MICHIGAN DESIGN MANUAL
BRIDGE DESIGN

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CHAPTER 2

STEPS IN PRODUCING PLANS

2.00

STEPS IN PRODUCING PLANS

This chapter briefly outlines the steps that are followed in producing plans for building and rehabilitating bridges and other structures on the trunkline system. Subsequent chapters will expand on this overview.

2.01

SOURCES OF ASSIGNMENT

No work can be started until it has been approved for programming by the Chief Engineer/Deputy Director Bureau of Highway Technical Services and programmed by the Bridge Systems Manager. Programming is based on available funding as appropriated by the Federal and State Transportation legislation.

2.01.01

"Improve and Expand" Projects

Engineering Reports for new work and major relocations are produced by the Project Development Section of the Design Division or Region/TSC Development personnel and serve as sources of assignments for the structure work required in the plan preparation of the Bridge Design Section.

2.01.02

Rehabilitation Programs

MDOT Regions and Bridge Systems Manager prepare an annual program of work to be performed. The program is based on needs observed in the field and the availability of funds to correct conditions as needed. (11-19-99)

2.01.03

Traffic and Safety Programs

The Division of Operations Safety Programs Section prepares an annual program of work to be performed. Funding for Safety Programs is usually based on separate categories of funding.

2.01.04

Turnback Projects

When the State relinquishes jurisdiction of a highway to a local authority, the State usually agrees to perform certain work on that highway prior to relinquishment. Such work is known as a "Turnback Project" and will be defined in an agreement with the local jurisdiction known as the "Turnback Agreement". For additional information regarding “Turnback Projects” see Chapter 12 of the Road Design Manual.

2.01.05

Region/TSC Requests

The Region/TSC Engineer in consultation with the Region Bridge Engineer may request work to be performed on projects in the Region/TSC based on citizens' requests or based on field observations by Region/TSC personnel.

2.01.06

Privately-Owned Facilities

Occasionally MDOT will agree to perform work on privately-owned facilities at the request and expense of private parties. Such work must not be undertaken without a written agreement between the private parties and MDOT.

2.01.07

Bridges to Remain In Place

Bridges to remain in place criteria occurs when a bridge carrying road project traffic falls within a road project and no work is planned for the bridge (see AASHTO publication, ***A Policy on Design Standards - Interstate System*** or ***A Policy on Geometric Design of Highways and Streets, 2011, 6th Edition***). If the bridge does not meet the criteria to "remain in place" the Road Designer or Road Project Manager must submit any necessary design exceptions or design variances for the bridge.
(10-22-2012) (3-21-2016) (8-22-2016)
(2-21-2017) (12-17-2018)

2.02

DATA SOURCES

Prior to preparation of Contract plans, the Design Engineer will request data from various sources to assist in the development of a set of contract drawings. Sources to be used are listed in the following paragraphs.

2.02.01

Engineering Reports

If an Engineering Report has been prepared and published by MDOT, it will provide the Design Engineer with general information regarding the location of the project and the proposed horizontal and vertical alignment. It may also include miscellaneous design constraints such as traffic control, architectural treatment, Michigan Department of Environment, Great Lakes and Energy (MDEGLE) permit and mitigation consideration, etc. It is essential that the design parameters established in the Engineering Report be closely followed in the preparation of the plans.
(10-22-2012) (6-24-2019)

2.02.02

Environmental Impact Statement, Environmental Assessment or Categorical Exclusion

All three documents will provide the Engineer with valuable information regarding the project. For definitions see Section 14.12 and 14.13. If an Environmental Impact Statement has been issued, the restrictions listed in the document must be closely observed during preparation of the plans. Engineers should work with their Environmental Coordinator(s) early on to determine what impact category each job will be classified as, and how to proceed. (11-19-99). (12-17-2018)

2.02.03

Asbestos Survey Data

A full structure asbestos survey is required to be on file for all elements of a bridge that are to undergo construction. This includes removal operations such as saw-cutting and chipping. The Design Engineer must check if there is an existing survey on file for the structure in MiBRIDGE at the start of a project. If there is not an existing survey on file, the Bridge Design Unit must submit a request as early as possible with the Environmental Services Section. For information on submitting a request for a survey see Section 14.13.05.
(11-24-2025)

2.02.04

Road Design

Road Design Plans will provide proposed alignments and grades in detail, and will provide cross-sections of the approaches.

2.02.05

Survey Data

The Design Engineer must determine whether sufficient survey data has been provided from other sources. If not, additional survey data such as a pickup survey must be requested from the Survey Section.

Normally, surveys should be ordered for all major reconstruction jobs, such as bridge widening. On stream or river crossings, survey requests should be combined/coordinated with those from the Hydraulics/Hydrology Unit to avoid duplication of effort by the Surveys Section. The Survey/Mapping Action Request, (Form 0226), is available from MDOT web site.
(8-20-2009) (10-22-2012) (5-28-2013)

2.02.06

Geotechnical Data

The Design Engineer must request data from MDOT Geotechnical Services Section to determine soil conditions and nominal bearing resistance to be used in the design of the foundations. They will also indicate whether piles are required, and if so, the type, section, estimated length and minimum penetration and determine the effect of scour on the stability of the structure. For additional information, refer to Section 3.01. (3-26-2018)

For rehabilitation projects that may result in load increases on foundations, the Design Engineer must perform a foundation analysis and consult with the Geotechnical Services Section. A copy of the analysis will be kept in the project design folder. (11-19-99)
(10-22-2012)

2.02.07

Hydraulic and Scour Data

The Design Engineer must request hydraulic analyses from the Hydraulics/Hydrology Unit to determine required waterway openings, scour countermeasures, and backwater calculations for proposed stream crossings. In most cases, two waterway analyses will be required by the FHWA. To accomplish this in time, the Hydraulics/Hydrology Unit must be involved as early as possible. The Bridge Unit should request data from them immediately after the project is assigned.

