

BRIDGE DESIGN MANUAL

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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 constructing and rehabilitating bridges and other structures on the trunkline system. Subsequent chapters will expand on this overview. Use this chapter in conjunction with [RDM Chapter 14](#).

2.01 SOURCES OF ASSIGNMENT

No work can be started until a project has been programmed and the Preliminary Engineering phase has been obligated. Projects are typically programmed by the Region Bridge Engineer and approved by the Bureau of Bridges & Structures (BOBS) Bridge Program Performance Engineer. Programming is based on available funding as appropriated by the Federal and State Transportation legislation.

2.01.01 Rehabilitation/Preservation Programs

(11-19-99)

Michigan Department of Transportation (MDOT) Regions and MDOT BOBS – Office of Structure Preservation 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.

2.01.02 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.

2.01.03 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 [RDM Chapter 12](#).

2.01.04 Region/TSC Requests

The Region Engineer/TSC Manager 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.

2.01.05 Privately-Owned Facilities

Occasionally MDOT will agree to perform work on privately-owned facilities at the request and expense of private parties. Any work outside MDOT ROW requires compliance with the Federal Highway Uniform Act. Consult the Region Real Estate Agent or Central Office Real Estate Services Section.

2.01.06 Bridges to Remain in Place

(2-23-2026)

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 publications, *A Policy on Design Standards - Interstate System* or *A Policy on Geometric Design of Highways and*

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Streets, 2018, 7th 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.

2.01.07 Design-Build Projects

If work is to be performed using the Design-Build delivery model, the plan development and review process will be completed in accordance with the [MDOT Design-Build Guidelines, 3rd Edition](#), in cooperation with the Innovative Contracting Unit.

Design-Build projects are typically managed by a TSC representative. When bridge work is involved, a Bridge Design representative is typically assigned, and serves as a subject matter expert for bridge related elements of the project.

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2.02 DATA SOURCES

Throughout the design process, the Design Engineer will request data from various sources to assist in the development of a bid package. Sources to be used are listed in the following paragraphs.

2.02.01 Engineering Reports

(6-24-2019)

If Early Preliminary Engineering (EPE) or Planning and Environmental Linkages (PEL) study has been performed for a project, the resulting documentation 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 (EGLE) permit and mitigation consideration, etc. It is essential that the design parameters established in the documentation be closely followed in the preparation of the plans.

2.02.02 Environmental Impact Statement, Environmental Assessment or Categorical Exclusion

(12-17-2018)

All three documents will provide the Engineer with valuable information regarding the project. For definitions see BDM Sections [12.12](#) and [12.13](#). 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.

2.02.03 Asbestos Survey Data

(11-24-2025)

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 BDM Section [14.13.05](#).

2.02.04 Road Design

If the bridge project is within the limits of a road project, Road Design Plans will provide proposed alignments and grades in detail, and will provide cross-sections of the approaches.

If a stand-alone bridge project impacts the approaching roadway, the Design Engineer must coordinate road work with the Region Design Engineer to request approach roadway project deliverables.

2.02.05 Survey Data

(5-28-2013)

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 MDOT Design Division, Survey Support Section.

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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 Survey Support Section. The Survey/Mapping Action Request, ([Form 0226](#)), is available from the MDOT web site.

2.02.06 Geotechnical Data

(3-26-2018)

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 will be provided. The Geotechnical Services Section will also design foundation piling to account for the effects of scour on the stability of the structure. For additional information, refer to BDM [Section 3.01](#).

For rehabilitation projects that may result in load increases on foundations, a foundation analysis may be required and consult with the Geotechnical Services Section.

2.02.07 Hydraulic and Scour Data

(11-19-1999)

The Design Engineer must request hydraulic analyses from the Hydraulic Unit to determine required waterway openings, scour countermeasures, and backwater calculations for proposed stream crossings. To accomplish this in time, the Hydraulic 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.

