Chapter 14. Bridge Selection, Scoping and Design

A. OVERVIEW

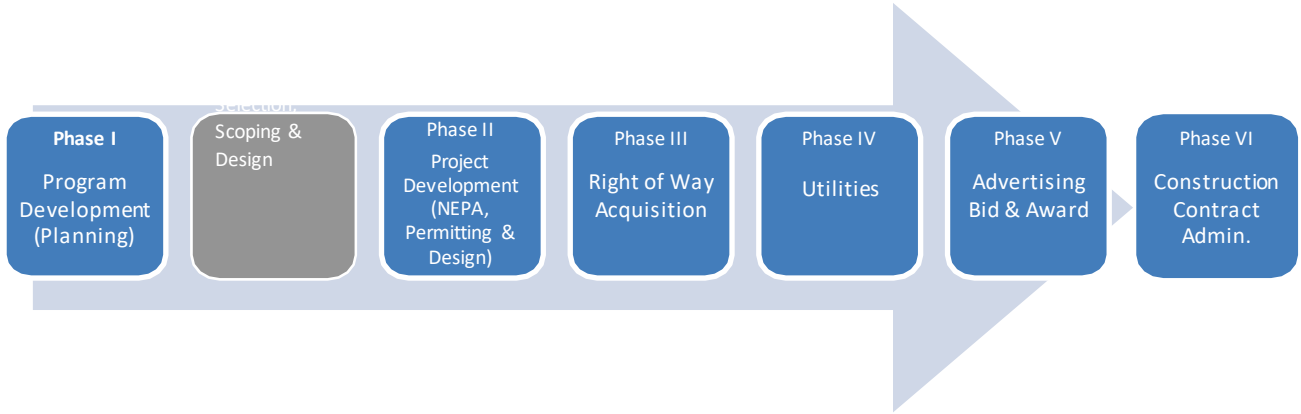
This chapter details bridge project design requirements for certified local public agencies (LPAs) and is applicable to all federal-aid bridge projects in conformance with the regulations adopted by FHWA of Title 23 of the Code of Federal Regulations (CFR) 650 on the National Bridge Inventory. LPAs receive federal funds through ODOT's Local Bridge Program (LBP) to replace or rehabilitate bridges that are structurally deficient or functionally obsolete.

Resources:
- National Bridge Inventory

There are two project delivery options available to a certified LPA:

- The first option is for the LPA to become certified with LPA's staff for bridge and highway-related structures design. This option requires a separate application and the successful completion of two demonstration projects. Contact the Certification Program Office for additional information and guidance.
- The second option is where the LPA does not become certified with LPA staff for bridge and highway-related structures design, but would like to utilize consultants for that type of work. If this delivery method is chosen, the LPA must meet the minimum staffing qualifications and coordination requirements to oversee the consultants, then receive ODOT approval as outlined in a document entitled *Qualifications and Coordination Requirements for Certified LPA not Certified in Bridge Design*. This document is located in Section D of this LAG for Certified LPAs.

Bridge selection, scoping and design occur as a part of project development and before advertising, bid and award.



B. BRIDGE DEVELOPMENT PROCESS

The following flow chart identifies the milestones within the project development process specific to bridge projects.

B.1. Project Selection

a. Bridge Funding

LPAs receive federal funds through ODOT's Local Bridge Program to replace or rehabilitate bridges that are structurally deficient or functionally obsolete. The required local agency match for bridge funds is federally stipulated at 10.27 percent local and 89.73 percent federal. The LPA is required to supply the local funding portion.

b. Bridge Selection Process

LPAs and ODOT have developed a technical ranking system to select and prioritize bridges for funding with Highway Bridge Program. Candidates for the program are accepted every three years coinciding with the Statewide Transportation Improvement Program (STIP). Additional details and specifics regarding local agency bridge project selection can be found in ODOT's Bridge Section; Bridge Priority Selection Policy.

Resources:
- ORS 366.155
- Highway Bridge Program
- Bridge Priority Selection Policy

Candidate bridge replacement projects in the small bridge category submitted by LPAs to ODOT will be evaluated under the direction of the Local Agency Bridge Selection Committee before being prioritized with a technical ranking system.

