17. Bridges. 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.

The following data and information are required for feasibility design of vehicular bridges. This document can be used to request design data for railroad and pedestrian bridges along with buried box, round, or arch culverts to be constructed under roadways. These buried structures qualify as bridges under the American Association of State Highway and Transportation Officials (AASHTO).

AASHTO's definition of a bridge is as follows: "a structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between undercopings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening."

A. **General Map Showing:**

(1) A key map locating the general map area within the State.

(2) A legend of symbols used for existing and constructed facilities.

(3) The location of the structure site, alignment of the roadway, highway, access road or railway.

(4) Existing towns, highways, roads, railroads, public utilities, transmission lines, substations, canals, dams, rivers and streams, stream-gauging stations, county, township, range, and section lines.

(5) Locations of potential construction and permanent access roads, detour routes and major crossings.

(6) Locations of borrow areas for natural construction materials, location of commercial quarries, 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 proposed bridge such as: recreation areas, fish and wildlife areas, building areas, and areas of archeological, historical and mining or paleontological interest.

A. **General Description of Local Conditions Covering:**

(1) **General Engineering Requirements.** There should be a narrative of the project area, which includes a brief description of the surrounding area,

the size of the nearest population centers, the condition of bridges and other structures and roads. This description shall include the following (if available):

(a) Location (structure name, structure number, state, county or route number, distance to nearest city or town, etc).

(b) Project description (new structure, replacement, or modification required due to necessary improvements, etc.).

(c) Site description (information relating to access for possible site visit by the design team, access for foundation exploration, and construction, and access limitations due to environmental restrictions, etc.).

(d) Weather and climate conditions that may affect design or construction (temperature extremes, local building code requirements for wind velocities, snow and ice loading, etc.).

(e) Utilities such as powerlines, waterlines, or telephone lines that require installation on the bridge superstructure or are in the vicinity and may be impacted by the project. Include names, telephone numbers, and internet and email addresses of the local utilities and names of contacts within their organization.

(f) Provide copies of relevant correspondence to and from stakeholders such as Federal, State or local agencies or private entities. These stakeholders input may have an impact in the design reviews or permitting process. Provide name of contact person, address, telephone number, internet and email address for potential direct contact by the design team.

(g) Provide copies of previous reports or studies that have been prepared by Reclamation or by others.

(h) The approximate distance from the nearest railroad shipping terminal to the structure site; load restrictions and physical inadequacies of existing roads and structures and an estimate of remedial improvements to accommodate construction hauling; and possible alternative means for delivering construction materials and equipment at the structure site.

(i) Local freight or trucking rates.

B. **Surface Data:**

(1) **Survey Control.** Survey control is required for all surveys including surveys associated with aerial topography. Show coordinate system and existing land survey monuments and special control points established for the survey. All preceding survey work and all subsequent survey work, including topography and location, and ground surface elevations of subsurface exploration, should be revised to conform with the permanent control system.

All points contained in the electronic files should have coordinates for northing and easting and values which correspond to the ground level elevations. Specify the vertical datum, such as National Geodetic Vertical Datum (NGVD), and the horizontal datum, such as the State Plane Coordinates (NAD83) along with epoch date.

Legends should show grid factors and reduction to sea level factor, or a combination of the two.

Feasibility phase: Tying to the State plane coordinate system or national coordinate system is recommended.

Specifications phase: Permanent horizontal and vertical survey control should be established at the earliest possible time. The coordinate system should be related to a State or national coordinate system.

(2) **Topographic Map.** When the horizontal alignment of the proposed bridge is known, the topographic map should embrace a minimum area of 100 feet upstream and 100 feet downstream and 100 feet beyond the ends of the structure. This area may have to be enlarged to cover any alternate alignments being evaluated or specific construction items such as cut and fill limits and channel modifications. Generally, both a map and an electronic file, in AutoCAD or compatible format, of the topography covering the structure site should be provided. The topographic map should be plotted to a scale of 1 inch equals 10 feet to 1 inch equals 20 feet with a maximum contour interval of 2-feet. Elsewhere, larger contour intervals may be acceptable. Details to be included are:

(a) Proposed bridge location.

(b) Locate and identify existing site features which would be important design information such as roads, parking, turnarounds, buildings, structures, power lines, buried utility lines, campgrounds, picnic areas, springs, marsh areas, overflow channels, channel changes, edge of water, high water marks, types of vegetative cover, large boulders, exposed rock, etc.

(c) Existing right-of-way and proposed acquisition of additional right-of-way should be discussed.

(d) Provide a profile along the existing or proposed road centerline extending at least 500 feet beyond the ends of the bridge. The profile should be plotted to a horizontal scale of 1 inch equals 20 feet. Indicate recommended grade; elevations of extreme low, present and extreme high water; elevations of the stream bottom in the vicinity of the proposed piers or abutments; and type of foundation material underlying the substructure locations.

(3) **Photographs.** Digital color photographs of all existing facilities or structures in the vicinity of the proposed bridge site with close-up views of any features which may affect designs. These photographs should be taken to best show the proposed structure and, if possible, indicate known tie points to the topographic maps.

C. **Foundation Investigation 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 an onsite inspection and a field conference be held.

