3. Leakage between gate frame and wall thimble: None allowed.
4. During concrete placement, firmly support in accurate position anchor bolts and other metalwork that will be embedded in concrete.

B. Install stem and lift in accordance with AWWA C560 and as shown on drawings.

1. Hand-wheel, when furnished: Locate centerline of hand-wheel at elevation between 2 and 3 feet above ground or structure on which gate operator will stand; unless otherwise dimensioned or noted on drawings.
2. Crank, when furnished: Locate centerline of crank at elevation between 2.5 and 3.5 feet above ground or structure on which gate operator will stand; unless otherwise dimensioned or noted on drawings.

C. Lubricate stem and lift in accordance with Manufacturer's instructions.

D. Mount separate actuator electrical disconnect close-coupled to actuator.

E. Make grounding, bonding, and conduit connection in accordance with NFPA 70.

F. Make electrical connections in accordance with manufacturer’s instructions and recommendations, and as shown.

G. Cable Tags and Terminal Connectors: In accordance with Division 16 – Electrical.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Test after gate and actuator have been installed.

1. Test LOCAL operation by opening and closing gate through its full range of operation.
2. Make required changes or adjustments until operation of gate and lift is approved by COR.
3. Field Test:
    a. Performed by manufacturer at site. Manufacturer shall be informed of test and be present at the test site prior to test.
    b. Properly lubricate and adjust each slide gate and motor operator.
    c. Operate each gate through one complete cycle and adjust as necessary.

d. Perform a leakage test.

e. Seating and unseating heads measured from top surface of water to centerline of gate leaf.

f. Witnessed and documented by COR.

END OF SECTION

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SECTION 11851 – SAFETY CABLE WITH FLOATS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Safety Cable With Floats:

1. Payment: Lump-sum price offered in the schedule.
    a. Includes cast-in-place concrete for anchor posts.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM F 667-06	Large Diameter Polyethylene Pipe and Fittings

B. Federal Specifications (FS)

1.	FS FF-C-450D(1)-73	Clamps, Wire Rope
2.	FS FF-T-276B(1)-89	Thimbles, Rope
3.	FS RR-W-410F	Wire Rope and Strand

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 11851 -1, Shop Drawings and Manufacturer's Recommendations:

1. Shop drawings of the layout and all construction installation details, including materials lists and manufacturer's installation recommendations.

C. RSN 11851-2, Approval Data:

1. Manufacturer's product data for the polyethylene floats.

PART 2 PRODUCTS

2.01 MATERIALS

A. Wire Rope: FS RR-W-410E, Type I, Class 3, Construction 6x37, drawn galvanized extra-improved plow steel, nylon covered cable with a 14,000 pound minimum tensile strength.

B. Wire Rope Clamps: FS FF-C-450D, type I, Class 2, hot dipped, galvanized.

C. Rope Thimbles: FS FF-T-276B, type III, hot dipped, galvanized.

D. Polyethylene Floats: TUFFBUOY T1818-PT, manufactured by Worthington Products, Inc., 3405 Kuemerle Ave NE, Canton OH 44705, (800) 899-2977; or equal, having the following essential characteristics:

1. Fabricated from an outer shell of chemically resistant polyethylene stabilized with an ultraviolet ray inhibitor meeting requirements of ASTM F 667.

2. Floats:

a. 18-inch diameter round units, with integral ends.

b. Shell molded of polyethylene with a minimum specific gravity of 0.95 and with an ultraviolet ray inhibitor incorporated into the polyethylene meeting requirements of ASTM F 667.

c. Line-through holes.

d. 1-inch diameter schedule 40 galvanized pipe through line-through holes.

e. Color: International safety orange.

3. Flotation material:

a. Polyurethane foam, 2-pound density, stabilized with an ultraviolet ray inhibitor meeting requirements of ASTM F 667.

b. Inner foam core: Minimum 95 percent closed cells. Does not absorb more than 10 percent water, by weight, when immersed for 24 hours under a 6-inch head of water. No voids which can fill with water and reduce buoyancy.

E. Accessories: As recommended by polyethylene float manufacturer.

F. Anchor Posts: In accordance with Section 05500 - Fabricated Metalwork.

G. Concrete Anchors and Reinforcing Bars:

1. In accordance with Section 03300 – Cast-In-Place Concrete.

2. Precast or cast at the job site.

H. Other Hardware:

1. Bolts, nuts, washers, cotter pins, screws, and other hardware: Zinc-coated steel products suitable for required application.

2.02 FABRICATION

A. Fabricate and galvanize custom metalwork in accordance with Section 05500 - Metal Fabrications.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install at location shown on drawings

B. Install in accordance with manufacturer's recommendations.

END OF SECTION

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SECTION 13110 – BURIED IMPRESSED CURRENT CATHODIC PROTECTION SYSTEM

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Buried Impressed Current Cathodic Protection System:

1. Payment: Lump sum price offered in the schedule.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM C 33-03	Concrete Aggregates

B. Bureau of Reclamation (USBR)

1.	USBR M-47	Standard Specification for Repair of Concrete, August 1996

C. NACE International (NACE)

1.	NACE RP0169-2002	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
2.	NACE TM0497-2002	Measurement Techniques Related to Criteria for Cathodic Protection on Underground or Submerged Metallic Piping Systems

D. National Electrical Manufacturers Association (NEMA)

1.	NEMA 250-2003	Enclosures for Electrical Equipment (1000 Volts Maximum)

1.03 DEFINITIONS

A. Structure: The pipe, gate, trashrack, tank, or other metalwork being monitored or cathodically protected.

B. Foreign Structure: Any metallic structure that is not intended to be electrically continuous with the structure requiring corrosion monitoring and/or cathodic protection.

C. Bonded Dielectric Coating: A protective barrier coating system with high electrical resistivity bonded directly to the underlying metal and for the most part physically and electrically isolating the metal from the electrolyte.

D. Electrolyte: An electrically conductive solution, such as soil or water. The terms for these specific conductive solutions may be substituted for the word "electrolyte" in these definitions.

E. Structure-to-Electrolyte Potential:

1. Also referred to as structure-to-soil, pipe-to-soil, fitting-to-soil, and structure-to-water potentials.

2. The potential, or voltage difference, developed by a structure in an electrolyte when compared with a stable reference electrode.

3. Static structure-to-electrolyte potential: The structure-to-electrolyte potential determined without any external current (e.g. prior to energizing a cathodic protection system, and with no galvanic couple, pH cell, interference currents, or the like present), or after such a current source has been disconnected for an extended time period. Also referred to as native structure-to-electrolyte potential.

4. Polarized structure-to-electrolyte potential: The structure-to-electrolyte potential determined after an external current, as from a cathodic protection system, has been flowing, but immediately after it has been interrupted. Also referred to as "instant off" structure-to-electrolyte potential, it is an IR-free reading.

5. Uncorrected structure-to-electrolyte potential: The structure-to-electrolyte potential determined with the cathodic protection system energized and cathodic protection current flowing. This potential is also sometimes called a protective potential and may contain significant IR drop error.

6. Polarization: The change from the static or native potential as a result of current having flowed across the electrode/electrolyte interface for some time. Also considered the difference between polarized and static potentials.

F. Portable Voltmeter: Any portable instrument for measuring voltage drops across electrical components or potential (voltage) differences between a structure and a stable reference electrode:

1. Should have a minimum input impedance of 10 megohm.

2. Should be capable of measuring DC voltages between + or – 0.1 millivolts and + or – 100 volts.

3. When measuring structure potentials using a digital instrument, the structure is typically connected to the positive terminal of a voltmeter and the reference electrode to the common (negative) terminal of the voltmeter. Polarity and voltage magnitude are then read directly as shown on the instrument display.

4. When measuring structure potentials using an analog instrument with a needle that swings only in one direction, reverse connections and interpretation of the polarity by the user are required.

G. Stray Current Interference: Corrosion resulting from current through paths other than the intended circuit - e.g., corrosion occurring on a protected structure caused by the cathodic

protection system on a foreign structure, or some other source of current, either AC or DC.

H. Cable: All metallic conductors other than the protected structures and the anodes; sometimes called wires.

I. Shunt: Calibrated resistor placed within a circuit to determine the current flow within the circuit. Calibration is typically expressed in ohms or amperage/voltage.

J. Reference Electrode: An electrode whose open circuit potential is constant under similar conditions of measurement, which is used for measuring the relative potentials of other electrodes (e.g. protected structures). Sometimes referred to as a reference half-cell, a copper/copper sulfate reference electrode (CSE) is often used for such a purpose.

K. Rectifier: An electrical/electronic device that converts an AC input to a DC output. The rectifier typically includes a step-down transformer section to reduce the incoming AC voltage as well as a rectification section that converts current to DC, along with meters fuses, lightning arresters, and other accessories.

L. Test Station: A location for conducting tests on a protected structure, normally having an enclosure containing terminals of cables from one or more structures.

M. Junction Box: An enclosure containing the terminals from multiple anodes along with accessories such as calibrated shunts and variable resistors. From the junction box, a single anode header cable is fed to a rectifier.

N. Rectifier: An instrument capable of converting AC power to DC power for use with anodes for an impressed current cathodic protection system.

1.04 QUALIFICATIONS

A. The Contractor shall employ the services of an individual having a NACE International Cathodic Protection Technician certification or higher to ensure cathoidc protection systems are properly installed.

B. Testing will be conducted by or under the direction of a Cathodic Protection Specialist. Testing personnel may be assisted by other qualified individuals.

1.05 SYSTEM DESCRIPTION

A. Provide impressed current cathodic protection and monitoring system for the exterior of the two pipes.

B. Provide all materials and engineering services to furnish, install, and energize the corrosion monitoring and impressed current cathodic protection system.

1. Include electrical continuity joint bonds, test stations, junction box, rectifier, anodes, and accessory equipment and features as directed in this specification or as otherwise indicated.

C. Impressed current system shall have capacity to:

1. Provide a minimum service life of 20 years (system and all components).

2. Maintain on all locations of protected structure(s), with reference to a copper/copper sulfate electrode placed close to (i.e. above) the structure:

a. A polarized structure-to-electrolyte potential of at least -0.850 volts on steel having a high quality bonded dielectric coating.

b. Alternately, -0.100 volts of polarization if criteria in a. cannot be obtained (e.g on bare or poorly coated steel structures).

c. A polarized potential at any point on a dielectrically coated structure not exceeding -1.100 volts in all instances.

D. NACE SP-0169 and NACE TM0497 shall apply to any issues not specifically addressed by this specification.

1.06 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals.

B. RSN 13110-1, Manufacturers Data and Preconstruction Drawings:

1. Manufacturers Data. Include catalog data sheets when available, for:

a. Cable.

b. Anode.

c. Junction box.

d. Rectifier.

e. Test station.

f. Permanent reference electrode.

g. Adjustable resistor and calibrated shunt resistor.

h. Exothermic metallurgical bond system (include instructions).

2. Preconstruction drawings:

a. Intended location of anodes, rectifier, junction box, permanent reference electrode, and test station.

b. Details of intended placement and bedding of anodes, including sand bedding of cables.

c. Typical details of intended junction box and test station wiring.

C. RSN 13110-2, As-Built Drawings:

1. Actual location of anodes, rectifier, junction box, permanent reference electrode, and test stations.
2. Details of actual placement and bedding of anodes, including sand bedding of cables.
3. Typical details of actual junction box and test station wiring.

PART 2 PRODUCTS

2.01 GENERAL

A. Materials shall provide a minimum service life of 20 years (system and all components).

2.02 CABLES

A. Single-conductor, stranded, plain, annealed copper cable.

B. Cable insulation:

1. Rated for 600 volts and direct immersion or burial.
2. Dual insulation consisting of Kynar™ or Halar™ with a secondary layer of high-molecular-weight polyethylene (HMWPE) for anode cables running underground.
3. Alternately, black HMWPE insulation with minimum thickness of 0.100 inch for other underground or above ground applications.

C. Unspliced lengths to permit installation from terminus to terminus (e.g. anode to junction box) free of splices and without stress.

D. Gauge:

1. No. 2 AWG or larger for bonding between pipes.
2. No. 6 AWG or larger for carrying current between structures and anodes.
3. No. 12 AWG or larger for determining of structure-to-electrolyte potentials.

2.03 IMPRESSED CURRENT ANODES

A. Anodes: center connected graphite anodes as supplied by Farwest Corrosion Control Co., 480 Artesia Blvd., Gardena CA, 90248, or equal, with the following essential characteristics:

1. Minimum weight:
   a. 62 pound
2. Wax or resin treated graphite anode material specifically designed for cathodic protection systems and the intended environment.

3. Low resistance center cable connection having a waterproof seal on both sides of the anode-to-cable connection.

B. Anode cable in accordance with cable requirements of this section.

C. Anode bed filled with carbonaceous backfill.

2.04 RECTIFIER

A. Constant voltage type with a rated output of at least 17 V – 6 A.

B. Air cooled.

C. Capable of continuous operation at 120 percent of rated output in ambient temperature of 50 degrees C.

D. Fitted with a heavy duty transformer with at least 15 percent over design capacity.

E. Of the silicon diode type.

F. Fitted with switchable meter(s) for determining output voltage and current, and which is (are):

1. Accurate within 2 percent of full scale.
2. Marked with a red line designating rated capacity.

G. Such that the output voltage is adjustable in 18 or more equal increments using quick-change knobs, or continuously from 0 to 100 percent rated output.

H. Energized by 120-volts, single phase AC.

I. Equipped with AC and DC lightning arrestors and protective fuses or circuit breakers.

J. Equipped with solderless, pressure-type terminals for anode and cathode cables.

K. Equipped with a single slide out rack for easy access to internal components during maintenance. The rack shall slide out the front of the cabinet.

L. Equipped with an accessible shunt on the front panel for determining current output. The shunt shall be stamped with the amperage per millivolt rating.

M. Engraved panel.

N. Fitted with a bracket for mounting in a NEMA 250, Type 4 box.

O. Properly grounded.

2.05 JUNCTION BOXES

A. Junction box specifically constructed for cathodic protection system installations:

1. NEMA 250, Type 1, hinged, vented for heat dissipation.
2. Engraved 1/4-inch minimum NEMA grade C phenolic panel.
3. Solderless, pressure-type terminals.
4. Brackets: Suitable for pole or wall mounting.

B. Identify terminals and cables.

C. Equip with 0.01 ohm calibrated shunts of adequate electrical rating for each anode.

D. Equip with variable resistors of adequate electrical rating to adjust the current flow of each anode.

E. Protect as required for permanency.

2.06 TEST STATIONS

A. Test stations: Big Fink, manufactured by Cott Manufacturing Company,1944 Gardena Avenue, Glendale CA 91204; or equal, having the following essential characteristics:

1. Above-ground, orange, post-mounted type.
2. Specifically constructed for cathodic protection system installations.
3. Protected as required for permanency.
4. Sufficient number of terminals (5 terminals minimum) with associated hardware for the number and size of cables and any other accessories required by the design.

B. Test station cables in accordance with cable requirements of this Section.

C. A permanent reference electrode shall be provided near the midway point of the pipes to allow potential monitoring at that location without entering the interstate 8 right of way.

1. The permanent reference electrode must have a minimum 20 year service life.
2. The reference electrode cable must meet the cable requirements of this section.

2.07 EXOTHERMIC METALLURGICAL BONDS

A. Exothermic metallurgical bond system by ThermOweld, 4102 South 74th East Ave., Tulsa, OK 74145-4700, or equal, having the following essential characteristics:

1. Specifically designed for cathodic protection systems.
2. The exothermic reaction produces molten copper alloy, which produces a permanent, high conductivity connection.

3. Uses a special alloy to provide minimum heat effect on the steel.

4. Current carrying capacity equal to that of the conductor.

2.08 DIELECTRIC METALLURGICAL BOND COATING

A. Dielectric material: Royston Handy Cap, manufactured by Royston Laboratories, Inc., 128 First St., Pittsburgh, PA, 15238; or equal, having the following essential characteristics:

1. Specifically designed for cathodic protection systems.

2. Applied with primer coat, as needed.

3. Approved dielectric coating material.

4. Suitable for the intended environment.

2.09 SAND BACKFILL

A. Sand backfill: ASTM C 33, fine aggregate.

2.10 WARNING TAPE

A. Polyethylene warning tape:

1. Minimum 3 inches wide.

2. Red with black lettering.

3. Suitable for direct burial.

4. “Caution –Cathodic Protection Cable Buried Below” printed on tape for its full length.

PART 3 EXECUTION

3.01 INSTALLATION

A. Cable:

1. Inspect for insulation defects prior to backfilling.

   a. Repair defects using approved methods or replace the cable.

   b. COR will inspect and approve all repairs prior to installation.

2. Install without kinks, stresses, and/or splices.

3. Buried applications:

   a. Minimum burial depth: 24 inches.

   b. Surround cable with 6 inches of sand backfill.

c. Place warning tape approximately 12 inches above cable for the entire length.

d. Run cable through rigid galvanized conduit, test station pipe, or similar protection once cable emerges from ground.

4. Connect to test station terminals with crimped, ring-tongue connectors.

5. Identify origin of cables terminating in an enclosure:

a. Factory printed letters on self-adhesive strips attached to the cables clearly visible within the enclosure.

b. Encase printed labels in clear heat shrink tubing.

B. Electrical continuity joint (jumper) bonds:

1. Provide metallurgical bonds between siphon pipes as indicated in this specification section or as necessary to ensure electrical continuity.

2. A minimum of two cables per location.

3. Allow for at least 1 foot of joint movement.

4. Jumper bond locations:

a. Between siphon pipes on both the upstream and downstream ends, minimum.

C. Structure connections:

1. One test cable and one bond cable per siphon pipe at each test station.

2. Connect cables and jumper bonds to structures by exothermic metallurgical bond.

a. Make exothermic metallurgical bond in accordance with the bonding supply manufacturer's instructions.

b. Bonds shall not damage the linings inside pipes or fittings; otherwise, repairs shall be required.

c. Test metallurgical bond integrity by striking side of weld nugget with a 16-ounce hammer, in presence of the COR.

d. Coat bare copper, weld nugget, and ferrous materials at metallurgical bonds with an approved dielectric metallurgical bond coating.

e. Allow dielectric material to cure before repair of the damaged structure coating or lining.

1) Repair dielectric coatings/linings in accordance with Section 09902 – Coatings

D. Impressed Current Anodes:

1. Install vertically as follows and as directed by the COR:

a. Number of anodes: Six anodes.

b. Approximate size of each anode: 80 inches x 4 inches, minimum 62 pounds.

c. Size of each anode bed: 9 feet x 10 inches diameter.

d. Anodes centered in the anode bed and surrounded with carbonaceous backfill.

e. Depth of anode bed: 50 feet from the top of the carbonaceous backfill to ground level.

f. Spacing between anode beds: 20 feet on center.

g. Anode beds installed between the new road and outlet structure approximately 125 to 300 feet from siphons; avoiding the fiber optic cable.

2. Energizing the system will be done at time of testing.

E. Anode Junction Box:

1. Connect individual anode cables to anode header cable through calibrated 0.01 ohm shunts inside the anode junction box.

2. Include a 5 ohm variable resistor in series with the calibrated shunt for each individual anode.

F. Electrical isolation:

1. All structures to be cathodically protected shall be electrically isolated from rebar or other extraneous metal.

G. Test Stations:

1. Locations:

a. Where test stations are not likely to be damaged or interfere with personnel and/or equipment (e.g., adjacent to above ground structures). Exact location is subject to approval of COR.

b. As close to each current carrying structure connection as possible and convenient.

c. One to monitor each end of each pipe and approximately the middle.

d. No test station is to be located within the interstate 8 right of way.

2. Permanently, uniquely, and clearly identify each test station.

3. Terminate all cables for a given location within the same test station enclosure. Identify all cables as to the distinct originating structure.

4. Contain two cables, at a minimum:

a. Bond cable from the protected structure.

b. Cable from the protected structure for determining structure to soil potentials.

3.02 ENERGIZING, ADJUSTING, AND TESTING

A. Energizing, adjusting, and testing will be performed by the Government under the direction of a NACE certified Cathodic Protection Specialist.

END OF SECTION

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SECTION 13111 – GALVANIC ANODE CATHODIC PROTECTION SYSTEMS FOR GATES AND POLES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Galvanic Anode Cathodic Protection Systems for Gates and Poles:

1. Payment: Lump sum price offered in the schedule.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM B 843-07	Magnesium Alloy Anodes for Cathodic Protection

B. NACE International (NACE)

1.	NACE RP0169-2002	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
2.	NACE TM0497-2002	Measurement Techniques Related to Criteria for Cathodic Protection on Underground or Submerged Metallic Piping Systems

C. National Electrical Manufacturers Association (NEMA)

1.	NEMA 250-2003	Enclosures for Electrical Equipment (1000 Volts Maximum)

1.03 DEFINITIONS

A. Structure: The pipe, gate, trash rack, tank, or other metalwork being monitored or cathodically protected.

B. Foreign Structure: Any metallic structure that is not intended to be electrically continuous with the structure requiring corrosion monitoring and/or cathodic protection.

C. Bonded Dielectric Coating: A protective barrier coating system with high electrical resistivity bonded directly to the underlying metal and for the most part physically and electrically isolating the metal from the electrolyte.

D. Electrolyte: An electrically conductive solution, such as soil or water. The terms for these specific conductive solutions may be substituted for the word “electrolyte” in these definitions.

E. Structure-to-Electrolyte Potential:

1. Also referred to as structure-to-soil, pipe-to-soil, fitting-to-soil, and structure-to-water potentials.
2. The potential, or voltage difference, developed by a structure in an electrolyte when compared with a stable reference electrode.
3. Static structure-to-electrolyte potential: The structure-to-electrolyte potential determined without any external current (e.g. prior to energizing a cathodic protection system, and with no galvanic couple, pH cell, interference currents, or the like present), or after such a current source has been disconnected for an extended time period. Also referred to as native structure-to-electrolyte potential.
4. Polarized structure-to-electrolyte potential: The structure-to-electrolyte potential determined after an external current, as from a cathodic protection system, has been flowing, but immediately after it has been interrupted. Also referred to as "instant off" structure-to-electrolyte potential, it is an IR-free reading.
5. Uncorrected structure-to-electrolyte potential: The structure-to-electrolyte potential determined with the cathodic protection system energized and cathodic protection current flowing. This potential is also sometimes called a protective potential and may contain significant IR drop error.
6. Polarization: The change from the static or native potential as a result of current having flowed across the electrode/electrolyte interface for some time. Also considered the difference between polarized and static potentials.

F. Portable Voltmeter: Any portable instrument for measuring voltage drops across electrical components or potential (voltage) differences between a structure and a stable reference electrode:

1. Should have a minimum input impedance of 10 megohm.
2. Should be capable of measuring DC voltages between + or – 0.1 millivolts and + or – 100 volts.
3. When measuring structure potentials using a digital instrument, the structure is typically connected to the positive terminal of a voltmeter and the reference electrode to the common (negative) terminal of the voltmeter. Polarity and voltage magnitude are then read directly as shown on the instrument display.
4. When measuring structure potentials using an analog instrument with a needle that swings only in one direction, reverse connections and interpretation of the polarity by the user are required.

G. Stray Current Interference: Corrosion resulting from current through paths other than the intended circuit - e.g., corrosion occurring on a protected structure caused by the cathodic protection system on a foreign structure, or some other source of current, either AC or DC.

H. Cable: All metallic conductors other than the protected structures and the anodes; sometimes called wires.

I. Shunt: Calibrated resistor placed within a circuit to determine the current flow within the circuit. Calibration is typically expressed in ohms or amperage/voltage.

J. Reference Electrode: An electrode whose open circuit potential is constant under similar conditions of measurement, which is used for measuring the relative potentials of other electrodes (e.g. protected structures). Sometimes referred to as a reference half-cell, a copper/copper sulfate reference electrode (CSE) is often used for such a purpose.

K. Test Station: A location for conducting tests on a protected structure, normally having an enclosure containing terminals of cables from one or more structures and from anodes along with accessories such as calibrated shunts.

L. Junction Box: An enclosure containing the terminals from multiple electrodes along with accessories such as calibrated shunts and variable resistors. From the junction box, a single cable is normally fed to a test station.

1.04 QUALIFICATIONS

A. The Contractor shall employ the services of an individual having a NACE International Cathodic Protection Technician certification or higher to ensure cathodic protection systems are properly installed.

B. Testing will be conducted by or under the direction of a Cathodic Protection Specialist. Testing personnel may be assisted by other qualified individuals.

1.05 SYSTEM DESCRIPTION

A. Provide galvanic anode cathodic protection and monitoring system(s) for the submerged metalwork, including:

1. Except for the gates at the pipe inlet structure, each gate, on each side including stop-log guides. The gates at the pipe inlet structure shall be cathodically protected only on the upstream side.
2. Immersed support poles for sensors and solar panels, and their ladders.

B. All materials and engineering services shall be provided to furnish, install, and energize the corrosion monitoring and galvanic anode cathodic protection system(s).

1. Include electrical continuity joint bonds, test stations, galvanic anodes, and accessory equipment and features as directed in this specification or as otherwise indicated.

C. Galvanic anode system(s) shall have capacity to:

1. Provide a minimum service life of 20 years (system and all components).
2. Maintain on all locations of protected structure(s), with reference to a copper/copper sulfate electrode placed close to the structure:

a. A polarized structure-to-electrolyte potential of at least -0.850 volts on steel having a high quality bonded dielectric coating.

b. Alternately, -0.100 volts of polarization (e.g. isolated bare or poorly coated steel structures).

c. A polarized potential at any point on a dielectrically coated structure not exceeding -1.100 volts in all instances.

D. Galvanic anodes shall be placed and connected:

1. Such as to provide adequate distribution of cathodic protection current, as indicated by potential readings.

2. Submerged and restrained (e.g. PVC half-pipe) in such a way as to:

a. Maintain sufficient anode material below the minimum normal operating water level.

b. Not allow the anodes to come in direct contact with the protected structure.

c. Not place stress on the anode cables.

3. Through cables:

a. Suitable for direct immersion.

b. Having all portions insulated that are exposed to electrolyte.

4. Through junction box(es) to protected structure(s):

a. Connecting individual anodes to the structure(s) through individual calibrated shunts within junction box(es) for current measurement.

b. Connecting individual anodes to the structure(s) through variable resistors within junction box(es) to allow equalizing current from individual anodes where multiple anodes are used or where adjustment of current may be needed.

c. Locating all junction boxes to make them readily accessible.

E. Electrical continuity joint bonds shall be provided:

1. Using metallurgical bonds at mechanical type joints (e.g., non-welded joints) between ferrous parts to be protected to ensure electrical continuity, where isolation is not required by design.

2. Bonding associated metalwork systems, where appropriate, for mutual protection.

F. NACE RP-0169 and NACE TM0497 shall apply to any issues not specifically addressed by this specification.

1.06 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals.

B. RSN 13111-1, Manufacturers Data and Preconstruction Drawings:

1. Manufacturers Data. Include catalog data sheets where available for.
    a. Cable.
    b. Anode.
    c. Junction box.
    d. Test station.
    e. Variable resistor and calibrated shunt resistor.
    f. Exothermic metallurgical bond system (include instructions).
2. Preconstruction drawings:
    a. Intended locations of anodes, junction boxes, and test stations.
    b. Details of intended placement and restraint of anodes.
    c. Typical details of intended junction box and test station wiring.

C. RSN 13111-2, As-Built Drawings:

1. Actual locations of anodes, junction boxes, and test stations.
2. Details of actual placement and restraint of anodes.
3. Typical details of actual junction box and test station wiring.

PART 2 PRODUCTS

2.01 GENERAL

A. Materials shall provide a minimum service life of 20 years (system and all components).

2.02 CABLES

A. Single-conductor, stranded, plain, annealed copper cable.

B. Cable insulation:

1. Rated for 600 volts and direct immersion.
2. Black, high-molecular-weight polyethylene (HMWPE) with minimum thickness of 0.100 inch.

C. Unspliced lengths to permit installation from terminus to terminus (e.g. anode to junction box or test station) free of splices and without stress.