The Hydraulics/Hydrology Unit will conduct a scour analysis and provide estimated total scour depths at the foundation for waterway crossings. This information will be forwarded to the Geotechnical Services Section.
(11-19-99)

2.02.08

Railroad Data

The Design Engineer must request information regarding frequency and speed of railroad movements, and information regarding clearances and loadings. Such requests must be submitted to the Railroad Coordination Unit – Office of Rail. See Chapter 13, Railroad Crossings, for additional details. (10-22-2012)

2.02.09

Aesthetic Recommendations

Consideration should be given to providing motorists with an unobstructed view of surrounding scenery. Toward this end the Roadside Development Unit should be consulted to determine whether an open railing is appropriate for a structure spanning a river.

2.02.10

Utility Data

The Design Engineer must coordinate with corresponding Region/TSC Utility/Permit Engineer to determine whether there are utilities at the site of the structure and whether they will be affected by the proposed construction. The designer must also determine whether existing utilities may represent a safety hazard to the construction forces and work with corresponding Region/TSC Utility/Permit Engineer to arrange any necessary temporary or permanent relocations. (12-17-2018)

2.02.11

Permits (11-19-99)

The Design Engineer, along with Environmental Services Section, must determine which permits and notice of coverages will be required for the proposed work and initiate actions to obtain those permits. See Chapter 14, Permit Applications, for additional information. (12-17-2018)

Application for MDEGLE permits should include detailed plans of any proposed haul route necessary to access the project site. See Section 2.02.15 for additional information. (10-22-2012) (6-24-2019)

2.02.12

Screening Requests and Ornamental Fencing

When work is performed on structures in the Metro Region, the Region Project Development or Bridge Engineer must be contacted, to see if pedestrian screening should be added to the proposed work. In other areas of the state the Region Bridge Engineer should be contacted to determine if pedestrian screening should be added. (9-2-2003)

Requests to add ornamental fencing to structures is determined during the project planning process or at project scoping. Refer to the ornamental fencing guidelines in Section 7.05.06. Region Bridge Engineers and Bridge Design Project Managers may be involved in this process. (3-28-2022)

2.02.13

Maintenance Reports

Before starting work on an existing structure, the Design Engineer should review the Maintenance Report/Bridge Scoping Report. An in-depth inspection should be requested if the extent of repairs on specific bridge elements is unknown or may change the scope of programmed work. (11-19-99)

2.02.14

Traffic and Safety Data & **Road Safety Audit**

The Division of Operations Safety Programs Section or Region Traffic & Safety personnel will provide traffic counts, crash history, and posted speeds when this information is relevant to Design decisions and requested by the Design Engineer. (10-22-2012)

The Project Manager (Project Owner) will request (Form #3767) that a Road Safety Audit (RSA) be conducted on project types that fall under the Warranting Conditions of the Road Safety Audit (RSA) Guidance document. This request will follow the process outlined in the guidance. RSAs should be conducted during the scoping process but are highly recommended to be scheduled prior to the Scope Verification meeting. (2-21-2017)

2.02.15

Preliminary Constructability Review

Constructability is taken into account during the scoping and early plan development process (and in conjunction with the Checklist for Constructability Review - Early Project Scoping (Form 1961). After the Job Concept Statement has been created in JobNet, the Project Manager/Concept Author should consult with the Region/TSC Delivery Engineer, the Region Bridge Engineer and Design Engineer/Cost and Scheduling Engineer concerning items such as Coordinating with other Agencies, Permits, Staging, Maintaining Traffic, Site Investigation, and Right of Way. Much of the work under this task should occur before the Scope Verification Meeting. On small projects this task may consist of only the transmittal of base plans to the Resident/Delivery Engineer for comment. On large projects with complex staging, one or more meetings with the Resident/Delivery Engineer, the Region/TSC Traffic and Safety Engineer, the Region Bridge Engineer and Design Engineer/Cost and Scheduling Engineer may be required throughout this task. In both instances the review and incorporation of any comments must occur prior to Preliminary Plan Development. Place completed and signed checklist in the Design project file and ProjectWise. (10-22-2012) (12-17-2018)

2.02.16

Scope Verification Meeting (11-19-99)

Design Engineers should verify the scope of work that has been programmed accommodates all legal users of the bridge, structure, etc. If the scope is unacceptable, the Design Engineer will request a scope verification meeting that includes the Region/TSC Project Development Engineer/Cost and Scheduling Engineer, Resident/Delivery Engineer, Bureau of Bridges and Structures (BOBS) Bridge Construction Engineer, and the Region Bridge Engineer. (12-17-2018) (12-16-2019)

Where a bridge will cross a waterway or wetland, the Region/TSC Construction Engineer should also be consulted to determine a practical means of accessing the project site during construction. If a haul route is required, the details will be included on the plans and in MDOT's request for a MDEGLE permit. (10-22-2012) (6-24-2019)

