

Bridge Design Scope of Work

1.0 PROJECT OVERVIEW

STATE has programmed the rehabilitation and reconstruction of existing Bridge 5900 to carry Trunk Highway 43 over the Mississippi River in Winona, Minnesota as part of State Project No. 8503-46. STATE intends to deliver this project through the Construction Manager/General Contractor (CMGC) delivery method as described in subsequent sections of this Scope of Work.

Bridge 5900 is eligible for listing on the National Register of Historic Places. Due to this designation and since the project is receiving funding from the Federal Highway Administration (FHWA), the project must comply with Section 106 of the National Historic Preservation Act of 1966 and the rehabilitation approach must meet the Secretary of the Interior's Standards for the Treatment of Historic Properties (SOI Standards) in order for the project to avoid an adverse effect. From 2009 to 2013, a scoping study was performed, which resulted in a preferred rehabilitation alternative. The results of the preferred rehabilitation and reconstruction alternative are shown in the Preliminary Bridge Plans for Bridge 5900.

CONTRACTOR will be required to refine the rehabilitation and reconstruction details to determine the Final Bridge Reconstruction and Rehabilitation Recommendations. To do so, CONTRACTOR will work collaboratively with the Project Historian to develop rehabilitation plans and Special Provisions that meet the SOI Standards. The Final Bridge Reconstruction and Rehabilitation Recommendations will be made through a process of ongoing investigation by CONTRACTOR, and collaboration with the Project Historian and other stakeholders engaged in the process. This project will be reviewed in accordance with a Section 106 Programmatic Agreement (PA) that has been established for the project.

A summary of work to be completed through this contract includes:

- a) Detailed analysis for completion of itemized TASKS (described later in this article)
- b) Development of visualizations and reports for use in collaborative evaluation
- c) Schedule allowances for review and collaboration amongst stakeholders
- d) Collaborative development of Final Bridge Reconstruction and Rehabilitation Recommendations
- e) Final Design Services for delivery of this CMGC project. This includes development of 30%, 60%, and 90% Plans, quantities, and Special Provisions, followed by certified construction plans and Special Provisions for a Final Issue for Bid Package for the rehabilitation and reconstruction of Bridge 5900.

NOTE: Items excluded from this scope of work include:

- a) Cost estimates
- b) Design of grading plans for the entire project and design of the new upstream Bridge 85851.
- c) Project Historian effort (Project Historian will be provided through MnDOT CRU).

STATE has determined this to be a major structure and will require an independent peer review of the bridge design, as described in subsequent sections of this scope of work.

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Description of Existing Bridge 5900:

Bridge No 5900 was constructed from 1941-1942 and includes 24 spans, for a total length of approximately 2,282 feet. The bridge has undergone several repair projects, including the replacement of the deck on spans 1, 2, 15-24, the placement of an overlay on the original deck (spans 3-14), widening of the roadway to 31 feet, replacement of concrete girder approach spans 1 and 2 with steel stringer spans in 1985, modifications to accommodate sidewalk support brackets, and addition of a reconfigured sidewalk. The 1985 repairs also included reconstruction of expansion joints, installation of bearings under beams that were added, and installation of a deck drainage system. Subsequent repairs were completed to the concrete piers in 1992 and 1998. The concrete filled panel sidewalk was replaced with a timber planking sidewalk in 2008. Repairs were also made to gusset plate connections and other members in several spans in 2001, 2008, and 2010.

The south approach spans 1 and 2 are continuous steel multi-beam spans; spans 3-14 are the original cast-in-place concrete beams with the addition of the outer line of prestressed concrete beams. Span 15 consists of 3 lines of riveted plate girders. The flanking approach spans leading to the main river spans are riveted steel deck trusses, each approximately 128' long, which includes spans 16 and 17 on the south approach and spans 21-24 on the north approach.

Spans 18-20 are a three-span continuous riveted steel cantilever through truss (approximately 933' in length). The main navigation span (span 19) is 450' long and includes a 200' long suspended span supported by pinned connections at each end. These main river spans (spans 18-20) will be rehabilitated as part of this Contract. All other spans will be replaced in kind.

Avoidance of any adverse effects is key for the project to meet federal laws and be completed on schedule. Final plans for Bridge 5900 will be completed as depicted in the Preliminary Plan and in accordance with the Final Bridge Reconstruction and Rehabilitation Recommendations (developed collaboratively by CONTRACTOR and the Project Historian to ensure compliance with the SOI Standards). Once plans are developed by CONTRACTOR in collaboration with the Project Historian, review and input from STATE, MnDOT's Cultural Resources Unit (MnDOT CRU), the State Historic Preservation Office (SHPO), FHWA, and other Stakeholders will occur.

Traffic will be detoured off of Bridge 5900 during construction. Bridge 85851 (S.B. TH 43) will be constructed first and will carry two-way traffic while Bridge 5900 is rehabilitated and reconstructed.

Bridge 5900 currently has a load posting limit of 40 tons and no permit loads are allowed. The rehabilitated and reconstructed Bridge 5900 should have no load permit restrictions and preferably include selective internal redundancy of key fracture critical components upon completion.

Project information and documents can be found at:

<http://www.dot.state.mn.us/d6/projects/winonabridge/index.html>

<ftp://ftp2.dot.state.mn.us/pub/outbound/district6/Winona%20Bridge/>

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(Check these websites frequently for updates.)

- a) Draft Preliminary Plan for Bridge 5900
- b) Geometric layout for the project
- c) Bridge 85851 Preliminary Bridge Plan
- d) Bridge 85851 Bridge Type Study Report (June 2013)

Additional project information will be provided upon request and includes:

- e) Bridge 5900 2012 Fracture Critical Bridge Inspection Report
- f) Plans and shop drawings for Bridge 5900 (12 sets from 1941 to 2010)
- g) Preliminary Scoping Study Reports
- h) Draft Programmatic Agreement between MnDOT and SHPO

CMGC Project Delivery Method

STATE intends to deliver this project through the Construction Manager/General Contractor (CMGC) delivery method. CONTRACTOR will become part of a collaborative project delivery team consisting of STATE, CONTRACTOR, PEER REVIEWER, Independent Cost Estimator, and the CMGC. STATE will procure the CMGC through a separate process to provide design input regarding construction means and methods, construction sequencing, risk mitigation strategies, innovations, and cost estimating. While the CMGC's input will serve to reduce changes and inefficiencies during construction, responsibility for the construction plans and specifications (i.e. Engineer of Record) will remain with CONTRACTOR and not with the CMGC. Information on STATE's CMGC program, and information specific to the CMGC Request for Qualifications (RFQ) and/or the Request for Proposals (RFP) for this project can be found at:

<http://www.dot.state.mn.us/const/tools/const-manager-general-contractor.html>

The CMGC will develop Opinion of Probable Construction Costs (OPPC) at the 30%, 60%, and 90% design phases based on CONTRACTOR submittals. CONTRACTOR will be required to participate in design review workshops and price reconciliation meetings at STATE's request.

The breakdown of Work Packages for the overall project is as follows:

- Work Package 1 – Early foundations for Bridge 85851 (delivered separately through MnDOT Contract No. 04040).
- Work Package 1A – Bridge 5900 scour mitigation, existing pile exploration, and evaluation of existing river piers for vessel impact (delivered through this contract). Work Package 1A must be submitted to coincide with delivery of Work Package 1.
- Work Package 2 – Remainder of Bridge 85851 design and specifications (delivered separately through MnDOT Contract No. 04040).

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Work Package 3 – Bridge 5900 rehabilitation and reconstruction plans (delivered through this contract). Refer to TASK N for clarification.

Ultimately, the CMGC will have the opportunity to bid the project competitively against an Independent Cost Estimate (ICE) for construction of the project. If the CMGC bidding efforts are unsuccessful, the construction plans and specifications prepared by CONTRACTOR may be used to advertise the project to other bidders.

Description of Anticipated Work

Work under this contract will include several tasks that are necessary to complete the investigation for rehabilitation alternatives **prior** to completion of the bridge plans. An outline of work items is included within this section, with more detailed descriptions of anticipated work in subsequent sections of this scope of work. Since the final determination of some rehabilitation items are subject to further evaluation, CONTRACTOR should base its proposal on the itemization of work items and deliverables as described in detail in this scope of work.

Continuous collaboration with the Project Historian is a requirement for this work. A major goal of the project is to provide reconstruction and rehabilitation to Bridge 5900 in accordance with SOI Standards for rehabilitation such that continued design refinement must work to avoid and minimize adverse effects on the historic property. CONTRACTOR will work closely with the Project Historian to receive direct input during the preparation of several reports (refer to Section 2.5), leading to the development of the Final Reconstruction and Rehabilitation Recommendations. CONTRACTOR should base its proposal on frequent meetings, phone calls, emails and other communication with the Project Historian in order to ensure compliance with the SOI Standards. The collaborative process requires an integrated approach and is not meant to be exclusively supplying plan sets or Special Provisions to the Project Historian for their comment after they are developed.