D. Gauge:

1. No. 6 AWG or larger for carrying current between structures and anodes, and for joint bonds between parts.

2. No. 12 AWG or larger for determining of structure-to-electrolyte potentials and from individual anodes.

2.03 GALVANIC ANODES

A. Galvanic anodes: Bare 2-1/2-inch diameter extruded high potential magnesium rod anodes manufactured by Farwest Corrosion Control Co., 480 Artesia Blvd., Gardena CA, 90248; or equal, with the following essential characteristics:

1. Minimum weights of magnesium:

a. 4 pounds per foot

2. High potential magnesium anode material specifically designed for cathodic protection systems and the intended environment.

3. Anode material meeting or exceeding the requirements of ASTM B 843 and having a minimum potential of -1.700 volts referenced to a copper/copper sulfate reference electrode (CSE).

4. Core:

a. Mild or galvanized steel centered within the anode material and extending essentially the entire length of anode

b. Exposed at one end for the anode-to-cable connection.

c. Connection between the anode cable and core: Crimped, silver-solder.

B. Anode-to-cable connection, including the crimped and silver-soldered connection, exposed core, and exposed copper cable shall be potted in epoxy by the supplier.

C. Anode cable in accordance with cable requirements of this section.

2.04 JUNCTION BOXES

A. Junction boxes specifically constructed for cathodic protection system installations when multiple anodes are used to protect a structure:

1. NEMA 250 type 3-R, hinged, lockable cabinets constructed of No. 16-gauge or thicker galvanized steel that are weatherproof and vented for heat dissipation.

2. Engraved 1/4-inch minimum NEMA grade C phenolic panels.

3. Solderless, pressure-type terminals.

4. Brackets: Suitable for pole or wall mounting.

B. Identify terminals and cables.

C. Equip with 0.01 ohm calibrated shunts of adequate electrical rating for each anode.

D. Equip with variable resistors of adequate electrical rating to adjust the current flow of each anode.

E. Protect as required for permanency.

2.05 TEST STATIONS

A. Test stations: Big Fink, manufactured by Cott Manufacturing Company,1944 Gardena Avenue, Glendale CA 91204; or equal, having the following essential characteristics:

1. Above-ground, post-mounted type.
2. Orange in color.
3. Specifically constructed for cathodic protection system installations.
4. Protected as required for permanency.
5. Sufficient number of terminals (5 terminals minimum) with associated hardware for the number and size of cables and any other accessories required by the design.

B. Test station cables in accordance with cable requirements of this Section.

2.06 EXOTHERMIC METALLURGICAL BONDS

A. Exothermic metallurgical bond system by ThermOweld, 4102 South 74th East Ave., Tulsa, OK 74145-4700, or equal, having the following essential characteristics:

1. Specifically designed for cathodic protection systems.
2. The exothermic reaction produces molten copper alloy, which produces a permanent, high conductivity connection.
3. Uses a special alloy to provide minimum heat effect on the steel.
4. Current carrying capacity equal to that of the conductor.

2.07 DIELECTRIC METALLURGICAL BOND COATING

A. Repair coating at exothermic metallurgical bonds.

PART 3 EXECUTION

3.01 INSTALLATION

A. Cable:

1. Inspect for insulation defects prior to installation.
    a. Repair defects using approved methods or replace the cable.

b. COR will inspect and approve all repairs prior to installation.

2. Install without kinks, stresses, and/or splices.

3. Run cable through rigid galvanized conduit, test station pipe, or similar protection once cable emerges from the water.

4. Connect to test station terminals with crimped, ring-tongue connectors.

5. Identify origin of cables terminating in an enclosure:

a. Factory printed letters on self-adhesive strips attached to the cables clearly visible within the enclosure.

b. Encase printed labels in clear heat shrink tubing.

B. Electrical continuity joint (jumper) bonds:

1. Provide metallurgical bonds at mechanical type joints (e.g., non-welded joints) between ferrous parts to be included in a particular cathodic protection system as indicated in this specification section or as necessary to ensure electrical continuity.

2. A minimum of two cables per bond joint.

3. Allow for at least 1/2-inch of movement.

4. Jumper bond locations:

a. Between gates and associated stop-logs.

b. Between associated gates.

c. Between sensor poles and their associated ladders.

d. Above water level when convenient.

C. Structure connections:

1. Connect cables and jumper bonds to structures by exothermic metallurgical bond.

a. Make exothermic metallurgical bond in accordance with the bonding supply manufacturer's instructions.

b. Bonds shall not damage the linings inside pipes or fittings; otherwise, repairs shall be required.

c. Test metallurgical bond integrity by striking side of weld nugget with a 16-ounce hammer, in presence of the COR.

d. Coat bare copper, weld nugget, and ferrous materials at metallurgical bonds with an approved dielectric metallurgical bond coating.

e. Allow dielectric material to cure before repair of the damaged structure coating or lining.

1) Repair dielectric coatings/linings in accordance with Section 09902 – Coatings

D. Galvanic Anodes:

1. Install as follows and as directed by the COR:

a. Two 8 foot long, 2-1/2-inch diameter anodes distributed equally on each side of the gates on the upstream side where 2 gates are to be protected.

1) Anodes at least 28 feet from the structures to be protected.

2) Anodes at least 10 feet from one another.

b. Two 8 foot long, 2-1/2-inch diameter anodes distributed equally on each side of the gates on the upstream side, and two additional of this size anode on the downstream side where a set of 3 gates are to be protected.

1) Anodes at least 28 feet from the structures to be protected.

2) Anodes at least 10 feet from one another.

c. One 5 foot long, 2-1/2-inch diameter anode for each of the 3 instrument support poles.

1) Anodes at least 28 feet from the structures to be protected.

2. Do not lower anodes into their restrained locations using the cable (e.g. lower anodes using a separate rope made of non-conductive material).

3. Do not connect anodes to structures at test stations; energizing the systems will be done at time of testing.

4. Connect galvanic anode cables to structures through individual calibrated 0.01 ohm shunts in a junction box or test station.

5. Include in series with the calibrated shunts a variable resistor in the junction box or test station capable of 0 to 20 ohms of resistance.

E. Electrical isolation:

1. All structures to be cathodically protected shall be electrically isolated from rebar or other extraneous metal not to be protected.

F. Test Stations:

1. Locations:

a. Where test stations are not likely to be damaged or interfere with personnel and/or equipment (e.g., adjacent to above ground structures). Exact location is subject to approval of COR.

b. As close to each current carrying structure and/or junction box connection as possible and convenient.

2. Permanently, uniquely, and clearly identify each test station.

3. Terminate all cables for a given location within the same test station enclosure. Identify all cables as to the originating structure.

4. Contain three cables, at a minimum:
    a. Current carrying cable(s) from the protected structure(s).
    b. Current carrying cable(s) from the anodes.
    c. Cable from the protected structure(s) for determining structure-to-water potentials.
5. At single anode locations, connect individual anodes to the structures through individual calibrated shunts, and variable resistors, of appropriate rating for current measurement.
6. At multiple anode locations, a cable between the test station and an anode junction box may be used to connect anodes to the structure.
    a. Connect individual anodes to the structures through individual calibrated shunts of appropriate rating within the junction boxes for current measurement.
    b. Install individual variable resistors in series with these calibrated shunts in the junction box.
    c. Install junction boxes adjacent to and preferably below test stations, where required.

3.02 ENERGIZING, ADJUSTING, AND TESTING

A. Energizing, adjusting, and testing will be performed by the Government under the direction of a NACE certified Cathodic Protection Specialist.

END OF SECTION

SECTION 13112 – SUBMERGED GALVANIC ANODE CATHODIC PROTECTION SYSTEM - PIPES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Submerged Galvanic Anode Cathodic Protection System – Pipes:

1. Payment: Lump-sum price offered in the schedule.

1.02 REFERENCES

A. NACE International (NACE)

1.	NACE SP0169-2007	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
2.	NACE TM0497-2002	Measurement Techniques Related to Criteria for Cathodic Protection on Underground or Submerged Metallic Piping Systems

1.03 DEFINITIONS

A. Structure: The pipe, gate, trash rack, tank, or other metalwork being monitored or cathodically protected.

B. Foreign Structure: Any metallic structure that is not intended to be electrically continuous with the structure requiring corrosion monitoring and/or cathodic protection.

C. Bonded Dielectric Coating: A protective barrier coating system with high electrical resistivity bonded directly to the underlying metal and for the most part physically and electrically isolating the metal from the electrolyte.

D. Electrolyte: An electrically conductive solution, such as soil or water. The terms for these specific conductive solutions may be substituted for the word “electrolyte” in these definitions.

E. Structure-to-Electrolyte Potential:

1. Also referred to as structure-to-soil, pipe-to-soil, fitting-to-soil, and structure-to-water potentials.

2. The potential, or voltage difference, developed by a structure in an electrolyte when compared with a stable reference electrode.

3. Static structure-to-electrolyte potential: The structure-to-electrolyte potential determined without any external current (e.g. prior to energizing a cathodic protection system, and with no galvanic couple, pH cell, interference currents, or

the like present), or after such a current source has been disconnected for an extended time period. Also referred to as native structure-to-electrolyte potential.

4. Polarized structure-to-electrolyte potential: The structure-to-electrolyte potential determined after an external current, as from a cathodic protection system, has been flowing, but immediately after it has been interrupted. Also referred to as "instant off" structure-to-electrolyte potential, it is an IR-free reading.

5. Uncorrected structure-to-electrolyte potential: The structure-to-electrolyte potential determined with the cathodic protection system energized and cathodic protection current flowing. This potential is also sometimes called a protective potential and may contain significant IR drop error.

6. Polarization: The change from the static or native potential as a result of current having flowed across the electrode/electrolyte interface for some time. Also considered the difference between polarized and static potentials.

F. Portable Voltmeter: Any portable instrument for measuring voltage drops across electrical components or potential (voltage) differences between a structure and a stable reference electrode:

1. Should have a minimum input impedance of 10 megohm.

2. Should be capable of measuring DC voltages between + or – 0.1 millivolts and + or – 100 volts.

3. When measuring structure potentials using a digital instrument, the structure is typically connected to the positive terminal of a voltmeter and the reference electrode to the common (negative) terminal of the voltmeter. Polarity and voltage magnitude are then read directly as shown on the instrument display.

4. When measuring structure potentials using an analog instrument with a needle that swings only in one direction, reverse connections and interpretation of the polarity by the user are required.

G. Stray Current Interference: Corrosion resulting from current through paths other than the intended circuit - e.g., corrosion occurring on a protected structure caused by the cathodic protection system on a foreign structure, or some other source of current, either AC or DC.

H. Cable: All metallic conductors other than the protected structures and the anodes; sometimes called wires.

I. Shunt: Calibrated resistor placed within a circuit to determine the current flow within the circuit. Calibration is typically expressed in ohms or amperage/voltage.

J. Reference Electrode: An electrode whose open circuit potential is constant under similar conditions of measurement, which is used for measuring the relative potentials of other electrodes (e.g. protected structures). Sometimes referred to as a reference half-cell, a copper/copper sulfate reference electrode (CSE) is often used for such a purpose.

K. Test Station: A location for conducting tests on a protected structure, normally having an enclosure containing terminals of cables from one or more structures and from anodes along with accessories such as calibrated shunts.

L. Junction Box: An enclosure containing the terminals from multiple electrodes along with accessories such as calibrated shunts and variable resistors. From the junction box, a single cable is normally fed to a test station.

1.04 QUALIFICATIONS

A. The contractor shall employ the services of an individual having a NACE International Cathodic Protection Technician certification or higher to ensure cathodic protection systems are properly installed.

B. Testing will be conducted by or under the direction of a Cathodic Protection Specialist. Testing personnel may be assisted by other qualified individuals.

1.05 SYSTEM DESCRIPTION

A. A directly connected galvanic anode cathodic protection system and monitoring capabilities will be provided for the submerged pipe interiors.

B. All materials and engineering services will be provided to furnish, install, and energize the corrosion monitoring and cathodic protection system(s).

1. Include test stations, galvanic anodes, supports, bonds, and accessory equipment and features as directed in this specification or as otherwise indicated.

C. Galvanic anode cathodic protection system(s) and components will have capacity to:

1. Provide a minimum service life of 20 years (system and all components).

D. Galvanic anodes will be placed and connected:

1. As indicated in this specification.
2. Submerged and restrained in such a way as to:
    a. Maintain sufficient anode material below the minimum normal operating water level.
    b. Not place stress on the anode cables, which will be.
        1) Suitable for direct immersion.
        2) Have all portions electrically insulated that are exposed to electrolyte.

E. NACE RP-0169 and NACE TM0497 shall apply to any issues not specifically addressed by this specification.

1.06 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals.

B. RSN 13112-1, Manufactures Data and Preconstruction Drawings:

1. Manufacturers Data, including catalog data sheets when available for:
    a. Cables.
    b. Anodes.
    c. Dielectric anode covering at anode hold points
    d. Test stations.
    e. Isolation kits.
    f. Exothermic metallurgical bond systems (including instructions).
    g. Coatings for metallurgical bonds
    h. Permanent reference electrodes.
    i. Splice kit for steel test coupon to cable connections.
2. Preconstruction Drawings:
    a. Intended location of anodes, and test stations.
    b. Details of intended placement and restraint of anodes, cables, and conduit.
    c. Typical details of intended test station wiring.

C. RSN 13112-2, As-Built Drawings:

1. Actual location of anodes, and test stations.
2. Details of actual placement and restraint of anodes, cables, and conduit.
3. Typical details of actual test station wiring.

PART 2 PRODUCTS

2.01 GENERAL

A. Materials shall provide a minimum service life of 20 years (system and all components).

2.02 PERMANENT REFERENCE ELECTRODES

A. Copper/copper sulfate permanent reference electrodes electrically isolated from the structure such as the model IR supplied by Electrochemical Devices, Inc. (P.O. Box 355, Belmont, MA 02478-0003) or equal.

1. Supported near the top of the pipes.
2. Having a nearby steel coupon:

a. Electrically isolated from the pipes and supports and from the reference electrodes.

b. Restricted from movement due to flowing water.

c. Spliced to a #12 AWG or larger cable returning to a test station.

d. With the cable to coupon splice sealed and suitable for immersion.

e. The steel coupon shall be at least 1/2-inch thick at its thinnest dimension and shall expose at least 1/4 square inch of steel.

B. Cables from the permanent reference electrodes and steel coupons meeting the cable requirements of this section.

C. Locate as indicated in the installation section.

2.03 CABLES

A. Single-conductor, stranded, plain, annealed copper cable.

B. Cable insulation:

1. Rated for 600 volts and direct immersion or burial.

2. Black, with a high-molecular-weight polyethylene (HMWPE) insulation at least 0.100 in. thick.

C. Unspliced lengths to permit installation from terminus to terminus (e.g. anode to structure or reference electrode to test station) free of splices and without stress.

D. Gauge:

1. No. 12 AWG or larger for determining of structure-to-electrolyte potentials.

2. No. 6 AWG or larger for current carrying anode cables and test station cable to structure.

2.04 GALVANIC ANODES

A. High potential magnesium rod anodes such as Galvomag anodes supplied by Farwest Corrosion Control (1480 W. Artesia Blvd., Gardena, CA 90248), or equal, with the following essential characteristics:

1. Anode material specifically designed for cathodic protection systems and the intended environment and providing an open circuit potential of at least -1.70 V with respects to a copper/copper sulfate reference electrode.

2. 2.5 inch diameter minimum.

3. Approximately 25 feet long with a 3-foot or longer #6 AWG bonding cable at each end installed by the manufacturer and sealed using an appropriate compound.

4. 4 lb/ft of anode material.

5. A steel or galvanized steel 3/16 inch core wire running the length of the anode rod.

B. Supports shall hold the anodes 7 inches from the interior wall of the pipes.

1. Where supports hold the anodes, the anodes shall be wrapped with a double thickness of dielectric barrier material, such as STOPAQ Coat Wrap CZH (AMCORR, 10624 Sentinel Dr., San Antonio, TX 78217) or equal, to a width of about 4 inches.

C. Anode cable in accordance with cable requirements of this section.

2.05 TEST STATIONS

A. Test stations: Big Fink, manufactured by Cott Manufacturing Company (1944 Gardena Avenue, Glendale CA 91204), or equal, having the following essential characteristics:

1. Above-ground, post-mounted type.

2. Specifically constructed for cathodic protection system installations.

3. Protected as required for permanency.

4. Sufficient number of terminals (5 terminals minimum) with associated hardware for the number and size of cables and any other accessories required by the design.

B. Test station cables in accordance with cable requirements of this Section.

2.06 EXOTHERMIC METALLURGICAL BONDS

A. Exothermic metallurgical bond system by Thermoweld (4102 South 74th East Ave., Tulsa, OK 74145-4700), or equal, having the following essential characteristics:

1. Specifically applicable to cathodic protection systems.

2. The exothermic reaction produces molten copper alloy, which produces a permanent, high conductivity connection.

3. Uses a special alloy to provide minimum heat effect on the steel.

4. Current carrying capacity equal to that of the conductor.

2.07 DIELECTRIC METALLURGICAL BOND COATING

A. Dielectric material, such as Bitumastic 50 (Carboline, 350 Hanley Industrial Court, St. Louis, MO 63144-1599) or equal:

1. Approved dielectric coating material.

2. Suitable for the intended environment.

PART 3 EXECUTION

3.01 INSTALLATION

A. Cable:

1. Inspect for insulation defects prior to installation.
    a. Repair defects using approved methods or replace the cable.
    b. COR will inspect and approve all repairs prior to installation.
2. Install without kinks, stresses, and/or splices.
3. Run structure and permanent reference electrode cables through PVC conduit, test station pipe, or similar protection.
4. Connect to test station terminals with crimped, ring-tongue connectors.
5. Identify origin of cables terminating in an enclosure:
    a. Factory printed letters on self-adhesive strips attached to the cables clearly visible within the enclosure.
    b. Encase printed labels in clear heat shrink tubing.

B. Structure connections:

1. Connect anode cables to structures by exothermic metallurgical bonds, either to the anode mounting hardware welded to the pipes (preferable for anodes) or to the pipes themselves.
    a. Make exothermic metallurgical bond in accordance with the bonding supply manufacturer's instructions.
    b. Bonds shall not damage the linings inside pipes; otherwise, repairs shall be required.
    c. Test metallurgical bond integrity by striking side of weld nugget with a 16-ounce hammer, in presence of the COR.
    d. Coat bare copper, weld nugget, and ferrous materials at metallurgical bonds with an approved dielectric metallurgical bond coating.
    e. Allow dielectric material to cure before repair of the damaged structure coating or lining.
        1) Repair dielectric coatings/linings in accordance with Section 09902 – Coatings

C. Galvanic Anodes:

1. Install horizontally as follows:
    a. Continuously (some minimal spacing allowed between anode ends) at the 3 o’clock and 9 o’clock positions in each pipe.

b. Support brackets restraining the anodes:

1) Shall be covered in the coating system used for the pipe interiors.

2) Hold the anodes at dielectrically wrapped sites on the anodes.

3) U-bolts and nuts or similar hardware restraining the anodes shall be 304 or 316 stainless steel (either L or non-L grade).

D. Electrical isolation:

1. All structures to be cathodically protected shall be electrically isolated from rebar or other extraneous metal.

2. Isolation kits (e.g. dielectric sleeve and washer, either one piece or two) shall be installed on the U-bolts or other fastener hardware holding the anodes to isolate them from the support system.

E. Permanent reference electrodes per pipe:

1. Provide a minimum of 3 reference electrodes oriented with the direction of flow along with electrically isolated steel test coupons.

2. Run reference electrode and test coupon cables through PVC conduit connected to a support system at the top of the pipes.

3. Locate reference electrodes and test coupons:

a. Near the top of the pipes.

b. About 140 feet from each end, and in the middle, of each pipe.

F. Test Stations:

1. Locations:

a. Where test stations are not likely to be damaged or interfere with personnel and/or equipment (e.g., adjacent to above ground structures). Exact location is subject to approval of COR.

b. As close to each current carrying structure connection as possible and convenient.

2. Permanently, uniquely, and clearly identify each test station.

3. Terminate all cables for a given pipe within the same test station enclosure. Identify all cables as to the originating structure and reference electrode.

4. Contain:

a. Cables from the permanent reference electrodes and steel test coupons.

b. Cables from the protected structures for determining structure to water potentials.

3.02 ENERGIZING, ADJUSTING, AND TESTING

A. Energizing, adjusting, and testing will be performed by the Government under the direction of a NACE certified Cathodic Protection Specialist.

END OF SECTION

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SECTION 13113 – SUBMERGED IMPRESSED CURRENT CATHODIC PROTECTION SYSTEM - TRASHRACKS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Submerged Impressed Current Cathodic Protection System – Trashracks:

1. Payment: Lump sum price offered in the schedule.

1.02 REFERENCES

A. NACE International (NACE)

1.	NACE RP0169-2002	Control of External Corrosion on Underground or Submerged Metallic Piping Systems
2.	NACE TM0497-2002	Measurement Techniques Related to Criteria for Cathodic Protection on Underground or Submerged Metallic Piping Systems

B. National Electrical Manufacturers Association (NEMA)

1.	NEMA 250-2003	Enclosures for Electrical Equipment (1000 Volts Maximum)

1.03 DEFINITIONS

A. Structure: The pipe, gate, trash rack, tank, or other metalwork being monitored or cathodically protected.

B. Foreign Structure: Any metallic structure that is not intended to be electrically continuous with the structure requiring corrosion monitoring and/or cathodic protection.

C. Bonded Dielectric Coating: A protective barrier coating system with high electrical resistivity bonded directly to the underlying metal and for the most part physically and electrically isolating the metal from the electrolyte.

D. Electrolyte: An electrically conductive solution, such as soil or water. The terms for these specific conductive solutions may be substituted for the word “electrolyte” in these definitions.

E. Structure-to-Electrolyte Potential:

1. Also referred to as structure-to-soil, pipe-to-soil, fitting-to-soil, and structure-to-water potentials.

2. The potential, or voltage difference, developed by a structure in an electrolyte when compared with a stable reference electrode.

3. Static structure-to-electrolyte potential: The structure-to-electrolyte potential determined without any external current (e.g. prior to energizing a cathodic protection system, and with no galvanic couple, pH cell, interference currents, or the like present), or after such a current source has been disconnected for an extended time period. Also referred to as native structure-to-electrolyte potential.

4. Polarized structure-to-electrolyte potential: The structure-to-electrolyte potential determined after an external current, as from a cathodic protection system, has been flowing, but immediately after it has been interrupted. Also referred to as "instant off" structure-to-electrolyte potential, it is an IR-free reading.

5. Uncorrected structure-to-electrolyte potential: The structure-to-electrolyte potential determined with the cathodic protection system energized and cathodic protection current flowing. This potential is also sometimes called a protective potential and may contain significant IR drop error.

6. Polarization: The change from the static or native potential as a result of current having flowed across the electrode/electrolyte interface for some time. Also considered the difference between polarized and static potentials.

F. Portable Voltmeter: Any portable instrument for measuring voltage drops across electrical components or potential (voltage) differences between a structure and a stable reference electrode:

1. Should have a minimum input impedance of 10 megohm.

2. Should be capable of measuring DC voltages between + or – 0.1 millivolts and + or – 100 volts.

3. When measuring structure potentials using a digital instrument, the structure is typically connected to the positive terminal of a voltmeter and the reference electrode to the common (negative) terminal of the voltmeter. Polarity and voltage magnitude are then read directly as shown on the instrument display.

4. When measuring structure potentials using an analog instrument with a needle that swings only in one direction, reverse connections and interpretation of the polarity by the user are required.

G. Stray Current Interference: Corrosion resulting from current through paths other than the intended circuit - e.g., corrosion occurring on a protected structure caused by the cathodic protection system on a foreign structure, or some other source of current, either AC or DC.

H. Cable: All metallic conductors other than the protected structures and the anodes; sometimes called wires.

I. Shunt: Calibrated resistor placed within a circuit to determine the current flow within the circuit. Calibration is typically expressed in ohms or amperage/voltage.

J. Reference Electrode: An electrode whose open circuit potential is constant under similar conditions of measurement, which is used for measuring the relative potentials of other electrodes (e.g. protected structures). Sometimes referred to as a reference half-cell, a copper/copper sulfate reference electrode (CSE) is often used for such a purpose.

K. Rectifier: An electrical/electronic device that converts an AC input to a DC output. The rectifier typically includes a step-down transformer section to reduce the incoming AC voltage as well as a rectification section that converts current to DC, along with meters fuses, lightning arresters, and other accessories.

L. Test Station: A location for conducting tests on a protected structure, normally having an enclosure containing terminals of cables from one or more structures and from anodes along with accessories such as calibrated shunts.

M. Junction Box: An enclosure containing the terminals from multiple electrodes along with accessories such as calibrated shunts and variable resistors. From the junction box, a single cable is normally fed to a test station.

1.04 QUALIFICATIONS

A. The Contractor shall employ the services of an individual having a NACE International Cathodic Protection Technician certification or higher to ensure cathodic protection systems are properly installed.

B. Testing will be conducted by or under the direction of a Cathodic Protection Specialist. Testing personnel may be assisted by other qualified individuals.

1.05 SYSTEM DESCRIPTION

A. Provide potential controlled impressed current cathodic protection and monitoring system for the submerged trashrack.

B. Provide all materials and engineering services to furnish, install, and energize the corrosion monitoring and impressed current cathodic protection system.

1. Include electrical isolation as needed, electrical continuity bonds, impressed current anodes, and accessory equipment and features as directed in this specification or as otherwise indicated.

C. Impressed current cathodic protection system shall have capacity to:

1. Provide a minimum service life of 20 years (system and all components).

2. Maintain on all locations of protected structure(s), with reference to a copper/copper sulfate electrode placed close to the structure:

a. A polarized structure-to-electrolyte potential of at least -0.850 volts on steel having a high quality bonded dielectric coating.

b. Alternately, -0.100 volts of polarization (e.g. isolated bare or poorly coated steel structures).

c. A polarized potential at any point on a dielectrically coated structure not exceeding -1.100 volts in all instances.

D. Impressed current anodes shall be placed and connected:

1. Such as to provide adequate distribution of cathodic protection current, as indicated by potential readings.

2. Submerged and restrained in such a way as to:

a. Maintain sufficient anode material below the minimum normal operating water level.

b. Not allow the anodes to come in direct contact with the protected structure.

c. Not place stress on the anode cables.

3. Through cables:

a. Suitable for direct immersion.

b. Having all portions electrically insulated that are exposed to electrolyte.

c. Protected by conduit above the water line.

4. Through junction box to protected structure:

a. Connecting individual anodes to the structure through individual calibrated shunts within junction box for current measurement.

b. Connecting individual anodes to the structure(s) through variable resistors within junction box(es) to allow equalizing current from individual anodes.

c. Locating the junction box to make it readily accessible.

E. NACE RP-0169 and NACE TM0497 shall apply to any issues not specifically addressed by this specification.

1.06 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals.

B. RSN 13113-1, Manufacturers Data and Preconstruction Drawings:

1. Manufacturers Data. Include catalog data sheets when available for:

a. Rectifier.

b. Cable.

c. Anode.

d. Junction box.

e. Test station.

f. Adjustable resistor and calibrated shunt resistor.

g. Exothermic metallurgical bond system (including instructions).

2. Preconstruction drawings:

a. Intended location of anodes, rectifier, junction box, and test station.

b. Details of intended placement and restraint of anodes.

c. Typical details of intended junction box and test station wiring.