After the "Scope Verification Meeting" the Design Project Manager will address any changes to the scope in a correspondence/letter to the involved attendees, including the Region Bridge Engineer. Once changes are agreed upon by all parties the Region Bridge Engineer or Design Project Manager will submit a Change Request in JobNet to reflect project changes. (8-20-2009)-(12-17-2018)

2.02.16 (continued)

After project scope has been agreed upon, the Project Manager should identify any Design Exceptions / Variances to MDOT standards that will be utilized in the design of the project. Exceptions / Variances to MDOT design standards should be identified, and, ideally, completed during the scoping process. However, if this has not been done, a Design Exception (DE) or Design Variance (DV) form should be completed. The Project Manager should consult with the Geometrics Unit of the Design Division when identifying and developing justification for design exceptions / variances. Previously completed Design Exceptions / Variances should also be reviewed for accuracy and revised at this time if needed.(8-20-2009)(10-22-2012)(2-21-2017)

For additional information see Sections 12.00-12.03 as well as Chapter 3 of the Road Design Manual. See Road Design Manual Section 14.11 for design exception / variance submittal procedures. (2-21-2017)

2.02.17

The Plan Review Meeting
(11-19-99) (12-17-2018)

During The Plan Review Meeting or field review of plans, Region/TSC engineers will again be consulted. Construction staging information should be reviewed by Region/TSC Field or Construction Engineer. The observations, discussions, and recommendations resulting from the meeting must be documented by a letter in the files. Generally, these letters are written by the Plans & Field Review Section representative who participated. However, if a Design Engineer arranges The Plan Review Meeting without someone from the Plans & Field Review Section, the Design Engineer will write the letter, addressing it to the Engineer of Design Operations - Structures Section.

At the time of The Plan Review Meeting, it is essential that Region/TSC personnel have had the opportunity to consider the nature and scope of work proposed by the Design Unit. Under ideal circumstances this is accomplished by distributing plans to provide 20 working days before the date of The Plan Review Meeting. Frequently, however, letting schedule changes leave insufficient time to "follow the book," and unit leaders must resort to alternatives.

1. If the plans are in a near-complete stage, that is, they clearly show all the proposed work, but they have not been reviewed for normal distribution, they can be transmitted as "advanced copies" to the Region/TSC with the notice of The Plan Review Meeting.

2. If plan preparation has not reached this stage, the unit should outline the proposed work with 8½" x 11" sketches. These then would accompany the notice of The Plan Review Meeting.

Project Managers should make an effort to combine The Plan Review Meetings for neighboring projects that have similar letting dates.

2.02.18

Region/TSC
Maintaining Traffic Recommendations

During The Plan Review Meeting or by separate request, the Region/TSC Traffic Engineer should be asked for recommendations for controlling traffic during construction. The designer will provide current details of approaches within 1500' of bridge reference lines to the Traffic Engineer to facilitate the preparation of maintaining traffic details, quantities, special provisions, etc. (3-20-92)

2.02.19 (10-22-2012) (12-17-2018)

Final Constructability Review
(Preconstruction Process Documentation (PPD) Task Description #3860)

Once the revisions from The Plan Review Meeting have been incorporated into the plans, Final Plans begin. After the final maintaining traffic special provision has been received, and staging typicals and/or plan sheets have been completed, this information plus any unique special provisions should be sent to the Resident/Delivery Engineer for review. Discussions concerning a Construction Critical Path Network, if applicable, should also occur at this stage. In conjunction with the Checklist for Constructability Review Project Development Phase (Form 1960), the work in this task must be addressed prior to the distribution of the final plan/proposal package for the OEC Meeting. Place completed and signed checklist in the Design project file and ProjectWise.

The final constructability review applies to all projects. On small projects this task may consist of only the transmittal of plans to the Resident or Delivery Engineer for comment. On large projects with complex staging, one or more meetings with the Resident/Delivery Engineer, the Region/TSC Traffic and Safety Engineer, Cost and Scheduling Engineer, and the Region Bridge Engineer may be required throughout this task. For projects in templates that do not require an OEC Meeting, the Final Constructability Review must be completed prior to Plan Completion.

2.02.20 (12-17-2018)

Final Project Coordination Meeting

The review of final plans and proposal and project coordination is completed through Final Project Coordination (FPC) meeting. The comments and information gathered at this meeting are used to complete the project and bring plans to 100% final stages in preparation for the Omissions/Errors Check (OEC). For more information regarding the FPC see Section 3.03.

2.02.21 (12-17-2018)

Omissions / Errors Check (OEC)

The sign off for 100% completed final plans and proposal is done through an Omissions / Errors Check (OEC) Review. For more information regarding OEC sign off see Section 3.04. (11-19-99)

2.02.22 (12-17-2018)

Rehabilitation Project Scoping (11-19-99)

Project Scoping Documents will be provided for all bridge rehabilitation projects and submitted to the Bridge Systems Manager. The document package will contain different items depending on if the scoping work is done by consultants or MDOT.

