

7. **Access Roads and Railroad or Highway Relocation.** The Introduction (Chapter 1) for these design data collection guidelines contains additional information concerning: preparing a design data collection request, design data collection requirements, and coordinating the design data collection and submittal. For a railroad or highway relocation, the data should represent the standards of design and construction which, in negotiations with the owner of the facility, have been agreed upon as satisfying the principle of equivalent replacement.

A. **General Map Showing:**

- (1) A key map locating the general map area within the State.
- (2) The alignment of the railroad or highway relocation or of the access road.
- (3) County and township lines.
- (4) Existing towns, highways, roads, railroads and shipping points, public utilities such as electric power and telephone lines, pipelines, etc., and stream-gauging stations.
- (5) Locations of sites required for construction facilities.
- (6) Locations of borrow areas for natural construction materials and disposal areas for waste excavation.
- (7) Existing or potential areas or features having a bearing on the design, construction, possible use and future maintenance of the relocation or access road such as: recreation areas, fish and wildlife areas, building areas, and areas of archeological, historical and mining or paleontological interest. The locations of these features should bear the parenthetical reference to the agency most concerned; for example, Reclamation, NPS, or FWS.

B. **Topographic Map.** A topographic map or strip topography showing the relocation or access alignment and the bridge structure sites with a scale of 1 inch equals 400 feet and a contour interval of not over 5 feet. A scale of 1 inch equals 100 feet (50 feet at bridge sites) and 2-foot contour intervals is desirable for making paper locations, bridge layouts, and earthwork quantity computations. A coordinate system should be established and related to a State or national coordinate system, if available. Show the coordinate system ties to the survey line and locate existing land survey corner monuments or special control points established for the topographic survey. Show all manmade features in the included area.

C. **Foundation Data:**

- (1) **General Engineering Requirements.** The need for foundation data should be established by originating office personnel with assistance from the region and TSC representatives. For major bridge structures and unusual or difficult road alignments, it is recommended that a field conference be held, including an onsite inspection.

The following data should reflect a recognition and consideration of the scope of the relocation or access required and the type and size of bridge structures anticipated.

- (2) **Geologic Data.** The following list of geologic design data provides general guidelines for the collection and reporting of geologic information for this type of facility. The geologist should apply these guidelines with good judgment and sound reasoning, elaborating upon them as required by the particular geologic setting and engineering requirements. Because the collection of geologic data is a dynamic process and often continues into the preparation of final designs, all stages of the specification design geologic exploration program must be constantly coordinated with the designer through the appropriate geology office. The TSC geologic and geophysical staff will provide necessary assistance and guidance in the gathering of these design data.
  - (a) Compilation, summary, and reporting of Reclamation and non-Reclamation geologic information on the area, with attention being paid to the sequence of explorations and historical geologic events.
  - (b) Surface geologic map of the alignment showing location of explorations. Locations of all existing explorations should be indicated by coordinates or stationing of the permanent survey control system for the facility.
  - (c) Specific foundation exploration at site of major bridges, deep cuts, other structures sites, or where problem areas such as soft foundation or poor drainage require.
  - (d) Factual narrative description of surficial deposits with attention being paid to engineering geologic matters, such as swelling minerals, low-density materials, presence of gypsum and other sulfates, caliche, erodibility (see *Earth Manual*).
  - (e) Factual narrative description of bedrock with attention being paid to engineering geologic matters such as swelling minerals, presence of gypsum and other sulfates; and depth of weathering, joints, faults, and other planes of weakness.