C. RSN 13113-2, As-Built Drawings:

1. Actual location of anodes, rectifier, junction box, and test stations.

2. Details of actual placement and restraint of anodes.

3. Typical details of actual junction box and test station wiring.

PART 2 PRODUCTS

2.01 GENERAL

A. Materials shall provide a minimum service life of 20 years (system and all components).

2.02 RECTIFIER

A. Potential controlled rectifier with a rated output of at least 5 V – 3 A as manufactured by Universal Rectifiers, Inc. (1613 Cottonwood Rd., Rosenberg, TX 77471), or equal, and having the following significant features:

1. Air cooled.

2. Capable of continuous operation at 120 percent of rated output in ambient temperature of 50 degrees Centigrade.

3. Fitted with a heavy duty transformer with at least 15 percent over design capacity.

4. Rectification section of the silicon diode type.

5. Built-in solid state current interrupter circuit housed within the rectifier cabinet and capable of:

a. Opening and closing the rectifier output circuit by fully adjustable, user selectable intervals between 0.1 seconds and 10 hours.

b. Continuously and automatically maintain rectifier output voltage to any preset value between 10 and 100 percent of rated output.

c. User selectable upper current limit control, capable of maintaining a preset current limit between 10 and 100 percent of rectifier rated current output under a short circuited rectifier output condition.

6. Capable of being operated in either the manual constant-voltage output or automatic constant-potential mode. The mode shall be selectable by positioning a single switch mounted on the front panel of the rectifier.

7. Fitted with switchable meter(s) for determining output voltage and current, and which is (are):

a. Accurate within 2 percent of full scale.

b. Marked with a red line designating rated capacities.

8. Such that the output voltage is adjustable in 18 or more equal increments using quick-change knobs, or continuously from 0 to 100 percent rated output.

9. Energized by 120-volts, single phase AC.

10. Equipped with AC and DC lightning arrestors and protective fuses or circuit breakers.

11. Equipped with solderless, pressure-type terminals for anode and cathode cables.

12. Equipped with an accessible shunt on the front panel for determining current output. The shunt shall be stamped with the amperage per millivolt rating.

13. Engraved panel.

B. The rectifier is to be supplied in a NEMA 250 3R lockable cabinet constructed of 11-gauge or greater galvanized steel. The cabinet shall have:

1. Front and side hinged doors and/or a single slide out rack for access.

2. A combination bracket for wall or pole mounting.

C. The rectifier and cabinet are to be properly grounded.

2.03 CABLES

A. Single-conductor, stranded, plain, annealed copper cable.

B. Cable insulation:

1. Rated for 600 volts and direct immersion or burial.

2. Anode cables black, with a high-molecular-weight polyethylene (HMWPE) outer jacket at least 0.060 in. thick and an inner jacket of Kynar or Halar at least 0.020 inch thick.

3. Structure and above water cables alternately black HMWPE insulation with minimum thickness of 0.100-inch.

C. Unspliced lengths to permit installation from terminus to terminus (e.g. anode to junction box or test station) free of splices and without stress.

D. Gauge:

1. No. 6 AWG or larger for current carrying cables between structures or anodes and rectifier.

2. No. 12 AWG or larger for determining of structure-to-electrolyte potentials.

2.04 IMPRESSED CURRENT ANODES

A. Impressed current anodes: high silicon cast iron tubular anodes as the Anotec anode type 2284 provided by Farwest Corrosion Control Co., 480 Artesia Blvd., Gardena CA, 90248, or equal, with the following essential characteristics:

1. Anode material specifically designed for cathodic protection systems and the intended environment.

2. Approximately 7 feet long, 2.2 inches in diameter, and at least 48 pounds per anode.

3. Chill cast.

4. Center connected cable, sealed, and having a connection resistance not exceeding 0.004 ohm.

B. Anode cable in accordance with cable requirements of this section.

2.05 JUNCTION BOXES

A. Junction box specifically constructed for cathodic protection system installations:

1. NEMA 250 type 3-R, hinged, lockable cabinets constructed of No. 16-gauge or thicker galvanized steel that are weatherproof and vented for heat dissipation.

2. Engraved 1/4-inch minimum NEMA grade C phenolic panels.

3. Solderless, pressure-type terminals.

4. Brackets: Suitable for pole or wall mounting.

B. Identify terminals and cables.

C. Equip with 0.01 ohm calibrated shunts of adequate electrical rating for each anode.

D. Equip with variable resistors of adequate electrical rating to adjust and balance the current flow of each anode.

E. Protect as required for permanency.

2.06 EXOTHERMIC METALLURGICAL BONDS

A. Exothermic metallurgical bond system by Thermoweld, 4102 South 74th East Ave., Tulsa, OK 74145-4700, or equal, having the following essential characteristics:

1. Specifically designed for cathodic protection systems.
2. The exothermic reaction produces molten copper alloy, which produces a permanent, high conductivity connection.
3. Uses a special alloy to provide minimum heat effect on the steel.
4. Current carrying capacity equal to that of the conductor.

PART 3 EXECUTION

3.01 INSTALLATION

A. Cable:

1. Inspect for insulation defects prior to installing.
    a. Repair defects using approved methods or replace the cable.
    b. COR will inspect and approve all repairs prior to installation.
2. Install without kinks, stresses, and/or splices.
3. Run through galvanized metal conduit once cables are above water.
4. Connect to terminals with crimped, ring-tongue connectors.
5. Identify origin of cables terminating in an enclosure:
    a. Factory printed letters on self-adhesive strips attached to the cables clearly visible within the enclosure.
    b. Encase printed labels in clear heat shrink tubing.

B. Structure connections:

1. Connect rectifier cable to structures and individual segments of the structure by exothermic metallurgical bonds.
    a. Make exothermic metallurgical bond in accordance with the bonding supply manufacturer's instructions.
    b. Bonds shall not damage the coating; otherwise, repairs shall be required.
    c. Test metallurgical bond integrity by striking side of weld nugget with a 16-ounce hammer, in presence of the COR.
    d. Coat bare copper, weld nugget, and ferrous materials at metallurgical bonds with an approved dielectric metallurgical bond coating.

e. Allow dielectric material to cure before repair of the damaged structure coating or lining.

1) Repair dielectric coatings/linings in accordance with Section 09902 – Coatings

2. Ensure metallurgical bonds do not interfere with operation of the rake mechanism or of any other feature.

C. Impressed Current Anodes:

1. Install horizontally as follows:

a. At least 23 feet from the structure to be protected.

b. One anode on the upstream side and one anode on the downstream side of the structure.

c. At least 4 feet from the side walls.

d. Isolated from any metal supports.

2. Connect anode cables to structures through calibrated 0.01 ohm shunts.

3. Include a resistor of appropriate wattage and capable of producing at least 5 ohms in series with the calibrated shunts to allow adjustment of individual anode current.

D. Electrical isolation:

1. All structures to be cathodically protected shall be electrically isolated from rebar or other extraneous metal.

3.02 ENERGIZING, ADJUSTING, AND TESTING

A. Energizing, adjusting, and testing will be performed by the Government under the direction of a NACE certified Cathodic Protection Specialist.

END OF SECTION

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SECTION 13423 – WATER-LEVEL MEASURING DEVICES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Water-Level Measuring Devices:

1. Payment: Lump sum price offered in the schedule.

1.02 PERFORMANCE REQUIREMENTS

A. The water-level measuring devices to perform the following functions:

1. Measures the water level using either ultrasonic technology or impulse radar technology.
2. Provides analog output signals proportional to the water level for water level indication to their respective RTU which transmits the data to the PLC located in the control building.
    a. Measures the water level downstream of the trashracks in the Forebay/Afterbay and provides a 4-20 mA output signal to the RTU.
    b. Measures the water level in Reservoir Cell No. 1 and provides a 4-20 mA output signal to the RTU.
    c. Measures the water level in Reservoir Cell No. 2 and provides a 4-20 mA output signal to the RTU.
3. The signals relayed to the PLC shall allow the PLC to determine the following:
    a. Water-level elevation at Forebay/Afterbay.
    b. Water-level elevation at Reservoir Cell No. 1.
    c. Water-level elevation at Reservoir Cell No. 2.

1.03 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals.

B. RSN 13423-1, Approval Data:

1. Commercial Products Data: Includes complete identifying data giving the manufacturer's name, type, model, size, dimensions, ratings, and characteristics of all the commercially available components for the water-level measuring devices. The commercial products data shall show assembly, type, and detailed dimensions and information.
2. Wiring diagrams and schematics including those showing connections to all external equipment.

C. RSN 13423-2, Final Data:

1. Service Manuals: The service manuals to include schematic and wiring diagrams, maintenance and operating instructions, identifying parts list, and the list of recommended spare parts.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect from corrosion, deformation and other types of damage during shipping, storage, and handling.

PART 2 PRODUCTS

2.01 WATER-LEVEL MEASURING DEVICES

A. Water-level measuring devices:

1. Non-contact measurement of water level using one of the measurement technologies listed below:
   a. Uses ultrasonic pulses and return echos to measure and provide analog outputs proportional to the water level for water level indication
   b. Uses impulse radar and return echos to measure and provide analog outputs proportional to the water level for water level indication.
2. Measuring range: 3 to 25 feet.
3. Dead band range: Not to exceed 3 feet below the face of the transducer.
4. Measuring interval:
   a. If ultrasonic technology transducers: Continuous.
   b. If impulse radar technology transducers: Not to exceed 20 second intervals.
5. Operates from the DC power source provided by the pole mounted solar panels.
6. All components shall be capable of outdoor operation in ambient temperatures ranging between minus 20 degrees to plus 140 degrees F.
7. Accuracy: $\pm$0.03 feet.
8. Three transducers with power/signal cables.
9. Interconnecting power/signal cables shall be shielded cable of the manufacturer's recommended size and type. Cable lengths to be determined by Contractor. No splices in the cables are allowed.
10. Each system shall provide a 4-20 mA output signal proportional to the measured water level for use by external systems.
11. Integrated lightning protection.

12. Provide the transducer mounting assembly hardware required for mounting each transducer onto the arm of their respective mounting pole.

2.02 ELECTRICAL EQUIPMENT

A. Electrical service for operation of the water-level measuring devices will be from their respective solar panel system.

B. Electrical cable and conduit external to the water-level measuring devices and the conduit between the transducers and the RTUs to be furnished and installed in accordance with Division 16 - Electrical.

2.03 FINISHES

A. Coat the water-level measuring equipment in accordance with Section 09902 – Coatings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the water-level measuring equipment in accordance with these specifications, the manufacturer's recommendations, and as shown on drawing 423-D-785.

B. Coordinate the installation of the transducer elements with the installation of the control and monitoring system equipment (Section 13455 – Control and Monitoring System) and with the installation of the mounting pole ladder (see drawing 423-D-772) to eliminate possible interference or misalignment problems.

C. Install the equipment on the mounting poles at the following locations:

1. One transducer and mounting assembly located downstream of the trashracks near the midpoint of the Forebay/Afterbay.
2. One transducer and mounting assembly located in the Reservoir Cell No. 1.
3. One transducer and mounting assembly located in the Reservoir Cell No. 2.

D. Power/signal cable from each transducer to be run in conduit (flexible and rigid) to their respective RTU.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. After complete installation of all equipment, the Contractor shall test the water-level measuring device system.

B. Perform testing in the presence of the COR. Notify the COR at least 5 days in advance of when tests are to be performed.

C. Testing shall demonstrate that all components operate in accordance with this Section and the manufacturer's requirements. Check all input and output signals.

D. The Contractor shall make all necessary corrections and adjustments to provide a complete installation satisfactory to the COR.

END OF SECTION

SECTION 13424 – ULTRASONIC FLOWMETERS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Ultrasonic Flowmeters:

1. Payment: Lump sum price offered in the schedule.

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME)

1. ASME MFC.5M – 1985(R2001) Measurement of Liquid Flow in Closed Conduits Using Transit-Time Ultrasonic Flowmeters

B. National Electrical Manufacturer's Association (NEMA)

1. NEMA 250-2003 Enclosures for Electrical Equipment (1000 Volts Maximum)

1.03 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals.

B. RSN 13424-1, Approval Data:

1. Detailed installation instructions and drawings showing installation details, detail dimensions, and locations of conduit connections. Include manufacturer's instructions for attaching flowmeter to pipes and installing cable to display transmitter.

2. Schematic and wiring diagrams for electrical equipment as required by Section 16051 – Electrical Drawings and Data.

C. RSN 13424-2, Final Data:

1. As-built drawings including as-built equipment layout and wiring diagrams. Refer to Section 01780 – Project Closeout.

2. Site test report.

3. Bound service manuals containing complete parts identification lists, and detailed instructions for installation, operation, and maintenance of flowmeter system.

1.04 SITE CONDITIONS

A. Ambient air temperature range: 0 degrees Fahrenheit to plus 140 degrees Fahrenheit.

B. Elevation: 145 feet above sea level.

1.05 DELIVERY, STORAGE AND HANDLING

A. Protect equipment from corrosion, deformation, and other types of damage during delivery, storage and handling.

1.06 WARRANTY

A. Provide a five-year warranty to guarantee products.

1.07 EXTRA MATERIALS

A. Transducers: Provide four transducers, conforming to specifications below.

B. Full set of replacement cards (PCI cards) for electronics.

C. Copy of software programs.

PART 2 PRODUCTS

2.01 ULTRASONIC FLOWMETER SYSTEM

A. Furnish the following equipment. No substitutions allowed except to accommodate model upgrades and model number changes that reflect changed manufacturer product lines:

1. Console: Furnish two Model 7720C flowmeter consoles, as manufactured by Accusonic Technologies Inc., 28 Patterson Brook Rd., Unit 1, W. Wareham, MA 02576 USA.
2. Transducers: Furnish internal mounted Model 7630/7695 transducers as manufactured by Accusonic Technologies Inc., 28 Patterson Brook Rd., Unit 1, W. Wareham, MA 02576 USA.
3. Sixteen transducers and sixteen assemblies for each outlet structure steel pipe.
4. RG-59 Transducer cables with EO connectors.

B. Transmitter/Console:

1. Enclosure: NEMA 250 Type 4X, hinged with hasp.
2. Outputs: 4-20 mA non-isolated or isolated; RS-232 outputs to the RTU provided by Section 13455 (Control and Monitoring System).
3. Display: LCD on front panel 2 lines of 20 characters.

4. Provide software that is Windows PC based, to include: site commissioning; real-time data collection; storage and on-line diagnostics. Include 2 PCI cards if supplied.

5. Capable of processing 8 acoustic paths.

6. Input Power: 12 volts DC. Power supplied from the solar panel system provided by Section 13455 - Control and Monitoring System.

C. Conform to ASME MFC.5M for flowmeter systems.

D. Two ultrasonic flowmeter systems shall be provided. One for each 108-inch outlet structure pipe as shown on drawing 423-D-786.

E. Each system consisting of the following:

1. Flowmeter systems based on measuring flow by transmitting acoustic pulses between pairs of transducers.

2. Eight-acoustic paths for each pipe.

3. Sixteen internal transducers per 108-inch I.D. steel pipe.

4. Transducer cables for each system.

F. Provide a transmitter/console, computing flow rate and totalized flow for each system.

G. Output signals from each transmitter/console unit sent to the RTU (see Section 13455 – Control and Monitoring System) which transmits the data to the PLC.

H. Conform to Table 13424A – System Parameters.

Table 13424A – System Parameters

Nominal Pipe Size ID	108-inch
Required Flowmeter Accuracy	+/- 1.0% (requires 5 diameters upstream and 2 diameters downstream at velocities greater than 1 ft/s)
Pipe Thickness - Steel	½-inch
Minimum Flowrate	0 ft^3/sec
Maximum Flowrate	900 ft^3/sec
Velocity Range	0 to 14 ft/sec
Maximum pipe pressure	25 lb/in^2

2.02 ELECTRICAL

A. Furnish transducer cables for the flowmeter system, specified by the flowmeter manufacturer, for connecting the transducers to the transmitters/consoles. Contractor to determine the required transducer cable length. Spliced cables will not be allowed.

B. Furnish signal cables between the transmitters/consoles to the RTU.

C. Furnish all supplies, electrical boxes, and accessories that are required to install the flowmeter system in accordance with Division 16 - Electrical.

D. Furnish all conduits in accordance with Section 16130 - Electrical Conduit.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the ultrasonic flowmeter equipment in accordance with the manufacturer's instructions and requirements, and in accordance with these specifications and drawing 423-D-786.

B. Install sixteen transducer assemblies for each of the two pipes.

C. Install two flowmeter transmitters/consoles in the electrical equipment cabinet as shown on drawing 423-D-786. Exact location to be determined by the COR.

D. Electrical:

1. Make all necessary electrical connections between the flowmeter transmitter/console and the solar panel system.
2. Make all necessary electrical connections between the flowmeter transducers and their respective transmitter/console and between the transmitters/consoles and the RTU.
3. Ground the flowmeter console in accordance with Section 16060 – Grounding and Bonding.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. General:

1. Perform site test within thirty days after installing the flowmeter systems.
2. Site test shall be witnessed by the COR.
3. Furnish testing equipment and additional hardware necessary for complete testing.
4. Make appropriate corrections and adjustments to equipment to correct deficiencies found during site testing, then retest.
5. Documentation:
    a. Sign and date.
    b. Identify specific feature being tested.
    c. Include test results and items such as ambient temperature which the test is performed.
    d. Submit as part of final data.

B. Site test:

1. Apply simulated flow signal inputs. Simulated signals to cover the minimum flow, at least two intermediate flows, and the maximum flow over flow range listed in Table 13424A - System Parameters.
2. Check displays for correct readouts, and check each I/O (input/output) point for correct I/O signal.
3. Test each output connection for correct output conformance.
4. Verify all instrumentation and indication devices function properly. Test all functions of each flowmeter transmitter for correct operation.

END OF SECTION

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SECTION 13425 – CANAL MEASURING DEVICE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Canal Measuring Device:

1. Payment: Lump sum price offered in the schedule.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM C 881/C 881M-02	Epoxy-Resin-Base Bonding Systems for Concrete

B. International Electrotechnical Commission (IEC)

1.	IEC 61000-4-5-2005	Electromagnetic Compatibility (EMC) – Part 4-5: Testing and Measurement Techniques – Surge Immunity Test

1.03 PERFORMANCE REQUIREMENTS

A. The canal measuring device to perform the following functions:

1. The canal measuring device is located upstream of the trashracks in the Drop 2 Inlet Canal and measures the canal water velocity, using the principle of a side-looking Doppler system.
2. Provides RS422 output signals of the temperature, flow, and measured water level elevation. The output signals will be sent to the PLC located at the control building.

1.04 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals.

B. RSN 13425-1, Approval Data:

1. Commercial products data for canal measuring device:
   a. Include complete identifying data giving the manufacturer's name, type, model, size, dimensions, ratings, and characteristics of all the commercially available components.
   b. Show assembly, type, and detailed dimensions and information.
2. Electrical wiring diagrams and schematics including those showing connections to all external equipment.

3. Equipment layout drawings and bill of materials listing each device or item of equipment.

C. RSN 13425-2, Final Data:

1. Service Manuals: The service manuals to include schematic and wiring diagrams, maintenance and operating instructions, identifying parts list, and the list of recommended spare parts.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect from corrosion, deformation and other types of damage during shipping, storage, and handling.

B. Provide special handling requirements for short term or long term storage, with respect to the sensor and/or the cable assembly.

PART 2 PRODUCTS

2.01 CANAL MEASURING DEVICE

A. Canal measuring device to consist of side-looking doppler current meter, canal mounting apparatus, interconnecting power/communication cable(s), AC/DC converter, and all additional equipment and software required for a complete installation.

B. Furnish and install the canal measuring device in accordance with this section and as shown on drawing 423-D-781.

1. The canal measuring device shall contain the following:
    a. Side-looking doppler current meter:
        1) Two-beam horizontal.
            a) 25 Degree slant angle for 2D water velocity.
        2) Vertical acoustic beam for water level.
        3) Pressure sensor.
        4) Temperature sensor.
        5) Multi-cell profiling (programmable, up to 10 equally-spaced cells).
        6) RS422 power/communication cable(s) between the transducer and the control building. Spliced signal cable will not be acceptable.
2. Communications:
    a. RS422 outputs to the PLC located within the control building.
    b. Software packages:
        1) Instrument setup, data collection, and flow calculation software.

2) Velocity-index discharge rating package.

3) Flow computation and output package, including total volume.

3. Canal mounting and extension modules as shown on drawing 423-D-781.

4. AC to DC converter to convert the service power to 7-15 volts DC, which is operating voltage of the measuring device. Electrical service will be 120 volts, AC, provided in the control building.

C. Electrical cable and conduit external to the canal measuring device and the conduit between the transducers and the PLC in the control building to be furnished and installed in accordance with Division 16 - Electrical.

2.02 EQUIPMENT

A. Canal measuring device: Argonaut SL1500 Side-Looking Doppler Current Meter as manufactured by SonTek/YSI, San Diego, CA; or equal with the following essential characteristics:

1. Side-looking doppler current meter:

a. Fully submersible, and designed for water velocity and level/depth measurements in canals.

b. Two-beam horizontal transducer for water velocity.

1) Utilizes the Doppler principle

2) Horizontal beam width: 1.4 degrees.

3) 25 Degree slant angle for 2D water velocity.

4) Accuracy: $\pm$1 Percent of measured velocity.

c. Vertical acoustic beam for water level.

1) Vertical beam width: 2.9 degrees.

2) Vertical beam range: 0.5 to 33 feet.

3) Accuracy:

a) Depth less than 3 meters: $\pm$ 0.3 centimeters ($\pm$0.01 feet).

b) Depth greater than of equal to 3 meters: $\pm$ 0.1 percent.

d. Power Ping Hi-Precision.

e. True Compass/Tilt.

f. Pressure sensor: 0.25 Percent accuracy.

g. Temperature sensor: $\pm$1 Degree Celsius accuracy.

h. Pressure rating: Up to 98 feet.

i. Incorporates an internal lightning protection to IEC 61000-4-5, level 4, as a means of protecting against a possible water lightning strike.

j. RS422 power/communication cable(s) between the side-looking doppler current meter assembly and the PLC located in the control building.

1) Wet-mate-able connector and locking sleeve on cable end connecting to the side-looking doppler current meter assembly.

2) Other end of power/communication cable supplied with the following:

a) Connection for mating with the RS422 communication port of the PLC.

b) Power connection for mating with the AC/DC converter.

k. AC/DC converter: Converts the 120 volts, AC service power to 7-15 volts DC, which is operating voltage of the measuring device.

2. Windows Software Packages:

a. Instrument setup, data collection, and flow calculation software.

b. Velocity-indexing discharge rating software.

c. Flow computation and output package, including total volume.

3. Excitation Voltage: 7 to 15 volts direct-current.

4. Capable of outdoor operation in ambient temperatures ranging between 23 degrees F and 140 degrees F.

B. Canal Mounting Apparatus:

1. Manufacturer's standard canal mounting apparatus with additional extension modules as shown on drawing 423-D-781.

2. Aluminum or stainless steel.

C. Epoxy Anchors:

1. Bolts with epoxy-resin-bonding system.

2. Anchors: Stainless steel, type 304.

3. Epoxy-resin-bonding system to conform to ASTM C 881, type 1.

4. The maximum embedment of the anchors to not exceed 2.25 inches (do not drill through the canal concrete lining).

5. Provide insulating sleeves and washers between the dissimilar metals of the anchors and the canal mount modules.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the canal measuring equipment in accordance with these specifications, the manufacturer's recommendations, and as shown on drawing 423-D-781.

B. Installation to include loading the required software onto the PLC associated with the canal measuring device as specified.

C. Make all electrical connections and grounding to the system in accordance with Division 16 – Electrical. Electrical service supply power will be 120 volts, AC, provided in the control building.

D. Epoxy Anchors:

1. Drill holes in concrete for installation of epoxy anchors. Drill the holes straight and true to the diameter and depth recommended by the anchor manufacturer, or 2.25 inches maximum, whichever is less.
2. If drilling water is used, clean the exposed concrete surfaces immediately after drilling to prevent discoloration.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. After complete installation of all equipment, the Contractor shall test the canal measuring device.

B. Perform testing in the presence of the COR. Notify the COR at least 5 days in advance of when tests are to be performed.

C. Testing shall demonstrate that all components operate in accordance with these specifications, the manufacturer's requirements, and shall check all input and output signals, and software capabilities. Testing shall demonstrate that the canal measuring device software loaded onto the PLC can do the following with the canal measuring device and output signals:

1. Instrument setup, data collection, and flow calculation software.
2. Velocity-indexing discharge rating software.
3. Flow computation and output package, including total volume.

D. The Contractor shall make all necessary corrections and adjustments to provide a complete installation satisfactory to the COR.

END OF SECTION

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SECTION 13455 - CONTROL AND MONITORING SYSTEM

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for complete electrical system.

1.02 REFERENCES

A. Electronic Industries Alliance (EIA)

1. EIA/ECA 310-2005 Cabinets, Racks, Panels, and Associated Equipment

B. Institute of Electrical and Electronic Engineers (IEEE)

1. IEEE C2-2007 National Electrical Safety Code (NESC)

C. National Electrical Manufacturers Association (NEMA)

1. NEMA 250-2003 Enclosures for Electrical Equipment (1000 Volts Maximum)

D. National Fire Protection Association (NFPA)

1. NFPA 70-2008 National Electrical Code (NEC)

1.03 PERFORMANCE REQUIREMENTS

A. Provide PLC to monitor water level in the reservoir, gate positions, canal level, and canal flow. PLC will control gate positions. PLC will be programmed by others.

B. Provide one solar-powered RTU system to monitor flow on the pipe outlet and transmit data to PLC.

C. Provide three solar-powered RTU systems to monitor water levels in the forebay/afterbay and two reservoirs and transmit data to PLC.

D. Outdoor Temperature Range: -10 degrees C to 60 degrees C.

1.04 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals and Section 16051 - Electrical Drawings and Data.

B. RSN 13455-1, Approval Drawings and Data:

1. Manufacturer's technical data for all equipment.

2. Equipment layout drawings.
3. Bill of materials.
4. Schematic diagram drawings.
5. Wiring diagram drawings.

C. RSN 13455-2, Test Report.

D. RSN 13455-3, Operation and Maintenance Manual:
1. Submit for all control and monitoring system equipment.
2. General descriptive information covering the basic features of the equipment.
3. Show information for ordering replacement parts, and maintaining and calibrating equipment.

PART 2 PRODUCTS

2.01 RESERVOIR INLET/OUTLET CONTROL AND MONITORING SYSTEM

A. PLC (Programmable Logic Controller):
1. TSX 37 10 PLC System manufactured by Modicon/Schneider Electric, North American Division, 1415 Roselle Road, Palatine, IL 60067; or equal, having following salient characteristics:
   a. Input power:
      1) 120 VAC. Provide power supply as required.
      2) Provide isolation features to prevent damaging electrical transients from entering controller.
   b. Memory:
      1) 14 KWords, minimum, battery-backed RAM.
      2) 12 KWords, minimum, Flash EPROM.
   c. Processor: Support addressing of specified I/O points.
   d. Rack(s): 4 slot, minimum.
   e. Modular components.
   f. 19-inch rack mountable.
   g. Provide equipment required to monitor temperature inside PLC cabinet.
   h. Provide equipment required to monitor incoming voltage at PLC.
   i. Modbus RTU protocol.
   j. Communications ports:

1) RS-485.

2) RS-422.

B. I/O Modules:

1. Accommodate all I/O points as specified and as indicated on drawings.

2. Same manufacturer as PLC.

3. 28 discrete I/O points.

C. System Software:

1. Operating system software:

a. Same manufacturer as PLC.

b. Store in on-board permanent flash memory.

c. Support communication systems.

D. Radio:

1. Model MDS 9810 manufactured by Microwave Data Systems, Inc., 175 Science Parkway, Rochester, NY, 14620; or equal, having following salient characteristics:

a. Full-duplex operation, spread-spectrum, up to 19.2 kbps data throughput, 1 watt transmit power, and sleep mode.

b. Configure radio at control building as master to communicate with pipe outlet, reservoir level RTUs, forebay/afterbay RTU, and IID radio system. IID radio system is located at the Coachella Turnout Structure.

E. Antenna:

1. Model 97-3194A16 manufactured by Microwave Data Systems, Inc., 175 Science Parkway, Rochester, NY, 14620; or equal, having following salient characteristics:

a. Type: Omni.

b. Frequency: 902-928 MHz.

c. Gain: 5 dB, minimum.

d. Provide with all mounting hardware required to install on mast on top of control building.