Candidate bridge rehabilitation projects in the small bridge category and bridges in the large bridge category are evaluated individually without using the technical ranking system.

After the technical review, bridge projects will be prioritized, scoped and then programmed in priority order, to the limits of available funding and placed in the STIP.

The emergency exception to the above selection process is discussed in the next subsection.

Resources:
- Statewide Transportation Improvement Program (STIP)

c. Emergency Exceptions

In the event a bridge has been destroyed or substantially damaged causing an emergency situation, and no other state or federal funds are available for its replacement or restoration, the LPA may apply for Local Bridge Program funds to have the bridge replaced or restored.

If the emergency request is approved, another project may have to be delayed by adding this project. The failed or damaged structure will be given a new Sufficiency Rating to reflect its new condition. A new technical ranking will be calculated, using the recalculated Sufficiency Rating. If the emergency structure has a lower priority than currently scheduled projects, the emergency funding will be denied. If the failed or damaged structure has 30,000 square feet of deck area or greater, the bridge will be evaluated and a funding strategy recommended by the Bridge Selection Review Committee.

B.2. Scoping

The scoping effort builds upon the information provided by the LPA in its project application. Scoping is the process of defining the parameters of the project and the level of effort required in the various project delivery phases.

Scoping will be performed using an ODOT Local Program scoping team. The scoping team may consist of staff from the following entities:

- ODOT Bridge Section, Senior Local Bridge Standards Engineer
- ODOT Regional staff
- Consultant
- LPA staff

In addition to this staff, it is recommended that other appropriate personnel participate on the scoping team to provide needed information regarding roadway design, environmental – including the ODOT Region Environmental Coordinator (REC), right of way, utilities, railroads, land survey, bridge foundation, hydraulics, and structural issues.

Scoping can be done by meeting with the assigned project personnel and specialists at the project site, or in the office, if sufficient data is available. ODOT and the scoping consultant coordinate a field review in consultation with LPA and the Regional Local Agency Liaison. The field review provides the initial project data and information needed to program the project in the STIP. It also guides the Project Development Team to the successful production of the Plans, Specification & Estimate (PS&E).

Additional information regarding PS&E is available in Section C, Chapter 11 in this LAG for Certified LPAs. It is recommended that the scoping process be documented by a bridge scoping package, as described below.

a. Bridge Scoping Package

Resources:
- Scoping Expectations Framework
- Scoping Notes
- Local Agency Technical Scope Sheet (734-5151)

The scoping team is responsible for developing a draft scoping package.

ODOT's Project Delivery Guide page provides links to the Scoping Expectations Framework and a checklist under the document entitled "Scoping Notes," which together provide an overview of ODOT's process for scoping projects. ODOT's process references the ODOT Business Case and Charter documents. However, for many Certified LPA projects, business case information will instead be documented in the LPA's funding application and charter-type information will instead be documented in a Local Agency Technical Scope Sheet (also posted on the ODOT Project Delivery page).

The draft scoping package at a minimum will include the following:

- The names and roles of the teams' members throughout the project (if known)
- Outside agency involvement
- Decisions regarding site investigation and analysis procedures for geometric design elements, foundations, hydraulics, structures, right of way, environmental, traffic, utilities and permits
- Preliminary discussion of alternative designs and establishment of the project limits
- "Scoping Notes"
- Discussion of funding and who will perform project development, advertisement, award and administration of construction
- Desired project schedule
- A detailed break-down of the cost for all phases of work

The scoping team will supply the draft scoping package for each bridge scoped to the ODOT Bridge Section, Regional Local Agency Liaison and the LPA for review and comment.