2.02.08 Railroad Data

(10-22-2012)

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 BDM [Chapter 11](#), Railroad Crossings, for additional details.

2.02.09 Aesthetic Recommendations

Consideration should be given to providing motorists with an unobstructed view of surrounding scenery. 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

(12-17-2018)

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.

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2.02.11 Permits

(6-24-2019)

The Design Engineer, along with the 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 BDM [Chapter 12](#), Permit Applications, for additional information.

Application for EGLE permits should include detailed plans of any proposed haul route necessary to access the project site. See BDM Section [2.02.15](#) for additional information.

2.02.12 Screening Requests and Ornamental Fencing

(3-28-2022)

When work is performed on structures, the Region Bridge Engineer should be contacted to determine if pedestrian screening should be added, especially on structures in urban areas such as the Metro Region.

Requests to add ornamental fencing to structures are determined during the project planning process or at project scoping. Refer to the ornamental fencing guidelines in BDM Section [7.05.06](#). Region Bridge Engineers and Bridge Design Project Managers may be involved in this process.

2.02.13 Bridge Records

(11-19-1999)

Before starting work on an existing structure, the Design Engineer should review available bridge records including existing plans, bridge inspection reports, work history and recommendations (in MiBRIDGE), and the 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.

2.02.14 Traffic and Safety Data & Road Safety Audit

(2-21-2017)

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.

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

2.02.15 Preliminary Constructability Review

(12-17-2018)

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](#)). The Project Manager should consult with the Region/TSC Construction Engineer, the Region Bridge Engineer, BOBS Bridge Construction and Design Engineer/Cost and Scheduling Engineer concerning items such as Coordinating with other Agencies, Permits,

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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/Construction Engineer for comment. On large projects with complex staging, one or more meetings with the Resident/Construction 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 ProjectWise.

2.02.16 Scope Verification Meeting

(12-16-2019)

Design Engineers should verify the scope of work for all programmed bridges, structures, etc. The Design Engineer will request a scope verification meeting that includes the Region/TSC Project Development Engineer, Cost and Scheduling Engineer, Resident/Construction Engineer, Bureau of Bridges and Structures (BOBS) Bridge Construction Engineer, and the Region Bridge Engineer. Invite the Region Real Estate Agent to the Scope Verification Meeting for any projects that have work, both temporary and permanent, outside the Right-of-Way. The programmed scope of work must accommodate all legal users of the bridge or structure.

For all projects, the scope verification meeting should include a discussion regarding 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 an EGLE permit (for waterway, wetland crossings, etc.).

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 Project Manager will submit a Change Request in JobNet to reflect project changes.

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 a Design Exception (DE) form ([Form DE26](#)) or Design Variance (DV) form ([Form DV26](#)) should be completed as early as possible in the design process as required. 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.

For additional information see BDM Sections [12.00-12.03](#) as well as RDM [Chapter 3](#). See RDM Section [14.11](#) for Design Exception / Design Variance submittal procedures.

2.02.17 Region/TSC Maintaining Traffic Recommendations

(3-20-1992)

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

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2.02.18 The Plan Review Meeting

(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 Construction Engineer and MDOT BOBS Construction Section. See RDM [Section 14.36](#) for more information.

2.02.19 Final Constructability Review

For information on final constructability review, Preconstruction Process Documentation (PPD) Task Description #3860, see RDM [Section 14.50](#).

2.02.20 Final Project Coordination Meeting

For information regarding the Final Project Coordination Meeting (FPC) see BDM Section [3.03](#) and RDM [Section 14.54](#).

2.02.21 Omissions / Errors Check (OEC)

For more information regarding OEC sign off see BDM Section [3.04](#) and RDM [Section 14.57](#).

2.02.22 Rehabilitation Project Scoping

(12-17-2018)

For information on Project Scoping refer to the [MDOT Scoping Manual](#).

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 BDM [Chapter 3](#) and [Chapter 4](#).

The Utility coordination process, in particular, should be initiated shortly after the project has been assigned.