F. UPS (Uninterruptible Power Supply):

1. Solid-state design.

2. Rack-mount type.

3. Input: 120-volt single phase 60 hertz.

4. Output: 120-volt single phase 60 hertz.
5. Batteries:
    a. Hot swap and user replaceable.
    b. Leak-proof.
    c. Maintenance-free sealed lead-acid.
6. Fully charge a completely discharged battery in 24 hours.
7. Size to provide 100 percent of full-load current required by PLC for 5 hours.
8. Integral power cord.

G. I/O Signal Transient Protector:

1. Furnish and install as required to protect I/O signals from damage due to lightning and surge voltage.
2. Solid state, no fuses or relays, automatically reset.
3. Provide two-stage protection against overvoltage transients: Gas discharge tube and silicon avalanche device.
4. Maximum Transient Voltage: 10 KV.
5. Clamping Time: 10 nanoseconds, maximum, with no output voltage overshoot.

2.02 PIPE OUTLET MONITORING SYSTEM

A. OutPAK-R900 Solar-Powered RTU System manufactured by Geomation, 25188 Genesee Trail Rd. #100, Golden, CO; or equal, having following salient characteristics:

1. Integrated solar-powered system to monitor pipe outlet flow, transmit flow data to control building via spread-spectrum radio, and provide power to RTU, flowmeters, and cathodic protection system.
2. RTU:
    a. Provide with input module for 4-20 ma signals from two flowmeters. Equip with transient protection.
    b. Program RTU to receive flowmeter signals and send the signals to the radio for transmission to the control building.
3. Solar Panel:
    a. Pole-mount.
    b. Size to charge battery for 7-day per week, 24-hour per day operation of RTU, flowmeters, and cathodic protection system.
    c. Cathodic protection system power requirement: In accordance with Section 13110 - Impressed Current Cathodic Protection System for

Exterior of Steel Pipes. Provide circuit breaker in accordance with Section 16441 - Distribution Panelboards.

d. Flowmeter power requirement: 35 watts, each. Provide circuit breakers in accordance with Section 16441 - Distribution Panelboards.

e. Provide transformers and inverters as required.

4. Antenna:

a. Pole-mount, yagi.

b. Gain: 5 dB, minimum.

c. As required to transmit flow data to control building PLC.

5. Radio:

a. Model MDS 9810 manufactured by Microwave Data Systems, Inc., 175 Science Parkway, Rochester, NY, 14620; or equal, having following salient characteristics:

1) Full-duplex operation, spread-spectrum, up to 19.2 kbps data throughput, 1 watt transmit power, and sleep mode.

2) Spread-spectrum type to transmit flow data to control building PLC.

6. Battery:

a. Rechargeable.

b. Size to provide power to system for one week with little or no sunlight.

7. Provide interconnection cables for all components as required.

8. Provide all mounting hardware as required.

2.03 RESERVOIR AND FOREBAY/AFTERBAY MONITORING SYSTEMS

A. OutPAK-R900 Solar-Powered RTU System manufactured by Geomation, 25188 Genesee Trail Rd. #100, Golden, CO; or equal, having following salient characteristics:

1. Integrated solar-powered system to monitor level, transmit flow data to control building PLC via spread-spectrum radio, provide power to RTU, and provide power to water-level measuring device.

2. RTU:

a. Provide with input module for 4-20 ma signal from water-level measuring device. Equip with transient protection.

b. Program RTU to receive water level signal and send signal to radio for transmission to control building PLC.

3. Solar Panel:

a. Pole-mount.

b. Size to charge battery for 7-day per week, 24-hour per day operation of RTU, and water-level measuring device.

c. Water-level measuring device power requirement: In accordance with Section 13423 - Water-Level Measuring Devices.

d. Provide transformers and inverters as required.

4. Antenna:

a. Pole-mount, yagi.

b. Gain: 5 dB, minimum.

c. As required to transmit water level data to control building PLC.

5. Radio:

a. Model MDS 9810 manufactured by Microwave Data Systems, Inc., 175 Science Parkway, Rochester, NY, 14620; or equal, having following salient characteristics: Full-duplex operation, spread-spectrum, up to 19.2 kbps data throughput, 1 watt transmit power, and sleep mode.

b. Configure to transmit flow data to control building PLC.

6. Battery:

a. Rechargeable.

b. Size to provide power to system for one week with little or no sunlight.

7. Provide interconnection cables for all components as required.

8. Provide all mounting hardware as required.

B. Provide three systems:

1. Forebay/afterbay.

2. Reservoir #1.

3. Reservoir #2.

2.04 CABINETS

A. Manufacturer's standard gauge sheet steel.

B. Floor-mounted.

C. Type:

1. Pipe Outlet: NEMA 250, Type 4.

2. Control Building: NEMA 250, Type 12.

D. Dimensions:

1. Pipe Outlet: 62 inches high by 60 inches wide by 20 inches deep.
2. Control Building: 72 inches high by 24 inches wide by 24 inches deep.

E. Seams:

1. Continuously welded.
2. Ground smooth.

F. Ground lug: For #4 AWG copper cable.

G. Continuous hinge.

H. Stainless steel clamps on 3 sides.

I. Doors:

1. Pipe Outlet: Double-access front doors.
2. Control Building: Single front door.

J. Hasp and staple for padlocking.

K. Drip shield to protect door hardware from dripping water and settling dust.

L. Backpanel for mounting equipment.

M. Wireway.

N. Provide pipe outlet cabinet with sunshield.

O. Finish:

1. Interior: Manufacturer's standard ANSI white.
2. Exterior: Manufacturer's standard ANSI white.

2.05 19-INCH RACKS

A. Rack Mount Angles:

1. Provide each rack with 2 angles, one pair.
2. Drill and tap No. 10-32 thread holes. Space holes in accordance with EIA 310-D (universal spacing).
3. Provide with all mounting hardware in manufacturer’s standard color and finish, white.
4. U-style.

2.06 INTERCONNECTION CABLE

A. In accordance with Section 16120 - Conductors and Cables, and manufacturer's recommendations.

2.07 MISCELLANEOUS MATERIALS

A. Furnish all materials required for operation of control and monitoring system.

B. Furnish standard commercial grades of materials suitable for intent of design.

2.08 FABRICATION

A. Design cabinet layouts.

PART 3 EXECUTION

3.01 INSTALLATION

A. In accordance with IEEE C2 and NFPA 70.

B. Wire following I/O to PLC:

1. RS-422: Canal Inlet Water Level.
2. Modbus Protocol:
    a. Gate Actuator Network: Includes gate operation and gate position for 11 inlet/outlet structure gates.
    b. Trashrake: Interface to built-in trashrake PLC.

C. Wire two 4-20 ma flowmeter signals to RTU at pipe outlet.

D. Wire 4-20 ma forebay/afterbay and reservoir signals to RTUs.

E. Furnish and install PLC monitoring system in PLC and Communication Cabinet in Control Building. Install antenna on mast on top of Control Building. Connect all equipment to grounding system.

F. Install pipe outlet monitoring system in Electrical Equipment Cabinet at pipe outlet. Install antenna and solar panel on pole. Install electronic equipment including RTU, radio, battery, and flow metering cabinets in cabinet. Connect all equipment to grounding system.

G. Install forebay/afterbay and reservoir monitoring systems on water level system structures in accordance with drawings. Install electronic equipment including RTU, radio, and battery in NEMA 250, Type 4 enclosures.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Post-Installation: Verify that all features function in accordance with specifications.

END OF SECTION

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SECTION 14510 – HYDRAULIC TRASH RAKE

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Hydraulic Trash Rake:

1. Payment: Lump sum price offered in the schedule.

1.02 REFERENCES

A. American Welding Society, Inc. (AWS)

1.	AWS D1.1/D.1.M-06	Structural Welding Code - Steel

B. American Institute of Steel Construction (AISC)

1.	AISC-S335-1989	Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design with Commentary, Part of M016 - Manual of Steel Construction-Allowable Stress Design, Ninth Edition

C. ASTM International (ASTM)

1.	ASTM A 27/A 27M-05	Steel Castings, Carbon, for General Application
2.	ASTM A 36/A 36M-05	Carbon Structural Steel
3.	ASTM C 881/C 881M-02	Epoxy-Resin-Base bonding Systems for Concrete

D. National Electrical Manufacturer's Association (NEMA)

1.	NEMA 250-2003	Enclosures for Electrical Equipment
2.	NEMA MG 1-2006 (R2007)	Motors and Generators

1.03 SYSTEM DESCRIPTION

1. Furnish and install one hydraulic trash rake, to make a complete operational system, to include the following:
   a. Capable of manual, continuous, and automatic modes of operation.
   b. Provide a Programmable Logic Controller (PLC) for augmenting automatic mode of operation.
   c. Hand-held pendant controls for manual operation.
   d. Control panel with pushbutton controls.

e. Weatherproof electrical plugs, conduits, and conductors for the power supply and remote start/stop systems. Coordinate with electrical installation for provisions to and from power supply and control interface points.

f. Travel beams and support systems with the necessary hardware for attachment of equipment.

g. Anchors, bolts, nuts, washers, and necessary hardware for attachment to concrete and steel structures.

2. Trash rake operation: When canal inlet gates are open, operate trash rake cleaning cycle on thirty minute intervals.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals and Section 16051 – Electrical Drawings and Data.

B. RSN 14510-1, Approval Drawings and Data:

1. Detailed shop drawings for all major components. Drawings to be complete in detail, show the thickness, type, grade, class of metals, and the dimensions. Drawings to show construction, assembly, and installation details, in relation to the existing structure.

2. Commercial products data: Include complete identifying catalog descriptions and data giving the manufacturer's name, type, model, size, dimensions, load ratings, and characteristics of all the commercially available components for the rake.

3. Hydraulic schematics that show the hydraulic system components and sizes, along with the operating pressures, capacities, and relief settings.

4. Electrical control diagrams, interconnection wiring diagrams, and schematics showing wire connections and conduit layout. Provide electrical control schematic diagrams in ladder-logic format and in accordance with Section 16051 – Electrical Drawings and Data.

5. Drawing 40-D-6032, for all motors.

C. RSN 14510-2, Purchase Order:

1. Copies of purchase order for hydraulic trash rake.

D. RSN 14510-3, Final Drawings and Data:

1. Service manuals:

a. Operating and maintenance instructions.

b. Full-size prints of installation and detailed assembly drawings.

c. Electrical schematics and wiring diagrams.

d. Lubrication schedule.

e. List of special tools.

f. Parts catalog for components provided.

2. Electronic copies of all drawings, schematics, and diagrams submitted in the service manuals in AutoCAD format in accordance with Section 16051 – Electrical Drawings and Data.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment from corrosion, deformation, and other types of damage.

1.06 SITE CONDITIONS

A. Ambient air temperature range: 0 degrees Fahrenheit to plus 130 degrees Fahrenheit.

B. Elevation: 145 feet above sea level.

1.07 SPARE PARTS

A. One operating coil for each type of motor contact.

B. Three renewable contacts for each type of motor contact.

C. Six fuses of each type of fuse.

D. One coil for each type of solenoid valve.

E. One year’s supply of lubricant.

F. One limit switch of each type.

G. One set of oil seals of each type and size.

H. A complete set of special tools and wrenches required for maintenance of the unit in an approved toolbox.

I. Two high-pressure filters, one suction strainer, and one kit of accessory fittings, o-rings, and seals for the hydraulic unit and cylinders.

J. Two indicating lamps of each type used.

K. One color cap for the indicating lamps of each type used.

PART 2 PRODUCTS

2.01 HYDRAULIC TRASH RAKE

A. Hydraulic trash rake system: Model ST8000 as manufactured by Atlas Polar Co. Ltd., Hydrorake Division, Toronto, Ontario, Canada with the following essential characteristics:

1. Type of material handled: Wet, solid materials comprising grass, moss, branches, small logs and stumps, silt, gravel, and trash.
2. Capable of manual, off, continuous, and automatic modes of operation.
3. Operates from a nominally rated service power of 480 volts, three phase, and 60 hertz.
4. Hand-held pushbutton controller (pendant), to operate the unit manually.
5. Limit Switches:
    a. To control the travel limits. Mounting and location of the limit switches to be determined by the manufacturers.
    b. Use adjustable limit switch trip levers to provide adjustment of the angular rotation of the pivot arm.
    c. Enclosure: NEMA 250, Type 4.
6. The lateral force range of the trash rake head on the trash rack: adjustable between 120 to 500 pound force.
7. Lift capacity up to at least 1,250 pounds.
8. Boom(s) type: Telescopic.
9. Properly locate bolts, handrails, and other miscellaneous fittings.
10. Coordinate the design of the unit with the installation of the trashracks and conveyors to properly locate equipment, anchors, and other miscellaneous deck fittings.
11. Trash rake capable of immediate operation, after standing idle for several months and having received only routine maintenance during the idle period.

2.02 COMPONENTS

A. Control Panel:

1. Enclosure: NEMA 250, Type 4, outdoor use, rigid, and dead-front type with swing-out panel and vibration isolators. Provide removable sun shields on top, sides and back of the enclosure. Space each sun shield 4-inches out from the enclosure.

2. Schematic Wiring Diagrams: Attached to the inside door of the control panel cabinet door showing the relationship and location of the controls and alarm contacts.
3. Lockable enclosure, with control devices mounted on an inner door that provides a dead-front panel.
4. Alarm light to indicate the unit has stopped in mid-cycle, overload tripping of any motor, or timer feedback with provisions for an alarm signal to a remote location.
5. Master ON/OFF switch:
    a. ON position: Selector switch is operated.
    b. OFF position: All electrical power is off.
6. Cycle Stop Limit Switch: Rake stops and returns to the park position.
7. Emergency Stop Pushbutton:
    a. Panel mounted.
    b. Push-Pull type with mushroom head.
8. Selector Switch:
    a. Three position selector switch, labeled MANUAL-AUTOMATIC - CONTINUOUS with START-STOP pushbuttons.
    b. In the MANUAL position: Rake controlled by a manually operated pushbutton station from the plug-in pendant. This mode locks out all other modes of operation.
    c. In the AUTOMATIC position: Contact closure indicates that the slide gates are opening and the trash rake will operate for 20 minutes continuously, then operate a cleaning cycle on 30 minute intervals.
    d. In the CONTINUOUS position: Rake will start up and run continuously until stopped by:
        1) Turning the selector switch to the OFF position,
        2) Pushing the CYCLE STOP pushbutton, or
        3) Contact closure from the conveyor emergency stop safety switch.
    e. When the emergency stop safety switch cables have been pulled, the conveyors and trash rake will immediately stop.
9. Magnetic Contactor:
    a. Magnetic, air-break, full-voltage type.
    b. Power supply: 120-volts, 60-hertz.
    c. Thermal overloads provided in each phase.
10. Step Down Transformer:

a. Adequate capacity for the control power requirements of the rake, to power the remote emergency stop safety switch, hydraulic oil pump and heater, and other miscellaneous devices (e.g.- maintenance power receptacles, etc.). Each control or power circuit to be provided by a circuit breaker or fuse.

b. Rated for 120-volt, 60 hertz service.

11. Disconnect Switch:

a. Horsepower rated.

b. Unfused.

c. Heavy-duty industrial type.

d. Rated 600-volts, 3-pole, single throw.

e. Mounted in the trash rake control panel and lockable in the open position.

B. Manually-Operated Hand-Held Pushbutton Station:

1. 20 Foot long power cord and suspension cable.

2. A plug-in connection located on the trash rake carriage.

3. A lockable, steel enclosure to store the hand-held controller, suspension cable, and power cord when not in use.

4. ON/OFF pushbuttons or selector switch to start/stop the hydraulic motors.

5. TRAVEL RIGHT and TRAVEL LEFT pushbuttons. Pushbuttons to be momentary contact type pushbuttons.

6. Rake UP and rake DOWN pushbuttons to provide raising and lowering of the trash rake head.

7. EMERGENCY STOP pushbutton.

8. All pushbuttons to be NEMA Type 4 water and oil-tight pushbuttons.

C. Programmable Logic Controller (PLC):

1. Power supply, I/O modules, and all necessary communication interface hardware.

2. Provided with hardware and software security features to protect the system program and database from unauthorized changes.

3. Provided with a memory module write protection, data file overwrite protection and communication channel protection.

4. Power supply: 120 VAC.

5. Memory: Flash memory and minimum of 4K program word memory capacity.

6. Processor: Addressing of 128 I/O points minimum

7. Communication with PLC in the control building: Modbus protocol.

8. Power supply module: The power supply module provided power to the processor and each I/O slot shall have an LED to indicate proper power supply. The power supply shall be able to withstand a brief power loss, typically between 20 milliseconds and 3 seconds.

9. The "wetting voltage" power supply shall be provided at the PLC cabinet to allow the PLC to read the dry contact, ESBI (Electrically Separate Binary Inputs). The wetting voltage shall be sized such that it will provide at least 50 percent larger than the power required to drive these transducers. The power supply shall be of the solid-state design and shall be capable of operating from the Contractor-furnished power conditioner.

10. I/O terminal blocks shall be provided to terminate all input/output points at the control cabinet before these points are connected to the PLC I/O modules.

11. Operating system software shall be multitasking, realtime capacity, support graphics and communications systems. The operating environments shall allow "WINDOWS/DOS"-executable files to be run without modification.

12. The Contractor shall be responsible for developing, installing and testing the project application PLC program. The program written in ladder logic diagram shall be implemented so that the automation system will automatically monitor and control the equipment as defined by this specification.

13. The man-machine interface (MMI) software shall be running under the operating software with the functional capabilities necessary to operate the hydraulic brush system and meet the requirements of these specifications.

14. Operator interface (i.e. touch screen, communication port for down/uploads, cable and all accessories) shall have capability to accept the screen displays and software download from appropriate programming device (e.g. - hand-held unit, personal computer, etc.).

15. Powerline conditioner shall be provided to provide clean power and protect the PLC power supply from transient, high frequency and other noise. The unit shall be capable of delivering a minimum of 1.5 times the total load of the automation system. The unit shall meet the following minimum requirements for surge protection:

    a. Spike attenuation: minimum of 200-to-1 reduction.

    b. Voltage regulation: +/-5 percent of normal voltage.

    c. Input: 120 VAC.

D. Induction Motors.

1. Sizes and horsepower determined by the manufacturer.

2. Speed: 1,800 rpm.

3. Continuous ratings.

4. Anti-friction bearings.

5. Drive motor: DC/variable speed.

6. TEFC type motors, nominally rated 480 volts, 3-phase, 60 hertz, designed for across-the-line starting at full voltage.

7. Ambient temperature 50°C for motor.

8. Conform to NEMA publication No. MG1, including characteristics, tests, and ratings unless otherwise specified.

9. Characteristics and torque requirements of the equipment load coordinated with the selection of the motor to obtain proper starting, acceleration and normal running of the equipment.

10. The horsepower rating of the motor such that it will continuously carry the maximum load developed under all operating conditions specified, at nameplate rating, with a 1.0 service factor.

11. The maximum temperature rise of the winding when the motor is delivering rated output at rated voltage and frequency not exceed 80°C by resistance for class B, F, or H insulation. The temperature rise of other parts of the motors in accordance with the standards for class B insulation.

12. Efficiency, stated on drawing 40-D-6032, to allow for friction, open-circuit core losses, stray-load losses, and I^2R losses in the stator and rotor at the temperature as obtained in the manner specified in NEMA MG1-12.53.a. The insulation treated to prevent injury from temporary exposure to dampness.

13. Internal ferrous surfaces, including rotor, finished with applied covering to inhibit corrosion.

14. Design the bearings for specific duty specified herein. The bearings to be oil or grease lubricated, and sealed against loss of lubricant or entrance of dirt. Each bearing insulated to prevent circulating currents from passing through the bearing surfaces. The bearing insulation may be omitted provided the induced shaft voltages are sufficiently low so that current will not flow through the bearing lubricating film from one bearing surface to another.

E. The chain's pins, rollers, and bushings to be carburized and hardened steel. Provisions made for lubrication of the chain joints.

F. Epoxy Anchors:

1. Bolts with epoxy-resin-bonding system: The epoxy-resin-bonding system to conform to ASTM C 881, type 1.

2.03 ELECTRICAL EQUIPMENT

A. Furnish all cables, conduits, terminations, and accessories required for interconnecting the equipment included in this section.

B. Power and control cables: Designed for outdoor use, with a water, oil, and ultraviolet-light resistant cable jacket.

C. The power and control cables to be managed by a festoon support system, consisting of a trolley track and cable carriers, to gather and extend the power cable as the trash rake carriage moves back and forth along the travel beam.

D. All electrical work and equipment to be suitable for 480 volt, three-phase, 60-cycle, power supply and in accordance with Section 16050 – Basic Electrical Materials and Methods.

E. The drive motor, structural frame, and all electrical enclosures to be grounded and bonded in accordance with Section 16060 – Grounding and Bonding.

2.04 TRAVEL BEAM

A. The travel beam upon which the unit travels to be a complete fabricated steel structure consisting of support brackets, concrete attachments, and bolted connections. Adjustability to be provided in all support brackets.

B. The rake support structure to have adequate stiffeners to provide minimum deflection under static and dynamic loads.

C. Top-rails to be smooth-surfaced throughout their length.

D. The ends of the top-rails to not overhang the terminal posts except where such overhang does not constitute a projection hazard.

2.05 FABRICATION

A. Structural Members: ASTM A 36, and/or the trash rake manufacturer’s recommended materials.

B. Trash raking units to be stable under all conditions of loading and to be rigid to prevent undue deflections and vibrations when traveling or during trash raking operations. Welding may be used in the construction.

C. All exposed edges of fabricated steel to be smooth and free from burrs.

D. Structural members of the trash rake system to be designed in accordance with the AISC-S335.

E. Welds in accordance with the applicable requirements of AWS D1.1.

F. Mechanical equipment to be simple and substantial in design, easily assembled, inspected, adjusted, painted, and taken apart.

G. Fastenings to be adequate to hold the parts in place under all conditions.

H. Steel castings, forgings, or wrought steel parts to be properly heat treated in accordance with the requirements of ASTM A 27.

2.06 PAINT AND PROTECTIVE COATINGS

A. Coat rake and components in accordance with Manufacturer's recommendations.

B. Coat steel travel beam and support structures in accordance with Section 09902 - Coatings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the hydraulic rake as shown on drawing 423-D-783 and in accordance with the manufacturer's instructions.

B. The runway travel beams to be straight with uniform cross-sections. The runway beams to be parallel to one another with respect to center to center spacing and the elevations shown on the drawing, within a tolerance of plus or minus 0.125-inches. At no location along the entire length of the runway beams may the tolerance be exceeded.

C. Connect the remote contact from the PLC with the trash rake control panel as a part of the installation for the hydraulic trash rake.

D. Flush and charge the hydraulic system. The hydraulic oil used for flushing to be removed from the installation site after flushing.

E. Provide all fasteners and other appurtenances of the equipment, as shown on the drawings, as necessary for a complete and functional installation.

F. Pivot Arm Adjustments:

1. Upon completion of preliminary testing, installation, assembly, alignment, and lubrication, the bridge and trip levers for the pivot arm rotation limit switch to be positioned to ensure the pivot arm assemblies not contact or interfere with any other object during testing or operating.

2. The gear motor reducer to be operated and the trip levers carefully adjusted until the rotating assembly stops upon contacting the trashrack.

G. Travel Limit Switches Adjustments:

1. Upon completion of the pivot arm adjustments, the bridge travel limit switches to be positioned a safe distance from the limits of travel to ensure the bridge stops prior to colliding with the travel limit stops.

2. Positioning the bridge travel limit switches to be performed at normal water levels and the unit operating in normal mode.

3. The bridge travel limit switches on the downstream end to be positioned with the pivot arm assembly lowered in the cleaning position.

4. The travel limit switches to be gradually repositioned and the spring rate adjusted on the bridge motor brake until the bridge stops smoothly near the travel limits.

5. The backup travel limit switches to be placed where they will not be actuated during normal operation, yet in the event of primary limit switch failure, will stop the bridge prior to colliding with the limit stops.

H. Trash Rake Adjustments:

1. Upon completion of the bridge travel limit switches adjustments, the trash rake to be evenly adjusted to firmly contact the trashracks during the cleaning operation.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. General:

1. Perform all mechanical and electrical assembly and operational tests to confirm that the equipment meets all requirements of this specification and applicable codes, standards, and regulations.

2. All testing, test equipment, and on-site test supervisor required for the field test furnished by the Contractor.

3. Perform all testing in the presence of the COR. Notify COR at least 5 days in advance when tests are to be performed.

4. Operational field testing of the unit to be conducted after the complete installation of the equipment.

5. Coordinate the testing date with the test date for the hydraulic trash rake.

B. Site Test:

1. After the unit has been installed and lubricated, operate the unit for a period of two hours to break-in the machinery and to ensure that all parts are properly lubricated. After this break-in period, inspect the equipment to determine that all parts have remained in correct alignment and that no excessive wear is present.

2. Rake Operation:

a. Operate the rake in the continuous mode through a minimum of two full continuous cleaning cycles.

b. Operate the rake in the automatic mode through a minimum of two full automatic cycles. Demonstrate that the hydraulic rake can be initiated by a contact closure from the cycle timer.

c. Operate the rake by means of the hand-held pushbutton pendant station. Demonstrate the operation of travel of the rake carriage:

1) Rake left and right travel.

2) Rake up and down travel.

3) Rake stop and stop.

4) Emergency stop.

3. All deficiencies noted in the conveyor system at the time of site testing will be corrected by the Contractor at no additional cost to the Government.

C. Restoration of the Trash Rake after Testing:

1. Upon completion of on-site testing, apply touch-up painting as required to restore the integrity of the paint system.

2. Drain, flush, and refilled all oil reservoirs with new lubricant.

3. Re-lubricate all parts lubricated with high-pressure grease.

4. Re-align the runway beams, if necessary, to provide smooth operation.

3.03 TRAINING

A. Provide training at the project site to instruct Government personnel in system operation and maintenance of the trash rake system equipment and controls.

B. Training to take at least 1 day for a minimum of 5 personnel.

C. The exact date and time to be made only by mutual agreement between the Government and the Contractor.

END OF SECTION

SECTION 14520 – TRASH RAKE CONVEYORS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Trash Rake Conveyors:

1. Payment: Lump sum price offered in the schedule.

1.02 REFERENCES

A. American Institute of Steel Construction (AISC)

1.	AISC-S335-1989	Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design with Commentary, Part of M016 - Manual of Steel Construction-Allowable Stress Design, Ninth Edition

B. American Society of Mechanical Engineers (ASME)

1.	ASME B20.1-2006	Conveyors and Related Equipment

C. ASTM International (ASTM)

1.	ASTM A 27/A 27M-05	Steel Castings, Carbon, for General Application
2.	ASTM A 36/A 36M-05	Carbon Structural Steel
3.	ASTM C 881/C 881M-02	Epoxy-Resin-Base Bonding Systems for Concrete

D. American Welding Society, Inc. (AWS)

1.	AWS D1.1/D1.1M-06	Structural Welding Code - Steel

E. National Electrical Manufacturer's Association (NEMA)

1.	NEMA 250-2003	Enclosures for Electrical Equipment
2.	NEMA MG1-2006(R2007)	Motors and Generators

F. Occupational Health and Safety Act (OSHA)

1.03 PERFORMANCE REQUIREMENTS

A. Conveyor belt travels at a speed within the range of 16 to 18 feet per minute.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 14520-1, Approval Drawings and Data:

1. Detailed shop drawings for all major components. Drawings are complete in detail, show the thickness, type, grade, class of metals, and the dimensions. Drawings to show construction and installation details, in relation to the existing structure. The lifting weights of the equipment.

2. Drawing 40-D-6032 for the drive motors.

3. Furnish calculations showing the loadings, stresses and deflections on the frame, supports, and conveyor belt. Furnish sizing calculations for the drive unit (i.e., motor, reducer, and belt) and the bearings. Furnish the assumed friction factors.