A. Scoping by MDOT

Provide the following when scoping work is done by MDOT:

1. Program Revision Request
   (within JobNet)
   (5-28-2013) (3-26-2018)

2. Project Concept Statement
   (from JobNet) (3-26-2018)

3. Bridge Cost Estimating Worksheet

   For worksheet and key see Bridge Management and Scoping website, under the “Project Estimating” menu. (2-22-2022)

4. Latest Bridge Inspection Report

5. Project Photos

Provide additional information if available, such as:

6. Detailed Inspection Report

7. Underclearance waiver information

8. Diver Inspection Report

9. Load Posting Form

10. Delamination Survey (10-22-2012)

11. Other pertinent information which will assist in the design

2.02.22 (continued)

B. Scoping by Consultant

In addition to the above, provide the following when scoping work is done by consultant:

1. Field Inspection Findings, describing all site issues

2. Recommended repair alternative

3. At least three rehabilitation options with cost estimates

4. Life Cycle Cost Analysis

   For worksheet see Bridge Management and Scoping website, under the "Project Estimating" menu. (2-22-2022)

The proponent Region has the responsibility for entering the project in JobNet (internal information system) and for submitting the Project Scoping Document Package to the Bridge Systems Manager. The project must also have the approval of the Regional Systems Manager/Associate Region Engineer of Development. (3-26-2018) (12-17-2018)

2.03

PLAN PREPARATION STEPS

Preparation of Plans for structures follows three steps. The first step is the development of a Study. The second step is the preparation of Preliminary Plans, and the third step is the development of Final Plans and accompanying specifications. A detailed discussion of each of these steps is covered in Chapters 3 and 4 of this volume.

2.03.01

FHWA Oversight / MDOT Oversight (12-5-2005) (7-23-2018)

Section 2.03.01 is currently under review to adopt revised oversight definitions and procedures. Oversight responsibility for individual project elements is determined exclusively for each project and mutually agreed on by MDOT and FHWA. Any questions regarding the status of projects should be directed to the appropriate FHWA Area Engineer

2.03.02

Study

The study establishes the general design features such as the type of structure, cross-section, waterway opening (size), span arrangement, and alignment. For waterway crossings, hydraulic and scour analyses to determine the size of opening and the impact of scour on the design of the foundation must be part of the study. Studies of federally financed projects for new bridge construction and major rehabilitation must be approved by the FHWA before proceeding with preliminary plan preparation. Normally, the structure proposed should be the most cost effective of those considered based on a life cycle cost analysis. Studies are normally not required for rehabilitation projects. For additional information see section 3.01 and 4.01. (11-19-99) (12-28-2020)

2.03.03

Preliminary Plans

Once the study is approved, preliminary plans and preliminary estimate of cost are prepared by the Design Unit for approval by the FHWA and other concerned agencies.

2.03.04

Final Plans

Work on final plans can begin after the FHWA has approved the preliminary plans and the project has been environmentally classified. The final plans consist of all the details necessary to build the structure, the quantities of the materials required for construction, and the specifications that must be included in the Bid Proposal.

2.03.05 (12-17-2018)

Changes During Plan Preparation

Before requesting changes in programming, the Project Manager should contact all persons, sections, Regions/TSCs or support areas having an interest in the project in order to include as many changes as possible in a single request. (9-1-88)

For bridge construction, rehabilitation, or preventative maintenance projects, a JobNet Change Request should be submitted to the Bridge System Manager for approval. Change Request may be submitted to request program revisions involving project costs, work revisions, work types, and scheduled dates. Program additions, deletions, project splits or consolidations (cost redistributions), and finance revisions must be requested and documented along with the Change Request submittal. All data and documentation supporting the requested change(s) should accompany any request submitted and can be attached in JobNet. A clear and concise justification (reason), which includes language indicating that the request was discussed and agreed with by the Region, must be submitted with all electronic Change Request submissions.
(11-19-99)

2.03.05 (continued)

Where it appears that a change in work scope may affect a project's environmental clearance, the Environmental Services Section should be notified as soon as possible. Notification should include copies of any correspondence, memos or forms that will help describe the project revisions. (8-6-92)

Project designs and plans should not be changed prior to receiving the approval of the Program Administration Division and the Change Request pertaining to the modifications.

2.03.06

Changes after Plan Completion

If policy or specification changes occur after the details have been completed, such changes must be discussed with the Chief Structure Design Engineer to determine if they will be retroactive. Addenda to a contract should be avoided where they do not significantly affect the bidding. Where they are required, an effort should be made to consolidate several items in one addendum with bridge and road unit leaders coordinating their submittals. The deadline for addenda is 10 days preceding the date of the letting. Projects not meeting the 10 day limit, but needing an addenda, should be discussed with Design Engineer-Specifications and Estimates. (2-23-2026)

2.03.07 (2-22-2021)

Authority for Bridge Closures

The responsibility/authority to close bridges is shared by many individuals. After initial assessment, closure actions may be initiated by:

- The Engineer/Construction Administrator
- The Design Engineer of Record (EOR)
- The Contractor's Safety Supervisor, or Site Superintendent
- The Bridge Owner

Concerns or questions related to bridge closures should be directed to one of these individuals. Additional information can be found at MDOT's Construction Manual website, Division 7 – Structures.

2.04

PLAN PRODUCTION PROCEDURE

It is the responsibility of the Project Manager and Design Engineer to produce sets of plans in a timely fashion and to be informed of the status of plans for a project at all times.

2.04.01

Unit Assignment

The Chief Structure Design Engineer will assign a project to a Design Unit and the Unit's Design Engineer will assign the project to an Engineer for plan preparation. The Engineer will gather information and data, perform necessary calculations, and run bridge program (internal only). (2-23-2026)

2.04.02

Plan Distribution

The plans are distributed for review to all interested agencies and parties according to the distribution schedules listed in Chapter 3 of this Manual. The Design Engineer will forward the Final Plans to the Specifications & Estimates and Plans & Field Review Section for preparation of the cost estimate and the contract documents. Final contract documents are advertised for bids by the Contracts Section.