The scoping team delivers the final scoping package to ODOT's Bridge Section. The Bridge Section will distribute the final scoping package so each involved entity and department has access to the package.

b. Rehabilitating vs. Replacing Decisions

On each project, a determination must be made as to whether an existing bridge should remain in place, be rehabilitated, or replaced. This decision should be based on an assessment of the structural and functional adequacy of the bridge for the type and volume of projected traffic

over its design life. The determination for replacement should consider historic significance of the bridge as well as the technical difficulty and impact to integrity when attempting to bring an older structure up to existing standards. If the project impacts a bridge owned by the State of Oregon, coordination with ODOT will be required before any decision can be finalized to replace or modify a historically significant bridge using federal funds. For other federally-funded projects on structures owned by counties and other local governments, ODOT can provide coordination and recommendations for evaluation and regulatory compliance.

i. Rehabilitated Bridges

Rehabilitated bridges should be designed to meet or exceed minimum standards as described previously in this chapter. Exceptions to these standards may be approved based upon individual site evaluations; however, the rehabilitated bridges should, as a minimum, meet the design loading requirements of ODOT's *Bridge Design Manual* Section 1.3.

Bridge rehabilitation projects must bring all major structural and safety features up to standards, as required for LBP funds. Substandard bridge rail should be upgraded to current standards. "Safety" curbs which can cause vehicles to vault, should be eliminated. Exceptions may be considered on a case-by-case basis if safety can be adequately enhanced for the intended use. Cost-effective considerations may prevent full widening or full upgrading of the bridge rail. Also, if the structure is listed on or determined eligible for the National Register of Historic Places, exceptions may be considered.

Resources:
- Bridge Design Manual
- National Register of Historic Places
- NCHRP Report 350
- Federal-Aid Policy Guide – Non-Regulatory Supplement
- AASHTO
- Crash Tested Barriers List

When a decision is made to retain a bridge, the bridge rail should be evaluated to determine if it can adequately contain and redirect vehicles without snagging, penetrating, or vaulting.

Consideration should be given to upgrading structurally inadequate or functionally obsolete bridge rail. The evaluation should be based upon criteria similar to that shown in the National Cooperative Highway Research Program's NCHRP Report 350, "Multiple-Service-Level Highway Bridge Railing Selection Procedures." Guidance concerning width, rail and geometric criteria tradeoffs and the effects on safety are contained in NCHRP's Research Digest 98 and Report 203 both entitled "Safety at Narrow Bridges" as noted in FHWA's Federal–Aid Policy Guide – Non- Regulatory Supplement. A list of crash tested barriers can be found through the FHWA website, linked in the resource box.

ii. Bridge Replacement

Bridge replacement projects should meet or exceed minimum standards as described previously in this chapter. In the case of bridges on low volume roads and streets, exceptions

may be appropriate if the existing road will not be upgraded in the foreseeable future (typically 20 years or more).

iii. Bridges Classed As Non-Deficient or Non-Functionally Obsolete

Bridges which have been strengthened or rehabilitated to eliminate deficiencies are to be reclassified as non-deficient in the bridge inventory. Those existing bridges for which FHWA has approved an exception to the AASHTO standards are also to be reclassified as non-deficient since it was determined that the bridge is adequate for the type and volume of projected traffic over its remaining design life. If exceptions were granted as a temporary measure because of a scheduled future replacement project, the bridge may remain classified as deficient.

c. Historic Bridge Coordination Procedures

The following are general guidelines for the treatment of existing bridges, bridge replacement and bridge rehabilitation projects for bridges 50 years or older. For bridges that are 50 years old or older, a determination of historic eligibility is required to be listed on the National Historic Register. Eligibility criteria is available at the National Register of Historic Places website.

i. National Historic Preservation Act

Bridges which have been listed on, determined eligible for or are considered potentially eligible for the National Register of Historic Places, should meet the following environmental requirements provided in Section 106 of the National Historic Preservation Act of 1966.

Section 106 Report requires that a determination be made regarding whether there are any National Register listed or eligible properties within the project area and the effect the proposed project will have on these properties. A LPA with a bridge project affecting a historically significant structure should contact the Regional Local Agency Liaison who will coordinate with ODOT's Cultural Resources staff.

This process, as outlined below, includes obtaining ODOT's concurrence on eligibility and level of effect prior to requesting a determination from the State Historic Preservation Office.

STEP 1: The Regional Local Agency Liaison will forward the Determination of Eligibility form and Cultural Resource Report to ODOT Cultural Resources staff, who will review and forward this documentation to the State Historic Preservation Office for concurrence.