Outline of Tasks:

- TASK A: Project Management
- TASK B: Data Collection and Analysis
- TASK C: Evaluate Existing Piers for Rehabilitation
- TASK D: Develop Superstructure Cross Section Alternatives (including traffic barrier details) for structural analysis and corresponding truss rehabilitation analysis (spans 18, 19, 20)
- TASK E: Develop Preliminary Bridge Design and Load Rating Criteria
- TASK F: Evaluate Redundancy Alternatives
 - a) Redundancy Alternatives for Existing Trusses (spans 18, 19, 20)
 - b) Redundancy Alternatives for New Construction (spans 16, 17, 21, 22, 23, 24)
- TASK G: Structural Inspection (spans 18, 19, 20)

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- TASK H: Development of Structural Models and Pre-Inspection Load Rating Analysis
- TASK I: Fatigue Life Evaluation
- a) Remaining Fatigue Life Evaluation for Rehabilitated spans (spans 18-20)
 - b) Fatigue Evaluation for Reconstruction (spans 16,17, 21-24)
 - c) Develop Preliminary Bridge Details for reconstruction and rehabilitation
- TASK J: Final Bridge Design and Load Rating Analysis
- a) Develop Final Bridge Design and Load Rating Criteria and Final Load Rating Report (spans 18-20)
 - b) Include Section Loss and Rehabilitated Members in section properties
 - c) Finalize Bridge Rehabilitation Details
- TASK K: Develop Final Bridge Reconstruction and Rehabilitation Recommendations
- TASK L: Develop QA Plan for Design, Fabrication, and Constructability of Trusses, and Develop Salvage and Haul Plan for FHWA Truss Research
- TASK M: Final Design Coordination
- TASK N: Develop Plans, Quantities, and Special Provisions for CMGC Work Packages:
- a) Work Package 1A includes scour mitigation plan for Bridge 5900, development of plans for safe enclosure to sample existing piles, and evaluation of existing piers for vessel impact. This work must be completed on an accelerated schedule to allow for CMGC review process and pricing, to be completed along with work for Early Foundations Contract for separate Bridge 85851. This work must be completed and delivered in accordance with Project Deliverables Schedule (see section 15.5).
 - b) Work Package 3 (includes plans, quantities, and Special Provisions for the rehabilitation and repair of Bridge 5900 delivered to allow for CMGC review process and pricing at 30%, 60%, 90%, and Final Issue for Bid Plans. This work must be completed and delivered in accordance with the Project Deliverables Schedule (see section 15.5).

Prior to commencement of final design, continued structural analysis and evaluation of rehabilitation alternatives is necessary to finalize aspects of the design as outlined in Section 2.5. CONTRACTOR will be required to develop the proposed plans in close collaboration with the Project Historian, and to vet alternatives with the project team. This effort will include brainstorming, focused discussions, risk assessment, alternative concept development, alternative concept refinement, structural load rating evaluation, development of structural plan sheets, development of 3D color visualization graphics, and presentation of alternatives to stakeholder group.

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CONTRACTOR will prepare brief reports that summarize technical findings and will work directly with the Project Historian to obtain input with respect to the SOI Standards. Reports should provide a balance of technical aspects integrated with SOI Standards. (Reports prepared by CONTRACTOR with direct input from Project Historian are required for Tasks C, D, F, and K as noted in Section 2.5 for Section 106 Review Process). CONTRACTOR will also assist with facilitating alternatives analysis evaluation by presenting findings to the project team, including FHWA, STATE, MnDOT CRU, SHPO and the CMGC.

CONTRACTOR will develop Final Bridge Reconstruction and Rehabilitation Recommendations (TASK K) after evaluation of CONTRACTOR's deliverables of reports for TASKS C, D, F, and K, in a collaborative effort with Project Historian, Bridge Office Project Manager, FHWA, STATE, MnDOT CRU, and the CMGC, in accordance with project goals and the SOI Standards.

Reports documenting findings for TASKS C, D, F, and K will be submitted with 30% Plans to MnDOT CRU and the SHPO for review and comment and require a 45-day review period. Resolution of any comments on 30% Plans will be addressed with submittal of 60% Plans, which will also require a 45 day review period. Resolution of any comments on 60% Plans will be addressed with submittal of 90% Plans, which will also require a 45-day review period. (Refer to deliverables schedule.)

2.0 TASK A: PROJECT MANAGEMENT: MEETINGS, QUALITY ASSURANCE WITH INTEGRAL PEER REVIEW, AND COLLABORATION PROCESS

2.1 Contract Administration and Schedule Management

2.1.1 Contract Administration

STATE will provide a Bridge Office Project Manager to give direction to CONTRACTOR's activities. It will be the responsibility of the Bridge Office Project Manager to receive the work produced by CONTRACTOR, review the work for compliance with contract requirements, and to recommend payment for such work.

CONTRACTOR's Project Manager will conduct the administration of the project, which will include communication with STATE, invoicing, supplemental agreements, cost and schedule updates, billing preparation, and other non-technical work. CONTRACTOR will also create an electronic project directory for project file sharing. Project directory standards and file naming standards are available upon request to the Bridge Office Project Manager.

No changes in CONTRACTOR project management or lead design personnel will be made without prior written consent of the Bridge Office Project Manager. STATE will notify CONTRACTOR in writing immediately if there are changes to STATE's project management personnel.

2.1.2 Schedule Management

STATE anticipates that the CMGC will provide a Critical Path Method (CPM) schedule. The Project Design Team will be expected to work together to develop the CPM schedule for this design project. It is anticipated that the deliverables for Work Packages 1 and 1A will be the initial focus of the CPM schedule. (Refer to TASK C for requirements.)

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2.2 Project Meetings

2.2.1 Design Team Kick-Off Meeting

CONTRACTOR will schedule a design kick-off meeting to establish communication protocol for the design, discuss known project issues, and review the project schedule.

CONTRACTOR will receive available project information from STATE, including the most up-to-date Preliminary Plan. At the kick-off meeting, CONTRACTOR will provide its Quality Management Plan (QMP) to STATE. *Note: CONTRACTOR must submit its list of meeting attendees to STATE's Project Manager five days prior to the meeting.*

2.2.2 Project Design Team (PDT) Meetings

STATE will establish a Project Design Team, which will include CONTRACTOR. PDT participants will include:

- CONTRACTOR
- Winona Project Manager
- Bridge Office Project Manager
- Roadway Project Manager (MnDOT District 6)
- Project Historian
- PEER REVIEWER's Project Manager
- FHWA
- CMGC
- MnDOT CRU
- MnDOT CMGC Program Manager
- Design Project Manager for Bridge 85851
- Peer Reviewer's Project Manager for Bridge 85851
- Independent Cost Estimator (ICE)

STATE will schedule bi-weekly progress meetings for the PDT (from January 2014 – June 2014) and monthly progress meetings thereafter through September 2015. No monthly meetings will be held for the months immediately following submittals of the 30%, 60%, and 90% plans.

For the purpose of cost estimating, CONTRACTOR should include 25 half-day meetings. These meetings will be held in addition to the collaborative meetings between CONTRACTOR and the Project Historian. CONTRACTOR and Project Historian must work closely together to develop proposed rehabilitation approaches that meet the SOI Standards, and to bring such approaches together to the PDT.

Meetings will be held at either the Bridge Office in Oakdale, Minnesota, or via teleconference (assume that 12 of the PDT meetings will be teleconferences). CONTRACTOR will coordinate meetings and agenda items with other project stakeholders as necessary. *Note: For PDT meetings, CONTRACTOR's Project Manager and lead superstructure designer must be in attendance. Subcontractors will attend PDT meetings on an as-needed basis, upon*

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approval of the Bridge Office Project Manager. (Assume half-day meeting durations). CONTRACTOR will record and submit meeting minutes to the Bridge Office Project Manager within three business days after each PDT meeting.

2.2.3 Comprehensive Project Team Kick-off Meeting

This meeting is intended to be the kick-off for the overall project team when the following parties are under contract: CONTRACTOR, PEER REVIEWER, Bridge 85851 designer, Bridge 85851 peer reviewer, Independent Cost Estimator, Project Historian, and the CMGC. STATE or STATE's General Engineering Consultant (GEC) will lead this meeting. The anticipated meeting date is mid-January 2014. The goal of the meeting will be to review project information submitted to date, review the CMGC process, schedule, and to review an outline for project risk assessment procedures. STATE anticipates that CMGC process refinements will occur as a result of this meeting.

2.2.4 Additional Project Meetings (as necessary)

CONTRACTOR will facilitate conference calls with the Bridge Office Project Manager, PEER REVIEWER, and Project Historian to discuss meeting minutes, design-specific issues, and peer review comments on deliverables that require resolution. (Assume 2 hour conference calls after preparation of meeting minutes, within 3 days of each PDT meeting).

2.2.5 Public Outreach Activities

CONTRACTOR will participate and provide support and necessary information for public outreach activities through open houses. At a minimum, there will be open houses in Winona near the 30%, 60%, and 90% plan stages. CONTRACTOR will provide all graphics and handouts specific to Bridge 5900. STATE will provide a location and notification of open houses.

2.2.5.1 Supplying Information to Third Parties

Upon request from the Winona Project Manager or the Bridge Office Project Manager, CONTRACTOR will furnish project information, including plan sheets, electronic data files (description of content), and design information to third parties within 10 business days. Information requests received directly by CONTRACTOR will be routed through and approved by either the Winona Project Manager or the Bridge Office Project Manager. When appropriate, this information may be furnished via ftp site, or disseminated by either paper or electronic format. Information may be supplied to only one recipient of an interested party (i.e. a property owner, an owner's attorney, etc.).