4. Commercial products data: Include complete identifying catalog descriptions and data giving the manufacturer's name, type, model, size, dimensions, load ratings, and characteristics of all the commercially available components for the conveyor.

5. Electrical control diagrams, interconnection wiring diagrams, and schematics showing all wire connections and conduit layout. Provide electrical control schematic diagrams in ladder-logic format.

C. RSN 14520-2, Purchase Orders:

1. Copies of purchase orders for trash rake conveyors.

D. RSN 14520-3, Final Drawings and Data:

1. Furnish service manuals that contain operating and maintenance instructions, full-size prints of the installation and detailed assembly drawings, electrical schematics and wiring diagrams, lubrication schedule and specifications, a list of special tools, and a parts catalog for all components provided under this section.

2. Electronic copies of all drawings, schematics, and diagrams submitted in the service manuals in AutoCAD format.

3. Furnish Government certified copies of all mechanical and electrical shop tests and NEMA motor test reports.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect all equipment from corrosion, deformation, and other types of damage.

1.06 SPARE PARTS

A. Furnish the following spare parts:

1. One operating coil for each type of motor contact.
2. One lubrication gun with the same size button-head attachment as provided at grease points on the conveyor system.
3. One year's supply of grease for the lubrication gun.
4. Three renewable contacts for each type of motor contact.
5. Six fuses of each type of fuse.
6. A complete set of special tools and wrenches required for maintenance of the conveyors in an approved toolbox.
7. Two indicating lamps of each type used.
8. One color cap for the indicating lamps of each type.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Conveyors:

1. Provide the conveyors with the following salient characteristics:
   a. Type of material handled: Wet, solid materials comprising grass, moss, tumbleweeds, branches, small logs and stumps, silt, gravel, and trash.
   b. Capable of operating outdoors in dust, direct sunlight, and ambient temperatures ranging from 23 to 140 ^{o}F.
   c. Capable of both continuous duty cycle and intermittent operation.
   d. Capable of manual and automatic modes of operation.
   e. Operates from a nominally rated service power of 480 volts, three phase, and 60 hertz.
2. Conveys trash at a speed within the range of 16 to 18 feet per minute.
3. Design loads:
   a. The drive unit, belts, and all load carrying components capable of starting against a debris load of 100 pounds per linear foot of conveyor length.
4. Provide all fasteners, shafting, bearings, sprockets, belts, and other appurtenances of the equipment, as shown on the drawings and as necessary for a complete and functional installation.

5. Coordinate the design of the unit with the installation of the hydraulic trash rake to properly locate bolts, and other miscellaneous deck fittings.

6. An alarm light at the control panel to indicate a unit stops in mid-cycle, or an overload tripping of any motor has occurred.

7. Conveyors capable of immediate operation, after standing idle for several months and having received only routine maintenance during the idle period.

2.02 COMPONENTS

A. Conveyors shall consist of the following components:

1. Belt-type conveyor:

   a. Dewatering belt of rubber with 1/2-inch holes on 6-inch centers.

   b. 29-Inches wide (width including frame).

2. Elevator conveyor:

   a. "Z''Belt a rubber belt with 3-inch Z pattern.

   b. 41-Inches wide (width including frame).

3. Conveyors started and operated in conjunction with the trash rake.

4. Ensure coordinating the design, installation, and operational requirements of the conveyors and the trash rake to ensure compatibility between the systems.

5. Pushbutton controls for manual operation.

6. Induction motors.

7. Gear reducers.

8. Control panel: To sequence automatic and manual operation.

9. Cables, conduits, terminations, and accessories required for the power supply, start/stop systems, and interconnecting the equipment included in this section.

10. Anchors, bolts, nuts, and washers for attachment to concrete and steel structures.

B. A combination starter with controls shall be furnished and installed for each conveyor in a common NEMA 250, Type 4 control panel enclosure at the location shown on drawing 423-D-783. The control panel for the conveyors to have the following features:

1. MANUAL/OFF/AUTOMATIC selector switch: A three-position selector switch provided as part of the combination starters and to provide the following operations:

   a. MANUAL position: Conveyors start and continue to run until the selector switch is turned to OFF.

b. OFF position: Conveyors are stopped and will not start in response to any automatic or manual operation (lock out mode).

c. AUTOMATIC position: Conveyors start, operate and stop in response to the following:

1) Conveyor TIME-DELAY relays from hydraulic trash rake.

2) When the emergency stop safety switch cable has been pulled, the conveyors and hydraulic trash rake will immediately stop.

d. Heavy-duty, rotary type with enclosed contacts.

e. Furnished with the contact arrangements specified.

f. Contacts meet rating designation A600 of the part ICS-2-125 of the NEMA standards.

2. Disconnect Switch.

3. Magnetic Contactor:

a. Magnetic, air-break, full-voltage type.

b. Power supply: 120-volts, alternating current, 60-hertz.

c. Thermal overloads provided in each phase.

4. Control Power Transformer:

a. Adequate capacity for the control power requirements of the drive motors and any other functions required by these specifications.

b. Standard dry-type design.

c. Rated for 120-volt, 60 hertz service.

5. Current-limiting fuse furnished on the secondary side of the control power transformer. The Contractor to determine the proper current rating for the fuse, unless otherwise indicated on the drawings.

C. Induction Motors:

1. Sizes and horsepower determined by the manufacturer.

2. Temperature 50 degrees C ambient.

3. Speed: 1,800 rpm.

4. Continuous ratings.

5. Anti-friction bearings.

6. TEFC type motors, nominally rated 480 volts, 3-phase, 60 hertz, designed for across-the-line starting at full voltage.

7. Conform to NEMA MG1, including characteristics, tests, and ratings unless otherwise specified.

8. Characteristics and torque requirements of the equipment load coordinated with the selection of the motor to obtain proper starting, acceleration and normal running of the equipment.

9. The horsepower rating of the motor such that it will continuously carry the maximum load developed under all operating conditions specified, at nameplate rating, with a 1.0 service factor.

10. Capable of operating in ambient air temperature range of plus 23 °F to plus 140°F at an altitude of 145 feet. The maximum temperature rise of the winding when the motor is delivering rated output at rated voltage and frequency not exceed 80°C by resistance for class B, F, or H insulation. The temperature rise of other parts of the motors in accordance with the standards for class B insulation.

11. Efficiency, stated on drawing 40-D-6032, to allow for windage, friction, open-circuit core losses, stray-load losses, and I^2R losses in the stator and rotor at the temperature as obtained in the manner specified in NEMA standard MG1-12.53.a. The insulation treated to prevent injury from temporary exposure to dampness.

12. Internal ferrous surfaces, including rotor, finished with applied covering to inhibit corrosion.

13. Design the bearings for specific duty specified herein. The bearings to be oil or grease lubricated, and sealed against loss of lubricant or entrance of dirt. Each bearing insulated to prevent circulating currents from passing through the bearing surfaces. The bearing insulation may be omitted provided the induced shaft voltages are sufficiently low so that current will not flow through the bearing lubricating film from one bearing surface to another.

D. Gear Reducers:

1. Standard high-grade, heavy-duty, commercial-type reducer.

2. Stress, torque, and horsepower rating of the reducer determined in accordance with applicable AGMA standards and designed for the duties specified.

E. Conveyor Belt Pulleys: Pulleys shall be crowned and shall have adequate means for keeping the belt centered.

F. Conveyor Belt Fabric:

1. Rubber belt with 1/2-inch holes on 6-inch centers for the flat conveyor.

2. Rubber “Z” belt for the elevating belt conveyor.

G. Bearings:

1. Anti-friction bearings, rated for the maximum loads incurred, with either sealed-lubrication or button-head high-pressure grease fittings.

2. The bearings in each conveyor tail shaft to be carried in an adjustable take-up frame so that the tension may be adjusted while the conveyor is in place.

H. Epoxy Anchors:

1. Bolts with epoxy-resin-bonding system: The epoxy-resin-bonding system to conform to ASTM C 881, type 1.

I. Grease Fittings: Uniform size at all places requiring lubrication.

J. Safety Features: Safety features provided to meet the requirements of the latest OSHA rules and regulations for conveyors and ASME B20.1 "Safety Standard for Conveyors and Related Equipment." In addition to the above requirements, provide the following safety features:

1. Provide guards at shear and nip points of the take-up frame.

2. Cover and guard hazardous shear points and nip points of the drive units.

3. Post warning signs along the conveyors to prevent injury by notifying personnel to remain clear of the conveyors or moving parts.

4. Provide guarding around the returning belts and rollers where personnel may come into contact with the moving parts.

5. Furnish and install an emergency safety stop switch with safety cables that extend along the entire length of the downstream side of the conveyor. Wire the safety stop switch to the controls of the conveyors and trash rake such that when the safety cable is pulled, the safety stop switch will initiate emergency stopping of the conveyors and the trash rake. Provide the safety stop switch with a positive safety lock to prevent accidentally resetting once the safety cable has been pulled. Manual resetting will be required.

6. The safety stop switch to be capable of operating with the safety cables extending in either or both directions from the actuating handle. Install the safety stop switch at the approximate location shown on the drawing (423-D-783). House the safety stop switch in a NEMA 250, Type 4 enclosure. Equip the safety stop switch with SPDT micro switches that close when the safety cable is pulled, thus activating a shutdown of the conveyors and the trash rake. The switches to be rated 10 amps (minimum) at 120 volts, alternating current.

7. The safety cable to be 0.0937-inch, 7 x 7 preformed, galvanized aircraft cable with either a vinyl or nylon protective coating. Provide the safety cables with the necessary connections to attach the cables to the safety stop switch actuating arm. Furnish and install supports for the safety cable to ensure that the weight of the cable alone will not actuate the safety stop switch.

K. Structural Members: ASTM A 36.

2.03 ELECTRICAL EQUIPMENT

A. Power and Control Cables:

1. Provide power and control cables to and from the control panel and to and from the conveyors.

2. Cables: Designed for outdoor use, with a water, oil, and ultraviolet-light resistant cable jacket, installed in conduits.

B. All electrical work and equipment to be suitable for 480 volt, three-phase, 60-cycle, power supply and be in accordance with Section 16050 – Basic Electrical Materials and Methods.

C. The drive motors, structural frames of the conveyors, and all electrical enclosures to be grounded.

2.04 FABRICATION

A. All exposed edges of fabricated steel to be smooth and free from burrs.

B. Design of structural members: Structural members of the conveyor systems to be designed in accordance with the AISC-S335.

C. Welds in accordance with the applicable requirements of AWS D1.1.

D. Mechanical equipment to be simple and substantial in design, easily assembled, inspected, adjusted, painted, and taken apart.

E. Fastenings to be adequate to hold the parts in place under all conditions.

F. Steel castings, forgings, or wrought steel parts to be properly heat treated in accordance with the requirement of ASTM A 27.

2.05 PAINT AND PROTECTIVE COATINGS

A. Coat components and structures in accordance with Section 09902 - Coatings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the conveyors as shown on drawings 423-D-783 and 423-D-784.

B. Install supports where required to provide for a stable installation.

C. Coordinate with electrical installation for provisions from power supply and control interface points.

D. The Contractor to make all necessary adjustments to provide a complete installation satisfactory to the COR.

E. Provide the manufacturers instructions for installation as part of these specifications for installation.

F. Connect the following external equipment with the starters and controls as a part of the installation for the conveyor systems:

1. Remote contact from the emergency stop safety switch.
2. Remote relay from the trash rake for starting and stopping the conveyors.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. General:

1. Perform all mechanical and electrical assembly and operational tests to confirm that the equipment meets all requirements of this specification and applicable codes, standards, and regulations.
2. All testing, test equipment, and on-site test supervisor required for the field test furnished by the Contractor.
3. Perform all testing in the presence of the COR. Notify COR at least 5 days in advance when tests are to be performed.
4. Operational field testing of the units to be conducted after the complete installation of the equipment.
5. Coordinate the testing date with the test date for the trash rake.

B. Operational Site Test:

1. After the units have been installed and lubricated, operate the units for a period of two hours to break-in the machinery and to ensure that all parts are properly lubricated. After this break-in period, inspect the equipment to determine that all parts have remained in correct alignment and that no excessive wear is present.
2. Make adjustments as required and retested until the units function properly according to this section.
3. The site test consists of operating the conveyor systems through at least two cycles in both the automatic and manual modes of operation.
    a. In the automatic mode, demonstrate that the conveyor systems operate satisfactorily with the trash rake and starts, operates, and stops in response to the remote contacts (conveyor time-delay relay/start signal relay) provided as part of the control panel for the trash rake.

b. In manual mode, demonstrate that the conveyors start and continuously operate until the conveyors are stopped by turning the selector switch to off.

4. Demonstrate that the conveyors and the trash rake stop when the safety cable attached to the emergency safety stop switch is pulled.

5. All deficiencies noted in the conveyor systems at the time of site testing will be corrected by the Contractor at no additional cost to the Government.

C. Restoration of the conveyors after testing:

1. Upon completion of on-site testing, apply touch-up painting as required to restore the integrity of the paint system.

2. Drain, flush, and refilled all oil reservoirs with new lubricant.

3. Re-lubricate all parts lubricated with high-pressure grease.

3.03 TRAINING

A. Provide training at the project site to instruct Government personnel in system operation and maintenance for each of the conveyor system equipment.

B. Training to take at least 1 day for a minimum of 5 personnel.

C. The exact date and time to be made only by mutual agreement between the COR and the Contractor.

END OF SECTION

SECTION 15701 – HVAC SYSTEM

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building. Lump sum price for control building shall include cost of:

   a. Providing the HVAC system as shown on drawings and in accordance with this Section and the following Sections:

      1) 15703 - Mechanical Identification – HVAC.

      2) 15810 – Ducts.

      3) 15820 – Duct Accessories.

      4) 15830- Fans.

      5) 15850 - Air Outlets and Inlets.

      6) 15940 - Sequence of Operation – HVAC.

      7) 15950 - Testing, Adjusting, and Balancing- HVAC.

2. Include the following costs in the applicable lump-sum prices offered in the schedule for the complete electrical system. Refer to Division 16 – Electrical.

   a. Furnishing and installing cable and conduit for HVAC system.

   b. Grounding for HVAC system.

1.02 PROJECT CONDITIONS

Table 15705A – Climatic Design Summary

Region	U.S.A	Summer Design Dry Bulb Temp.	124 ^{o}F
Location	Arizona	Summer Coincident Wet Bulb Temperature	72.0 ^{o}F
City	Yuma	Summer Daily Temperature Range	23 ^{o}F
Latitude	32.7	Winter Design Dry Bulb Temperature	40 ^{o}F
Longitude	114.6	Winter Coincident Wet Bulb Temperature	33.6 ^{o}F
Elevation	23	Atmospheric Clearness Number	1.05

Table 15705A – Climatic Design Summary

Soil Conductivity	.800 BTU/Hr/ft/ ^{o}F	Average Ground Reflectance	.20

1.03 DESCRIPTION OF HVAC SYSTEM

A. HVAC System:

1. Ventilation for occupancy:

   a. The equipment building is an above grade facility and the expected amount of infiltration air in both the Electrical Room and Generator Room for this type of building construction shall provide adequate ventilation for maintenance occupancy without the mechanical ventilation system being energized.

2. Provides outside ventilation air as needed to cool and ventilate the Generator Room.

3. Provides cooling via a packaged terminal air conditioner wall mounted air conditioning unit to maintain approximately 70 degrees Fahrenheit in the Electrical Room.

4. Equipment:

   a. Generator Room:

      1) The room ventilating system consists of two stationary air intake louvers with associated counter weighted back draft dampers, and a wall-mounted propeller exhaust fan with counter balanced exhaust damper and stationary exhaust louver.

   b. Electrical Room:

      1) The room cooling system consists of a Trane model PTEE 090 (208 volts) packaged terminal air conditioner manufactured by The Trane Company, 6200 Troup Highway, Tyler TX 75707, (903) 581-3200; or equivalent packaged terminal unit with the following essential characteristics:

         a) Minimum of 9,000 BTU/hr cooling capacity.

         b) Wall mounted remote display temperature control module.

         c) Operating voltage of 208 volts.

         d) Capable of mounting in a standard 16-inch by 42-inch wall sleeve such that the unit is mounted to the interior of the bullet resistant louvered wall opening as shown on drawing 423-D-812 to prevent possible theft.

5. Control:

a. Generator Room:

1) Operation of the wall mounted propeller exhaust fan is controlled via a wall mounted toggle switch located near the entrance to the room such that maintenance personnel may selectively turn the exhaust fan on or off during occupancy.

b. Electrical Room:

1) Operation of the wall mounted air conditioning unit is controlled via the front panel control board provided with the unit.

END OF SECTION

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SECTION 15703 - MECHANICAL IDENTIFICATION – HVAC

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

PART 2 PRODUCTS

2.01 NAMEPLATES

A. Plastic Nameplates: Laminated three-layer plastic with engraved white letters on black contrasting background color. Provide in accordance with standard drawing 40-D-6234.

B. Metal Nameplates: Manufacturer’s standard for equipment.

2.02 TAGS

A. Provide tags only where physical construction of equipment precludes attachment of nameplates.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches round.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inches diameter with smooth edges.

D. Information Tags: Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install identifying devices after completion of coverings and painting.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or a combination of mechanical fasteners and adhesive.

C. Install metal nameplates with manufacturer's standard method.

D. Install labels with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

E. Identify fan with metal nameplates.

F. Identify control dampers and motors, and thermostats with plastic nameplates.

END OF SECTION

SECTION 15810 – DUCTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM A 36/A 36M-05	Carbon Structural Steel
2.	ASTM A 90/A 90M-07	Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
3.	ASTM A 653/A 653M-07	Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process
4.	ASTM A 924/A 924M-07	General Requirements for Sheet Steel, Metallic-Coated by the Hot-Dip Process

B. Sheet Metal Air Conditioning Contractors(National Association (SMACNA)

1.	SMACNA 006-2006	HVAC Duct Construction Standards - Metal and Flexible
2.	SMACNA 1143-1985	HVAC Air Duct Leakage Test Manual

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 15810-1, Approval Data:

1. Shop Drawings: Indicate duct fittings, gages, sizes, welds, and configuration.
2. Product Data: Submit data for duct materials.
3. Manufacturer's Certificate: Certify that installation of all duct products meet or exceed specified requirements.

C. RSN 15810-2, Final Data:

1. As built drawings detailing field fabrications/modifications of ductwork sleeves and transitions.

1.04 PERFORMANCE

A. Perform work in accordance with SMACNA 006-2006.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years experience.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures during and after installation of duct sealant.

1.07 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.01 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A 653 and ASTM A 924 galvanized steel sheet, lock-forming quality, having G90 zinc coating in conformance with ASTM A 90.

1. Provide United States Standard 16 gauge thickness for all ducts unless otherwise noted.

B. Fasteners: Rivets, bolts, or sheet metal screws.

C. Hanger Rod: ASTM A 36; steel, galvanized, threaded both ends, threaded one end, or continuously threaded as required.

2.02 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA 006 using 16 gauge thicknesses for all ducts unless otherwise noted here within. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Minimum 4-inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field verify inlet/outlet locations and sizes prior to construction to insure proper fit and alignment.

B. Verify sizes of equipment connections before fabrication.

1. If necessary, provide transitions or sleeves between wall opening and HVAC equipment, to ensure proper fit and alignment of equipment.

3.02 INSTALLATION

A. Install ducts in accordance with SMACNA 006.

B. Provide adequate access into ductwork for cleaning purposes.

C. Seal duct in accordance with SMACNA 006:

1. Provide SMACNA Seal Class C for all ducts.

D. Use double nuts and lock washers on threaded rod supports.

E. Provide duct sleeve (maximum four inches in depth), as shown on drawing 423-D-814, suitable for mounting counter balanced back draft dampers CBBD2, CBBD3, and CBBD4.

3.03 CONTRACTOR FIELD QUALITY TESTING

A. Test, adjust, and balance air system in accordance with Section 15950 - Testing, Adjusting, and Balancing – HVAC System.

END OF SECTION

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SECTION 15820 - DUCT ACCESSORIES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 REFERENCES

A. International Conference of Building Officials (ICBO)

1.	IBC-2006	International Building Code (IBC)
2.	UMC-2006	Uniform Mechanical Code (UMC)

B. National Fire Protection Association (NFPA)

1.	NFPA 90A - 2002	Installation of Air-Conditioning and Ventilating Systems

C. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

1.	SMACNA 006-2000	HVAC Duct Construction Standards: Metal and Flexible
2.	SMACNA 1819-2002	Fire, Smoke and Radiation Damper Installation Guide for HVAC System

D. Underwriters Laboratories (UL)

1.	UL 181 - 2005	Factory-Made Air Duct and Air Connectors
2.	UL 181A - 2005	Closure systems for Use with Rigid Air Ducts

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 15820-1, Approval Data:

1. Shop Drawings: Indicate shop fabricated assemblies.
2. Product Data: Submit product data for shop fabricated assemblies including: product description, application, performance data, dimensions, construction materials, code and standard compliance and certification.

C. RSN 15820-2, Final Data:

1. Manufacturer's Installation Instructions: Back-draft dampers.
2. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
3. Operation and Maintenance Data: Submit for back-draft damper.

PART 2 PRODUCTS

2.01 BACK-DRAFT DAMPERS

A. Multiple-interconnected, parallel-blade, counterbalanced type suitable for intake and exhaust applications. Operate by pivoting blades along centerline or one edge of damper with adjustable counterbalance for horizontal airflow. Initial opening shall be adjustable to 0.01-inch w.g. or lower. The full open differential pressure shall be adjustable from 0.02- to 0.05-inch w.g.

B. Provide 4-inch (maximum) airfoil blades with edge seals. Frame and blades constructed from extruded aluminum sufficiently rigid to avoid generation of vibration and noise. Support blades in corrosion resistant pivots securely fastened to frame.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify ducts and equipment installation are ready for accessories.

3.02 INSTALLATION

A. Install back-draft dampers on building intake and exhaust openings where indicated on drawings 423-D-809, 423-D-811, 423-D-812 and 423-D-814.

B. Install in accordance with SMACNA 006, NFPA, UL, IBC, UMC, and manufacturers' recommendations.

C. Securely fasten duct accessories to ductwork with screws or bolts to prevent generation of vibration and noise.

D. Securely fasten dampers to ductwork, sleeves or wall openings with screws or bolts. Seal space between frame and openings or sleeves with UL listed sealant. Adjust damper counterbalance to allow the design airflow rate.

END OF SECTION

SECTION 15830 – FAN

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 REFERENCES

A. Air Movement and Control Association (AMCA)

1.	AMCA 99-2003	Standards Handbook
2.	AMCA 210-1999	Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
3.	AMCA 300-2005	Reverberant Room Method for Sound Testing of Fans
4.	AMCA 301-2006	Methods for Calculating Fan Sound Ratings from Laboratory Test Data

B. National Electrical Manufacturers Association (NEMA)

1.	NEMA 250-2003	Enclosures for Electrical Equipment (1000 Volts Maximum)

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 15830-1, Approval Data:

1. Shop Drawings: Indicate size, dimensions and configuration of fan assembly, mountings, construction materials, weights, ductwork and accessory connections.
2. Product Data: Submit data on fan and accessories including: AMCA fan performance curves with specified operating point clearly plotted, power, efficiency, RPM, sound power levels for both fan inlet and outlet at rated capacity. Fan Manufacturer's performance tables may be substituted for the performance curve provided the tables show the full operating range for each fan proposed.
3. Electrical characteristics, connection requirements, wiring diagrams, and schematics. Wiring diagrams and schematics shall be in accordance with Section 16051 – Electrical Drawings and Data.

C. RSN 15830-2, Final Data:

1. Operation and Maintenance Data: Service manuals including:

    a. Manufacturers' descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings. Include instructions for lubrication, motor and drive adjustment and replacement, and wiring diagrams.

    b. Copies of all previously approved drawings and data with as-built changes.

1.04 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect motors, shafts, and bearings from weather and construction dust.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not operate fans for any purpose until ductwork is clean, bearings lubricated, and fan has been test run under observation.

1.07 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.01 WALL MOUNTED PROPELLER EXHAUST FAN

A. Fan Unit: Greenheck model SE1-12-436-G horizontal direct discharge, propeller, sidewall exhaust fan or equivalent, including motor, support frame, all accessories required for installation and operation, or equal with the following essential characteristics:

1. Designed to pull 300 cfm of outside air through an interior mounted insect and bird screens, intake louver, intake control damper, interior damper guard, the room being ventilation cooled, and the fan motor-side intake guard, and to exhaust the air through an exhaust air counter balanced damper, and exhaust air stationary louver.

    a. Estimated range of static pressure: 0.20 to 0.30-inch wg.

    b. Voltage: 115-volt, 1-phase, 60-hertz.

    c. All ratings corrected for operation at elevation 200 feet above sea level.

d. Motor Horsepower: 0.1-Hp. Estimated and allocated on the electrical drawings from the HVAC power supply. If a higher horsepower fan motor is needed, then the circuit breaker rating, motor starter, and related electrical components must be sized to match the fan and motor to meet NEMA and specifications requirements.

e. Room air temperature range: 0 degrees Fahrenheit to 116 degrees Fahrenheit.

f. Outdoor air temperature range: 0 degrees Fahrenheit to 124 degrees Fahrenheit.

g. Drive:

1) Direct drive.

2) Rating: Minimum of 1.5 times the nameplate rating of the motor.

h. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

i. Sound Ratings:

1) 65-dBA (maximum).

2) Per AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

j. Fabrication: Conform to AMCA 99.

k. Temperature Limit: Maximum ambient temperature 124 degrees Fahrenheit (50 degrees Celsius).

l. Static and Dynamic Balance: Eliminate vibration or noise transmission to occupied areas.

B. Controls:

1. On/Off selector switch mounted to either side of the doorway of the engine generator room (approximately 5’ off the floor) as shown on 423-D-809. See also section 15940 - Sequence of Operation - HVAC.

C. Electrical Characteristics and Components:

1. Motor:

a. Across-the-line, full-voltage-starting, induction type.

b. Rated 115 volts, 1-phase, 60 hertz.

c. ODP conforming to NEMA MG-1.

d. Rated for operation in 124 degrees Fahrenheit environment at elevation 200 feet above sea level.

e. The nameplate horsepower rating shall be a minimum of 115 percent of the BHP required at the specified performance.

f. Designed for both intermittent and continuous operation.

2.02 PAINTING

A. Provide and repair manufacturer(s) standard paint finish in accordance with Section 09902 - Coatings, unless otherwise noted.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install fans where shown on drawing 423-D-812.

B. Install in accordance with manufacturers recommendations.

C. Install on/off toggle switch for fan control in an easy to reach location approximately 5-foot off the floor to either side of the generator room doorway.

D. Service equipment in accordance with manufacturer’s instructions.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. After installation and servicing is complete, prepare equipment for testing.

B. Follow the requirements of Section 15950 - Testing, Adjusting, and Balancing – Ventilating.

END OF SECTION

SECTION 15850 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 REFERENCES

A. Air Movement and Control Association (AMCA)

1.	AMCA 500-L – 2007	Laboratory Methods of Testing Louvers for Rating

B. American Society of Mechanical Engineers (ASME)

1.	ASME B18.2.1-1996(2005)	Square and Hex Bolts and Screws (Inch Series)

C. ASTM International (ASTM)

1.	ASTM A 90/A 90M-07	Weight (Mass) of Coating on Iron or Steel Articles with Zinc or Zinc-Alloy Coatings
2.	ASTM A 307-07b	Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
3.	ASTM A 563-07a	Carbon and Alloy Steel Nuts

D. American Welding Society (AWS)

1.	AWS D1.1/D1.1 M-2006	Structural Welding Code – Steel

E. Federal Specifications (FS)

1.	FF-S-92B	Screw, Machine: Slotted, Cross-Recessed or Hexagon Head

F. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

1.	SMACNA-006-2006	HVAC Duct Construction Standard - Metal and Flexible

G. Underwriters Laboratories

1.	UL 752-05	Standard for Safety

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals.