STEP 2: If a property is on or eligible for the National Register of Historic Places, then the Criteria of Adverse Effect will be applied. The Regional Local Agency Liaison will forward the Finding of Effect to ODOT's Cultural Resources staff, who will review and forward this documentation to State Historic Preservation Office for concurrence. The Finding of Effect and other related forms can be found in ODOT's Cultural Resources Manual. If the project will have an Adverse Effect on historic properties, the Finding of Effect must indicate alternatives considered that avoid, minimize, or mitigate effects to historic properties.

STEP 3: If the project will have an Adverse Effect on historic properties, contact the Regional Local Agency Liaison who will coordinate with the LPA for the development of a Memorandum of Agreement with the Advisory Council, State Historic Preservation Office, ODOT and FHWA. The Memorandum of Agreement will include measures to mitigate the adverse effects on a resource prior to final environmental document preparation.

Resources:
- ODOT Cultural Resources page
- National Register of Historic Places
- State Historic Preservation Office (SHPO)
- Section 106 of the National Historic Preservation Act of 1966
- Bridge Design Manual

STEP 4: Projects which involve right of way acquisition or excavation have potential to uncover archaeological or historical resources. Under these conditions, an archaeological survey or archaeological clearance letter must be completed. For information on archaeological surveys, contact the Regional Local Agency Liaison who will coordinate with ODOT Region Environmental Coordinators (RECs) and other appropriate Environmental staff.

ii. Section 4(f)

Section 4(f) requirements may apply if the proposed project will adversely affect the historic integrity of the National Register or register eligible property. When a Section 4(f) Evaluation is required, the Section 106 Report and Draft Section 4(f) Evaluation will be prepared separately to satisfy the requirements of both laws. For further details, see Section C, Chapter 6 of this manual. LPAs are to send Section 4(f) Evaluations to the Regional Local Agency Liaison who will coordinate with ODOT's Cultural Resources staff to review and forward this documentation to FHWA for approval.

iii. Design Considerations

Consideration should be given to design standard exceptions for railing replacements, roadway widths, etc., when the structure is listed on or determined eligible for the National Register of Historic Places according to the criteria in ODOT's *Bridge Design Manual*.

For additional information contact the ODOT Regional Local Agency Liaison, or refer to ODOT's Cultural Resources website, ODOT's Covered Bridge website and FHWA's Covered Bridge Manual.

B.3. Design Acceptance Package (DAP)

The Design Acceptance Package is a critical milestone of the decision-making process that establishes the geometric boundaries of the project footprint, and provides for a more reliable update to the project scope, schedule, and budget. Design acceptance occurs at the end of the initial design phase and requires all project disciplines to review the design for balance of

context with standards and policies. At this time, technical and non-technical stakeholders review design elements according to their specific interest.

Note on ADA: Bridge work may trigger ADA-related work and design exception processes. Refer to ADA Compliance for Bridge Work and Design Considerations in the ODOT Bridge Design Manual.

a. Type, Size & Location (TS&L) Design Package

The TS&L Design Package is part of the Design Acceptance Package. See Section C, Chapter 10 of this manual for further details.

The TS&L design package shall include:

- TS&L Plan and Elevation drawing
- TS&L Estimate of structure construction cost
- TS&L Narrative, including a discussion of the bridge alternative study
- TS&L Geotechnical Report
- Draft Hydraulics Reports
- A list of anticipated design exceptions or design deviations required for the execution of the project.

The above items should be prepared in accordance with:

- ODOT Bridge Design Manual Sections 2.4, 3.3.4 3.3.5 and 3.9, Type, Size, and Location (TS&L) Design, and CAD Manual, Section 6 Type, Size and Location Plan & Elevation.
- ODOT Geotechnical Design Manual for TS&L Foundation Design Memo.
- ODOT Hydraulics Manual for Draft Hydraulics Report.

Resources:
- Bridge Design Manual
- CAD Manual
- Geotechnical Design Manual
- Hydraulics Manual

The plans as submitted for review should be prepared in such a manner that when reduced to half size (11 inches by 17 inches) all notes and details will be legible. All contract documents shall be prepared in English units. Additional information, refer to ODOT's Bridge Engineering Section's *Bridge Design Manual*, Section 2.6 Type, Size and Location Plan and Elevation for the check-list.