2.04.03

Estimating Man-Hours (12-17-2018)

For estimating man-hour requirements of future projects, the average values of recently similar projects will generally serve as a guide, as well as the budgeted dates generated in the Planisware system. If unusual features are anticipated, the man-hour estimate will be adjusted accordingly. (11-19-99)

In estimating the unit's man-hour capabilities, the effects of temporary absences should be anticipated. This accounts for intermittent personnel absences for alternate assignments, training, vacations, holidays, etc. Temporary training assignments for new hires may also be a consideration.

2.04.04

Project History

Unit Design Engineers should keep an accurate and thorough history record of each project. These records are necessary to explain design costs and letting delays. Among items documented should be the changes in scheduling, whether or not the unit leader is aware of the reasons.

2.04.05

Project Contact Person

Prior to Letting, all Contractor requests for information concerning the project should be directed to the engineer who has been designated in the proposal as the project contact person, generally the Project Manager/Cost and Scheduling Engineer. (11-19-99)

2.05

BRIDGE DESIGN QUALITY ASSURANCE & QUALITY CONTROL (5-23-2016)

2.05.01

Overview

A. To ensure bridges are designed correctly, with no errors once the design calculations, drawings, and specifications are finalized, MDOT requires QA/QC procedures in accordance with this section.

B. The MDOT Bridge Design QA/QC program consists of organizational procedures established to ensure a deliberate and systematic program that reduces the risk of introducing errors and omissions into bridge design final contract documents. The MDOT QA/QC program provides checks and balances within the organization to assure quality in final contract plans and specifications. The MDOT QA/QC program is implemented at different levels or phases of project activity, as defined in the MDOT Bridge Design Manual, the MDOT Road Design Manual, and the MDOT Quality Assurance and Quality Control Process Guide for Project Managers and as included in this section.

C. The rigor and level of resources allocated to QA/QC applications on a given bridge are tempered by the size, complexity, and degree of redundancy in the structural system involved, and by the degree of standardization of the design. For major projects involving unusual, complex, and innovative features, a peer review may be desirable to raise the level of confidence in the quality of design and construction.

2.05.02

Definitions

A. Quality Control (QC).

Procedures followed within a unit or working group to check the accuracy of the calculations, drawings, and specifications for the purpose of detecting and correcting design omissions and errors to accomplish the overarching goal of producing complete and error free final plans and specifications. QC occurs continuously throughout the course of a project.

B. Quality Assurance (QA).

Review procedures followed by staff outside the unit or working group to ensure the QC procedures were effective in preventing mistakes and promoting consistency in the development of bridge design calculations, drawings, and specifications.

C. Program Level Quality Assurance (PLQA).

Review procedures followed by management to assure the effectiveness of QC and QA procedures in verifying and measuring the level of quality of the entire bridge design QA/QC program.

D. Peer Review.

A review by a separate unit or consultant not intimately involved with the design of the structure. Determination of the need for a peer review is made by the Chief Structure Design Engineer, with guidance provided by the MDOT Bridges and Structure Committee. (2-23-2026)

E. Designer.

An individual directly responsible for the development of design calculations, drawings, specifications, and review of shop drawings related to a specific bridge design.

2.05.02

F. Checker.

An individual responsible for performing technical review of design calculations, drawings, and specifications.

G. Reviewer.

An individual responsible for performing QA procedures that ensure that QC procedures were performed properly.

H. Engineer of Record (EOR).

An individual responsible for all aspects of the design of the structure, including the design of all of the bridge's systems and components. This individual is appointed by the bridge owner, and must be a licensed Professional Engineer in the State of Michigan. For MDOT in-house projects, the bridge squad leader is the EOR, and signs, but does not seal the final contract plans. For consultant-designed projects, the EOR is the consultant Project Manager, and is required to seal and sign his/her portion of the final contract plans.

I. Peer Review Engineer

An individual who is a licensed Professional Engineer in the State of Michigan and has recent experience as either a Designer or Checker (as defined in this section of the MDOT Bridge Design Manual) with elements similar to those that will be included in the peer review. While it's preferred that the experience be on projects in Michigan, having Michigan experience is not required. (2-23-2026)

2.05.03

Implementing and Documenting Procedures

A. Qualification of the Designer, Checker, and Reviewer.

The Designers, Checkers, and Reviewers are key personnel providing well-designed, accurate, and constructible plans for use in the construction of bridges. The Designers, Checkers, and Reviewers must be experienced in structural designs and familiar with the current AASHTO bridge design and construction specifications and the MDOT Bridge Design Manual, Bridge Design Guides, and procedures.

1. Designer and Checker.

The following are the requirements for a bridge Designer and Checker.

a. Possess a professional engineer (PE) license in Michigan with experience as a Bridge Engineer. A Designer or Checker without a PE license works under the direct supervision of a professional engineer licensed in Michigan who is the Reviewer and Engineer of Record for the project.

b. Non-engineer staff are often utilized to design and check CADD drawings, develop quantity calculations and perform other non-structural design functions during the course of a project. As noted above, all work is done under the direct supervision of a professional engineer licensed in Michigan who is the Reviewer and Engineer of Record for the project.

c. The Designers' and Checkers' experience is commensurate with the complexity of the bridge being designed. Whenever possible, the experience of the Checker exceeds the experience of the Designer.