2.3 Quality Management Plan (QMP) and Quality Assurance/Quality Control (QA/QC)

CONTRACTOR will develop a Quality Management Plan that specifies how QA/QC activities will be performed for the duration of the project to ensure delivery of a quality product in a timely manner that conforms to established contract requirements. CONTRACTOR will prepare the QMP and distribute it to all project team members, including subcontractors. Components of the QMP must include the following:

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- a) A List of Requirements
- b) Intent of the QMP
- c) Process to integrate MnDOT CRU/SHPO, PEER REVIEWER, CMGC, and STATE input
- d) Technical Document Review Process (for reports and plans)
- e) Checking Procedures
- f) Quality Control Verification
- g) Definitions

The entire design of Bridge 5900 must comply with the requirements of the “Design QC/QA Process” as defined in the MnDOT LRFD Bridge Design Manual, Section 4.1. As part of the QMP, the CONTRACTOR must specifically address what process will be used for the following elements based on the level of complexity as shown:

Intermediate elements:

- a) Truss elements for both the approach deck trusses and main thru-truss
- b) All piers except river piers (piers 18 and 19)

Complex elements:

- c) Gusset plates
- d) River piers (piers 18 and 19)

CONTRACTOR must ensure that the following Quality Control procedures are performed:

- **Design and Plan Sheet Check**

CONTRACTOR is responsible for the completeness and accuracy of its work. Final design calculations and plan sheets must be independently checked and reconciled prior to submittal. Review comments from STATE, the CMGC, and PEER REVIEWER on various plan submittals do not relieve CONTRACTOR of its liability for an inaccurate or incomplete bridge plan. At the 60% and 90% submittals, CONTRACTOR will submit a memo—certified by the Lead Quality Control Checker—that confirms that all aspects of the independent check have been performed in accordance with the QMP.

- **Quantity Check**

Final quantities shown in the plans will be the reconciliation of two independently made sets of calculations. Each set of calculations will be included with CONTRACTOR’s submittals and deliverables.

- **Computer Programs**

All computer programs and/or spreadsheets utilized by CONTRACTOR must be verified by CONTRACTOR through its in-house Quality Assurance Program. Input and output forms with the specific title of the program/spreadsheet will be included in CONTRACTOR’s design and quantity calculations.

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- **Quality Assurance Verification**

CONTRACTOR's Quality Assurance Manager will review the entire plan design and production process to assure the completeness and adequacy of the work, and that it conforms to CONTRACTOR's Quality Assurance procedures.

- **Review Comment Resolution**

At the 30%, 60%, and 90% submittals, PEER REVIEWER will submit comment logs, which document peer review comments, CONTRACTOR's responses, and the status of final disposition. CONTRACTOR is responsible for resolution of comments from PEER REVIEWER and the CMGC, and resolution of red-lined revisions from STATE.

2.4 Peer Review Coordination

STATE has determined this project to be a major structure based on MnDOT's Bridge Design Manual criteria; therefore, a design review with independent design computations will be made by a PEER REVIEWER. CONTRACTOR will cooperate with PEER REVIEWER as part of the project team, and will coordinate the development of design and load rating criteria with PEER REVIEWER at the onset of design. Coordination efforts will be continuous throughout all design phases of the project and will be coordinated through project meetings and conference calls to be scheduled after each PDT meeting.

CONTRACTOR will coordinate formal reviews for concurrence with PEER REVIEWER at the following stages of design:

- a) Design and load rating criteria development
- b) Review of Vessel Impact Study (study provided by Bridge 85851 Engineer of Record)
- c) Model development review for superstructure and substructure analysis and design
- d) 60% Plan Work Package 1A
- e) 90% Plan for Work Package 1A
- f) Final resolution of 90% plan comments (for Issue for Bid Package)
- g) Completion of reports for TASKS identified in section 2.5
- h) Final Bridge Reconstruction and Rehabilitation Recommendations
- i) 30% Plan submittal for Work Package 3
- j) 60% Plan, with independent calculations (final design of bridge is expected to be complete by this stage of the project)
- k) 90% Plan, completely checked and ready for the peer review
- l) Final resolution of 90% Plan comments (for Issue for Bid Package)
- m) Load rating with independent calculations
- n) Special Provisions (at the 60% and 90% submittals for Work Package 1A, and at the 30%, 60%, and 90% submittals for Work Package 3)

The results of the reviews will determine that the design and plans comply with design standards and the established design criteria. The Bridge Office Project Manager will resolve any outstanding issues with CONTRACTOR and PEER REVIEWER.

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2.4.1 Peer Review Process

Contract deliverables that require peer reviews will follow these general guidelines:

- a) CONTRACTOR will coordinate the reviews with PEER REVIEWER, the CMGC, and the Bridge Office Project Manager.
- b) CONTRACTOR will submit six copies (or sets) of each deliverable to STATE (4), PEER REVIEWER (1), and the CMGC (1) in accordance with the contract deliverables schedule.
- c) PEER REVIEWER and the CMGC will return contract deliverables to CONTRACTOR with red-lined notations, corrections, and comments in accordance with the contract deliverables schedule.
- d) CONTRACTOR will arrange a meeting with PEER REVIEWER, the CMGC and the Bridge Office Project Manager to discuss corrections and provide plan interpretation. Any design related issues that arise during the peer reviews should be resolved during these meetings.
- e) CONTRACTOR will either make the revisions suggested by PEER REVIEWER and the CMGC or provide written justification to the Bridge Office Project Manager for proceeding without incorporating suggested revisions.
- f) Upon resolution of any design related issues, CONTRACTOR will submit final deliverables to STATE in accordance with the contract deliverables schedule.

2.5 Section 106 Review Process

Since Bridge 5900 is eligible for listing on the National Register of Historic Places, the project must comply with Section 106 of the National Preservation Act, which provides protection against adverse effects for historic properties. Avoidance of an adverse effect under Section 106 is critical to avoid a Section 4(f) impact under the Department of Transportation Act of 1966, which requires avoidance of adverse impacts to a historic resource unless no prudent and feasible alternative exists.

A Section 106 Programmatic Agreement has been developed for the project, and includes the required review process that will need to occur with development of the project plans in order to ensure the avoidance of an adverse effect to Bridge 5900. The collaboration between CONTRACTOR and the Project Historian is critical in order for the project to meet the schedule and all the required federal review processes.

MnDOT CRU has obtained the services of a Project Historian to help develop the reports and rehabilitation plans that affect the historic nature of the structure. CONTRACTOR will coordinate with the MnDOT CRU representative and the Project Historian from the onset of the project to ensure that the design complies with the Secretary of the Interior Standards for the Treatment of Historic Properties (SOI Standards).

Prior to development of final plans, CONTRACTOR, in collaboration with the Project Historian, will submit reports at key phases of project development for evaluation by FHWA, STATE, MnDOT CRU, SHPO, and the CMGC.

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Further refinement on project details will be assessed with respect to CONTRACTOR-provided analysis and development of details. A collaborative review process between CONTRACTOR and the Project Historian will be required in order to develop *summary reports* prepared and presented by CONTRACTOR at the following key phases:

- TASK C: Evaluate existing piers for rehabilitation (piers 16-23)
Prepare *Summary Report for Pier Rehabilitation – Bridge 5900 with direct input from Project Historian*
Present report to FHWA, STATE, MnDOT CRU, the CMGC, PEER REVIEWER
Develop plans for Work Package 1A (see Work Package 1A delivery schedule)
- TASK D: Develop superstructure cross section alternatives
Prepare *Summary Report for Deck Alternatives – Bridge 5900 with direct input from Project Historian*
Present report to FHWA, STATE, MnDOT CRU, the CMGC, PEER REVIEWER
- TASK F: Evaluate redundancy alternatives
Prepare *Summary Report for Redundancy Alternatives- Br 5900 with direct input from Project Historian*
Present report to FHWA, STATE, MnDOT CRU, the CMGC, PEER REVIEWER
- TASK K: Develop Final Bridge Reconstruction and Rehabilitation Recommendations
Prepare *Summary Report with input from Project Historian*
Present report to FHWA, STATE, MnDOT CRU, the CMGC, PEER REVIEWER
- TASK N: Develop Plans for Work Packages (see Work Package Delivery Schedule)
Prepare *Design Summary Report with direct input from Project Historian at 30%, 60%, and 90% Plan submittals*
- a) Each submittal of TASK C, TASK D, TASK F, and TASK K will require 15 days for MnDOT CRU review.
 - b) Each submittal of 30%, 60%, and 90%, and final plans for Work Package 3 will require 45 days for MnDOT CRU and SHPO reviews.
 - c) Eight copies of all products will be submitted to the Bridge Office Project Manager for distribution and review as follows: MnDOT CRU (2), FHWA (1), Bridge Office (2), D6 (2), PEER REVIEWER (1).

3.0 DESIGN STANDARDS AND GOVERNING DOCUMENTS

All designs will conform to applicable requirements of the following:

- a) Approved Bridge Preliminary Plan (with any approved changes from this project);
- b) Final Bridge Reconstruction and Rehabilitation Recommendations (*Developed by CONTRACTOR*)¹
- c) 2013 AASHTO Agenda Item 25 (Revision 1) – (*Revisions to Gusset Plate Design*)²

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- d) 2013 AASHTO Agenda Item 41 (Revision 1) – (*Revision to MBE for Gusset Plate Rating*)²
 - e) The current American Association of State Highway and Transportation Officials (AASHTO) Load Resistance Factor Design (LRFD) Design Specifications;
 - f) Project Specific Bridge Design and Rating Criteria
 - g) The Manual for Bridge Evaluation, AASHTO, (current edition);
 - h) AASHTO Guide Specifications and Commentary of Vessel Collision Design of Highway Bridges, current edition with interims;
 - i) Foundation Analysis and Design Recommendation (FADR), developed by CONTRACTOR
 - j) MnDOT Bridge Inspection and Field Manual
 - k) MnDOT LRFD Bridge Design Manual (5-392);
 - l) MnDOT Bridge Details Manual Parts I and II;
 - m) In-progress Visual Quality Manual;
 - n) MnDOT Computer Assisted Design & Drafting (CADD) Standards;
 - o) MnDOT Bridge Preservation, Improvement and Replacement Guidelines
 - p) Secretary of Interior Standards for Treatment of Historic Properties (SOI Standards)³
 - q) Secretary of Interior Standards Interpreted for Bridge Repair, Rehabilitation, and Replacement Situations³
 - r) Section 106 of the National Historic Preservation Act of 1966
 - s) MnDOT Management Plan for Historic Bridges in Minnesota
 - t) National Park Service “Preservation Brief No 15, Preservation of Historic Concrete”
 - u) Environmental Assessment (EA)
 - v) Programmatic Agreement between MnDOT and SHPO
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- 1) As previously stated, the Final Bridge Reconstruction and Rehabilitation Recommendations will be developed by CONTRACTOR in a collaborative process that will include direct input from Project Historian and evaluation of CONTRACTOR’s deliverables for TASKS identified in section 2.5.
 - 2) AASHTO AGENDA ITEMS 25 and 41 were approved by AASHTO and will be incorporated into the Design Criteria.
 - 3) MnDOT CRU will make final determination as to whether or not developed plans meet the SOI Standards.