B. RSN 15850-1, Approval Data:

1. Product Data: Submit manufacturer's drawings for outlets and inlets including, louver, backdraft dampers and screen construction drawings showing sizes, welds, finish, mounting details, bill of materials, etc.

2. Schedule: Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

3. Performance Data: Air outlet and inlet performance data including: Manufacturer's published table showing airflow range, pressure loss at rated airflow, spread angle, maximum velocity, noise criteria (NC) rating.

4. Manufacturer's descriptive data for bullet resistant louvers, certificate, and test report showing compliance with UL – 752.

C. RSN 15850-2, Final Data:

1. Balancing Data: Submit balancing data including static pressure losses through louvered openings and air flow measurement data indicating minimum air flow requirements have been met.

2. Copies of all previously approved drawings and data with as-built changes.

PART 2 PRODUCTS

2.01 BULLET-RESISTANT STATIONARY LOUVERS

A. General: Provide bullet-resistant stationary louvers which meet or exceed UL level 2 standard threat level located as shown on specification drawing 423-D-809 423-D-811 and 423-D-812. Louvers and frames shall be factory fabricated from steel shapes to the opening dimensions indicated and suitable for mounting in two inch embedded tubular steel frames, with combination insect/bird screens frame-mounted on the exterior face of the louver. All welds shall be ground smooth to allow for maximum air transfer.

B. Quantity and Size:

1. Generator Room

a. Exhaust

1) One (1), nominal 68-inch wide by 68-inch high to fit into two inch embedded tube frames furnished as shown on drawings 423-D-809, 423-D-811 and 423-D-812.

2) One (1), nominal 16 – inch diameter circular louver as shown on drawings 423-D-811 and 423-D-812

b. Intake

1) Two (2), nominal 52-inch wide by 68-inch high to fit into two inch embedded tube frames furnished as shown on drawings 423-D-809, 423-D-811 and 423-D-812.

2. Electrical Room

a. Intake

1) One (1), 42 – inch wide by 16 – inch high to fit into two inch embedded tube frames furnished as shown on drawings 423-D-809, 423-D-809 and 423-D-812.

C. Rated in accordance with AMCA 500L.

D. Weatherproof type having a free area not less than 50 percent of the gross area

E. Blades and frames constructed from galvanized steel having G90 zinc coating in conformance with ASTM A 90.

F. Provide with 5-inch deep blades spaced on not more than 4-inch vertical centers, sloped at a 45 degree angle

G. Blades shall be continuously welded to the frame along edges to prevent leakage of water.

H. Louvers shall be painted to match the building exterior color.

2.02 SCREENS

A. Insect and bird screen shall be mounted together in a single frame constructed of 16-gauge galvanized sheet metal in a sandwiched style configuration with the insect screen being placed behind the bird screen material for protection from flying debris. Dimension frames and screens to match size of tube frame opening. Frame shall be painted to match the louver color. Mount screens on exterior of louver faces by securely fastening the frame to the two inch embedded tubular frame.

1. Insect Screen

a. Provide a stainless steel wire, 14 x 18 mesh insect screens offering no less than 75 percent free area.

2. Bird Screen

a. Provide a stainless steel wire mesh bird screen offering no less than 75 percent free area.

2.03 FASTENERS

A. Bolts Nuts & Screws:

1. Bolts: ASTM A 307, grade A.

2. Nuts: ASTM A 563, grade A.

3. Length of bolt threads: In accordance with ASME B18.2.1.

4. Threads: Class 2, free fit, American National coarse-thread series.

5. Machine Screws: FS FF-S-92B.

B. Anchor Bolts:

1. Adhesive Anchors:

a. Stainless steel, type 304.

b. Anchor rods shall have rolled threads.

c. Provide adhesive capsule having the following essential characteristics:

1) Resin adhesive capsules with hardener.

2) One capsule length minimum bolt embedment length unless indicated otherwise on drawings, but not less than 3-1/2-inch minimum embedment.

3) Anchor system shall be designated to provide good performance for dynamic loads.

C. Sealing Tape:

1. Silver-gray vinyl plastic tape with a rubber adhesive designed for duct sealing.

2. Flame resistant and will not support combustion.

3. Low moisture transmission rate. Suitable for use as a vapor barrier.

4. Physical properties:

a. Adhesion to steel: 35 oz/in width.

b. Tensile strength at break: 18 lb/in width.

c. Elongation at break: 205 percent.

d. Backing thickness: 4.75 mils.

e. Total tape thickness: 5.6 mils.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field verify inlet/outlet locations and sizes prior to construction to insure proper fit and alignment.

B. Verify ceiling and wall systems are ready for installation.

3.02 INSTALLATION

A. Louvers

1. Install in tube frames, mounted flush with the exterior of the building surface as indicated on drawing 423-D-814.
2. Install screens as shown on drawing 423-D-814.
3. Install in accordance with SMACNA 006.
4. Securely fasten to ductwork, wall or frames with screws or bolts. Provide adequate clearance for maintenance.
5. Apply approved Type A sealant between louvers and tube frame in building wall.
6. Install louver blades sloped down to the outside.
7. Install screens on the outdoor face of louvers.
8. Grind exterior surfaces flush and smooth
9. Painting and repair of damaged surfaces shall be in accordance with Section 09902 – Coatings.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.04 TESTING

A. Balancing: Section 15950 - Testing, Adjusting, and Balancing – HVAC System.

END OF SECTION

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SECTION 15940 – SEQUENCE OF OPERATION - HVAC

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum three (3) years experience.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 NORMAL HVAC SYSTEM OPERATION

A. Design: The HVAC system shall provide the following modes of operation:

1. Electrical Room Cooling:

a. Operation of the wall mount air conditioning unit shall be controlled by the onboard controls furnished with the unit. Setpoints shall be set in accordance with the COR at the time of installation.

b. Operation of generator room ceiling exhaust fan shall be controlled by an on/off toggle switch located on either side of the generator room doorway, approximately 5 feet off the floor.

B. Counter-Balanced Backdraft Damper (CBBD) Operation:

1. The exhaust air dampers are adjustable counter-balanced back draft dampers initially adjusted to open at a differential pressure of 0.01inches wg, and designated as follows:

a. CBBD1 in the discharge from fan NPF1.

b. CBBD2 in the cooling air discharge from the engine-generator.

2. The intake air dampers for the engine-generator are adjustable counter-balanced back draft dampers initially adjusted to open at a differential pressure of 0.01 inches wg, and designated as follows:

a. CBBD3 and CBBD4 in the intake of the engine-generator

END OF SECTION

SECTION 15950 - TESTING, ADJUSTING, AND BALANCING - HVAC

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 REFERENCES

A. American Refrigeration Institute (ARI)

1.	ARI 575 – 94	Method of Measuring Sound Within Equipment Space

B. National Environmental Balancing Bureau (NEBB)

1.	NEBB TAB - 2005	Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals.

B. RSN 15950-1, Approval Data:

1. Sample NEBB report forms.
2. Copy of NEBB supervisor certification.
3. Instrument calibration reports: Identify all instruments to be used, calibration frequency, and last date of calibration.
4. System diagram.
    a. Indicate planned locations of flow and pressure measurements; volume control dampers, thermostats, controllers, and settings.

C. RSN 15950-2, Final Data: Reports:

1. Provide NEBB certified data sheets in letter size binder manuals, complete with index page and indexing tabs, with cover identification at front and side.
2. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets.
3. List of instruments actually used for conducting the system testing, adjusting and balancing. Include calibration frequency and last date of calibration.
4. Record actual locations of flow and pressure measurements; volume control dampers, thermostats, controllers, and settings.

5. Field inspection report. Report defects and deficiencies noted during performance of services, which prevent system balance.

1.04 PERFORMANCE REQUIREMENTS

A. Perform work in accordance with NEBB TAB.

B. Perform work under supervision of NEBB Certified Testing, Balancing and Adjusting Supervisor.

1.05 SCHEDULING

A. Schedule and provide assistance in final adjustment of system.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Duct systems are clean of debris.
4. Fans are rotating correctly.
5. Backdraft dampers operate correctly.

3.02 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments and calibration records available to the COR to facilitate spot checks during testing.

3.03 ADJUSTING

A. Test, adjust, and balance the complete HVAC system and all associated equipment and accessories.

B. Adjust fans to provide required, or design, supply, and exhaust air quantities at site altitude. See generator manufacturer for required airflow rates including required combustion and cooling air flow rates.

C. Measure outdoor air (supply air) quantities at inlet louvers or dampers.

D. Measure exhaust air quantities at exhaust damper inlets or outlets.

E. Measure total pressure across fans with fans operating and doors closed.

F. Adjust outside air and exhaust dampers to operate at design conditions.

G. Ensure recorded data represents actual measured or observed conditions.

H. Provide system schematic with required and actual air quantities and pressures recorded across intake louvers and dampers, and across exhaust dampers and fans.

I. Permanently mark settings on adjustment devices allowing settings to be restored. Set and lock memory stops.

J. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

K. Leave systems in proper working order, closing access panels, closing doors to electrical switch boxes, and restoring temperature controls to specified settings.

3.04 SOUND AND VIBRATION

A. Measure sound in accordance with ARI 575. Certify sound levels are within the acceptable limits for the equipment as published in ARI 575.

B. With the doors closed, take sound level measurements inside and outside the building for each of the following operating conditions:

1. Fan NPF1 operating with the generator off.
2. Generator operating with the fan NPF1 off.
3. Generator operating with fan NPF1 on.
4. Background noise with fan NPF1 and generator off.

C. Record the sound measurement locations with the sound level data for each operating condition.

3.05 REPORT FORMS

1. Submit data on NEBB report forms.

B. Sound Level Report:

1. Location.
2. Octave bands - equipment off.
3. Octave bands - equipment on.

4. RC level - equipment on.

END OF SECTION

SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Complete electrical system:

1. Payment: Lump sum price offered in the schedule.
    a. Performing required design.
    b. Transporting and storing equipment and materials.
    c. Furnishing certified calibrated testing equipment.
    d. Performing testing.
    e. Modifying equipment.
    f. Assembling, adjusting, and installing equipment.
    g. Painting equipment and materials.
    h. Brackets, fasteners, bolts, nuts, lock washers, and other accessories required for mounting or installing electrical equipment and materials.
    i. Drilling holes in steel structures (other than tubular structures) as required for mounting or installing electrical equipment and materials
    j. Furnishing, handling, and storing spare parts for electrical equipment.
    k. Furnishing special tools and appliances for maintenance and adjustment of equipment
    l. Making electrical connections.
2. Does not include electrical drawings and data. Refer to Section 16051 – Electrical Drawings and Data.
3. Does not include automatic transfer switch and engine-generator set. Refer to Section 16132 – Automatic Transfer Switch and Section 16232 – Engine-Generator Set.
4. Does not include interior luminaires and exterior luminaires. Refer to Section 02001 – Control Building.

1.02 REFERENCES

A. ASTM International (ASTM)

1. ASTM A 123/A 123M-02 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
2. ASTM A 153/A 153M-05 Zinc Coatings (Hot-Dip) on Iron and Steel Hardware

B. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2-2006 National Electrical Safety Code (NESC®)

C. National Fire Protection Association (NFPA)

1. NFPA 70-2008 National Electrical Code (NEC®)

1.03 DESIGN REQUIREMENTS

A. Perform additional electrical design required.

B. Change designs as required where Contractor-furnished electrical equipment and materials differ in size, type, ratings, or other physical properties from designs in these specifications. Contracting Officer will approve changes at Contractor's expense, unless Contractor can demonstrate that changes are necessary regardless of manufacturer.

C. Design, materials, and installation details not specifically covered in referenced standards or these specifications are subject to approval of Contracting Officer.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Manufacture, construct, and assemble electrical equipment in accordance with NEMA, IEEE, ICEA, UL, ASTM, and NFPA 70 standards.

B. Test and label all electrical equipment and assemblies in accordance with a NRTL (Nationally Recognized Testing Laboratory) accredited by Federal Occupational Safety and Health Administration. If NRTL labeling is not provided, then provide evidence of a NRTL listing.

C. Galvanize mounting brackets, bolts, nuts, and washers for major items of electrical equipment such as distribution panelboards, motor control boards, auxiliary control boards, and motor control centers in accordance with ASTM A 123 and A 153.

D. Provide galvanized steel or non-corrosive metal for mounting bolts, nuts, and washers for minor items of electrical equipment and lighter weight items. Do not use cadmium-plated mounting hardware.

E. Provide special tools and appliances furnished by manufacturer for maintenance and adjustment of manufacturer's electrical equipment.

PART 3 EXECUTION

3.01 INSTALLATION

A. Do not install electrical equipment until approval drawings and data for associated equipment have been approved by Government.

B. Electrical Installations, Assembly Operations, and Adjustments: Comply with NFPA 70 and IEEE C2.

C. Make electrical installations complete and ready for service.

D. Install electrical equipment in accordance with directions furnished by manufacturer's instruction books.

E. Tighten nuts used in electrical equipment assembly with torque wrenches to torque values recommended by equipment manufacturers.

F. Drill holes in bolted steel structures and provide fastenings required for mounting or installing electrical equipment and materials.

G. Do not drill holes in tubular steel structures. Fasten to tubular steel structures by means of properly drilled and tapped pads or brackets welded to tubular members.

H. Installation of electrical equipment includes:

1. Drilling holes, furnishing hardware, and assembling components to each other.
2. Furnishing materials for and making all connections correctly in accordance with final wiring diagrams.
3. Tagging wires and cables at each end.

I. Correct errors made during installation.

J. Correct errors and discrepancies found during field testing. These corrections include making wiring changes, equipment replacements, drawing revisions, and adjustments to settings of electrical equipment.

3.02 REPAIR

A. Repair damaged painted surfaces of equipment to match original finish.

3.03 FIELD QUALITY ASSURANCE

A. Government will inspect electrical equipment during construction. Final acceptance of equipment will be made after equipment is installed, tested, and made operational.

B. All equipment field tests to be witnessed by Government. Provide proof of Government witness on field test reports.

END OF SECTION

SECTION 16051 - ELECTRICAL DRAWINGS AND DATA

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Electrical Drawings and Data:

1. Payment: Lump sum price offered in the schedule.

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME)

1. ASME Y14.1 - 2005 Decimal Inch Drawing Sheet Size And Format

1.03 SUBMITTAL REQUIREMENTS

A. In addition to the requirements in Section 01330 – Submittals, prepare electrical drawings and data submittals in accordance with the following.

1. General:
    a. Be complete, accurate in content, and legible.
2. Drawings:
    a. Title block:
        1) Include name of Project feature.
        2) Include name of equipment being represented.
        3) Type of drawing, such as schematic diagram, wiring diagram, single-line, equipment layout.
    b. Device designations and symbols: As shown.
    c. Size: D-size prints as defined in ASME Y14.1 made from original drawings, unless specified otherwise.
    d. Indicate changes on revised drawings to distinguish them from previous submittals. Describe reasons for significant changes in submittal letters.

B. Shop Drawings and Manufacturer’s Data:

1. General: Furnish with manufacturer’s standard format.
2. Equipment Layout Drawings:
    a. Indicate dimensions of equipment.
    b. Indicate location of devices and items of equipment including nameplates, terminal blocks, wiring ducts, bus, conduit entries, and other features in their relative physical location.

c. Indicate method of securing equipment to deck, floor, or wall.

d. Identify each device and item of equipment with a bill of material reference number.

3. Bill of Material List:

a. Provide information on manufacturer, style, type, rating, quantity, and other identifying information for each device or item of equipment.

b. Provide unique reference number for each device or item of equipment listed on bill of material.

4. Nameplate List: Provide information on type of material, size, engraved lettering, and method of attachment.

5. Schematic Diagrams:

a. Format:

1) Label rungs with sequential numbers starting with number 1.

2) Locate rung numbers adjacent and to left of associated rung.

b. Identify devices and items of equipment with designations as shown. If not shown, provide manufacturer's standard designation.

c. Provide unique designations for wires as shown. If not shown, provide manufacturer's standard designation.

d. Indicate terminal or pin designation for devices or items of equipment.

e. Indicate functional operation.

f. Describe unusual or nonstandard operation.

g. Indicate ratings and/or values of all devices.

h. Indicate all contacts, including spare contacts, for each motor contactor coil, auxiliary relay, and timer.

i. Indicate a complete cross-reference between other schematic and wiring diagrams.

j. Indicate switch developments for each selector switch and limit switch.

6. Wiring Diagrams:

a. Indicate equipment as mounted on each back panel, side panel, and door. Show panel and door as viewed from wiring side.

b. Identify each item of equipment with the device designation indicated on schematic diagrams.

c. Develop point-to-point wiring diagram in accordance with drawing 104-D-1165.

d. Indicate cables, cable and individual wire designations, and connections to all external circuits.

7. Manufacturer's Technical Data:
    a. Provide technical data for each device or item of equipment.
    b. Include manufacturer's name and address; catalog number, type, style, or model number; electrical ratings; and dimensions.
    c. Where several items are listed on same sheet, clearly identify items being submitted for approval.
    d. Demonstrate proposed device or item of equipment meets specifications requirements.
    e. Mark catalog data sheet with appropriate bill of material (BOM) item number.
    f. Assemble catalog data sheet into one enclosing cover with bill of material (BOM) index.

C. Sample Wiring and Interconnection Diagram: Sample of actual wiring diagram that will be submitted as a check print and final As-Built drawing.

D. Check Prints: Full-size schematic and wiring diagram that show As-Built condition of equipment at time of shipment.

E. As-built Drawings:
1. Mark prints of electrical specifications drawings to show As-Built conditions.
2. Provide dimensioned location of grounding electrodes.
3. Provide dimensioned location of buried grounding cables.
4. Provide dimensioned location of concrete embedded conduit.
5. Provide dimensioned location of direct buried conduit.
6. Mark specification drawings in accordance with the following:
    a. Red: Additions to original drawings.
    b. Green: Deletions from original drawings.
    c. Blue: Notations necessary for explanation of As-Built markings.

F. Test Reports:
1. Typed 8 1/2- by 11-inch sheets bound in a folder or 3-ring binder.
2. Certified as complete and accurate by person or organization performing the tests.

G. Wiring Checkout Test Plan: Names and qualifications of personnel performing checkout and testing, test methods, and test schedule.

H. Operation and Maintenance Instructions Books:
1. Assemble each set of material into one or more books with enclosing covers.

2. Include the following:

   a. Index sheet at front of each book which provides page or index tab number information for each major section or division.

   b. Manufacturer's operation and maintenance procedures; installation details, as required; and manufacturer’s technical data for each device or item of equipment.

   c. List of recommended spare parts and components.

   d. Complete parts lists for all replacement parts.

   e. Copies of factory test reports.

   f. Half-size schematic and wiring diagrams revised to reflect the As-Built condition of the equipment.

   g. Bill of material revised to reflect As-Built material list.

   h. Electronic drawing files for As-Built schematic, wiring, and interconnection diagrams in AUTOCAD® format (.dwg) or Drawing Transfer Format (.dxf) on CD-ROM disc.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 16060 - GROUNDING AND BONDING

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for complete electrical system.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM B 3-01(2007)	Soft or Annealed Copper Wire
2.	ASTM B 8-04	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
3.	ASTM B 228-04	Concentric-Lay-Stranded Copper-Clad Steel Conductors

B. Institute of Electrical and Electronic Engineers (IEEE)

1.	IEEE 81-1983	Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
2.	IEEE 142-1991	Grounding of Industrial and Commercial Power Systems
3.	IEEE C2-2007	National Electrical Safety Code (NESC)

C. National Fire Protection Association (NFPA)

1.	NFPA 70-2008	National Electrical Code (NEC)

D. Underwriters Laboratories (UL)

1.	UL 467-2004	Grounding and Bonding Equipment

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals and 16051 - Electrical Drawings and Data.

B. RSN 16060-1, Test Reports:

1. Results of grounding system resistance test.

1.04 SYSTEM DESCRIPTION

A. Grounding Electrode Systems:

1. Concrete-encased electrode for control building.

2. Ground rod grounding electrodes for solar-powered RTU system.

B. Ground plates.

C. Equipment grounding conductors.

1.05 DESIGN REQUIREMENTS

A. Construct and test grounding system for control building.

B. Construct grounding system for solar-powered RTU system.

C. Grounding Systems Conductor Sizes: In accordance with NFPA 70 unless shown otherwise.

D. Conform to IEEE 142 and NFPA 70.

1.06 PERFORMANCE REQUIREMENTS

A. Ground System Impedance to Ground: Less than 10 ohms for control building grounding electrode system.

PART 2 PRODUCTS

2.01 MATERIALS

A. Ground Cable.

1. Annealed bare-copper cable:
   a. ASTM B 8, class B.
   b. Solid wires used in forming the copper cable: ASTM B 3.
2. Copper-clad steel cable: ASTM B 228.
3. Concentric stranded. Solid conductor may be used for cable sizes less than 4 AWG.

B. Ground Rods:

1. Type: Solid, copper-clad steel.
2. Length: 10-feet.
3. Diameter: 3/4-inch, nominal.
4. Conform to UL 467.

C. Ground Plates:

1. Cast copper or copper-alloy.

2. Four-hole type unless shown otherwise.

3. Designed for installation in concrete walls or floors.

4. Use exothermic process for connection to grounding system. Use of compression type ground plates is not acceptable.

2.02 CONNECTIONS

A. Mechanical Connections:

1. Use connectors secured by nuts, bolts, or allen head devices.

2. Connector Material: Copper alloy.

B. Compression Connections: Use connectors secured by indent or circumferential crimps.

C. Exothermic Connections:

1. Use exothermic welding process.

2. Use fresh stock from same manufacturer.

3. Weld metal and starting material: No significant quantities of hazardous ingredients.

PART 3 EXECUTION

3.01 INSTALLATION

A. Ground and bond electrical equipment, and metallic equipment and structures in accordance with NFPA 70, IEEE C2, and as shown.

B. Install ground equipment and material in accordance with manufacturer's instructions and recommendations.

C. Install equipment grounding conductor for feeder and branch circuits. Size conductor in accordance with NFPA 70 unless shown otherwise.

D. Ground rods:

1. Drive ground rods vertically until tops of rods are within 2 inches above installation location of ground cables to which rods will be connected.

2. If solid rock is encountered within 3 feet of the subgrade, grout ground rod into 1-1/4 inch vertical hole such that top of rod is within 2 inches above installation location of ground cables to which rod will be connected.

3. If solid rock is encountered deeper than 3 feet below the subgrade, drive ground rod to refusal at approximately a 45 degree angle, then bend ground rod horizontally such that top of rod is within 2 inches above installation location of ground cables to which rod will be connected.

E. Control Building Grounding Electrode:

1. Install in accordance with NFPA 70.
2. Grounding Electrode Conductor: 4 AWG.

F. Solar-Powered RTU System Grounding Electrode:

1. Install two ground rods in accordance with NFPA 70.
2. Grounding Electrode Conductor: Solid-conductor 6 AWG.

G. Connections:

1. Make all ground connections between equipment and miscellaneous metalwork, and ground plates of grounding system whether or not such grounding connections are shown.
2. Number of grounding connections for equipment may be one, two, or more in some cases.
3. Remove paint, enamel, scale, oil, grease, or other foreign nonconductive material from point of contact on metal surfaces before making ground connections.
4. Repair damaged or removed paint or galvanizing material on metal finishes.
5. Use exothermic connections for connections buried in earth or embedded in concrete.
6. Install ground plate as shown on drawing 40-D-4334, Figure 4.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Test Resistance of Grounding System:

1. Notify COR at least 48 hours in advance of time of test in order that test may be witnessed by a representative of COR.
2. Perform test no sooner than 30 days after completion of structural concrete work.
3. Use fall of potential method in accordance with IEEE 81.
4. Testing device:
    a. Heavy-duty, low-resistance earth resistance tester with direct-reading and direct-current ohmmeter.
    b. Capable of measuring ground resistance to an accuracy of 0.5 ohms or better.
5. Test performance:
    a. Initial distance between remote current electrode (C) and grounding system under test (X): At least six times longest diagonal dimension of grounding system.

b. Beginning at electrode X, drive potential-reference electrode (P) into ground at a number of test points on a straight line between electrode X and electrode C.

c. Distance between test points: Approximately 5 percent of actual distance between electrodes X and C.

d. Continuously log apparent resistance readings for each test point and plot curve of resistance versus distance to ensure that the electrode C location is giving acceptable results as indicated in IEEE 81.

e. Measure and record test points until reaching electrode C or as directed by COR. If plot of resistance vs. distance curve indicates remote current electrode is in area of influence of grounding system, increase distance between electrode C and grounding system, and measure and record a new set of test data.

B. Supplemental Grounding Electrode:

1. If resistance of grounding system is greater than 10 ohms, the COR will require 40 calendar days after receipt of grounding system resistance test reports to determine location, type, and size of additional grounding electrodes.

2. If supplemental grounding electrodes are necessary, the COR will provide revised grounding system drawings.

3. If supplemental grounding electrodes are installed, retesting of the grounding system impedance will be required.

END OF SECTION

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SECTION 16080 – WIRING CHECKOUT AND TESTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for complete electrical system.

1.02 REFERENCES

A. National Fire Protection Association (NFPA)®

1. NFPA 70- 2008 National Electrical Code (NEC)®

1.03 DEFINITIONS

A. Qualified Person: In accordance with Article 100 of NFPA 70.

1.04 PERFORMANCE REQUIREMNENTS

A. These tests are in addition to tests required by Section 16120 – Conductors and Cables.

B. Furnish materials, including test instruments, required for checkout and testing.

C. Make wiring changes and drawing revisions to ensure there are no discrepancies between check prints, and internal equipment wiring and external cabling.

D. Replace defective equipment and make device setting adjustments as required for operation of electrical systems in accordance with specifications and manufacturer's instructions.

E. If required during testing, remove and replace wire connections.

F. Make wiring changes, wire tag revisions, and other repairs or revisions during the testing session the discrepancy is discovered.

G. Perform wiring checkout and operational and functional tests in presence of the COR.

1.05 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals and 16051 – Electrical Drawings and Data.

B. RSN 16080-1, Wiring checkout test plan.

1.06 QUALIFICATIONS

A. Testing Personnel:

1. Competent and qualified person to perform wiring checkout, and operational and functional testing.
2. Have thorough knowledge of the electrical equipment, installation, and drawings.
3. Qualified to operate equipment being tested.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 CONTRACTOR FIELD QUALITY TESTING

A. Notify COR in writing 14 days in advance of each testing session.

B. Provide following at time wiring checkouts and tests are performed:

1. Two complete sets of full-size (D-size) electrical schematic and wiring diagram check prints for equipment being tested.
   a. One set to be used and maintained by the COR.
   b. One set to be maintained by Contractor and used to produce final drawings.
2. Operation and maintenance instruction books and test reports for equipment being tested.

C. Perform wiring checkout and tests in accordance with approved testing plan and the following:

1. Wiring Checkout:
   a. Use electrical schematic and wiring diagram check prints to perform internal wiring check of equipment.
   b. Use electrical schematic and wiring diagram check prints to perform wiring check of external cabling.
   c. Perform a complete wire-by-wire, contact-by-contact, terminal-by-terminal check of circuit logic.
   d. Verify contact configuration and contact numbering.
   e. Verify continuity of wiring.
   f. Verify proper wire tagging at ends of conductors and cables.

g. Check conductors for insulation damage. Perform additional insulation resistance test of damaged conductors.

2. Operational and Functional Testing:

a. Perform after completion of wiring checkout of equipment being tested.

b. If required, adjust and calibrate protective devices in accordance with specifications, and manufacturer's instructions and recommendations.

c. Check electrical systems and controls for proper sequence of operation, correct adjustments and settings, and agreement with schematic diagram.

END OF SECTION

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SECTION 16120 - CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for complete electrical system.

1.02 REFERENCES

A. ASTM International (ASTM)

1.	ASTM B 8-04	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

B. National Fire Protection Association (NFPA)

1.	NFPA 70-2008	National Electrical Code (NEC)

C. National Electrical Manufacturers Association (NEMA)

1.	NEMA WC 70-1999	Nonshielded Power Cables Rated 2000 Volts or less for the Distribution of Electrical Energy

1.03 DESIGN REQUIREMENTS

A. Determine conductor sizes, except where shown or specified, in accordance with NFPA 70. In event of conflict between design requirements and NFPA 70, the more stringent requirement applies.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals and Section 16051 - Electrical Drawings and Data.