2.05.03 A. (continued)

2. Reviewer.

The Reviewer possesses a professional engineer (PE) license in Michigan, and has significant experience in bridge design and is familiar with MDOT's bridge design and construction practices, procedures, and policies.

Implementing and Documenting Procedures (continued)

B. Minimum Items/Areas Required to Be Checked.

Design calculations, design drawings, and contract documents are required to be verified by a Checker with a thorough and comprehensive understanding of the project and design methods. In particular, the following minimum items/areas must be checked:

1. Design Computations and Checks.

   All structural components, including deck, superstructure, and substructure components. The assumptions of the bridge design including general conditions and loadings are documented. Computations needed to determine type, size, and location of the bridge are checked including grade and quantity calculations.

2. Bridge Contract Drawings Checks.

   All components (as described above) of bridge design drawings are checked in detail. Plan notes are checked, including verification of correct materials specified. Plan notes must not alter the work, materials, or method of payment for standard pay items. All quantities and pay items are verified to be in conformance with plan details, and pay item wording checked against MDOT Standard Specifications for Construction or associated special provisions. In cases where the Designer is not the drawing Checker, the Designer at least reviews the drawings to ensure that they are in conformance with the design. After any required changes are made, names or initials are placed on the drawings indicating the individual who prepared the drawing, the individual who modified the drawing (as needed), and the Designer. The plans include the name of the unit or work area responsible for the plans. Consultant plans include their company logo.

3. Bridge Design Contract Document Checks.

   All special provisions are reviewed for appropriateness with respect to the contract plans and pay items and MDOT Standard Specifications for Construction. All permits, certifications, clauses and other supporting information are reviewed to ensure they are complete and correspond with the plans and remainder of contract package and that there are no conflicts between any documents.

Implementing and Documenting Procedures (continued)

C. QC Procedures.

1. A supervisor or team leader is responsible for determining the necessary technical knowledge and experience of the Designer and Checker for that specific design. Designers and Checkers are assigned to bridge projects by matching experience and performance to project complexity.

2. The Checker is responsible to the supervisor for quality control of the design, which includes checking the design calculations, plans, and specifications to assure accuracy and constructability. One hundred percent of all design calculations, quantity calculations, plans, and specifications are checked as part of the QC process.

3. All bridge plan sheets include the names or initials of the person who drafted the details along with the Checker of the sheet and the date last revisions were made to that plan sheet. See Guidelines For Bridge Plan Preparation (MDOT Sample Plans Bridge) of Development Guide (Design Submittal Requirements Chapter 7) for guidelines related to drafting and plan preparation.

4. All special provisions include the author's initials and work area identifier, and are subject to a well-defined review process facilitated by MDOT's Quality Assurance Section that includes various subject matter experts.

   a. Unique special provisions authored specifically for a project are drafted by the Designer or support area and submitted for review and approval during the course of the project.

   b. Previously approved special provisions can be used as long as approved in the current Standard Specifications for Construction edition year, and are reviewed by the Designer to assure that the entire content is appropriate for a project. (12-17-2018)

   c. Frequently used special provisions are utilized on projects as noted in specific use statements and are incorporated into the project without any changes.

5. Software programs such as MDOT's Bridge Design System, MDX, or Leap Bridge, various finite element modeling programs, among others, are often too complex for a Designer and Checker to review and confirm directly. The Designer and Checker must fully understand the methodology, assumptions, and limitations of each program prior to utilizing output on a project. This can be accomplished through review of all available program documentation and independent verification with hand calculations, spreadsheets or other known and proven software.

Implementing and Documenting Procedures (continued)

6. All design calculations include name or initials of the Designer and Checker along with the date designed and checked.

   a. Hand calculations have a "prepared by", and "checked by" notation for each page of the calculations.

   b. Spreadsheets, MathCad calculations, and computer programs have a "prepared by" and "checked by" notation on the user input and results pages. These sheets are generated specifically for a project, or are utilized from a previous project, sometimes generated by others. The Checker is responsible for reviewing the data input, and the Designer and Checker must have a full understanding of the methodology, assumptions, and limitations of the program or spreadsheet and be able to verify that they are appropriate for the design.

7. All calculations are checked vs. the Final Package Submittal for the project.

   a. All dimensions, member sizes, bar sizes from design calculations are verified to match plan dimensions.

   b. Reinforcing steel takeoffs are performed and verified for consistency between detail drawings and Steel Reinforcement Detail sheets.

   c. A final cost estimate (project verification estimate) is printed, and the wording for each pay item is verified for consistency between the cost estimate, plan drawings and (if applicable) special provisions.

8. Calculations.

   At the completion of the project, provide a set of design calculations for all elements of the bid package for the design file. All calculations include completed "prepared by" and "checked by" fields. Consultants provide calculations sealed/stamped and signed by the Engineer of Record for the project, who is licensed in Michigan. Design calculations are stored within the project file in ProjectWise and hard copies (if applicable) are stored in the MDOT Design Unit in accordance with the MDOT plan retention policy.

9. The design file includes (but is not limited to) the following.

   a. Design calculations.

   b. Check calculations (e.g. to verify computer output, if applicable).

   c. Supporting reports (e.g. geotechnical recommendations).

   d. Cost estimates including quantity calculations and supporting documentation

   e. Review comments/resolutions.

   f. Documentation substantiating the completion of Quality Control and Quality Assurance procedures in accordance with this document and other accepted standards.