ODOT reviewers will ensure that LPA plans, details and specifications are legible and that the work is constructible. With ODOT approval, the plans, details and specifications are not required to be written or shown in precisely the same manner as ODOT-prepared documents.

b. Bridge Alternatives Study

Typically, up to three bridge structure-type alternatives are investigated, prior to completion of Type, Size & Location (TS&L) Design Package. The available foundation and hydraulics information is used to develop the appropriate structure-type alternatives. Preliminary square foot cost estimates are developed for the bridge using historical cost data. In some cases, it may be useful to develop sketches for the bridge alternatives.

ODOT and the LPA will discuss advantages, disadvantages, and cost estimates for each, and the recommended alternative. The preferred alternative is presented in the TS&L Report.

c. Type, Size and Location Study for Major or Unusual Structures

For bridge replacement projects of a major or "unusual" structure, FHWA requires a LPA to conduct a more detailed Type Size & Location Report. Factors which constitute "unusual" site conditions are defined in ODOT's Bridge Engineering Section's *Bridge Design Manual,* Section 2.4.3(2) Special Considerations for Federal-aid Projects, Unusual Structures.

B.4. Preliminary Plan Package

Preliminary Plans is for technical staff to provide comments and feedback on the adequacy and appropriateness of the bridge design with regard to the standards described under the "Bridge Design Standards" section of this chapter and the project needs.

Preliminary Plans Review Package shall include:

- Preliminary Bridge Plans
- Preliminary Cost Estimates
- Final Foundations Report
- Final Hydraulics Report

The above items should be prepared in accordance with:

- ODOT's Bridge Design Manual
- Geotechnical Design Manual for Final Foundation Report
- Hydraulics Manual

B.5. Advance Plans

Advanced Plans Package is a key interim step of the contract document phase and requires all project disciplines to review draft contract documents for completeness and accuracy. It is for technical staff to provide quality control review of the project plans, specifications, and estimates as a package.

a. Advanced Plans Review Package

The Advanced Plans Review Package shall include:

- Advanced Bridge Plans
- Advanced Bridge Construction Cost Estimate
- Advanced Construction Standard Specifications and Special Provisions

b. Quality Control/Quality Assurance

A Class I check will be performed on the advance plans, specifications and estimates, as described in ODOT's Bridge Engineering Section's *Bridge Design Manual* at Section 3.5.7. Class II and III checks will be considered based on the complexity of the bridge project, per *ODOT's Bridge Design Manual* Section 3.5.7.

At this point, foundation and hydraulics engineers will review the final plans and specifications for conformance with the report recommendations.

B.6. Final Plans Package

This step occurs in follow-up to review and comment on the advanced plans, and specifications, and cost estimate. It is the last opportunity for contract documents to be reviewed by technical staff for quality control and document completeness, before the project is ready to move forward for FHWA review (when needed) and PS&E submittal.

Based on the comments provided during the Advanced Plans review, the draft contract documents are advanced to the final plans. The Final Plans Review Package shall include:

- Final Bridge Plans
- Final Bridge Construction Cost Estimate and
- Final Construction Standard Specifications and Special Provisions

B.7. Plans, Specifications and Estimates (PS&E)

This point of decision-making provides certainty of the completeness of a project for bid. Decision-making with any desired interim milestones between Design Acceptance and PS&E Submittal (e.g., TS&L, Advanced, and Final Plans) should be addressed through individual Quality Control Plans and Project Development Change Requests as needed.

For information regarding PS&E submittals, refer to Chapter 11, in Section C of this manual.

B.8. Project Completion

Resources:
- National Bridge Inventory
- ODOT Load Rating

LPAs shall submit to ODOT all as-built bridge drawings, pile records, foundation reports, hydraulics reports, and a PE stamped load rating report for all National Bridge Inventory structures. This information must be submitted to ODOT within 90 days of the issuance of Second Notification pursuant to Oregon Standard Specification 00180.50(g), or Agency's approved equivalent. As-built bridge drawings shall be in accordance with the CAD Manual, Section 7.11.1.