B. RSN 16120-1, Shop Drawings and Manufacturer’s Data:

1. Manufacturer’s technical data.

C. RSN 16120-2, Test Reports:

1. Continuity and insulation resistance tests.

1.05 DEFINITIONS

A. Cable: A conductor with insulation, or a stranded conductor with or without insulation and other coverings or a combination of conductors insulated from on another.

B. Power Cable: For power loads including motors, feeder and branch circuits, ventilating system circuits, and cable used for controlling motors and ventilating equipment.

C. Building Premises Wire: For connection of separately-housed components to one another such as wiring device and luminaire circuits.

D. Instrumentation Cable: For transducer output circuits and other instrument analog signals.

E. Telemetry Cable: For supervisory computer control and logic level signals.

PART 2 PRODUCTS

2.01 CABLE, GENERAL

A. Manufactured no more than 24 months prior to Notice to Proceed.

B. Round.

C. Copper conductor: ASTM B 8, class B or C.

D. AWG or kcmil designation.

E. Stranded conductors, except for solid conductor building premises wire.

2.02 PHASE IDENTIFICATION

A. Power Cable Phase Conductors and Building Premises Wire:

1. 120/240, single-phase: Black.
2. 120/208- or 240-volt. 3-phase: Black, red, blue. Colored phase tape may be used in lieu of colored insulation.
3. 277/480-volt, 3-phase: Black with brown, orange, yellow phase tape.

B. Neutral (Grounded) Conductors: In accordance with NFPA 70.

C. Equipment Grounding Conductors:

1. 6 AWG and smaller: Green insulation.
2. Larger than 6 AWG: Green tape at both ends and visible points including junction boxes.

2.03 POWER CABLE

A. Single-conductor or multiconductor, nonshielded type.

B. Suitable for installation in conduit and for general use.

C. Type: THHN/THWN rated for 600 volts.

D. Conform to NEMA WC 70, UL listed, and UL labeled.

2.04 BUILDING PREMISES WIRE

A. Type: Single, solid conductor THHN/THWN rated for 600 volts

B. Size: 14 AWG for 15 ampere branch circuits, 12 AWG for 20 ampere branch circuits, or as shown.

C. Suitable for installation in conduit and for general use.

D. Conform to NEMA WC 70, UL listed, and UL labeled.

2.05 INSTRUMENTATION CABLE

A. Type: Single-pair shielded or multiple individual shielded pairs with overall shield.

B. Suitable for installation in conduit and for general use.

C. Size: 16 AWG or as shown.

D. Insulation: 300 volt, 105 degrees C, minimum.

E. Single-Pair Shield: Aluminum-mylar tape providing 100 percent coverage with a tinned, stranded copper drain wire.

F. Multiple Pair Shields:

1. Pair shield: Aluminum-mylar tape providing 100 percent coverage with a tinned, stranded copper drain wire.
2. Cable shield: Aluminum-mylar tape providing 100 percent coverage with a tinned, stranded copper drain wire.

G. Jacket: Black PVC with rip-cord.

2.06 TELEMETRY CABLE

A. Belden Blue Hose® standard cable manufactured by Belden; or equal, having the following essential characteristics:

1. Type: Single twisted-pair shielded cable.
2. Conductor: 20 AWG stranded tinned copper with polyethylene insulation.
3. Shield:
    a. One layer of aluminum foil-polyester tape providing 100 percent coverage.

b. One layer of tinned copper braid providing 55 percent coverage.

4. Drain Wire: Stranded tinned copper.

5. Outer Jacket: Sunlight-resistant polyvinyl chloride (PVC).

2.07 ACCESSORIES

A. Single Conductor Markers:

1. Type: Heat-shrink, printable sleeve.

2. Color: White.

3. Machine labeled with conductor two-line designation.

B. Multiconductor Cable Tags:

1. Type: Flat, rigid, tie-on, non-adhesive label.

2. Shape: Rectangular.

3. Color: White.

4. Machine labeled with cable designation.

5. Attach to cable with standard nylon cable ties.

C. Terminal connectors:

1. Heavy-duty, insulated, pressure-crimp-type with ring tongues.

2. Tin-plated copper.

3. Serrated inner barrel.

4. UL listed.

5. Compatible with conductor size and type of cable for which it is used.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with NFPA 70.

B. Terminate control and instrumentation wire with terminal connectors.

C. Install cable without exceeding allowable pulling tensions and sidewall pressures recommended by cable manufacturer.

D. Leave sufficient length cable ends to make connections conveniently to equipment, fixtures, and devices.

E. Provide building premises wire for branch circuits feeding 120 volt receptacle and lighting loads.

F. Conduit installation:

1. Do not pull cable into conduits until conduit runs have been cleaned and are free from obstructions and sharp corners.

2. Install cable to prevent cuts or abrasions in insulation or protective covering, or kinks in cable.

3. Lubricant:

a. Use only as aid to pulling.

b. Soapstone or other suitable material not injurious to cable sheath.

G. Telemetry Cable: Use for connecting gate actuator digital control modules.

H. Grounding:

1. Ground shielding of instrumentation and telemetry cables only to source equipment ground bus using pressure crimp type connectors with ring tongues on drain wire.

2. Ground spare conductors by wire jumpers from equipment terminal block points to equipment ground bus.

I. Marking:

1. Identify power cable phases and building premises wire in accordance with this Section.

2. Instrumentation Cable and Telemetry Cable:

a. Identify cable using single conductor markers.

b. Use cable designations as shown.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. Perform testing after installation, but before connection to equipment.

B. Test cables in large groups to minimize number of testing sessions.

C. Notify COR, in writing, of date, time, and cables to be tested at least 5 working days before testing.

D. Perform following tests:

1. Continuity test: Test continuity of each conductor prior to performing insulation resistance test in to insure correct cable connection.

2. Insulation resistance tests for power, control, and instrumentation cables:

a. Measure insulation resistance between each conductor and station ground with all other conductors in same cable or conduit grounded.

b. Test voltage: 1,000 volts direct-current, minimum.

c. Minimum acceptable insulation resistance: R in MΩ = (rated voltage in kV + 1) x 1000/length in ft.

d. Record following test data on test report for each conductor tested:

1) Date of test.

2) Name or names of Contractor's personnel who performed test.

3) Name of Government inspector who witnessed test.

4) Conductor identification.

5) Megohms between conductor and ground.

6) Total length of conductor.

END OF SECTION

SECTION 16130 - ELECTRICAL CONDUIT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for complete electrical system.
2. Includes cost of accessories.

1.02 REFERENCES

A. American National Standards Institute (ANSI)

1.	ANSI C 80.1-1994	Rigid Steel Conduit - Zinc Coated (GRC)

B. ASTM International (ASTM)

1.	ASTM D 3485-02	Smooth-Wall Coilable Polyethylene (PE) Conduit (Duct) for Preassembled Wire and Cable

C. National Electrical Manufacturer's Association (NEMA)

1.	NEMA 250-2003	Enclosures for Electrical Equipment (1000 Volts Maximum)
2.	NEMA FB 1-2007	Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable
3.	NEMA RN 1-2005	Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
4.	NEMA TC 2-2003	Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
5.	NEMA TC 3-2004	Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing
6.	NEMA TC 7-2005	Smooth-Wall Coilable Electrical Polyethylene Conduit

D. National Fire Protection Association, Inc (NFPA)

1.	NFPA 70 - 2008	National Electrical Code (NEC)

E. Underwriters Laboratories (UL)

1.	UL 360-2003	Liquidtight Flexible Steel Conduit
2.	UL 651-2005	Schedule 40 and 80 Rigid PVC Conduit

1.03 DESIGN REQUIREMENTS

A. Wiring Trough: Determine dimensions in accordance with requirements of NFPA 70.

B. Cast Junction Box:

1. Determine dimensions in accordance with requirements of NFPA 70 and manufacturer's recommendations for conduit spacing and clearances.

2. Determine size and location of conduit entrances.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals and 16051 - Electrical Drawings and Data.

B. RSN 16130-1, Shop Drawings and Manufacturer's Data:

1. Manufacturer's technical data.

a. Wiring trough.

b. Cast junction box including dimensions, and size and location of conduit entrances.

C. RSN 16130-2, As-Built Drawings: Concrete embedded conduit and direct buried conduit.

PART 2 PRODUCTS

2.01 RIGID METAL CONDUIT (RMC)

A. Conform to ANSI C80.1

B. Fittings and Conduit Bodies: Conform to NEMA FB1.

2.02 PLASTIC-COATED RIGID STEEL (PCRS)

A. Rigid Steel Conduit: Conform to ANSI C80.1.

B. External Coating: Conform to NEMA RN 1 with 0.040-inch thickness, minimum.

C. Internal Coating: 0.002-inch of urethane, minimum.

D. Conduit Fittings: Coated with same material as conduit.

2.03 RIGID POLYVINYL CHLORIDE CONDUIT (PVC)

A. Product Description: Schedule 40 and 80 PVC conduit. Conduit and elbows furnished with integral bell end.

B. Length: Manufacturer's standard 10 or 20 foot lengths.

C. PVC Solvent Cement: In accordance with NEMA TC 2 and as recommended by manufacturer.

D. Conduit conform to NEMA TC 2, NFPA 70, and UL 651. Fittings and conduit bodies conform to NEMA TC 3, NFPA 70, and be UL listed.

2.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Suitable for indoor and outdoor use.

B. Sunlight resistant.

C. Color: Black.

D. Conform to UL 360 and UL listed.

2.05 HIGH-DENSITY POLYETHYLENE FLEXIBLE CONDUIT (HDPE)

A. Suitable for direct burial.

B. Coiled shape not retained when taken off reel.

C. Adhesive, couplings, and transition fittings in accordance with manufacturer's recommendations and instructions.

D. Nonmetallic, prelubricated, extruded, flexible high-density polyethylene resin type.

E. Minimum bending radius of less than or equal to 14 times the outside diameter of conduit.

F. Furnish with 3/8-inch woven tape pull member.

G. Conform to NEMA TC7 and ASTM D 3485.

2.06 WIRING TROUGH

A. Material: 16 gauge or 14 gauge galvanized steel.

B. Enclosure:

1. NEMA Type 3R in accordance with NEMA 250.
2. Drip shield top and no knockouts.

C. Slip-on removable cover fastened with captivated screws along bottom edge and provided with provision for padlocking.

D. Embossed mounting holes on back of enclosure.

E. Finish: Manufacturer's standard grey coating.

2.07 CAST JUNCTION BOX

A. Type YT sidewalk box manufactured by O-Z/Gedney; or equal with following essential characteristics:

1. Cast iron box, flange and cover suitable for flush mounting in concrete deck.
2. Cover:
    a. Cross-ribbed checkered with pry bar slots.
    b. Neoprene gasket.
    c. Suitable for vehicular traffic (H-20 loading).
    d. Secured with stainless steel screws.
3. Conduit Entrances: Bossed, drilled, and tapped.
4. Finish: Hot dip galvanized.
5. Provide following engraved lettering on covers:
    a. Boxes housing power cable: "ELECTRIC".
    b. Boxes housing instrumentation and telemetry cable: "TELEMETRY".

2.08 CAST DEVICE BOX

A. Type FD box manufactured by Cooper Crouse-Hinds; or equal, having the following essential characteristics:

1. Rectangular, deep-wiring device outlet box with threaded hub connections for rigid steel conduit.
2. Material: Iron alloy or copper-free aluminum.
3. Number of gangs: As required.
4. Provide plugs for unused openings.
5. Extension rings: Iron alloy with corrosion-resistant finish.

2.09 WATERTIGHT CONDUIT HUBS

A. Myers® hub manufactured by Cooper Crouse-Hinds, catalog series ST-, STA-, and SSTG-; catalog series HUB- and HUBG- manufactured by Appleton; catalog series CHM- and CHMG- manufactured by O-Z/Gedney; or equal.

2.10 WARNING TAPE

A. Type: Heavy-duty polyethylene, detectable underground warning tape.

B. Width: 6 inches.

C. Color: Black on red.

D. Legend: Continuously imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW"; or equivalent wording.

2.11 UTILITY MARKER

A. Weather resistant, single-piece marker at least 62-inches in length.

B. Constructed from a durable, UV resistant composite material.

C. Flexible and resistant to damage by vehicles, animals, or vandals.

D. Permanently affixed label that identifies buried electrical conduit below.

E. Purpose: Identify ends of buried PVC conduit beneath interstate highway I-8.

2.12 FOAM SEALANT

A. Hydra-Seal™ S-60 WTF manufactured by Arnco Corporation; Polywater® Duct Sealant manufactured by American Polywater Corporation; or equal.

2.13 CONDUIT ACCESSORIES

A. Fittings required to complete electrical conduit systems. Includes, caps, connectors, couplings, nipples, bushed nipples, reducers, elbows, pipe plugs, locknuts, bondnuts, bushings, seals, and any other fittings.

B. Devices required to fasten, clamp, attach, and support conduit in place. Includes supports and clamps complete with bolts, washers, and nuts.

C. Thread Lubricant: Lithium, graphite, or zinc based material designed to inhibit corrosion and to lubricate metal-to-metal joints.

D. Electrical duct seal for sealing ends of raceways.

E. Fabricated Sheet Steel Boxes:

1. Large junction and conduit boxes, excluding outlet boxes, to contain wiring devices or to accommodate lighting fixtures.
2. Sheet steel thickness: No. 14 United States Standard gauge, minimum.
3. Sheet steel finish: Galvanized.
4. Attach covers with bronze, brass, or stainless steel screws or bolts.
5. Boxes exposed to weather:

a. Weather-resistant and watertight type.

b. Provide covers with gaskets.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with NFPA 70 with proper fittings and supports.

B. Conduit Bends:

1. Make bends with standard conduit bending machines.
2. Ensure conduit bends are free from kinks, indentations, or flattened surfaces.
3. Radius of bends: In accordance with NFPA 70.
4. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduit.
5. Bending of conduit with pipe tee or vise is not acceptable.

C. Install cast junction boxes in concrete structure decks as shown.

D. Determine routing of exposed, buried, and embedded conduit when not shown.

E. Remove burrs and sharp corners at ends of metal conduit.

F. Coat male threads of rigid metal conduit with thread lubricant before making joints.

G. Tighten conduit joints securely to ensure electrical continuity and to prevent entrance of moisture or foreign material.

H. Install bushings or CHASE® nipples on ends of conduit to protect insulation of insulated conductors from abrasion.

I. Use electrical duct seal to seal ends of raceways that terminate at outdoor boxes, panelboards, wiring troughs, or cabinets and to seal ends of raceways that enter a building or structure from underground.

J. Stub conduit that terminates at horizontal surfaces 2 inches above finished floor level and terminate with coupling and plug. Replace plug with bushing or CHASE® nipple before installing insulated conductors.

K. Tighten conduit to electrical equipment mounted on tubular metal structures securely and support rigidly in place by conduit clamps, hex head nuts, and threaded 3/8-inch stud fasteners driven by powder-actuated tools.

L. Use liquidtight flexible metal conduit for conduit connections to equipment subject to vibration, where flexibility is required, or where shown. Maximum length to be 24 inches.

M. Furnish and install firestopping around conduit that penetrates the wall between engine-generator room and electrical control room. Furnish and install system in accordance with Section 07840 – Firestopping.

N. Conduit Terminations at Sheet Metal Enclosures:

1. Make terminations at NEMA 250 Type 4 and Type 4X enclosures using a watertight conduit hub.

2. Make terminations at all other sheet metal enclosures using a coupling and CHASE® nipple. Install the conduit and coupling square to the enclosure. Tighten the CHASE® nipple with no exposed threads. Use of two locknuts, one inside and the other outside the enclosure, is not acceptable.

O. Conduit Embedded in Concrete:

1. Use rigid steel type, unless indicated otherwise.

2. Determine locations of embedded conduit stub-ups based on equipment being furnished.

3. Hold conduit, conduit fittings, and conduit boxes securely in position while concrete is being placed.

4. Protect ends of conduit to prevent entrance of concrete, sand, or other foreign material.

5. Terminate ends of conduit that do not terminate at boxes with couplings and pipe plugs or insulating bushings and caps.

6. Clean concrete from inside of conduit boxes immediately after forms are removed.

7. Clean threads for attaching devices and covers to boxes.

8. Swab conduit within 24-hours after removal of forms with clean dry rags until conduit is thoroughly cleaned and dried.

9. Grease threads of removed plugs and reinstall plugs to prevent entrance of water or foreign material.

10. Seal conduit boxes with rubber gasketed blank cover.

P. Exposed Conduit Runs:

1. Straight and parallel with each other and with centerlines of room or structure.

2. Support conduit rigidly from wall or ceiling within 3 feet of each outlet box, junction box, cabinet, or fitting; and at intervals of not more than 5 feet.

3. Installation includes, where required, drilling holes in bottom, side, or top of enclosures or plates of other electrical equipment.

Q. PVC Conduit:

1. Schedule 40: Install for underground, concrete encased, exposed applications in accordance with NFPA 70, and as shown.
2. Schedule 80: Install where conduit is subject to physical damage and as shown.
3. Join conduit and fittings in accordance with NEMA TC 2 and manufacturer's instructions. Use manufacturer's recommended cement.
4. Before applying cement, ensure surfaces to be joined are wiped clean and are free of dirt, oil, grease, or moisture.
5. Apply full even coat of cement to entire area inserted in bell or fitting.

R. Buried Conduit:

1. Depth, minimum: 24 inches.
2. Install 2 inches of sand around each conduit.
3. Install detectable warning tape above conduit in accordance with manufacturer's instructions and at the manufacturer's recommended depth.
4. Cap both ends of buried empty conduit beneath Interstate Highway I-8. Provide utility markers to mark location of each end.
5. Backfill and compact remaining portions of trench in accordance with Section 02318 – Earthwork for Structures.

END OF SECTION

SECTION 16132 – AUTOMATIC TRANSFER SWITCH

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Automatic Transfer Switch:

1. Payment: Lump-sum price offered in the schedule.

1.02 REFERENCES

A. National Electrical Manufacturer's Association (NEMA)

1. NEMA 250-2003 Enclosures for Electrical Equipment (1000 Volts Maximum)

B. National Fire Protection Association (NFPA)

1. NFPA 70-2008 National Electric Code

1.03 SYSTEM DESCRIPTION

A. Transfer switch to be automatic so that when normal service power has been interrupted, the engine-generator will start and when the generator has attained the rated voltage and frequency of the distribution source the load will be transferred.

B. Switch to have mechanical and electrical interlocks.

C. Switch to have time delays.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals and Section 16051 – Electrical Drawings and Data.

B. RSN 16132-1, Approval Drawings and Data:

1. Commercial product data.

2. Electrical control diagrams, interconnection wiring diagrams, and schematics showing wire connections and conduit layout for all electrical products. Provide electrical control schematic diagrams in ladder-logic format.

C. RSN 16132-2, Final Drawings and Data:

1. Service manuals:

a. Operating and maintenance instructions.

b. Full-size prints of installation and detailed assembly drawings.

c. Electrical schematics and wiring diagrams.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment from corrosion, deformation, and other types of damage.

PART 2 PRODUCTS

2.01 AUTOMATIC TRANSFER SWITCH

A. Manufacturer of the automatic transfer switch shall be the same as the manufacturer of the engine/generator.

B. Ratings**:** 225 Amperes, 480 Volts, 3-Pole, switched neutral.

C. Wall mounted.

D. Solid-state control circuitry.

E. Fully programmable exerciser clock.

F. Attach schematic wiring diagrams to inside of door panel.

G. Enclosure: NEMA Type 12 in accordance with NEMA 250.

H. Provide switch with mechanical and electrical safety interlocks.

I. Provide auxiliary form “C” contacts, one normally open and one normally closed.

J. Adjustable Time Delay Functions:

1. Engine Start: Prevents nuisance engine-generator starts due to momentary power system variation or loss.
2. Transfer Normal to Emergency: Allows engine-generator to stabilize before application of load. Prevents power interruption if Normal source variation or loss is momentary.
3. Transfer Emergency to Normal: Allows the utility to stabilize before transfer of load. Prevents power interruption if return of Normal source is momentary.
4. Engine-Generator Stop: Maintains availability of engine-generator for immediate reconnection if Normal source fails shortly after transfer. Allows gradual engine-generator cool down by running unloaded.

2.02 ELECTRICAL EQUIPMENT

A. Furnish all cables, conduits, terminations, and accessories required for interconnecting the equipment included in this section. Reference Division 16.

B. Power and control cables: Designed for indoor use, with a water, oil, and ultraviolet-light resistant cable jacket.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install transfer switch in accordance with manufacturer's recommendations and NFPA 70.

B. Locate the switch in the electrical room as shown on drawing 423-D-782 on a wall mount and make all necessary connections.

C. Ground and bond the switch in accordance with NFPA 70.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. On-Site Test:

1. After the engine-generator has been completely installed and tested, connect the transfer switch.
2. Conduct on-site test to test the ability of the switch to operate properly.
    a. Sense failure of the normal source.
    b. Send a start command to the generator and have the generator respond properly.
    c. After a time delay, switch should sense proper voltage and frequency from the generator then transfer the load to the generator.
    d. Sense the return of proper voltage of the normal source.
    e. After a time delay, transfer load back to the normal source.
    f. After Engine-Generator Stop time delay (cool down cycle), shut down the engine.

END OF SECTION

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SECTION 16140 – WIRING DEVICES

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for complete electrical system.

1.02 REFERENCES

A. National Electrical Manufacturers Association (NEMA)

1. NEMA WD 1-1999(2005) General Requirement for Wiring Devices
2. NEMA WD 6-2002 Wiring Devices - Dimensional Requirements

B. National Fire Protection Association (NFPA)

1. NFPA 70 – 2008 National Electrical Code (NEC)

C. Underwriters Laboratories (UL)

1. UL 943 – 2006 Ground-Fault Circuit-Interrupters

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals and Section 16051 - Electrical Drawings and Data.

B. RSN 16140-1, Shop Drawings and Manufacturer's Data:

1. Manufacturer's technical data.

PART 2 PRODUCTS

2.01 LIGHT SWITCH

A. Type: Specification grade, single-pole.

B. Snap-type switch.

C. Rated Voltage: 120/277 volts, 60 Hz.

D. Current: 20 amperes.

E. Device Body and Handle: Impact resistant plastic with toggle handle.

F. Terminals: Screw type for line wiring and grounding.

G. Color: Ivory.

H. Conform to NEMA WD1, WD6, and be UL listed.

2.02 GFCI DUPLEX RECEPTACLE

A. Specification grade, ground fault circuit interrupter duplex plug receptacle.

B. Rated Voltage: 125 volts, 60 Hz.

C. Current: 20 amperes.

D. Type 5-20R in accordance with NEMA WD 6.

E. Have lockout feature in accordance with UL 943 that prevents GFCI from being reset after GFCI circuitry failure.

F. Black test and red reset pushbuttons.

G. Ivory, impact resistant plastic device body.

H. Screw terminals for line wiring and grounding.

2.03 SPECIAL PURPOSE RECEPTACLE

A. Purpose: Receptacle for control room air conditioner.

B. Heavy-duty specification grade single receptacle.

C. Rated Voltage: 250 volts, 60 Hz.

D. Current: 20 amperes.

E. Type 6-20R in accordance with NEMA WD 6.

F. Red, impact resistant plastic device body.

G. Screw terminals for line wiring and grounding.

2.04 COVER PLATES

A. Indoor Use:

1. Material: Sheet steel, sheet aluminum, or iron alloy.
2. Suitable for mounting on cast type FD device box.

B. Outdoor Use:

1. Weatherproof Light Switch Cover Plate: Catalog No. DS 185 manufactured by Crouse-Hinds®; catalog No. WCT1 manufactured by Appleton®; Red Dot® catalog No. CCT manufactured by Thomas & Betts; or equal.

2. Weatherproof GFCI Cover Plate: Red Dot® catalog No. CKMGV manufactured by Thomas & Betts; or equal having the following essential characteristics:

   a. Type: While-In-Use cover as required by NFPA 70.

   b. Material: Die cast copper-free aluminum.

   c. NEMA 3R rating in accordance with NEMA 250.

   d. Hinged, lockable cover.

   e. Suitable for GFCI receptacle mounted in cast type FD device box.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install wiring devices in cast device boxes and in locations shown.

B. Install plumb and level.

C. Support wiring device boxes independently of conduit by attachment to building structure or structural member.

D. Make wiring and conduit connections.

E. Ground and bond in accordance with NFPA 70.

F. Mounting Height and Location:

1. General:

   a. Dimensions are to centerline of box.

   b. Where specified heights do not suit building construction or finish, adjust up or down to avoid interference. Do not straddle masonry block joints or other construction joints.

2. Light Switch: 48 inches above floor.

3. Convenience receptacle:

   a. Building interior: 15 inches above floor.

   b. Outdoor: 24 inches above finished grade or deck.

4. Special purpose receptacle: Near air conditioner and within reach of the plug.

END OF SECTION

SECTION 16212 - METER SOCKET AND SERVICE DISCONNECT

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for complete electrical system.

1.02 REFERENCES

A. American National Standard Institute (ANSI)

1.	ANSI C12.7-2005	Requirements for Watthour Meter Sockets

B. National Electrical Manufacturer's Association (NEMA)

1.	NEMA 250-2003	Enclosures For Electrical Equipment (1000 V Maximum)
2.	NEMA FU 1-2002	Low Voltage Cartridge Fuses
3.	NEMA KS 1-2001(2006)	Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)

C. National Fire Protection Association (NFPA)

1.	NFPA 70-2008	National Electrical Code (NEC)

1.03 DESIGN REQUIREMENTS

A. Meter Socket: Meet the requirements of IID Energy.

1. Electric Utility Service Provider: Imperial Irrigation District Energy (IID Energy), 1699 W. Main Street, Suite A, El Centro, CA 92243, telephone 760-482-3300.

B. Service Disconnect Switch: Mounted in the meter socket enclosure or provided as a separate device.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals and Section 16051 - Electrical Drawings and Data.

B. RSN 16212-1, Shop Drawings and Manufacturer's Data:

1. Manufacturer's technical data.

PART 2 PRODUCTS

2.01 METER SOCKET

A. System: 3-phase, 4-wire.

B. Voltage Rating: 600 volt, 60 Hz.

C. Nominal Voltage: 480/277Y volts

D. Current Rating: 200 amperes.

E. Enclosure: NEMA 3R in accordance with NEMA 250.

F. Sealing ring (i.e., ring-type socket).

G. Provided with instrument transformers as required by IID Energy.

H. Mounting: Pedestal mount on concrete pad or above ground mount on metal combination channel structure.

I. Conform to the requirements of IID Energy, ANSI C12.7, and be UL (Underwriters Laboratories) listed.

2.02 SERVICE DISCONNECT SWITCH

A. Type: Heavy-duty, fused, three-pole with solid neutral and rated for service entrance duty.

B. Enclosure: NEMA type 3R in accordance with NEMA 250.

C. Voltage Rating: 600 volts, 60 Hz.

D. Current Rating: 200 amperes.

E. Switch Mechanism/Handle:

1. Switch Operating Mechanism: Made from steel, with no plastic parts.
2. Switch Operating handle:
    a. Integral part of the switch enclosure. Use of cover as disconnect device is not acceptable.
    b. Made from steel, with no plastic parts other than handle grip.
    c. Have provisions for padlocking in the OFF position.

F. Switch Cover Interlock:

1. Prevent unintentional opening of switch cover when switch is ON.

2. Prevent closing switch with switch cover open.

G. Current Carrying Parts: Plated to resist corrosion.

H. Spring reinforced fuse clips.

I. Fuses:

1. 600 volt, current-limiting type suitable for service entrance equipment and feeder protection.