Construction requirements of STATE’s current Standard Specifications for Highway Construction and any supplements thereto on file in the Office of the Commissioner of Transportation must be incorporated into the plans.

Current standard details and plans for various bridge components as illustrated in the MnDOT Bridge Details Manual Part I and Part II will be incorporated into the detail plans whenever applicable. Microstation files are available on the Bridge Office website. It is CONTRACTOR’s responsibility to modify these details for conformance with design.

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4.0 TASK B: Data Collection and Analysis

From 2010 to 2013, a scoping study was performed, which resulted in a preferred rehabilitation alternative (as shown in the Preliminary Plan for Bridge 5900). Key project background scoping information is summarized in the following memorandums and reports:

- a) Winona Bridge Retrofit Concepts – Memorandum October 9, 2009
- b) Winona Bridge – Foundation Study – Memorandum July 28, 2010 [Revised May 13, 2013]
- c) Winona Bridge Scour Evaluation – Memorandum August 11, 2010
- d) Winona Bridge Main Truss Rating – Memorandum October 6, 2010
- e) Winona Bridge Main Truss Gussets – Memorandum October 28, 2010
- f) Winona Bridge Main Span Truss Member and Gusset Plate Rehabilitation – Memorandum December 9, 2010
- g) Winona Bridge Deck Rehabilitation Options – Memorandum February 8, 2011
- h) Bridge 5900 Timber Pile Foundation Testing Feasibility Investigation, August 15, 2011, Revised and Finalized December 1, 2011
- i) Winona Bridge – Spans 1 thru 15 (South Approach) – Memorandum September 16, 2011
- j) Bridge # 5900 – 2012 - Routine Inspection Report 6-15-2012
- k) Bridge # 5900 – 2012 - 7 Day FC Bridge Inspection Report 10-3-2012
- l) Bridge # 5900 – 2012 Routine and Fracture Critical Inspection Report 1-24-2013
- m) Bridge # 5900 – 2013 Routine Bridge Inspection Report 6-10-2013
- n) Programmatic Agreement
- o) Bridge 5900 plans and shop drawings

All bridge plans and inspection reports are available electronically at the following FTP site:

<ftp://ftp2.dot.state.mn.us/pub/outbound/district6/Winona%20Bridge/>

The Programmatic Agreement between MnDOT and SHPO will be made available upon completion of the environmental assessment.

5.0 TASK C: Evaluate Existing Piers for Rehabilitation

5.1 Condition Assessment of Existing Timber Piles

This work includes development of sampling protocol for the assessment of the structural condition of the existing timber pile foundations at select piers. Previous consideration on methods of providing excavation and sampling of existing timber piles at river piers was determined to be not feasible; however, STATE desires to assess the condition of a representative sample of the in-place timber piles. CONTRACTOR will collaborate with the CGMC and PDT to explore means and methods for safe excavation and sampling of piles at piers 16, 19, 20, and 23. CONTRACTOR will design protection enclosures with means for extracting cores from timber piles based on consultation with the CMGC and prepare plans for construction to provide safe excavation to permit sample coring of existing piles. Three cores will be extracted from each of the piers identified and evaluated by an independent laboratory to determine the structural properties of the timber pile core samples. CONTRACTOR will then determine the structural integrity of the piles and assess any strength reduction to pier capacity. CONTRACTOR will submit a brief report

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(Condition and Strength Evaluation for Existing Piers and Foundations, –Piers 16-23 (Report C) summarizing the recommendations for repairs, strengthening, or pier protection requirements (as applicable) for piers 16-23.

5.2 Structural Capacity Evaluation (piers 16-23)

a) Extreme Event Evaluation

CONTRACTOR will provide extreme event analysis for vessel collision forces combined with scour and design scour mitigation measures (piers 18-23)

b) Structural Evaluation Without Strengthening

CONTRACTOR will provide analysis for substructure evaluation to determine if any strengthening requirements are needed for piers 16-23, including evaluation of piles, footings, pier shafts, and pier caps. Upon completion of the condition assessment, the condition of the in-place piling must be considered with this evaluation.

c) Structural Strengthening

Upon completion of task b) above, CONTRACTOR will provide means of strengthening pier foundation piles for piers 16-23. If river piers require strengthening, CONTRACTOR will develop details for installation of stay-in-place sheet piles to encase soil mass beneath piles, reinforce with new perimeter piles, and protect with riprap for permanent scour mitigation measures. This concept will be explored in detail, along with other concepts developed by CONTRACTOR and the CMGC.

d) Pier Protection Considerations

Consideration will be given to use of a pier dolphin fender system if existing piles are found to be incapable to resist vessel impact forces and corresponding design scour for extreme event analysis. The concept is deemed less desirable, but may be explored pending results of analysis defined above.

5.3 Scour Evaluation and Scour Mitigation Measures

Evaluation for scour will be provided by STATE. CONTRACTOR will consider theoretical depth of scour and combine with extreme event analysis of piers 18-23. The Vessel Impact Study will be provided by the Engineer of Record for Bridge 85851. CONTRACTOR will review and evaluate the vessel impact study for concurrence of design forces. Prior to completion of pile sampling, CONTRACTOR will perform preliminary analysis of vessel impact resistance assuming piles will be of acceptable integrity for continued use. CONTRACTOR will evaluate vessel collision forces on existing piers as deliverable early on as noted in deliverables for Work Package 1A.

CONTRACTOR will develop scour mitigation measures to ensure stability of Bridge 5900 foundations during construction of Bridge 85851. Consideration must be given to future potential foundation repairs such that scour mitigation measures will not impede future repair plans. Scour mitigation measures will be developed into a scour mitigation plan and will be included with other plan items in Work Package 1A deliverables.

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5.4 Bridge Foundation Recommendations

CONTRACTOR will review geological, hydrological and environmental data collected by STATE for the project, as well as the FADR for Bridge 85851 (provided by others). CONTRACTOR will collect and evaluate the following data:

- a) Live load, wind, ice and barge impact forces, as well as demands imposed by extreme event analysis. This will include load cases considering full vessel impact forces applied concurrently with one-half of the long term scour applied at the 2% flowline, and a load case considering empty barge impact (drifting) with one-half of the predicted long term scour plus one-half of the predicted short term scour.
- b) Bridge Hydraulics Memo will be provided by STATE for determination of river hydraulics and scour potential at river piers.
- c) CONTRACTOR will provide consideration of limitations and constraints on river and near-shore construction to preserve marine habitat and to address seasonal weather conditions.
- d) CONTRACTOR must provide enclosure geometrics for pile sampling and details of any footing enclosures for scour mitigation to STATE for evaluation of temporary river stage increase. CONTRACTOR must also provide details of any temporary fill or other obstructions that are proposed to be placed within the river for evaluation.
- e) CONTRACTOR must provide details of any pier protection, pier footing and column geometrics and other details that affect the waterway or navigation clearances, which will be used to determine the estimated scour for structural modeling. Any obstructions placed within the waterway will be subject to approval by STATE, US Coast Guard (USCG), and the Corps of Engineers.
- f) Vessel traffic and local agency data to assess requirements for accommodating local river traffic and complying with USCG regulations during foundation construction.
- g) Pier cofferdam loads, riprap used for scour mitigation, or other improvements must be included with design loads for evaluation of pile loads (include with design).
- h) Preliminary foundation and boring information provided by STATE, which will include preliminary foundations sizes as shown on the preliminary bridge plan.
- i) Foundation cofferdam construction details.

CONTRACTOR will provide a Geotechnical Engineer to evaluate the existing piles on Bridge 5900. Evaluation will include a condition assessment of existing piles, evaluation of the load carrying pile capacity, and determination of foundation strengthening requirements.

CONTRACTOR will consult with STATE, PEER REVIEWER and the CMGC for input and constructability reviews for any proposed pier strengthening recommendations.

STATE will provide soil borings near each of the substructures, along with the MnDOT preliminary foundation report.

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CONTRACTOR is responsible for any other geotechnical parameters needed for river pier foundation modeling and design, such as sub-grade modulus and other parameters required for pile soil interaction analysis.