2.03.01 Risk Based Project Involvement (RBPI)

(3-23-2026)

The Federal Highway Administration (FHWA) Michigan Division uses a risk-based stewardship and oversight (RBSO) approach to determine how and when the FHWA is involved in programs and projects, while remaining consistent with statutes, regulations, Executive orders, and administrative and financial controls. RBSO integrates risk management into the FHWA performance planning process to identify agency-wide stewardship and oversight (S&O) initiatives. See the [Michigan Division Risk Based Project Involvement Guidance](#) document.

2.03.02 Study

(12-28-2020)

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. The study also details structure options considered, constructability considerations, utility impacts and maintenance of traffic considerations.

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Generally, projects with federal funding (including projects identified as RBPI projects by FHWA) no longer require FHWA approval of the study unless the bridge is on the interstate system and meets one or more of the following criteria:

- Has difficult or unique foundation challenges
- Involves a new or complex design with unique operational or design features
- Has an exceptionally long span (exceeding 500 feet)
- Is designed with procedures that depart from currently recognized acceptable practices.
- Overall length exceeding 1500 feet, or excessive width.

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](#).

2.03.03 Preliminary Plans

Once the study is approved, preliminary plans and preliminary estimate of cost are prepared by the Design Unit for review by the project team, affected utility companies, MDOT Quality Assurance, municipalities, and other project stakeholders.

2.03.04 Final Plans

Work on final plans can begin the Plan Review has occurred, 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 Changes During Plan Preparation

(12-17-2018)

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.

For bridge construction, rehabilitation, or preventative maintenance projects, a JobNet Change Request should be submitted to the Bridge Program Performance Engineer for approval. Change Requests 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.

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.

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

2.03.06 Changes after Plan Completion

(2-23-2026)

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. See RDM [Section 14.63](#) for more information.

2.03.07 Authority for Bridge Closures

(2-22-2021)

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](#).

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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 Leader will assign the project to an Engineer for plan preparation.

2.04.02 Plan Distribution

The plans are distributed for review to all interested agencies and parties according to the distribution schedules listed in RDM [Chapter 14](#). For stand-alone bridge projects, the Design Engineer will develop all plans, proposal, cost estimate and supporting documents for project review and submittal. For bridge projects that are packaged with road projects, the Design Engineer will generally submit plans, proposal, and cost estimate to the Region or TSC Project Manager for packaging. Final contract documents are advertised for bids by the Bureau of Finance and Administration, Contract Services Division, Construction Contracts Unit.

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.

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 Project Manager is aware of the reasons.

2.04.05 Project Contact Person

(11-19-1999)

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.

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2.05 BRIDGE DESIGN QUALITY ASSURANCE & QUALITY CONTROL

(5-23-2016)

2.05.01 Overview

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

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.

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

(2-23-2026)

A. Quality Control (QC)

1. 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)

1. 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)

1. 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

1. 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.

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E. Designer

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

F. Checker

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

G. Reviewer

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

H. Engineer of Record (EOR)

1. An individual responsible for all aspects of the design of the structure, including the design of all 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 inhouse 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

1. 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.

2.05.03 Implementing and Documenting Procedures

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

1. 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 design and familiar with the current AASHTO bridge design and construction specifications and the MDOT BDM, [Bridge Design Guides](#), and procedures.
2. The Designer and Checker.
 - a. The following are the requirements for a bridge Designer and Checker.
 - 1) Possess a professional engineer (PE) license in Michigan with experience as a Bridge Engineer.
 - a) A Designer or Checker without a PE license works under the direct supervision of a professional engineer licensed in Michigan who is the Reviewer or Engineer of Record for the project.

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- 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 or Engineer of Record for the project.
- 2) 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.

3. Reviewer

- a. The following are the requirements for a bridge Reviewer.
 - 1) The Reviewer possesses a professional engineer (PE) license in Michigan.
 - 2) The Reviewer has significant experience in bridge design and is familiar with MDOT's bridge design and construction practices, procedures, and policies.