- (f) Photographs, preferably in color, of representative or particular geologic conditions.
- (g) Selected determination of engineering properties of surficial deposits and bedrock by laboratory or field tests (in-place density, penetration resistance, permeability, shear strength, and consolidation or expansion characteristics, etc.). The type and number of samples and tests required should be determined in cooperation with the TSC.
- (h) Summary and data of exploration geophysical surveys (seismic, resistivity, etc.).
- (i) Determine ground water conditions with attention being paid to water levels and their seasonal fluctuation occurrence of unconfined and confined aquifers, potential seepage areas, water-producing capabilities, chemistry, and land subsidence.
- (j) Logs of explorations. Logs of drill holes advanced by churn drilling, chop and wash, or other methods which result in less than adequate sample recovery should be augmented by appropriate borehole electric (geophysical) logs.
- (k) Evaluation of landslide, snowslide, and rockfall conditions. A complete map of possible slide areas with as much detail as practicable.
- (l) Document past, present, and possible future petroleum water, and mineral extraction operations in vicinity.
- (m) Determine geologic conditions which may affect construction methods such as, boulders on ground surface, marshes, drilling conditions, and stability of grout or footing holes, ground temperatures, gases. Any potential surface water runoff problems should be brought to the attention of a regional hydrologist.

**D. Corrosion Survey.**

- (1) In situ electrical resistivity measurements of geologic materials in the area of construction. Additional measurements should be made in the areas where there is a pronounced change in type of geologic materials, drainage, and/or moisture conditions.
- (2) Performance history of materials of construction that have been used in the area.

- (3) List of structures in the vicinity of (within ¼ mile) the proposed structure and appurtenant features. Determine if buried structures in the vicinity have corrosion protection and, if so, the type of corrosion protection.
- (4) List location, output, and purpose of the direct-current sources in the earth situated within ¼ mile of the proposed structure and appurtenant features. If the purpose of the direct current is for cathodic protection, describe the structure protected and its location.
- (5) Chemistry of geologic materials, ground water, and/or product water.

**E. Construction Materials Data Including:**

- (1) Location of and distance to suitable borrow areas for permeable and impermeable soil materials for fill or embankment; and for riprap for channel or slope protection. If quantities are limited, give approximate volumes available.
- (2) An earth materials report containing complete detailed information on those potential sources of soils and rocks that have been selected for final consideration. (See *Earth Manual*.)
- (3) Information on concrete aggregates. (See “Final Investigations” in *Concrete Manual*.)
- (4) Data on commercial concrete plants within practical hauling distance from the bridge site.
- (5) Information on sources and character of acceptable road surfacing materials. Consider excavated material as a possible source.
- (6) Results of sampling and analysis of materials, including previous tests conducted at the Engineering and Research Center.
- (7) Information, including catalogues, on firms within practical hauling distance from the bridge site which manufacture precast concrete products such as beams and piles.

**F. Operating Data Including:**

- (1) For railroad: Track classification, type of service, limiting grades and curvature, design load limits, other operating limitations or requirements, and typical roadbed section showing depth and type of ballast, weight of rail, and size, spacing, and type of tie.
- (2) For railroad: Information on operating facilities such as communication lines, signal systems, passing tracks and sidings, service roads and depots.

- (3) For roads: Road classification, design speed, limiting grades and curvature, design load limits, superelevation limits and typical roadway section showing road width and thickness and type of surfacing.

**G. Miscellaneous Data:**

- (1) For railroad, drawing of typical roadway cross section showing:
  - (a) Centerline of track.
  - (b) Subgrade (top of embankment or bottom of excavation).
  - (c) Roadbed widths (shoulder to shoulder) at subgrade for both embankment and excavation.
  - (d) Embankment slopes and excavation slopes (earth and rock).
  - (e) Required berms.
  - (f) Thickness and top of embankment riprap, if required.
  - (g) Dimensions and positions of roadbed ditches and service road.
  - (h) Clearance between multiple tracks on curves and tangents.
  - (i) Dimensions of ballast section.
  - (j) Size of ties and weight of rail (welded or jointed rail).
  - (k) Distance from subgrade to top of rail.
- (2) For highway or road, drawing of typical roadway cross section showing:
  - (a) Centerline of road.
  - (b) Subgrade (top of embankment or bottom of excavation).
  - (c) Roadbed widths (shoulder to shoulder) at subgrade for both embankment and excavation.
  - (d) Embankment slopes and excavation slopes (earth and rock).
  - (e) Required berms.
  - (f) Thickness and top of embankment riprap, if required.
  - (g) Dimensions and positions of roadbed ditches, and protective dikes and ditches.