CONTRACTOR will perform geotechnical engineering analysis for all bridge foundations, including any recommended structural improvements to the existing pier foundations for piers 16 through 23. CONTRACTOR's assessment should be included in Report C. CONTRACTOR will provide Foundation Analysis Design Recommendations (FADR) for substructures based on STATE's preliminary foundation and boring information. This includes analysis of various foundation options, including driven piles of varying type and diameter. CONTRACTOR will collect and evaluate cost data for various pile sizes and shapes. Pile analysis will be performed using FHWA's Driven Program (or similar analysis program). Pile drivability will be evaluated, and CONTRACTOR will conduct wave equation analysis (GRLWEAP) of potential hammer types. CONTRACTOR will analyze lateral resistance capabilities with LPILE/GROUP software (or similar analysis program). At a minimum, CONTRACTOR will evaluate spread footings and 2 pile types/sizes for approach piers 1-15, and consider 3 alternatives for pier strengthening, if needed.

In general, the work and services to be provided will follow MnDOT's Specifications for Subsurface Investigation and Geotechnical Analysis and Design Recommendations. This document, entitled "consultdrillreport.doc" may be found downloaded from the following website: <http://www.mrr.dot.state.mn.us/geotechnical/foundations/tcontract.asp>

5.5 Additional Items for Approach Piers and Abutments

CONTRACTOR will collect and evaluate the following data:

- a) Abutment fill and settlement surcharge recommendations to determine pile down drag conditions;
- b) Information on any existing utilities that may need to be either moved or replaced. If utilities are not moved or replaced, CONTRACTOR will need to design foundations to avoid or mitigate the presence of any existing utilities;
- c) Groundwater elevations and corrosive material data to assess pile construction and durability requirements.

5.6 Final Foundation Recommendation

Final determination of recommended foundation types will be made based on recommendations from CONTRACTOR, with concurrence from STATE. A standard summary form of the recommended foundation alternatives for each substructure will be provided by STATE.

6.0 TASK D: Develop Superstructure Cross Section Alternatives

CONTRACTOR will develop superstructure cross section alternatives for replacement of the existing bridge deck on spans 18, 19, and 20. Cross section alternatives must include:

- a) Exodermic deck system
- b) Half-filled grid with overfill
- c) High performance concrete 7" CIP deck

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d) Lightweight concrete deck

Previous study of deck rehabilitation options are summarized in the *Winona Bridge Deck Rehabilitation Options – Memorandum February 8, 2011*. Further study of superstructure alternatives is necessary for assessment of details integral to each alternative, and for final determination of corresponding repairs that would be necessary to the gusset plates and truss members for each alternative. No sidewalk will be included in the alternatives.

The lightweight concrete deck alternative could help to reduce rehabilitation needs on spans 18, 19, and 20. However, use of a lightweight concrete mix for the bridge deck is currently perceived as a risk to the intended design life of the structure due to concerns with durability of the lightweight concrete with freeze thaw conditions and application of de-icing chemicals. Further study of lightweight concrete deck alternatives will be provided by STATE in consultation with lightweight concrete experts.

CONTRACTOR will proceed with developing alternatives noted (a, b, and c) while STATE continues to consider the use of lightweight concrete.

CONTRACTOR will develop superstructure cross section alternatives showing details of traffic barriers (including attachment details), expansion joint details, including attachment to stringers and floor beams, and incorporation of bridge deck drainage system details. Condition evaluation of existing stringers and existing floor beams will be included for determination of replacement alternatives that include any modifications proposed to the existing stringer and floor beam system. Inclusion of a separate chip seal overlay will be considered with alternatives (a) and (b).

Bridge traffic railing alternatives will be considered that offer lightweight alternatives and provide complete separation from existing truss members. Alternatives for providing protection of truss members by use of rub-rails or other means will be included to reduce snagging hazards and impact potential of truss members. Review of proposed traffic railings by Project Historian and the Bridge Office will be required to vet acceptable railing alternatives.

The deliverables for this TASK will include plan sheets for each superstructure alternative with corresponding details identified above, and a brief report summarizing the details, corresponding dead load of each alternative, and a discussion of life expectancy and durability considerations. Corresponding dead load of each alternative will be included in evaluation of subsequent truss rating to assess modifications for strengthening of truss members and gusset plates.

Prior to final determination of any strengthening requirements, CONTRACTOR must complete work for TASKS E-I.

Final selection of the superstructure cross section will be made prior to TASK J so that evaluation of other rehabilitation needs resulting from completion of other TASKS can be assessed together with rehabilitation needs resulting solely from the superstructure dead load considerations.

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7.0 TASK E: DESIGN AND LOAD RATING CRITERIA

Project load rating criteria will be based on the following outcomes:

- a) HL93 loading
- b) Removal of 80,000 lb. restriction
- c) Accommodate all permit trucks
- d) 50-year minimum design life for rehabilitation
- e) 75-year minimum design life for reconstruction

7.1 Design and Load Rating Criteria Development

CONTRACTOR will coordinate the development of design and load rating criteria for this project with PEER REVIEWER at the onset of the design. This will include development of all live load models, distribution factors, section reduction factors, and load factors for corresponding loadings. Evaluation will be based on HL-93 loading and permit vehicle loading, and load and resistance factor rating per the Manual for Bridge Evaluation, current edition.

7.2 Design and Load Rating Criteria Requirements

CONTRACTOR will design Bridge 5900 in accordance with design parameters and special design criteria. The design criteria will be developed as project-specific requirements in addition to the basic codified design requirements for the bridge. CONTRACTOR will perform the following tasks:

- a) Develop truss design and load rating criteria to be utilized by the designer and reviewed by PEER REVIEWER and STATE. This will include design specifics like specified material properties, recommended allowable stresses, load factors, bridge condition rating parameters, fatigue detail allowable stress parameters, and fatigue vehicle parameters.
- b) Separate criteria will be developed for evaluation of existing truss members and for evaluation of new truss members.
- c) Consider of alternative load path redundancy for select existing truss members. Final selection of key components for determination of alternative load path redundancy will be an iterative approach requiring analysis of truss and subsequent evaluation of members for fatigue life, high exposure to elements, high vulnerability, and assessment of condition and remaining service life of individual members.
- d) New truss members will include consideration of details to accomplish internal redundancy and use of high performance steel.
- e) Development of Design and Load Rating Criteria will be based on the Bridge 5900 Preliminary Load Rating Criteria (For Existing Truss Spans 18, 19, 20 (see TASK H) as a baseline, with input and concurrence from the Bridge Office Project Manager and PEER REVIEWER at the onset of the project.

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8.0 TASK F: Evaluate Redundancy Alternatives

Preliminary scoping studies were performed to assess means of providing complete load path redundancy to Bridge 5900. Study of various alternatives for accomplishing complete external load path redundancy resulted in the conclusion that the addition of separate duplicate trusses or use of separate cable suspension system would have significant adverse visual impacts and would result in a finding of adverse effect on the historic bridge. However, further study of alternatives to provide internal system redundancy is required to explore these alternatives in further detail.

a) Redundancy Alternatives for Existing Trusses (spans 18, 19, 20)

CONTRACTOR will perform analysis and study of existing bridge details to explore feasibility and means of providing modifications to the existing truss (spans 18, 19, 20) to provide internal system redundancy of gusset plates, pin connections, and truss members. CONTRACTOR will consider use of high strength bars and high performance steel with this evaluation.

CONTRACTOR will provide an initial evaluation of components with regard to risk, considering condition of the existing element (i.e. section loss), future exposure to de-icing chemicals, evaluation of exposure to vehicle impact, and evaluation of theoretical remaining fatigue life. This evaluation will form the basis for priority ranking of elements and used for selection of redundancy of key components. CONTRACTOR will use quantitative and qualitative evaluation processes to prioritize elements with regard to risk mitigation with consideration of over-plating of select elements to create redundancy of key components.

b) Redundancy Alternatives for New Construction (spans 16, 17, 21-24)

CONTRACTOR will evaluate alternative means of accomplishing redundancy for the new truss members including consideration of internal redundancy of gusset plates, pin connections, and truss members. CONTRACTOR will consider use of high strength bars and high performance steel with this evaluation.

Connection details will be drawn as 3D renderings to provide clear illustration for evaluation. Any proposed repairs to the truss spans or internal redundancy plating for new spans must be designed with intention of minimizing adverse visual impacts. Members used for redundancy or strengthening should be concealed internally within existing members where possible.

CONTRACTOR will work collaboratively with the Project Historian to develop concepts for redundancy with respect to the SOI Standards. This includes development of concept alternatives that will be summarized in a draft report or memo for initial evaluation. CONTRACTOR must complete TASKS G, H, and I so that consideration may be given to the existing condition of elements, the load rating for individual elements, and the fatigue life of individual elements. These results will be incorporated into a risk assessment and included in the Final Report for Redundancy Alternatives.

9.0 TASK G: Structural Inspection

This task includes CONTRACTOR-provided supplemental inspections of Bridge 5900 for only the portions of Bridge designated for rehabilitation (superstructure Spans 18-20 and substructure piers 16-23,

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and north abutment). CONTRACTOR's supplemental inspections require access to evaluate condition of structural members. Access for inspections and required traffic control will be provided by STATE (District 6).

CONTRACTOR's supplemental inspections are not intended as complete fracture critical inspections, but must encompass the designated portion of Bridge 5900 to the extent necessary to validate documented existing conditions and to provide section loss measurements of members where needed. Condition and section loss measurements of Bridge 5900 are documented in STATE's 2012 (and previous) fracture critical inspection reports, and will be updated in 2014. CONTRACTOR will thoroughly review the reports for condition assessment of the bridge prior to inspection.

CONTRACTOR's supplemental inspections will be independent from STATE's inspection. Inspections provided by CONTRACTOR may be scheduled to coincide with traffic closures for the 2014 Fracture Critical Inspection provided by STATE. The anticipated duration of the traffic closure for bridge inspection is 1-2 weeks in late May or early June 2014. CONTRACTOR's supplemental inspections of the superstructure spans 18-20 will preferably occur after STATE has completed its Fracture Critical Inspection of these spans.