B. Minimum Items/Areas Required to Be Checked.

- 1. 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:
 - a. Design Computations and Checks.
 - 1) All structural components, including deck, superstructure, and substructure components.
 - 2) The assumptions of the bridge design including general conditions and loadings are documented.
 - 3) Computations needed to determine type, size, and location of the bridge are checked including grade and quantity calculations.
- 2. Bridge Contract Drawings Checks.
 - a. All components (as described above) of bridge design drawings are checked in detail.
 - b. Plan notes are checked, including verification of correct materials specified.
 - c. Plan notes must not alter the work, materials, or method of payment for standard pay items.
 - d. 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.

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- e. 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.
- f. 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.
 - 1) 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.

- a. All special provisions are reviewed for appropriateness with respect to the contract plans and pay items and MDOT [Standard Specifications for Construction](#).
- b. 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.

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 the project's 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) or 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.

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- 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.
- 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 against 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.
 - a. At the completion of the project, provide a set of design calculations for all elements of the bid package for the design file.
 - b. All calculations include completed "prepared by" and "checked by" fields.
 - c. Consultants provide calculations sealed/stamped and signed by the Engineer of Record for the project, who is licensed in Michigan.
 - d. 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.

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- 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.

D. QA procedures.

1. A systematic process for plan development and quality assurance is defined in other sections of the MDOT BDM and the MDOT [RDM](#).
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 RDM [Chapter 14](#).
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 is 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. 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 the experience of the Designer and Checker, complexity of the project, uniqueness of project parameters and details.
5. 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 with 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.

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6. 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.
- E. In-House Design Quality Control/Quality Assurance.
1. 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.
 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.
- G. Corrective Actions.

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1. QA/QC procedures are implemented on all projects. Through the PLQA, the overall program is continually monitored for effectiveness. When the level of QC or QA is found to be insufficient, corrective actions are required.
2. 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.
 - b. Concerns with the 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.
3. 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:

1. The Department's level of expertise relevant to the elements included in the design of the project.
2. The use of new or innovative design or construction methodologies.
3. The assessed risk on the project due to:
 - The redundancy of the structure.
 - 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.
 - The complexity of the required design details.
 - The existing geotechnical conditions.
 - The existing hydraulic conditions and the construction sequence required to permit the project.
 - The construction sequence.
 - The construction schedule.
 - 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:

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- A. Work on bridges that are part of an international border crossing.
- B. Work on bridges with non-redundant steel tension members (NSTM).
- C. 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
- D. Work on bridges with movable spans.
- E. Accelerated Bridge Construction techniques including, but not limited to:
 - 1. Superstructure slide
 - 2. Self-propelled modular transporters (SPMTs)
- F. Girder launching to construct the superstructure.
- G. Straddle bent piers.

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

- A. Reviewing all relevant design calculations prepared by the EOR. Review the design calculations after all required QC checks have been completed by the EOR.
- B. 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.
- C. 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.
- D. 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.

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 BDM [Section 2.05.02.1](#).

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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 BDM [Section 2.05.02.1](#). 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.

A peer review does not relieve the EOR of ensuring that both Quality Control and Quality Assurance reviews are completed in compliance with BDM [Section 2.05](#). 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.
 - 1. 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.
- C. 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 for periodic reviews depends on the complexity of the bridge projects.

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2.05.06 References and Other Sources of Information

(5-22-2023)

1. MDOT Bridge Design Manual
 - The procedures involved in preparing bridge plans, quality control and quality assurance are interlaced within Chapters 2-5.
4. MDOT Road Design Manual
 - Specifications and Special Provisions guidance are addressed in [Chapter 11](#).
 - Procedures for plan preparation are addressed in [Chapter 14](#). Procedures for plan preparation for projects requiring Right-of-Way are addressed in [Chapter 5](#).
5. Preconstruction Process Documentation (PPD) Task Manual
 - 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.
6. 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.