Implementing and Documenting Procedures (continued)

D. QA procedures.

1. The MDOT Quality Assurance and Quality Control Process Guide for Project Managers provides a deliberate and systematic process for plan development and quality assurance. These processes are further defined in other sections of the MDOT Bridge Design Manual and the MDOT Road Design Manual.

2. The MDOT Design Division Quality Assurance Section performs QA during The Plan Review, Final Project Coordination (FPC), Plan Completion (Omissions and Errors Check) and Final Package Submittal stages of each project. The Quality Assurance Section reviews all project contract documents, facilitates department wide review, and documents all review comments in accordance with section 14 of the MDOT Road Design Manual. (12-17-2018)

3. In accordance with National Bridge Inspection Standard requirements, a load rating is performed for each bridge rehabilitation and bridge replacement/new construction project. For bridge rehabilitation projects, a preliminary load rating is typically performed at The Plan Review stage, and finalized at the Plan Completion stage. For new or reconstructed bridges, load rating is typically performed at Plan Completion stage. Load rating calculations serve as a QA of structural design of the beams for projects, and feedback is provided to the Designer if deficiencies are discovered.

4. MDOT's Bridge Field Services (BFS) section performs QA at the Plan Completion (Omissions and Errors Check) stage of each project. BFS maintains a plan review checklist

comprised of focus areas for plan reviews based on past experience with construction issues. BFS focuses specifically on constructability and structural fabrication aspects of bridge projects and provides feedback to the designer for incorporation into the final project package.

5. QA is performed by the project supervisor or team leader at various times during the project and at The Plan Review, Final Project Coordination, Plan Completion, and Final Package submittal stages. While QC is performed on one hundred percent of project documents, the level of QA performed by the supervisor or team leader is subject to the supervisor's discretion based on a combination of factors such as experience of the Designer and Checker, complexity of the project, uniqueness of project parameters and details. (12-17-2018)

6. PLQA is performed by the Chief Structure Design Engineer to ensure that the bridge design units, consultant coordinators, and consultant design teams are performing adequate QA/QC in accordance to this document. This involves periodic review of a representative sample of bridge design units and consultant coordinator projects at selected project milestones. The Chief Structure Design Engineer may assign peer reviews to promote consistency and uniformity between MDOT working units and between MDOT in-house and consultant designers. Performance measures will be developed and used to track progress in key areas. (2-23-2026)

7. If the QA review shows evidence that the proper QA/QC process is not being properly followed, a more rigorous review of the QA/QC process documentation is performed, and recommendations are provided.

2.05.03

Implementing and Documenting Procedures (continued)

E. In-House Design Quality Control/Quality Assurance.

All bridges designed by MDOT are reviewed in compliance with this document and the referenced manuals and procedures. Each work unit documents a process for implementing the procedures to assure consistency within the Bridge Design Section.

F. Design Consultant Quality Control/Quality Assurance.

1. Every consultant performing bridge design for MDOT is required to have its own QA/QC process in place. As part of the prequalification application, each consultant must submit a Quality Control Plan in accordance with the MDOT Consultant Prequalification Instructions. The QA/QC program document is available to the MDOT consultant coordinator to review as necessary throughout the course of a project.

2. Project proposals define the QA/QC program and responsibilities specific to a project. In general, each prime consultant and sub consultant follows their own documented QA/QC procedures on file with their prequalification. Additionally, the prime consultant for a project is responsible for project level QA of sub consultant's deliverables to assure uniformity within the project and to assure that sub consultant's procedures are being followed. Documentation of QA/QC procedures for a specific project will be furnished to MDOT at any point during a project upon request.

2.05.03 D. (continued)

3. At the completion of a project, the consultant furnishes the completed design package, including all design calculations, quantity calculations, and documentation of completed QA/QC along with a letter certifying completion of QA/QC.

4. Consultant design contracts have clauses protecting MDOT from design errors and omissions by requiring that the consultant's work meet "sound, prudent, appropriate, and required professional standards and practices," and that the consultant will promptly revise work that does not meet MDOT criteria, at no additional cost to MDOT.

5. The Consultant Coordinator or Project Manager assures that the documented QA and QC program is followed by the consultant in accordance with this document and the project QA/QC program by performing cursory checks of submittals and contract documents throughout the course of the project and requiring changes as appropriate. Additionally, consultant coordinators will verify reasonableness of the design based on knowledge of design standards and engineering judgement.

6. At the completion of each project, consultants are rated via performance evaluations. Past performance is a part of the scoring criteria for proposals for all Quality Based Selections. Consultants are also scored based on the experience of their QA/QC review team and the quality of their QA/QC plan as detailed in a project proposal.

2.05.03

Implementing and Documenting Procedures (continued)

G. Corrective Actions.

QA/QC procedures are implemented on all projects. Through the PLQA, the overall program is continually monitored for effectiveness. When level of QC or QA is found to be insufficient, corrective actions are required.

1. The following actions are taken if QA or PLQA reviews indicate that a specific design unit, consultant, or consultant coordinator is not following the process.

    a. The representative sample of projects for that unit or coordinator is increased until the Chief Structure Design Engineer is satisfied that the issue is corrected. (2-23-2026)

    b. Concerns with consultant's performance are noted on consultant's review at the completion of the project.

    c. Concerns with MDOT staff member's performance are reflected in the staff member's annual performance review or interim performance review, depending on severity.