Bridges designed using the AASHTO Load Resistance Factor Design (LRFD) Bridge Design Specifications will be load rated using the AASHTO Guide Manual for Condition Evaluation and Load and Resistance Factor Rating (LRFR) of Highway Bridges and the ODOT LRFR Manual (Tier 2). Documentation of the completed load ratings, including electronic files, will be consistent with the requirements contained in the ODOT LRFR Manual (Tier-2).

Refer to Section C, Chapter 17 of this manual and the LPA Master Certification Agreement for additional information.

C. BRIDGE DESIGN, PRACTICE AND POLICIES

C.1. Bridge Design and Standards

Design standards for bridge projects on the National Highway System and the Oregon State Highway System shall be in compliance with the standards specified in the current *AASHTO LRFD Bridge Design Specification*, AASHTO guide specifications for highway bridges, ODOT Hydraulics Manual, and related references as well as the following ODOT manuals:

- Bridge Design Manual
- Geotechnical Design Manual

a. Bridge Design and Standards for Non-Highway System

Design standards for bridge projects on the non-National Highway System and the Local Agency Road System shall be in compliance with the standards specified in the current *AASHTO LRFD Bridge Design Specification*, AASHTO guide specifications for highway bridges, ODOT Hydraulics Manual, and related references as well as the ODOT manuals listed above except as modified by this section:

BDDM Section 1.23 "Bridge End Approach Slabs and Slope Paving" is modified as follows:

Add the following:

Approach slabs may be deleted under certain conditions. A geotechnical and structural evaluation is required for considering the deletion of approach slabs and approval of a deviation from ODOT Senior Local Bridge Standards Engineer. The final decision on whether or not to delete approach slabs shall be made by the ODOT's Senior Local Bridge Standards Engineer with consideration to the geotechnical and structural evaluation.

Design all bridge components for full seismic loading according to the current edition of *AASHTO Guide Specifications for LRFD Seismic Bridge Design*, and the LPA is not required to design to *Bridge Design Manual* 1.17.2.

1) Design to the 1000 year criteria.

1.17.2 Applications of AASHTO LRFD Bridge Design Specifications

1.17.2.1 General Considerations is modified as follows:

LPAs shall design to AASHTO seismic design specification and are not required to follow the *Bridge Design Manual*, State seismic design requirements.

C.2. Deviations/Design Exception Process

Deviations and design exceptions from the Bridge Design Standards identified previously in this chapter, and the standards identified in Section C, Chapter 9 of this manual, require approval of a Local Agency Design Exception Request from ODOT. The deviation and design exception process is described in Section C, Chapter 9 of this manual.

C.3. Proprietary or Patented Products

For projects bid prior to October 28, 2019, FHWA disallowed the use of proprietary or patented products, processes, or specifications on federally funded projects unless certain criteria were met and such usage was documented in a letter of Public Interest Finding.

Effective October 28, 2019, through a Notice of Final Public Rulemaking, FHWA rescinded its restriction on the use of proprietary and patented products.

However, when an LPA determines that "no approved equal" for a specified product will be allowed, state law still requires an LPA's contract review board to issue an order waiving state law limitations on the use of proprietary and patented products. See Section C, Chapter 11 of this manual for additional information.

C.4. Value Engineering Study

Bridge projects over $40 million must include a Value Engineering Study during the design phase.

See Section C, Chapter 9 of this manual for additional information about Value Engineering.

C.5. Approach Guard Rail and Bridge Rail

On all projects involving bridges, the approach guard rail should be evaluated and upgraded to current standards. Approach guard rail, if warranted, must be properly anchored to the bridge. The transition between the approach guard rail and the bridge rail should be smooth and of sufficient strength (i.e., reduced post spacing) to prevent snags and vehicle pocketing.

Consideration should be given to design standard exceptions where safety can be adequately enhanced for the intended use and when the structure is listed on or determined eligible for the National Register of Historic Places.

Bridge rail designs for new and reconstructed bridges shall have been successfully crash tested and adopted as an ODOT standard or approved by ODOT according to ODOT's *Bridge Design Manual*, which contains specific requirements relating to railings on historic bridges.