(2) **Geologic Data.** The amount and detail of foundation data required for a feasibility design will vary greatly because of the wide range of size and complexity encountered in bridge design. The guiding criteria should be to provide sufficient data to allow the designer to determine the type of foundation required for the structure and to identify major foundation problems. Adequate foundation data may be obtained for small structures from an inspection of surface conditions and one or two exploratory holes or test pits to determine type of overburden and foundation conditions some distance below the base of the structure. These data, and any other data in the following paragraph that are relevant, along with a brief description of geologic conditions of the site, can be included in the design data.

For larger and more complex structures, a more comprehensive geologic program will be required, including a geologic report. For structures of this magnitude, a field conference should be held, including an inspection of the site to determine the geologic investigations program. In developing the geologic program and in preparing the geologic report, the following should be considered.

(a) A resume of the regional geology.

(b) 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.

(c) A surface geologic map of the bridge site, plotted on the topographic map of the bridge site, showing surface geology and the location of geologic sections, soil profiles, and of all subsurface explorations, including coordinates or stationing.

(d) A description and interpretation of site geology including physical quality and geologic structure of the foundation strata, seasonal ground water, ground subsidence, existing and potential landslide, snowslide and rock fall areas, surface water runoff; and engineering geologic interpretations as appropriate.

(e) Geologic logs of all subsurface exploration.

(f) Geologic sections, with soil profiles as required, showing known and interpreted subsurface conditions.

- A classification, in accordance with the Unified Soil Classification System, of the soil in each major stratum.
- A description of the undisturbed state of the soil in each major stratum.
- A delineation of the lateral extent and thickness of critical, competent, poor, or potentially unstable strata, in foundations and excavation slopes, especially those to be permanently exposed.
- An estimate or a determination by tests of the significant engineering properties of the strata, such as density, permeability, shear strength, and consolidation or expansion characteristics; and the effect of structure load, changes in moisture, and fluctuations or permanent rise of ground water on these properties

(g) Digital color photographs of pertinent geologic and topographic features of the terrain.

(h) Samples of foundation strata as needed for visual examination or laboratory testing. Test pits and results of material testing should be included.

(i) A determination of natural ground water conditions at the site.

D. **Hydrologic Data (Required for bridges crossing rivers and streams):**

(1) Annual periodic fluctuations of stream or river water levels.

(2) Drainage area located upstream of the bridge site.

(3) Anticipated occurrence and amounts of sediment, ice (thickness), and drift (trash).

(4) Erosion protection requirements and calculated scour depths, which will be used for support structure foundation design.

E. **Design Standards:** For vehicular bridges, the design code is the American Association of State Highways and Transportation Officials (AASHTO) Load and Resistance Factor Design Specifications published by AASHTO.

F. **User and Operating Data:**

(1) For road and highways:

(a) Number of traffic lanes, including shoulders.

(b) Pedestrian sidewalk requirements.

(c) Typical roadway cross section.

(d) Deck protection or rehabilitation.

(e) Existing cross drainage structures located within the proposed construction site, including hydraulic requirements.

(2) For railroad bridges:

(a) Track classification, type of service, design load limits, typical roadbed section.

G. **Construction Materials Data Including:**

(1) Inventory of available borrow areas for permeable and impermeable soil materials required for fill or embankment; distance to quarry or stockpile for riprap required for channel or slope protection.

(2) Information on concrete aggregates. (See “Final Investigations” in the *Concrete Manual*.)

(3) Data on commercial concrete and precast concrete plants within practical hauling distance from the bridge site.

(4) Results of sampling and analysis of materials, including previous tests conducted at the Technical Service Center (TSC).

(5) Information, including catalogues, on firms within practical hauling distance from the bridge site which manufacture precast concrete products such as beams and piles.

H. **Cost Data:**

(1) Estimate of cost of right-of-way or easements. Include supporting data.

(2) Estimates of cost for relocating public utilities within the construction area.

(3) Estimates of cost for removal of buildings and other structures within the construction area.

(4) Provide any pertinent cost estimates or information that has been prepared or obtained by Reclamation or the owner.

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 the bridge structure with the surroundings and the need for restoring and for reseeding cuts and fills.

(3) Comment on any ecological, aesthetic, or other environmental aspects peculiar to this location which would affect the bridge layout or roadway approaches.

(4) Furnish data on allowable noise limits in the vicinity of the proposed bridge 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.

(5) 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.

(6) Background on the need for fish protection and passage during construction at stream crossings.

(7) Recommendations or commitments to maintain specific flow requirements for biological and/or recreational resources.

(8) Any threatened and/or endangered critical habitat in/or adjacent to the potential alignments.

(9) Wildlife, wetlands, required environmental permits, construction window, traffic restrictions, and detour requirements.

(10) Erosion and sediment control.

(11) The need for a field conference to resolve critical environmental problems with participation of other agencies.

(12) Review of designs by other agencies.

(13) Railroad, highway, or access road clearing plan to consider fish and wildlife requirements.

(14) Anticipated public use of Reclamation access roads.

(15) Applicable permits and monitoring requirements.

K. **Site Security.** Many Reclamation projects may require a security risk assessment. The need for a site-specific security risk assessment should be considered for feasibility designs where an assessment may impact the field cost estimate and for specifications designs. Specific issues to consider are contained in Section 14 of Chapter 7 – Site Security and Public and Worker Safety. If assistance is required to determine specific design data needs, contact the Office of Security, Safety and Law Enforcement. Where design data and designs include site-specific security assessment, compliance with Reclamation Manual DM Part 444 – Physical Protection and Facility Security, Chapters 1 and 2 is required.