2. If, during the review of project submittals, it is evident that the consultant team has not followed QA/QC practices, payment for hours associated with QA of a project as negotiated prior to the start of a project can be withheld.

2.05.04

Peer Reviews

Determine the need for a peer review based on the following factors:

- The Department's level of expertise relevant to the elements included in the design of the project.
- The use of new or innovative design or construction methodologies.
- The assessed risk on the project due to:

    1. The redundancy of the structure.
    2. The feature intersected by the structure, with features like navigable waterways, environmentally sensitive areas, and multi-level interchanges typically increasing the risk to the project.
    3. The complexity of the required design details.
    4. The existing geotechnical conditions.
    5. The existing hydraulic conditions and the construction sequence required to permit the project.
    6. The construction sequence.
    7. The construction schedule.
    8. The operational importance of the structure.

Other factors may also be used to assess the need for a peer review on a project. Consider a peer review of projects where the scope of work leads to increased risk to the Department. Consider factors such as:

- Work on bridges that are part of an international border crossing.
- Work on bridges with non-redundant steel tension members (NSTM).
- Work on bridges that are unique structure types or fall outside of the current design standards. This may include, but is not limited to:

    1. Bridges designed as a frame;
    2. Post-tensioned concrete box girders;
    3. Arches (excluding buried culverts);
    4. Suspension or cable stay spans.

2.05.04 (continued)

- Work on bridges with movable spans.
- Accelerated Bridge Construction techniques including, but not limited to:
  1. Superstructure slide
  2. Self-propelled modular transporters (SPMTs)
- Girder launching to construct the superstructure.
- Straddle bent piers.

Potential scope of work items for a peer review includes, but is not limited to the following:

- Reviewing all relevant design calculations prepared by the EOR. Review the design calculations after all required QC checks have been completed by the EOR.
- If required on a project, review the Structure Study after all required QC and QA checks have been completed and before submittal to the Chief Structure Design Engineer.
- Review the plans at the Plan Review milestone to verify that the details reflect the calculations developed for the project, account for the existing conditions at the site, and reflect the agreed to construction sequence.
- Review the plans at the Final Plan Coordination (FPC) milestone to verify that the details reflect the calculations developed for the project, that the plans are complete and account for the existing conditions at the site, and reflect the agreed to construction sequence.

The Peer Review Engineer selected to complete the peer review must be independent from the in-house Bridge Design Unit or the Consultant serving as the EOR for the project.

2.05.04 (continued)

For in-house designed projects, it is desired to determine if a peer review is warranted on a project as part of the Scope Verification phase of the project. A peer review can be initiated after the Scope Verification is completed if a factor warranting a peer review is identified during a later phase of the project. The Chief Structure Design Engineer in consultation with the EOR for the project is responsible for evaluating the project and for making a recommendation if a peer review is warranted based on these guidelines. The Peer Review Engineer may be another in-house design unit or a Consultant meeting the minimum requirements specified in Section 2.05.02.I. (2-23-2026)

For Consultant designed projects, determine if a peer review is warranted prior to developing the Consultant Request for Proposal (RFP) documents. The Chief Structure Design Engineer in consultation with the Consultant Coordinator for the project is responsible for evaluating the project and for making a recommendation if a peer review is warranted based on these guidelines. The Consultant RFP documents must state that a peer review will be implemented on the project. The Peer Review Engineer must be another Consultant meeting the minimum requirements specified in Section 2.05.02.I. Select the Consultant Peer Review Engineer using a separate requisition and Contract. The Consultant Peer Review Engineer shall not be a subconsultant to the Consultant EOR. (2-23-2026)

A peer review does not relieve the EOR of ensuring that both Quality Control and Quality Assurance reviews are completed in compliance with Section 2.05 of the Bridge Design Manual. The EOR is still responsible for the completeness and accuracy of the work performed under their supervision.

The Peer Review Engineer is expected to participate as part of the project team from the beginning of the project, so they have the same understanding of the project scope of work, project goals and constraints, and project risks as the EOR.

2.05.05

Role of Federal Highway Administration (FHWA)

A. Initial Review and Approval of Program.

The general role of FHWA Division Office is to review each State Highway Agency (SHA) QA/QC Program and to ensure the QA/QC program is thorough, effective, documented, and followed. Further, it is the role of the FHWA Office of Bridge Technology to assure uniformity within division offices regarding implementation of this guidance.

B. Periodic Program Reviews.

FHWA division offices may perform periodic reviews of the MDOT's programs. Upon request, MDOT will provide project documents to the FHWA division office for review, in accordance with the Federal-Aid Stewardship Agreement. The need of periodic reviews depends on the complexity of the bridge projects.

2.05.06

References and Other Sources of Information (11-24-2025)

A. MDOT Bridge Design Manual

The procedures involved in preparing bridge plans, quality control and quality assurance are interlaced within Chapters 1 – 5. (11-24-2025)

B. MDOT Road Design Manual

Specifications and Special Provisions guidance are addressed in Chapter 11. (12-17-2018)

Procedures for plan preparation are addressed in Chapter 14.

2.05.06 (continued)

C. Preconstruction Process Documentation (PPD) Task Manual (5-22-2023)

Documents the preconstruction process as it pertains to project development. Networks based on the PPD Tasks are used to plan and to track virtually every aspect of a project design schedule.

D. Guidelines For Bridge Plan Preparation (MDOT Sample Plans Bridge)

Bridge sample plans including plan sheet examples of typical plan set detailing preferred details and drafting procedures.