C.6. Foundation Design

Bridge foundation design standards may be found in ODOT's Geotechnical Design Manual, which is available on ODOT's Geo-Environmental website. This manual establishes ODOT standards for all aspects of foundation design including site reconnaissance (scoping), office research, field investigations, foundation selection and design, and seismic design. Provide information in the final Geotechnical Report.

ODOT foundation design methods generally follow those described in *AASHTO LRFD Bridge Design Specifications*.

NOTE: The value of an experienced foundation specialist is critical even on a small bridge project. This is because a large error in the constructability of even a small foundation can occasionally result in an extremely costly "fix" during construction.

a. Foundation Investigation

The level of foundation investigation for a specific project will require careful consideration by the geotechnical engineer and appropriate members of the project development team. Some guidelines which will aid the team in their determination are as follows:

- Exposed bedrock can reduce the need for extensive investigation unless the structure is unusually large or part of a critical road network. For certain structures, the quality of the rock and its consistency at depth will be required.
- Single span bridges can typically accommodate settlement, such as differential settlement, better than multiple span bridges. Although settlement must be considered, there may be less need for extensive settlement prediction methods depending on the foundation conditions and the performance requirements of the structure.

- The cost-benefit of extensive subsurface exploration may be reduced somewhat on projects with small, relatively low cost bridges. When very small foundations are needed, construction cost overruns resulting from a lack of subsurface information may also be small. On small projects, an assessment may be made to compare and balance the costs of a standard exploration program with the potential consequences and cost impacts that could occur during construction due to a lack of sufficient foundation information.
- In areas where the geologic model is well known from previous investigation and is known to be very consistent, the need for additional exploration may be reduced to that sufficient for confirmation of the expected profile.
- Bridge replacements which do not involve raising the road grade and have no significant increase in load on the underlying soil, greatly reduce the concern for stability or settlement, unless the site is in a high seismic zone.

Sites with bedrock either exposed at the ground surface or within shallow test pit depth will sometimes require only minimal investigation if the bedrock is of good quality and the structure is supported on lightly loaded spread footings. If the structure is a major bridge, an arch structure, involves drilled shafts or highly loaded footings additional investigation of the bedrock materials will be required. The scour potential of bedrock materials must also be considered.

b. Foundation Exploration

The level of effort expended in performing subsurface exploration and design should be consistent with type of structure and type of foundation proposed based on literature or office review and initial scoping. Sufficient information to develop an understanding of the site geology is always necessary. Also, it is essential to understand that subsurface exploration and design is a step by step process in which ongoing interaction and communication with the geotechnical and hydraulics specialists (or sub consultants) and structural designer are required if the final product is to be determined in an efficient and cost effective manner.

Below is a table to help describe the different expectations for foundational exploration.

Two primary factors in determining the level of investigation appropriate for a given project	• The selection of the individuals directing the foundations work who have specific successful experience with bridge foundation work and • The foundation designer's understanding of the entire overall project requirements
The subsurface data should provide support for the following	• Definition of the geologic model and • Selection of the type of support and the design parameters

The foundation report should explain and support	• Understanding of the needs and scope of the project throughout all design and construction phases; • Use of state-of-the-practice design as described in ODOT's Geotechnical Design Manual and the AASHTO LRFD Bridge Design Specifications; and • Constructability of the project. • A contingency for consultation during construction for any design contracts for foundation exploration

c. Foundations Report

Any LPA bridge scheduled for new construction must have a foundations report prepared and finalized prior to completion of the bridge design. The foundation report will be prepared in conformance with the guidelines provided in ODOT's *Geotechnical Design Manual* in conjunction with the following guidelines:

The foundation report contains information needed by the structural designer to understand the site conditions, complete the foundation design and provide specifications as needed for the project and address construction situations. The report is based on an understanding of the overall project requirements. The foundation report is written and finalized after interaction with the structural designer which leads to a proposed foundation design and the Type Size & Location plan and narrative. The report should also demonstrate good project understanding. In addition to foundation recommendations, it includes a brief description of reasonable alternative designs and the reasons why the recommended alternate was selected. Alternatives may be eliminated when believed to be impractical, without detailed analysis, or appropriate for the site conditions and structure type.