2. Current rating: As shown.

J. Engraved Nameplates:

1. Conform to drawing 40-D-6234 using type A material and 1/2 inch lettering.

2. Engraving: "Control Bldg Service Disconnect".

K. Conform to NEMA KS 1 , FU 1, and to be UL labeled and listed.

2.03 ENCLOSURE FINISHES

A. Manufacturer's standard grey weatherproof finish.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install equipment on electrical equipment support as shown on miscellaneous metalwork drawing.

B. Locate equipment no more than 80 feet from the pole-mounted power transformer. Do not mount equipment on IID Energy power poles.

C. Items furnished and installed by IID Energy:

1. Power transformer.

2. Meter.

3. Cables between power transformer and meter socket.

D. Make cable and conduit connections on load side of meter socket.

E. Ground and bond equipment in accordance with the requirements of IID Energy and NFPA 70. Ground equipment to grounding electrode system installed at power transformer.

END OF SECTION

SECTION 16232 - ENGINE-GENERATOR SET

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Engine-Generator Set:

1. Payment: Lump-sum price offered in the schedule.

1.02 REFERENCES

A. National Electrical Manufacturer's Association (NEMA)

1.	NEMA 250-2003	Enclosures for Electrical Equipment (1000 Volts Maximum)
2.	NEMA FU 1 - 2002(2007)	Low Voltage Cartridge Fuses
3.	NEMA ICS 2 – 1996(2005)	Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC
4.	NEMA ICS 5 – 2000	Industrial Control and Systems: Control Circuit and Pilot Devices
5.	NEMA MG 1-2006(2007)	Motors and Generators

B. National Fire Protection Association (NFPA)

1.	NFPA 30-2008	Flammable and Combustible Liquids Code
2.	NFPA 37-2006	Installation and Use of Stationary Combustion Engines and Gas Turbines
3.	NFPA 54-2006	National Fuel Gas Code
4.	NFPA 70-2008	National Electric Code
5.	NFPA 90A-2002	Installation of Air Conditioning and Ventilating Systems
6.	NFPA 110-2005	Emergency and Standby Power Systems

C. Underwriters Laboratories (UL)

1.	UL 142-2006	Steel Aboveground Tanks For Flammable and Combustible Liquids
2.	UL 2085-1997	Protected Aboveground Tanks for Flammable and Combustible Liquids

D. Occupational Health and Safety Act (OSHA)

1.03 SYSTEM DESCRIPTION

A. Furnish and install an indoor diesel engine-generator set with engine, generator, cooling system, fuel tank and components, fuel lines, starting system, control system, exhaust system, vibration isolators, and all other accessories to make a complete operational system.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01330-Submittals.

B. RSN 16232-1, Approval Drawings and Data:

1. Detailed shop drawings for components.
2. Commercial product data for components.
3. Electrical control diagrams, interconnection wiring diagrams, and schematics showing wire connections and conduit layout. Provide electrical control schematic diagrams in ladder-logic format.

C. RSN 16232-2, Final Drawings and Data:

1. Service manuals:
    a. Operating and maintenance instructions.
    b. Full-size prints of installation and detailed assembly drawings.
    c. Electrical schematics and wiring diagrams.
    d. Lubrication schedule.
    e. List of special tools.
    f. Parts catalog for components provided.
2. Electronic copies of drawings, schematics, and diagrams submitted in the service manuals.
3. Certified copies of mechanical and electrical test reports for factory and field tests.
4. Photographs: Including one side view of installed engine-generator set showing fuel system and one end view of engine-generator set after installation.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment from corrosion, deformation, and other types of damage.

1.06 SITE CONDITIONS

A. Ambient air temperature range: plus 0 degrees Fahrenheit to plus 140 degrees Fahrenheit.

B. Elevation: 145 feet above sea level.

1.07 SPARE PARTS

A. Furnish the following spare parts in a metal box:

1. Twelve engine oil filters.
2. One complete set of engine V-belts.
3. Six fuses of each type of fuse.
4. Four air filter elements.
5. Four engine fuel filters.

PART 2 PRODUCTS

2.01 ENGINE-GENERATOR SET

A. Fully operational system with associated control and electrical equipment installed complete.

B. Nameplate Rating: 150 kW.

C. Engine:

1. 4-cycle.
2. Fuel: Diesel.
3. Rated speed: 1800 rpm.
4. Starting system: 12-volt.
5. Governor: Isochronous capable of plus or minus 0.25 percent steady-state frequency regulation.
6. Cooling system: Closed recovery, liquid coolant, with a unit-mounted radiator, belt-driven pusher fan, thermostatic temperature control, and engine-mounted circulating pump.

D. Power Factor: 0.8.

E. Voltage: 480Y/227 volts.

F. Phase: 3-phase.

G. Frequency: 60 hertz.

H. Generator:

1. Salient-pole, brushless, 12-lead reconnectable.

2. Self-ventilated of drip-proof construction with amortisseur rotor windings and skewed stator for smooth voltage waveform.

3. Winding insulation: Class H as defined in NEMA MG-1.

4. Temperature winding of rotor and stator limited to NEMA Class F ratings.

I. Voltage Regulator: Solid-state type. Torque-matched with under-frequency and over-voltage protection and 3-phase voltage sensing.

J. Excitation System: Brushless type.

K. Voltage Regulation: Plus or minus 2.0 percent between no load and full-rated load.

L. Conform to NFPA 30, 37, and 54.

2.02 COMPONENTS

A. Output Circuit Breaker:

1. Type: Molded-case, thermal-magnetic.

2. Ratings: As shown.

B. Battery:

1. Voltage: 12 volt DC**.**

2. Type: Lead-acid.

3. Rated: 550 (minimum) cold cranking amps.

4. Accessories: One set of cables of the engine manufacturer's recommended size and type.

5. Life expectancy: 6 years on float charge.

6. Insulation: Size and type recommended by the manufacturer of the battery.

C. Battery Charger:

1. Type: 10-ampere automatic float and equalize.

2. Voltage: 12 volts DC.

3. Service power: 120 volts, single phase, 60 hertz.

4. Enclosure: NEMA 1 enclosure.

5. Meters: Direct-current voltmeter and ammeter. Accuracy within 2 percent of full scale.

D. Coolant Heater:

1. Service power: 120 Volts, single phase, 60 hertz.

2. Size: Manufacturer's standard.

E. Digital Electronic Control Panel:

1. Circuitry: Solid-state circuitry.
2. Mounting: Vibration isolators.
3. Schematic wiring diagrams: Attached to the inside door of the control panel cabinet door showing the relationship and location of the controls and alarm contacts.
4. Selector switch:
   a. Three position selector switch, labeled MANUAL-OFF-AUTOMATIC, START-STOP pushbuttons or selector switch, and a fault reset switch.
   b. In the MANUAL position, manual startup or shutdown of the engine-generator set in response to START-STOP pushbuttons or selector switch.
   c. In the OFF position, prevention of manual or automatic operation of the engine-generator set and a lockout safety for periodic maintenance and resetting of the engine-generator.
   d. In the AUTOMATIC position, starting and operating the engine-generator in response to the automatic engine-starting system controls.
5. Electronic indicators:
   a. Engine
      1) Running time meter (hour meter) to log actual hours of engine operation.
      2) Oil pressure.
      3) Oil temperature.
      4) Engine coolant temperature.
      5) Fuel-level indication meter.
   b. Alternator:
      1) Line-to Line and line-to-neutral AC volts
      2) 3- phase AC current
      3) Frequency
      4) Total and individual phase kW and kVA

F. Alarm Contacts:

1. Alarm contacts wired to terminal blocks in the engine-generator control panel, to close and indicate the following conditions:
   a. Weak battery warning.

b. Engine-generator running.

G. Alarm LCD Illuminated Annunciation Lamps:

1. Engine:

a. Engine-generator running.

b. Engine-generator shutdown.

c. Engine-generator overspeed shutdown.

d. Engine-generator low oil pressure shutdown.

e. High engine coolant temperature.

f. Low coolant level.

g. Engine-generator low coolant temperature.

h. Weak battery warning.

i. Engine-generator overcrank shutdown.

j. Failure to start after the stipulated number of cranking attempts.

k. Fail to start (overcrank) shutdown.

l. Low fuel level in the main fuel tank.

2. Alternator:

a. Overcurrent and short circuit shutdown.

b. Overcurrent warning.

c. Single & 3-phase fault regulation.

d. Over and under voltage shutdown.

e. Over and under frequency shutdown.

f. Overload warning with alarm contact.

g. Reverse power and reverse Var shutdown.

h. Excitation fault.

H. Shutdown Controls:

1. Conditions:

a. Overspeed

b. Low oil pressure

c. High engine coolant temperature.

d. Low coolant level.

e. Low coolant temperature.

f. Failure to start after the stipulated number of cranking attempts.

g. Low fuel level in the main fuel tank.

2. Alternator:

a. Overcurrent and short circuit.

b. Overcurrent warning.

c. Single & 3-phase fault regulation.

d. Over and under voltage.

e. Over and under frequency.

f. Overload warning with alarm contact.

g. Reverse power and reverse Var.

h. Excitation fault.

I. Exhaust System:

1. Air duct section: Between engine-generator and building in accordance with NFPA 90A.

2. Flexible Exhaust Connector: Spiral or bellows type.

3. Exhaust Piping: Carbon steel with sweeping long-radius elbows.

4. Rain Cap: Installed on the discharge end of the exhaust pipe.

5. Condensation Trap and Drain Valve: Install before muffler.

6. Muffler: Rated for residential noise applications.

7. Exhaust thimble with bird screen.

J. Resistive Load Bank:

1. Operate in conjunction with automatic transfer switch, load bank controller, and engine-generator controls.

2. Used for testing and exercising engine-generator. Also used to maintain minimum load on engine-generator during emergency operation.

3. Load Bank Rating: 75 kW, 1.0 p.f., minimum.

4. Voltage: 480 volt, 3-phase, 3-wire, 60 Hz.

5. Duty cycle: Continuous.

6. Load steps: Five, minimum.

7. Enclosure: NEMA 250 Type 1.

8. Air-cooled and mounted directly to engine-generator radiator.

9. Load control: One magnetic contactor for each branch circuit (load step).

10. Branch circuit protection: 600 volt, current-limiting fuses.

K. Automatic Load Bank Controller:

1. Provide manual control of resistive load bank for engine-generator testing.
2. Provide automatic control of resistive load bank for exercising the engine-generator and for maintaining minimum load on engine-generator during emergency operation.
3. Enclosure: NEMA 250 Type 1, wall mount, and hinged door.
4. Provided with load sensor that will add and subtract load steps to maintain minimum load on engine-generator.
5. Provided with current transformers as required.
6. Provide, at least, the following functions:
    a. MANUAL-OFF-AUTO mode selector switch.
    b. Manual RUN and STOP pushbuttons.
    c. Master load control switch.
    d. Load control switches, one for each load step.
    e. Lamp test pushbutton.
7. Provide, at least, the following indicating lights:
    a. Power connected to load bank.
    b. Load bank in MANUAL mode.
    c. Load bank in AUTO mode.
    d. Load bank operating normally.
    e. Master load switch on.
    f. Load step on (one for each load step).

2.03 FUEL SYSTEM

1. Double Containment Fuel Pipe System, UL approved.
    a. Seamless standard weight black steel inner fluid carrier pipe.
    b. Installed between engine generator and fuel tank as shown on the drawing.
    c. Interstitial leak detection system installed on tank.
    d. Pipe Sizes: In accordance with manufacturer's recommendations based on kilowatt rating, lift, and run requirements of engine-generator set.
2. Flexible Fuel Line Sections: Connecting between the fuel tank piping and the engine-generator set.
3. Diesel Fuel Storage Tank:

a. Double wall (secondary containment), aboveground, steel fuel tank.

b. Inner tank size: At least 500 gallon capacity but not to exceed 660 gallons.

c. UL 2085 listed.

d. Fabricate tank in cylindrical shape. Fabricate each tank wall in accordance with UL 142.

e. Secondary containment:

1) Double steel wall to be tested for tightness.

2) Monitoring conduit: 1-inch diameter rigid, steel.

3) Interstitial leak detection system installed on tank.

f. Provide tank with emergency and normal vent piping, rain cap, necessary nipples, and threaded steel pipe.

g. Earthquake restraints.

h. Automatic shutoff valve: Float operated valve to provide overfill protection.

4. Fuel Level Indicator:

a. Float and arm type.

b. Resistant output from a potentiometer which is linear and proportional to the level in the tank.

c. Suitable for diesel fuel.

d. On-site digital indication in gallons.

e. Low-level warning light, mounted on the engine-generator control panel.

f. Operate from a service voltage of 120 volts, single phase, and 60 hertz.

2.04 ELECTRICAL EQUIPMENT

A. Furnish all cables, conduits, terminations, and accessories required for interconnecting the equipment included in this section. Reference Division 16 - Electrical**.**

B. Fuses conform to NEMA FU 1.

C. Contactors conform to NEMA ICS 2.

D. Control circuit and pilot devices conform to NEMA ICS 5.

E. Electrical equipment enclosures conform to NEMA 250.

2.05 NAMEPLATE

A. Location: Attached to control panel.

B. Inscribe the following:

1. Ratings: kW and kVA, rpm, three-phase, 60 hertz, voltage, full load current.
2. Engine: 4-cycle engine, fuel type, number of cylinders.
3. Name and address of manufacturer.

2.06 CONTRACTOR SOURCE QUALITY TESTING

A. Perform mechanical, electrical, and operational tests to confirm that equipment meets specification requirements and applicable codes, standards, and regulations.

B. Furnish test equipment and factory test supervisor.

C. Perform testing in presence of the COR.

D. Notify COR at least 5 days in advance when tests are to be performed.

E. Documentation:

1. Date and sign.
2. Identify specific feature being tested.
3. Include test results and items such as: rated loads, power factor, ambient temperature, altitude, and fuel grade under which the test is performed.
4. Submit as part of final data.

F. Factory tests to include the following:

1. Full load test: Conducted and documentation provided per NFPA 110.
2. Cycle crank test: Conducted and documentation provided per NFPA 110.
3. Vibration:
    a. Loads: 50, 75, and 100 percent of nameplate rating.
    b. At each of the loads, conduct a vibration test and document engine-generator set vibration in mils (peak to peak).
    c. Acceptable level of vibration: Vibration tolerance not greater than 5 mils (peak to peak), at full-rated operating speed, as measured in any direction (horizontal, vertical or axial) on the main frame, engine, generator, and associated components.
    d. If vibration exceeds this tolerance, properly balance and/or provide vibration isolators to reduce vibrations to an acceptable level prior to shipping.

G. Test generator in accordance with NEMA MG-1. Demonstrate and document that electrical properties of generator excitation system, voltage regulation system, engine

governor system, illuminated annunciators, and controls are acceptable for intended purpose and are in accordance with specification requirements.

H. Make adjustments as required and retest until unit functions properly.

I. Correct defects demonstrated by the above tests by and at the expense of the Contractor to make the equipment fully operational to the satisfaction of the COR.

2.07 PAINT AND PROTECTIVE COATINGS

A. Coat the engine-generator set equipment in accordance with Section 09902 - Coatings.

B. Coat the fuel tank and fuel piping in accordance with Section 09902 - Coatings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the engine-generator set in the Control Building as shown on drawing 423-D-782.

B. Install electrical equipment and components in accordance with NFPA 70.

C. Lubricate equipment in accordance with manufacturer's recommendations.

D. Install engine-generator set according to manufacturer’s instructions and as shown on the drawings.

3.02 CONTRACTOR FIELD QUALITY TESTING

A. General:

1. Perform mechanical, electrical, and operational tests to confirm that equipment meets specification requirements and applicable codes, standards, and regulations.
2. Furnish test equipment and a factor authorized, on-site test supervisor.
3. Perform testing in presence of the COR.
4. Notify COR at least 5 days in advance when tests are to be performed.
5. Conduct on-site testing of engine-generator unit after complete installation of equipment.
6. Documentation:
    a. Sign and date.
    b. Identify specific feature being tested.
    c. Include test results and items such as rated loads, power factor, ambient temperature, altitude, and fuel grade under which the test is performed.

B. On-Site Test.

1. Conduct on-site test and document per NFPA 110.
2. Test: Approved by the COR.
3. Correct defects disclosed by the tests, or vibration which is detrimental to the equipment, to the satisfaction of the COR.

3.03 TRAINING

A. Provide training at the project site to instruct Government personnel in systems and operations of the engine-generator set and fuel tank equipment.

END OF SECTION

SECTION 16441 - DISTRIBUTION PANELBOARDS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for complete electrical system.

1.02 REFERENCES

A. National Electrical Manufacturers Association (NEMA)

1.	NEMA 250-2003	Enclosures for Electrical Equipment (1000 Volts Maximum)
2.	NEMA PB 1-2006	Panelboards
3.	NEMA PB 1.1-2002	General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less

B. National Fire Protection Association (NFPA)

1.	NFPA 70-2008	National Electrical Code (NEC)

C. Underwriters Laboratories, Inc. (UL)

1.	UL 50-1995	Enclosures for Electrical Equipment
2.	UL 67-1993	Panelboards
3.	UL 489-2002	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
4.	UL 1449-2006	Surge Protective Devices

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals and Section 16051 - Electrical Drawings and Data.

B. RSN 16441-1, Shop Drawings and Manufacturer’s Data:

1. Manufacturer’s technical data.
2. Nameplate list.

PART 2 PRODUCTS

2.01 DISTRIBUTION PANELBOARDS

A. Enclosure: NEMA Type 1 in accordance with NEMA 250. Manufactured from sheet steel with hinged door.

B. Ratings: As shown.

C. Solid neutral bus.

D. Bus Material: Copper.

E. Mains: Molded-case circuit breaker. Size as shown.

F. Branch Circuits: Molded-case circuit breakers. Size as shown

G. Mounting: Wall.

H. Neutral and ground bus provided with sufficient number of points to singularly terminate each individual conductor requiring a connection.

I. Panelboard DHB suitable for use as service entrance equipment.

J. Accessories:

1. Copper ground bus.
2. Circuit Directory:
    a. Show breaker number and connected load.
    b. Use machine lettering for directory entries. Hand written directory entries are not acceptable.
    c. Provide transparent cover for directory.

K. Nameplates:

1. In accordance with drawing 40-D-6234.
2. Provide nameplate for each panelboard with following engraving:
    a. “Panelboard DHA”.
    b. “Panelboard DHB”.
3. Provide nameplate for each branch circuit, feeder, and main circuit breaker in panelboard DHA.

L. Conform to NEMA PB-1, UL 50, UL 67, NFPA 70, and be UL listed.

M. Finish: Manufacturer’s standard grey coating.

2.02 MOLDED CASE CIRCUIT BREAKER

A. Thermal-magnetic type with inverse-time trip characteristics on overload and instantaneous trip on short circuit.

B. Voltage, Trip Rating, and Number of Poles: As shown.

C. Interrupting Rating: Not less than interrupting rating of panelboard.

D. Quick-make and quick-break toggle mechanisms.

E. Trip-free operating handle.

F. Single operating handle. Use of handle ties on multiple-pole circuit breakers is not acceptable.

G. Equip with padlock attachments for locking breakers in “OFF” position.

H. Conform to UL 489 and be UL listed.

2.03 TRANSIENT-VOLTAGE SURGE SUPPRESSOR (TVSS)

A. Utilize metal oxide varistors (MOV).

B. Maximum Continuous Operating Voltage (MCOV): Not less than 115 percent of nominal system voltage.

C. Protection Modes: Line to neutral (L-N), line to ground (L-G), and neutral to ground (N-G).

D. Suppressed Voltage Rating (SVR): Not to exceed 800 volts for L-N, L-G, and N-G modes.

E. LED indicators to show loss of protection and status of TVSS.

F. Conform to NFPA 70, UL 1449, and be UL listed.

2.04 FABRICATION

A. Install TVSS directly to panelboard DHA bus and as an integral component of panelboard. TVSS not required in panelboard DHB.

B. Mount ground bus at bottom of panelboard enclosure. Bond bus to enclosure.

C. Provide blank cover for unused panelboard spaces.

D. Mount circuit directory on inside of door.

E. Attach panelboard nameplate to outside of panelboard with self-tapping screws.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in locations shown with top circuit breaker not more than 78 inches above finished floor.

B. Install in accordance with manufacturer's instructions and recommendations, NEMA PB 1.1, NFPA 70.

C. Ground and bond panelboards in accordance with NFPA 70.

D. Make conduit and cable connections.

E. Lace and group conductors with nylon tie straps. Terminate only one conductor at each circuit breaker terminal. Form and train conductors in panelboard enclosure neatly parallel and at right angles to sides of box. Do not extend uninsulated conductor more than one-eighth inch from terminal lug.

F. Do not splice conductors in panelboards.

G. Maintain conductor phase identification in accordance with Section 16120 – Conductors and Cables.

END OF SECTION

SECTION 16460 – LIGHTING AND DISTRIBUTION TRANSFORMER

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for complete electrical system.

1.02 REFERENCES

A. National Electrical Manufacturers Association (NEMA)

1. NEMA 250-2003 Enclosures for Electrical Equipment (1000 Volts Maximum)
2. NEMA ST 20-1992 Dry-Type Transformers for General Applications

B. National Fire Protection Association (NFPA)

1. NFPA 70-2008 National Electrical Code (NEC)

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittals and Section 16051 - Electrical Drawings and Data.

B. RSN 16460-1, Shop Drawings and Manufacturer's Data:

1. Manufacturer's technical data.

PART 2 PRODUCTS

2.01 TRANSFORMER

A. Type: General purpose, dry-type.

B. Enclosure:

1. NEMA Type 1 in accordance with NEMA 250.
2. Fabricated from heavy gauge, sheet steel.

C. Voltage: 480-208Y/120, 3-phase, 60 Hz.

D. Winding: Continuous wound copper conductors.

E. kVA Rating: As shown.

F. Temperature Rise: 115 degrees C above 40 degrees C ambient.

G. Taps: Two 5 percent below rated primary voltage, minimum.

H. Mounting: Wall.

I. Conform to NEMA ST 20 and be UL listed.

J. Finish: Manufacturer's standard grey coating.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumb and level in location shown.

B. Install in accordance with manufacturer's recommendations, specific transformer markings, and installation instructions.

C. Ground and bond transformer in accordance with NFPA 70.

D. Make conduit and cable connections.

E. Fasten removable panels and covers securely.

END OF SECTION

SECTION 16510 – INTERIOR LUMINAIRES

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 REFERENCES

A. National Fire Protection Association (NFPA)

1. NFPA 70-2008 National Electrical Code (NEC)

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01330 - Submittals and Section 16051 - Electrical Drawings and Data.

B. RSN 16510-1, Shop Drawings and Manufacturer's Data:

1. Manufacturer's technical data.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide all necessary mounting hardware.

B. Provide lamps for all installed luminaires.

C. Luminaires UL (Underwriters Laboratories) listed and labeled.

2.02 TYPE AA LUMINAIRE

A. CC-G-4-X-S-WG-S-K42-MK-1-1 manufactured by Holophane, 214 Oakwood Avenue, Newark, OH 43055; or equal, having following essential characteristics:

1. Duty Type: Dry, indoor industrial.
2. Lamp: 4 foot fluorescent, F54T5HO.
3. Lamp Holders: Rotational locking sockets.
4. Ballast: Rapid start, electronic for two 54W T5HO lamps.
5. Ballast Voltage: 120 volts, 60 Hz.
6. Housing: Cold rolled steel with all exposed surfaces painted with baked-on polyester white powder coat.
7. Reflector: Enhanced specular aluminum with a total reflectivity of 95 percent.

8. Shield: Wire grille.
9. Uplight Options: None required.
10. Mounting: Pendant or chain.

2.03 FABRICATION

A. Luminaires requiring special modifications to be modified and wired by manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install luminaires and accessories in accordance with manufacturer's instructions and recommendations.

B. All supports to be attached to the building girts, purlins, and/or steel framework. Do not attach any supports directly to the pre-insulated metal walls or roof panels.

C. Install specified lamps in luminaires.

D. Install fittings and accessories required for complete installation.

E. Make electrical connections to branch circuits using building premises wire.

F. Ground and bond luminaires in accordance with NFPA 70.

G. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

H. Clean luminaires, touch up damage, and install new lamps for broken or burned out lamps.

END OF SECTION

SECTION 16520 – EXTERIOR LUMINAIRES

1.01 MEASUREMENT AND PAYMENT

A. Cost:

1. Include in lump sum price offered in the schedule for control building.

1.02 DESIGN REQUIREMENTS

A. Luminaire Poles: Determine shaft base size and wall thickness to meet specified requirements.

1.03 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittals and Section 16051 - Electrical Drawings and Data.

B. RSN 16520-1, Shop Drawings and Manufacturer's Data:

1. Manufacturer's technical data for luminaires and poles.
2. Manufacturer's technical data for luminaire pole anchor system.
3. Dimensioned drawings showing location of luminaire poles on concrete structures.

PART 2 PRODUCTS

2.01 GENERAL

A. Furnish all necessary mounting hardware.

B. Provide lamps for all installed luminaires.

C. Luminaires UL (Underwriters Laboratories) listed and labeled.

2.02 TYPE B LUMINAIRE

A. WL2K-10DMH-12-BK-F1-WL2KPR12-LAMP manufactured by Holophane, 214 Oakwood Avenue, Newark, OH 43055; or equal, having following essential characteristics:

1. Type: Metal Halide.
2. Voltage: 120 volt.
3. 100 watt, clear lamp.
4. Weather resistant die cast aluminum housing.

5. Integral HID ballast.
6. Glass refractor.
7. Specular anodized aluminum reflector.
8. Photo-cell control.
9. Wet location listed.
10. Black paint finish.
11. Wall mounted.

2.03 TYPE C LUMINAIRE

A. AS2-250M-SR4W-277-RPA-SCWA-SF,PER-DNA-LPI manufactured by Lithonia Lighting, One Lithonia Way, Conyers, GA 30012; or equal, having following salient characteristics:

1. Lamp Type and Wattage: Metal halide, 250 watt.
2. Voltage: 277 volts.
3. Distribution: Type IV.
4. Ballast: Super CWA pulse start.
5. Mounting: Round pole. Provided with integral arm,
6. Finish: Natural aluminum.
7. Options: Single fuse and NEMA twist-lock receptacle for photo cell.
8. Accessory: Lithonia Lighting type PE7 NEMA twist-lock photo cell; or equal.
9. UL listed.

2.04 POLE FOR TYPE C LUMINAIRE

A. Shaft Type: Straight round aluminum.

B. Nominal Mounting Height: 16 feet.

C. Finish: Brushed aluminum.

D. Cast aluminum anchor base.

E. One luminaire per pole.

F. Accessories:

1. Hand hole including cover plate and stainless steel attachment hardware.
2. Grounding lug.
3. Anchor bolts including factory template for setting anchor bolts.

G. Manufacturer: Same as luminaire.

2.05 FABRICATION

A. Luminaires requiring special modifications shall be modified and wired by manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install luminaires, poles, and accessories in accordance with manufacturer's instructions and recommendations.

B. Install luminaires and poles at locations indicated on drawings.

C. Mount light poles on reinforced concrete deck using factory-supplied anchor bolts. Install anchor bolts in concrete deck in accordance with manufacturer's instructions and using factory-supplied template.

D. Install light poles plumb with bases level, aligned, and adjusted to correct grade. Use steel shims as necessary.

E. Secure pole bases in place and fill spaces beneath base with nonshrink grout in accordance with Section 03622 – Grouting Mortar for Equipment and Metalwork.

F. Install specified lamps in luminaires.

G. Aim and adjust luminaires as indicated on drawings.

H. Install fittings and accessories required for complete installation.

I. Make conduit connections.

J. Make connections to branch circuits. Use insulated conductors with insulation suitable for temperature conditions within luminaire.

K. Bond luminaires to branch circuit equipment grounding conductor.

L. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

M. Remove dirt and debris from enclosures.

N. Clean photometric control surfaces as recommended by manufacturer.

O. Clean finishes and touch up damage to match surrounding finish.

P. Clean luminaires and install new lamps for broken or burned out lamps.

END OF SECTION