CONTRACTOR's supplemental inspections will include visual and tactile inspection of existing condition of structural components with the aid of photographs, tape measures, chipping hammers, binoculars, wire brushes, keel and carpenter's level, and carpenter's square. Inspection will also include portions of substructures above waterline and exposed to view for piers 17-24.

Structural Inspection Preparation

- a) Study and review the existing 2012 Fracture Critical Inspection Report.
- b) Itemize members for which section loss is documented.
- c) Review non-destructive testing procedures, including plate thickness measurement and magnetic particle testing procedures.
- d) Develop inspection forms to be used during the field inspection.
- e) Complete pre-inspection planning session to estimate time required for inspection of individual components and overall time required to complete the inspection. Prepare detailed time estimate with summary of intended inspection procedures and operations.
- f) Coordinate meeting with STATE's Fracture Critical Inspection Unit and STATE's D6 Inspection Unit for review and comment on inspection planning.
- g) Participate in Safety Training session prior to inspections.
- h) CONTRACTOR's inspectors must be ASNT NDT Level II or III for any nondestructive testing performed, including Ultrasonic Testing (UT) based thickness readings.

Upon completion of supplemental inspections, CONTRACTOR will submit a *Bridge Inspection Report* to document additional findings, including:

- a) Section loss measurements, as needed (to be used in subsequent structural analysis.)

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- b) Chloride level concentration in piers 16-23 (per CONTRACTOR-devised sampling plan, to be reviewed and approved by STATE).
- c) Results of Timber Pile Assessment for Piers 16, 19, 20, and 23 (include results from TASK C, section 5.1).

MnDOT Fracture Critical Inspections include the evaluations listed below that should be noted by CONTRACTOR during supplemental inspections of Spans 17, 18, and 19. (Complete independent inspection of all elements is not intended, but CONTRACTOR must make its own determination on extent of supplemental inspection for verification of condition and extent of section loss measurements needed for subsequent structural analysis).

- a) Condition and flatness (using carpenter's square) of gusset plate connections and measurement of section loss where section loss is evident.
- b) Extent of pack rust between members, especially for gusset plates and lattice on members below the deck that are subject to exposure to de-icing chemicals.
- c) Condition of lower chord members, including section loss measurement where section loss is evident.
- d) Condition of vertical and diagonal truss members and section loss.
- e) Condition of portal and bracing members and section loss.
- f) Condition of floor beam connections, floor beams, and section loss.
- g) Condition of all stringer connections, stringers, and section loss.
- h) Condition of hanger details and section loss.
- i) Condition of pin connections on hanger span (ultrasonic testing will be provided by STATE).¹
- j) Condition of bearing assemblies and assessment if bearings appear to be free, locked up, or show signs of recent movement.
- k) Condition of guard rail attachment and rub rail attachment to verticals and measured section loss where section loss is evident on verticals.

Bridge components NOT included in CONTRACTOR's supplemental inspections:

- a) Ultrasonic testing of pin connections (will be completed by STATE during 2014 Fracture Critical Inspection).
- b) Inspection of superstructure portion of spans 1-17 and 21-24.
- c) Underwater inspections.

10.0 TASK H: Structural Models and Pre-Inspection Load Rating Analysis for Spans 18-20

CONTRACTOR will develop a quantitative analysis of the structural components using 2D and 3D models of the existing trusses based on review of bridge plans, shop drawings, material properties, section properties, and geometry and dimensions specified in the existing plans for Bridge 5900.

The 2D models must be developed for each truss as a baseline for load rating comparison and calibration of all 3D truss models. A 3D model may be used only after sufficiently calibrated to the 2D model to ensure that support conditions, deck stiffness, and other boundary conditions are calibrated within

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reasonable limits (as determined by STATE and PEER REVIEWER) and compare well with the results from the 2D analysis.

Prior to use of any 3D analysis models, STATE requires that CONTRACTOR develop 2D models and corresponding live load distribution factors, and develop influence lines for determination of live load effects, including results on members from concurrent live load vehicles occupying other concurrent loading positions. The results from the 2D and 3D analyses must include development of a spreadsheet for importing analysis output results for evaluation of bridge ratings factors for HL-93 loadings, and permit truck analysis as part of the design and load rating analysis.

Model development must include the development of live load cases for bridge design in accordance with AASHTO LRFD Manual, and bridge ratings in accordance with the AASHTO Manual for Bridge Evaluation (MBE).

For verification of existing bridge ratings factors, include modifications to truss members and gusset plate members as shown in repair plans and as-built drawings for previous repairs.

Preliminary Load Rating Criteria (For Existing Truss Spans 18, 19, 20):

- a) Design Load Rating (per MBE 6A.4.3) - HL-93 loading, (modified per MnDOT Memo to Designers: LRFD and Bridge Load Rating Issues, February 14, 2005).
- b) Legal Load Rating (per MBE 6A.4.4) (for verification of current rating)
Legal Load Ratings will include Minnesota Legal (Posting) Loads per MnDOT LRFD Manual section 15, Appendix 15-D.
- c) Permit Load Rating (per MBE 6A.4.5)
Permit load ratings will include Minnesota Standard Permit Trucks per MnDOT LRFD Manual section 15, Appendix 15-E and Appendix 15-F.

Condition Factor: (for use prior to obtaining measured section losses)

- a) Top chord 0.95
- b) Bottom chord 0.85
- c) Vertical and diagonal members extending below deck: 0.85
- d) Gusset plates above deck: 0.95
- e) Gusset plates below deck: 0.85

Notes: Above condition factors apply for all members except on members and gusset plates where field measured section loss data is used, whereby, a 0.95 condition factor should be used to account for 5% variation in field measured section loss.

System Factor = 0.90 maximum (modify as required per MBE Table 6A.4.2.4-1) applied to all members, combined with appropriate Condition Factor.

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Minimum inventory rating factor: 1.0 (for design HL-93, modified per MnDOT Memo to Designers: LRFD and Bridge Load Rating Issues, February 14, 2005).

Minimum Permit Load Rating Factor 1.15 for Annual Permit Loads.

Minimum Permit Load Rating Factor for Single trip permits, 1.15 desired, 1.05 min..

Load Factors per AASHTO MBE, current edition.

Gusset Plate Ratings per 2013 AASHTO Agenda Item 25 and 41

Initial load ratings will be based on full section properties with condition reduction factors specific to location as noted above, except for members where documented section loss is included in the analysis.

Upon completion of inspection, CONTRACTOR will report percent section loss for primary members and gusset plates on spans 18, 19, and 20, (based on CONTRACTOR'S inspection results and measured section loss), and incorporate any reduced section properties (and 0.95 condition factor to account for 5% variation in measured section) into subsequent rating analysis of existing truss members.

Condition factors specified will be combined with any section loss from measurements. Consideration must be given to modification of section reduction factors to include consideration of immediate rating (upon completion of construction) and future ratings during the design life of the bridge, utilizing reduced member section properties in consideration of future section loss potential for bottom chord and other truss members.

A separate task of completing the ratings for the entire bridge (after completion of the entire design) will be required as described in Section 15.2.3B and Section 16.

11.0 TASK I: Fatigue Life Evaluation

a) Determine remaining Fatigue Life of rehabilitated Spans (spans 18-20):

This includes fatigue evaluation of truss members in accordance with the provisions of the Manual for Bridge Evaluation (MBE) section 7. All existing truss members for spans 18-20 will be evaluated under fatigue loading in accordance with these provisions to determine results of remaining fatigue life. Evaluation procedure will be reviewed with PEER REVIEWER and STATE and documented in design criteria. Results of remaining fatigue life analysis of members will be considered in rehabilitation needs and in subsequent quantitative analysis of risk mitigation by selective redundancy of high risk elements.

b) Fatigue Evaluation for Reconstruction (spans 16, 17, 21-24):

This includes fatigue evaluation of new superstructure members with conscious effort to use best practice details in newly constructed spans, while maintaining a no-adverse effect determination. Develop details that include internal redundancy by staggering splices in members and using built-up

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sections or other methods. Consider benefits of use of highly ductile high performance steel at select locations.

- c) Develop preliminary bridge details for reconstruction and rehabilitation for review by Project Historian and PDT for consideration, documentation and constructability reviews.

12.0 TASK J: Final Bridge Design and Load Rating Analysis

- a) Develop final bridge design and load rating criteria
- b) Include section loss and rehabilitated members in section properties
 - i. Refine the structural computer models prepared under TASK H. The structural models will be adjusted to account for previous repairs made and include findings of the field inspections conducted by the CONTRACTOR. Adjustments are anticipated to include section loss due to corrosion and/or previous repairs or modifications.

Computer analysis models and summary report findings will, as a minimum, include the following:

- a) Rating evaluation for existing conditions of truss members (spans 18-20) with current deck and sidewalk loading.
- b) Rating evaluation for existing conditions of truss members (Spans 18-20) with reduced dead load (remove sidewalk and consider high performance concrete with 7" deck).
- c) Rating evaluation for existing conditions of truss members (spans 18-20) with reduced dead load (remove sidewalk and consider light weight deck alternative).
- d) Fatigue evaluation for existing conditions of truss members (spans 18-20) with reduced dead load (remove sidewalk and consider lightweight deck alternatives).
- e) Evaluation of recommended superstructure alternative with rating factors for all truss members and gusset plates. Any lightweight deck alternatives recommended must first be discussed with STATE, with consideration of longevity and anticipated life span based demonstrated use on similar project(s).