A Foundation Data Sheet is part of the bridge plans for all bridge projects that include any subsurface exploration work such as test borings or test pits.

d. ODOT Review Effort

ODOT's Geotechnical Design Manual provides guidelines for the review of foundation reports. A checklist is provided to aid in the review process. However, it is understood that not every guideline within the Geotechnical Design Manual applies to each project. The consultant's report should state that the items were either not applicable or have been resolved, either by engineering judgment, site inspection, or by analysis. In the review process, ODOT engineers will normally base their comments on the data presented in the consultants' documents. If the basis for a design element is not clearly stated or resolved, a question or comment may be given. ODOT will clearly indicate whether comments are informational, or are requirements which affect legal, safety, or significant economic issues.

The geotechnical designer should remain involved throughout project development and should also review and comment on both the Type Size & Location and final plans and specifications.

ODOT requires that consultants use sound engineering judgment in establishing the approach and scope of geotechnical work. Some latitude will be allowed in the degree of documentation if the selected foundation is believed to be practical, safe and cost-effective.

C.7. Hydraulic Investigation Guidelines

a. Overall Hydraulic Design

ODOT's Bridge and Hydraulic Engineering and Environmental Services (HEES) Sections and FHWA require that the structure not wash out or suffer significant damage or failure during a 500-year flood event.

Resources:
- ODOT Hydraulics Engineering
- Hydraulics Manual

LPAs should use ODOT's Hydraulics Manual along with the guidelines depicted in Section D of this manual (Bridge Hydraulics Performance Specification).

b. Hydraulics Report

The hydraulics report contains information needed by the structural designer to understand the site conditions, complete the bridge opening design and address construction situations. The report is based on an understanding of the entire, overall project requirements. The hydraulics report is written and finalized after interaction with the structural designer, roadway designer, foundation designer, environmental specialists and regulatory agencies.

This process leads to a proposed hydraulic opening, scour provisions and the Type Size & Location report and narrative. In addition to the bridge opening recommendations, the hydraulics report also includes a description of reasonable alternative designs and the reasons why the recommended alternate was selected.

A draft hydraulics design shall be submitted to identify hydrologic factors and parameters that will affect the selection of the structure. The study must be detailed enough so that the proposed structures layout and type can be identified. The draft Hydraulic report will need to be submitted in time to be used in the TS & L phase of the project.

The hydraulics information, along with the foundations information are key components for determining the scour risk for the structure.

An engineer with a hydraulics specialty should remain involved throughout project development. The hydraulics engineer should review and comment on both the Type Size & Location and preliminary PS&E documents. Contracts should also include a contingency for consultation during construction if there are unusual circumstances or problems involving rip rap placement or other special features.

The designer or project manager shall submit the Hydraulics Report with scour analysis and a Temporary Water Management Plan to the ODOT for review and comment prior to the start of construction of project elements effecting drainage.

The final Hydraulics Report will include all supporting analysis and drawings. An electronic file with all pertinent data used to run the computer model as well as contour mapping depicting cross section locations used to generate the computer model, shall be kept on file and submitted as requested by ODOT.

A temporary Water Management Plan shall be submitted. When a bridge project is in the Federal Emergency Management Agency floodway, provide a 100-year no-rise certification to the regulatory agency.

Also refer to the Bridge Hydraulics Performance Specifications in Section D of this manual.

c. ODOT Review Effort

The Hydraulics Performance Specifications in Section D of this manual are intended to be a comprehensive representation of areas with possible applicability. However, it is understood that not every item applies to each project. The engineer's report should state that the items were either not applicable or have been resolved, either by engineering judgment, site inspection, or by analysis.

In the review process, ODOT engineers will normally base their comments on the data presented in the engineer's documents. If the basis for a design element is not clearly stated or resolved, a question or comment may be given. ODOT will clearly indicate whether comments are informational, or are requirements which affect legal, safety, or significant economic issues.

Communication between ODOT and the engineer is encouraged during project development.