- (h) Number of courses of surfacing, types of materials, thickness and width of each course, and transverse slope from crown.
  - (i) Amount of superelevation (including changes in subgrade) and widening for horizontal curves.
  - (j) Position of guardrails, guard posts, or delineators.
- (3) For railroad, alignment and profile drawings (prepared in the current or compatible CADD software, 24 inches by 36 inches in plot size, with horizontal scale of 1 inch equals 200 feet and vertical scale of 1 inch equals 20 feet) showing:
- (a) Horizontal position of track centerline with complete curve and spiral information, right-of-way lines, existing track for 1,000 feet each way from points of connection, and any survey ties.
  - (b) Vertical position on track centerline of original ground line, new subgrade (with complete information on grades, elevations, and vertical curves), existing subgrade for 1,000 feet each way from points of connection, and any survey ties or datum equations.
  - (c) Location, type, and nominal dimensions of all required structures and operating facilities (bridges, culverts, ditches, passing tracks, sidings, motorcar set-offs, etc.).
  - (d) Location of any existing intersecting facilities, watercourses, or other physical features affecting the new line.
  - (e) Location of protective ditches and dikes.
  - (f) Location and type of right-of-way fencing and gates.
- (4) For highway or road, alignment and profile drawings (prepared in current or compatible CADD software, 24 inches by 36 inches in plot size with horizontal scale of 1 inch equals 100 feet and vertical scale of 1 inch equals 10 feet) showing:
- (a) Horizontal position of road centerline with complete curve information, right-of-way lines, existing road for 500 feet each way from points of intersection, and any survey ties.
  - (b) Vertical position on road centerline of the original ground line, new subgrade (with complete information on grades, elevations, and vertical curves), existing road surface for 500 feet each way from points of intersection, and any survey ties or datum equations.

- (c) Location, type, and nominal dimensions of all required structures (bridges, culverts, etc.).
  - (d) Location of any existing intersecting facilities, watercourses, or other physical features affecting the new road.
  - (e) Location of protective ditches and dikes.
  - (f) Location of guardrails, guard posts, or delineators.
  - (g) Location and type of right-of-way fences and gates.
  - (h) Location of any existing roadway lighting and/or requirements for new roadway lighting.
- (5) Structure details:
- (a) Site topography for each structure (including tunnel portals) on a scale of 1 inch equals 50 feet and a contour interval of 2 feet. For major drainage structures, the topography should extend a minimum of 500 feet upstream and downstream from the site.
  - (b) Recommended type, size, dimensions, and kind of construction material (and alternatives).
  - (c) For drainage structures: shape, size, slope, and character of each catchment area, probable rainfall intensity, and anticipated runoff through each structure; location, distance, physical dimensions, and characteristics of, any downstream streamflow, control; and recommendations for wingwalls or headwalls.
  - (d) For bridges and overpasses; hydrologic stream data; clearances (with permissible encroachments during construction) and controlling elevations (existing water surface, top of rail, crown of road, etc.).
  - (e) For tunnel: cross section showing inside clearance line, roadbed section with ditches and gutters, dimensions of safety niches (and motorcar set-offs for railroad); recommended type of lining, if required; profile on centerline showing ground surface, elevation and grade of subgrade, and geologic data.
  - (f) For railroad: standard designs and loadings for structures; standards for rails, tie plates, angle bars, bolts, spikes, lock washers, and rail anchors; specifications for ballast; standard designs for turnouts, guardrails, derails, road crossings, motorcar

setoffs, roadway signs and fencing; and any design or construction practices or procedures not in accord with Bureau practice.