The intent of this step is to bring all previous analysis considerations together for final determination of rehabilitation needs and finalize bridge rehabilitation details. Assessment of individual ratings analysis for various alternatives is intended to isolate rehabilitation needs due to each individual consideration. The results of this analysis should be summarized in load rating factors for each truss member and provided to STATE and PEER REVIEWER for evaluation.

13.0 TASK K: Develop Final Bridge Reconstruction and Rehabilitation Recommendations

CONTRACTOR and Project Historian must collaborate with the Bridge Office Project Manager, District 6 staff, and MnDOT CRU to develop Final Bridge Rehabilitation and Reconstruction Recommendations. Final recommendations should include specific detailed description of the following components, along with clarification notes on 30% Plans.

- a) Approach spans 1-15
- b) Approach spans 16-17
- c) Rehabilitated spans 18-20
- d) Approach spans 21-24
- e) North abutment (south abutment to be replaced)
- f) Piers 16-23

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- g) Foundation strengthening for piers 18-19
- h) Bearings piers 18-19
- i) Truss spans 18-20
 - i. Removal of sidewalk and sidewalk support brackets
 - ii. Details for removal of lattice bracing, and pack rust remediation
 - iii. Details for removal of truss gusset plates, and pack rust remediation
 - iv. Details for rivet replacements and button head bolt installation clearances
 - v. Floor beam connection repairs
 - vi. Stringer replacement details and connection repairs
 - vii. Orthotropic deck details
 - viii. Expansion joint details showing fit-up with orthotropic deck and stringers
 - ix. Gusset plate repairs (lower chord)
 - x. Barrier attachment details to orthotropic deck, rub rail attachment to verticals
 - xi. Suspended span hanger details
 - xii. Miscellaneous truss member repairs
 - xiii. Identification of historic elements previously removed from the structure (e.g. ornamental lighting, etc.) that are to be replaced.

CONTRACTOR will prepare *Summary Report of Final Bridge Reconstruction and Rehabilitation Recommendations* with input from Project Historian. Present report to FHWA, STATE, MnDOT CRU, the CMGC, and PEER REVIEWER. Allow 15 days for review and comment by PDT. Finalization of this step will include submittal all summary reports as noted in Section 2.5, along with 30% Plans for 45-day review by SHPO, and submitted by MnDOT CRU.

13.1 TASK L: Develop Constructability Plan for Design, Fabrication, and Constructability of Trusses

a) Design, Fabrication, and Constructability of New Trusses:

Include design criteria, material properties, and methodology for determining camber due to deflections and axial deformation including any special fabrication requirements. Establish requirements for full assembly prior to drilling gusset plates or other proposed methods with input from MnDOT Bridge Office Fabrications Engineer. Review tolerances for bolt placement and special considerations for button head bolt installation procedures, limitations, and specified locations for use. Include other considerations based on CONTRACTOR's expertise with the design of new trusses. This task requires close coordination with the CMGC. Submit for review and comment to STATE, PEER REVIEWER, and the CMGC. Allow for 30 days' review.

b) Design, Fabrication, and Constructability of Rehabilitated Trusses:

Include design criteria, material properties, and methodology for determining camber due to deflections and axial deformation, and any special fabrication requirements. Establish requirements for disassembly, sequential removal, sequential field drilling, sequential bolt installation, sandblasting, containment and field painting, and assembly. Include design of strong back system or other load bypass systems, and any falsework required to provide in-field repair of truss members and

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gusset plates. Consider unique characteristics of each gusset plate node and develop potential repair schemes for rehabilitation of each unique node that potentially requires rehabilitation by disassembly. Review tolerance for bolt placement and special considerations for button head bolt installation procedures, limitations and specified locations for use. Include other considerations based on CONTRACTOR's expertise with the design rehabilitated trusses. Submit for review and comment to STATE, PEER REVIEWER and the CMGC. Allow for 30 days' review.

c) Develop Bridge Removal Details, Special Provisions, and QA Plan to Deconstruct and Transport Deck Girder Truss for FHWA Study:

Project funds will be used for an independent study to deconstruct, transport and forensically analyze select portions of the Bridge 5900 deck trusses slated for replacement. The goals are to:

- i. Objectively characterize their condition and material properties;
- ii. Evaluate their effect on load capacity in laboratory conditions;
- iii. Compare to assumptions of the Bridge 5900 rehab study;
- iv. Contribute to a body of knowledge in the structural engineering community to help inform future rehab studies of steel trusses.

Procedures (including any necessary contract Special Provisions) for preserving the extant integrity of select portions of the deck trusses for study will be written and included in the contract for bridge construction. FHWA and STATE will be among the participants providing input on the scope of the study, extent of intact removal sections, and location for transporting deck truss section for testing. Develop outline for work based on input from FHWA and STATE. Develop DRAFT Special Provisions based on further input from FHWA and STATE. CONTRACTOR will develop pay-items, quantities and Special Provisions to include with 30%, 60 %, 90% and Final Special Provisions.

14.0 TASK M: Final Design Coordination

14.1 WORK PACKAGE 1A:

a. Scour mitigation

CONTRACTOR will develop scour mitigation strategies with input from STATE. Schemes should initially include analysis of sheet pile encasement of footings and perimeter pile installation if needed, with placement of rip-rap layer adjacent to, but not on top of existing footing for scour mitigation. Consider foundation strengthening concepts for evaluation, including use of micro-piles, adjacent pile transfer beams, and other foundation strengthening and scour mitigation measures for further analysis. Concept development should occur early on in process for evaluation, concurrence, and selection of preliminary design concepts.

b. Foundation analysis for vessel impact

CONTRACTOR will provide analysis of existing river piers with consideration of foundation improvement concepts approved for further analysis from step a. Consideration should be given to use of sheet pile enclosures with single wrap around footings and band wrap around footings to contain soil. Depth of sheet piling and stability of sheet pile must be considered. Other foundation improvement concepts are encouraged for consideration. Provide geotechnical and

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structural analysis to determine adequacy of proposed improvements to resist extreme event loads due to vessel impact and scour events. Scour depth determination will be provided by STATE Bridge Hydraulics Engineer.

c. Pier strengthening and/or pier protection system

Make final determination of scour mitigation and/or pier strengthening requirements based on concepts developed, preliminary analysis, and CONTRACTOR-provided final analysis for review. Consider timing of required repairs with respect to construction of upstream Bridge 85851 and any other construction impacts. Consider and recommend extent of repairs to be included in Work Package 1A. If directed by STATE, CONTRACTOR will develop plans, quantities, and Special Provisions for inclusion of 60%, 90%, and Final IFB Package for Work Package 1A. This work should be completed prior to submittal of 60% Plans for OPCC process.

d. Materials sampling and condition assessment of foundation piles

CONTRACTOR will develop plans for condition assessment of existing timber piles at piers 16, 19, 20, and 23. (Refer to Section 5, TASK C). Provide concept plans for evaluation at project meetings for review by PDT. Develop plans, quantities, and Special Provisions for inclusion of 60%, 90%, and Final IFB for Work Package 1A.

CONTRACTOR will also provide all temporary and permanent waterway obstructions including temporary sheet pile or permanent sheet piling for foundation investigation and foundation repairs to STATE for river hydraulic assessment and final hydraulic and scour analysis. Completion of this work is a high priority and time sensitive and should be included with submittal of 60% Plans for Work Package 1A (with prior early discussion on concept development).

14.2 WORK PACKAGE 2 (Final Design Coordination)

Work packages 1 and 1A are primarily comprised of an early foundations package for the advanced construction of the river piers and north abutment foundations for Bridge 85851 (provided by others), but also includes items for scour mitigation, analysis of existing Bridge 5900 piers, and foundation materials sampling as defined above.

Work package 2 consists of the design of the remainder of Bridge 85851 (provided by others), along with the corresponding roadway plans for the project (provided by others). No Bridge Plans for Bridge 5900 are anticipated to be included in Work Package 2. However, several items will require coordination and concurrent design of Bridge 5900, to ensure that the design of the roadway plans are coordinated with the design of Bridge 5900, particularly on the approach spans. The design of the approach spans for Bridge 5900 should proceed simultaneously with the design of the roadway plans for Work Package 2. CONTRACTOR may proceed with entire design of approach spans, upon approval of 30% plans.

Anticipated items that must be coordinated between CONTRACTOR and the designer of the roadway plans include: deck drainage system, down spout tie-in locations, abutment approach

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panel review and coordination (approach panels to be included in grading plans), approach span pier footing elevations, review of pier footings near approach roadway underpasses, pier geometrics and pile spacing and footing size for consideration of utility relocation as requested, coordination on junction box locations for lighting conduit for Bridge 5900 (navigation lighting, aerial beacon lighting, and possible roadway lighting). The design of the approach spans for Bridge 5900 must occur with the development of the grading plans for the project and should occur on a parallel path with the development of reports for further consideration of truss rehabilitation alternatives.

14.3 ADDITIONAL FINAL DESIGN COORDINATION – Work Package 3

14.3.1 Structure Site Data

CONTRACTOR will obtain current structure site data including final proposed roadway geometry and typical sections, topographic maps of the site, and other data on features affecting the bridge design such as rail lines, hydraulic structures, right-of-way, city streets, and existing utilities. CONTRACTOR will collect this information from STATE. It is not anticipated that CONTRACTOR will be required to perform field survey work.

14.3.2 Foundation Recommendations Analysis

CONTRACTOR will review available foundation information and reports and provide geotechnical engineering analysis for all bridge foundations, and will provide Foundation Analysis Design Recommendations (FADR) for substructures based on STATE's preliminary foundation and boring information. Final determination of recommended foundation types will be made based on recommendations from CONTRACTOR, with concurrence from STATE. A standard summary form of the recommended foundation alternatives for each substructure will be provided by STATE.