- (g) For highway or road: standard designs and loadings for structures; standards and specifications for surfacing; standard designs for cattle guards, guardrails or guard posts, roadway signs and culvert markers, and fencing; and any design or construction practices or procedures not in accord with Bureau practice.
- (6) Estimated quantities for all construction schedule items which cannot readily be determined in design office, i.e., earthwork (common and rock), overhaul of roadway excavation with free-haul distance, riprap guardrail, culverts, and right-of-way fencing and gates.
- (7) For railroad: a summary of the current quality and standards of construction of existing railroad for both track and structures with photographs of typical features.
- (8) Designated areas to be cleared of vegetation, with description of kinds, size, and density of growth. State recommended method of payment, i.e., lump-sum price for area with defined limits or unit price per acre for area with limits subject to change during construction. Use separate payment items for clearly defined areas differing in growth density and difficulty of clearing operations. If vegetation to be cleared is very sparse or is such as can be removed without special equipment or separate operations, the cost of clearing should be included in the prices bid for excavation or prices bid for other items of work.

**H. Cost Data:**

- (1) Estimate of cost of right-of-way or easements. Include supporting data.
- (2) Information on local labor supply and labor problems.
- (3) Information on important construction work in progress or planned in the vicinity and the presence of interested contractors or subcontractors in the area.
- (4) Estimates of cost for relocating public utilities within the construction area. Include supporting data.
- (5) Estimates of cost for removal of buildings and other structures within the construction area. Include a general description and recommended disposal of the structures.

**I. Environmental Considerations.** Implementation of design features should be consistent with the environmental commitments listed in the project's NEPA compliance



document. Implementation of design features should be consistent with agreements reached between Interior bureaus, Federal agencies, and other governmental agencies.

Design data should include, as a minimum, a brief description of the environmental resources that could be affected by the proposed development. The emphasis should be on those areas within the range of alternatives open to the designers in developing a railroad or highway relocation, an access road alignment, or a bridge structural design. The following items should also be considered in preparing design data:

- (1) Cultural (historical, archeological, architectural, and paleontological) resources along or adjacent to any potential alignment.
- (2) The need for blending roadways and structures with the surroundings.
- (3) Comment on any ecological, aesthetic, or other environmental aspects peculiar to this location which would affect roadway alignment or bridge layout or conceptual design.
- (4) Indicate the suitability and possibility of present or future use of land adjacent to Reclamation facilities by the public for recreation, hobbies, sports, leisure, education, health, housing, etc. Provide data on zoning regulations and subdivision proposals.
- (5) Furnish data on allowable noise limits in the vicinity of the proposed railroad, highway, or access road alignment where fixed by law or local ordinance, or where otherwise considered necessary or advisable; measurements of existing daytime and nighttime ambient noise levels in the area; and distances to the nearest residential units.
- (6) Identify special environmental compliance requirements including water quality standards such as suppression of nitrogen, adequate oxygen levels, and temperature control and control of turbidity during construction; preservation of existing growth adjacent to construction; obliteration of temporary or abandoned roadways and restoration to original appearance; dust abatement, etc. Give recommendations on steps to be taken to meet these requirements.
- (7) Impact of moving construction materials on existing road facilities, including consideration of such factors as traffic congestion, effect on road condition, air pollution, etc.
- (8) Background on the need for fish protection during construction at stream crossings.
- (9) Recommendations or commitments to maintain specific flow requirements for biological and/or recreational resources.

- (10) Comment on disposal of material from clearing operations. Consider State and local burning regulations, burying or chipping of materials, and maximum utilization of merchantable timber.
- (11) Erosion and sediment control.
- (12) The need for a field conference to resolve critical environmental problems with participation of other agencies.
- (13) Review of designs by other agencies.
- (14) Railroad, highway, or access road clearing plan to consider fish and wildlife requirements.
- (15) Anticipated public use of Reclamation access roads.
- (16) Any threatened and/or endangered critical habitat in/or adjacent to the potential alignments.