14.3.3 Hydraulics Data Review

CONTRACTOR will review available hydrology and hydraulics data and reports, and review preliminary deck drain locations. CONTRACTOR will provide final design of deck drainage sizes and locations, and design of deck drainage system. Some coordination with the roadway designer will be necessary to coordinate downspout locations and connection to the roadway drainage system. Final design of deck drains will be submitted to STATE Bridge Office Hydraulics section for review. Work for this task must be completed early on so that the design of the storm water ponds may proceed early with the roadway grading plans in Work Package 2.

14.3.4 Visual Quality

Visual Quality (VQ) for this project will be determined in collaboration with the City of Winona, STATE's District 6 staff, Bridge Office staff, MnDOT CRU, and other select stakeholders. CONTRACTOR will review the Visual Quality Manual (developed by others) for items particular to Bridge 5900. In order to meet the SOI Standards, Bridge 5900 will be rehabilitated in kind (i.e., any removed elements will be replaced as close as possible to the original design, with certain variations made to allow for modern codes).

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CONTRACTOR will note any modified construction (i.e., not in kind replacement) and work with the Project Historian to find more appropriate rehabilitation approach if possible. Upon request, CONTRACTOR will provide drawings for assessment of adverse effects for the Project Historian's review. It is intended that ongoing visual quality efforts will be led by a Visual Quality Manager (provided by others). CONTRACTOR will be expected to develop 2-D architectural drawings of Bridge 5900, working primarily with the Project Historian and PDT rather than the visual quality committee. Project renderings showing Bridge 85851, Bridge 5900, and other project features will be provided by others. CONTRACTOR will comply with requests for information particular to the design of Bridge 5900 for development of 3-D drawings and visualizations prepared and presented by others.

15.0 TASK N: Plan and Special Provisions Development, to be completed in collaboration with Project Historian

15.1 Develop Plans for Work Package 1A (pay items, quantities, Special Provisions)

30 % Plans (prepared for entire bridge):

CONTRACTOR will provide project management services, including peer review coordination, for the development of the 30% Plan. The 30% Plan allows PEER REVIEWER, STATE, and the CMGC an early review of the final design for conformance with the approved Preliminary Plan, aesthetic guidelines, and key design specifications. The intent of this review is to identify design discrepancies at an early stage and avoid major plan modifications resulting from future reviews. These partially completed plans will be used to share technical information for purposes of coordination and to build consensus with STATE and PEER REVIEWER.

CONTRACTOR will provide 30% Plans for the entire Bridge 5900 for this submittal and include a working point layout sheet. CONTRACTOR will validate the locations of the fixed and expansion bearings, and bridge expansion joint types and locations.

At this stage, there will be a discussion of potential revisions to the design criteria, development and presentation of project standard details, and development of a draft list of pay items and an outline of the Special Provisions. The plans will be on 11" x 17", 20-lb white bond paper or approved equivalent. STATE, PEER REVIEWER, and the CMGC may meet with CONTRACTOR to return a copy of the 30% Plan containing its red-lined notations and corrections. STATE will authorize CONTRACTOR in writing to proceed with final design in conformance with the red-lined copy of the 30% Plan. If CONTRACTOR disagrees with PEER REVIEWER or the CMGC's notations and corrections, these differences must be resolved. CONTRACTOR may proceed with design prior to the written authorization at its own risk.

15.1.1 Design Considerations

The following items will be considered:

- a) Contaminated soils
- b) Utilities (identified in Preliminary Plan, with potential for additional utilities identified during final design)

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- c) Preliminary bridge deck drainage review (final deck drainage design provided by CONTRACTOR)
- d) Foundation type for river piers
- e) Construction staging
- f) Navigational lighting
- g) Verification that profile grade and structure depth provide the required clearances
- h) Vessel Impact Study review
- i) Security Assessment
- j) Review identified historic elements
- k) Review approach spans proposed
- l) Participate in discussions with beam fabricators for special form inserts for haunched PCBs
- m) Aesthetic lighting
- n) Preliminary locations of bridge mounted signs

15.1.2 Work Package 1A (60% Plans, quantities, Special Provisions for scour mitigation and pier pile evaluation)

CONTRACTOR will provide project management services, including peer review coordination, for the development of the (60%) design for the Work Package 1A (Refer to above Section 14.1 for description). The 60% Plan allows PEER REVIEWER, STATE, and the CMGC an early review and initiates the 60% OPCC Process.

15.1.3 Work Package 1A (90% Plans, quantities, Special Provisions for scour mitigation and pier pile evaluation)

Issue for Bid Package must include the following:

- a) GP&E for Bridge 5900
- b) Index, quantities, and pay items
- c) General notes
- d) Sheet pile layout tied to working points
- e) Plan and elevation views for pile sampling enclosure construction
- f) Existing pier layout and pile details for piers 16, 19, 20, and 23
- g) Sheet pile enclosure details
- h) Scour mitigation details (assume sheet pile scour mitigation)
- i) Bridge survey sheets showing existing utility locations
- j) Bridge foundation sheets showing soil borings
- k) Special Provisions for Work Package 1A

15.2 Develop Plans for Work Package 3, pay items, quantities, and Special Provisions

- a) 30 % Plans
- b) 60 % Plans
- c) 90% Plans
- d) Issue for Bid Package

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FINAL BRIDGE PLAN PREPARATION (Source Codes ABUT, DECK, GEOM, PIER)

CONTRACTOR will conduct detailed bridge design in accordance with design standards and geometric, material, and procedural requirements for the associated rehabilitation construction work identified herein, and submit a Certified Final Bridge Plan for the State Bridge Engineer's signature.

All plan submittals will be on 11"x17", 20 lb. white bond paper, or an approved equivalent. Plan sheets must be produced using the latest version of MicroStation.

15.2.1 Finalize Bridge Geometry and Layout

CONTRACTOR will review the final 3D geometry of the associated roadways as it affects the bridge design. If CONTRACTOR, the CMGC, or PEER REVIEWER proposes substantial changes to the Preliminary Plan—and STATE accepts the proposed changes—CONTRACTOR will update the Preliminary Plan, including any associated roadway geometric changes. CONTRACTOR will submit the updated Preliminary Plan and/or roadway geometric modifications for STATE's approval.

15.2.2 Develop Load Cases

CONTRACTOR will develop AASHTO LRFD load cases and combinations, and perform concurrent load rating analysis with the rehabilitated truss design considering various light weight superstructure alternatives and design and load rating criteria per Article 12.0 of this exhibit.

15.2.3a Superstructure Design

Design superstructure in accordance with applicable LRFD provisions and MnDOT standards.

15.2.3b Final Load Rating Report

Develop *Final Load Rating Report* for entire Bridge 5900. The report should be organized into subsections for initial post-tensioned slab spans, prestressed beam spans, steel plate girder span, deck truss spans, and rehabilitated main river spans. The report should be developed to include the rehabilitated truss members with any built up or strengthened sections incorporated into the members and gusset plates per final plans). The report should be completed for presentation to the PEER REVIEWER as soon as possible, prior to submittal of the 90% Plans to permit peer review. Coordination with PEER REVIEWER is required throughout the design process to enable concurrent rating analysis and intermediate comparisons of results prior to the 90% Plan submittal. The report must include the form for the controlling member for entire bridge and forms/tables for each superstructure type. CONTRACTOR will develop a Bridge Rating Manual for the superstructure types that cannot be rated by software that STATE is using in subsequent task (refer to section 16.0).

15.2.4 Substructure Design

CONTRACTOR will design substructure elements in accordance with applicable LRFD provisions and MnDOT standards, including piers, abutments and foundations. CONTRACTOR will evaluate any conflicts between the in-place bridge and new bridge foundations and piling.

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15.2.5 Aesthetic Element Design

CONTRACTOR will provide structural engineering necessary for incorporation of aesthetic features.

15.2.6 Drainage and Utility Design and Detailing

CONTRACTOR will incorporate details for accommodating bridge deck drainage and utilities to be carried by the bridge. Required river hydrology will be completed by STATE. Required roadway hydraulics, including size and placement of deck drains and design of deck drainage system will be provided by CONTRACTOR. Location of any bridge mounted signs will be determined early on by others (roadway designer). Loads from sign structures must be incorporated into the design.

15.2.7 Constructability Analysis and Design

CONTRACTOR will perform constructability studies of the structure and details at the 30%, 60% and 90% stages of plan development. The CMGC, PEER REVIEWER, and STATE will provide constructability input; however, CONTRACTOR will remain responsible for the adequacy of all constructability studies.

15.2.8 3D Drawings for Constructability Studies

CONTRACTOR will prepare sufficient 3D drawings for constructability reviews with input from the CMGC on means and methods. 3D drawings will illustrate proposed bridge rehabilitation of all truss repairs proposed for spans 18, 19, and 20, and include temporary supports proposed or other means necessary to relieve or bypass loads at truss gusset plates for proposed repairs. CONTRACTOR will present the 3D drawings to the CMGC and PEER REVIEWER during the constructability review process.

15.2.9 Bridge Coordinate Geometry

CONTRACTOR will calculate bridge deck geometry based on final roadway plan and profile. Provide all coordinate geometry in the plans, including approach slab and immediate transition areas.

15.2.10 Security Assessment

CONTRACTOR will provide a Security Assessment following the guidelines of current FHWA practices in conformance with project guidelines. STATE anticipates that CONTRACTOR will develop details to install security cameras on and off the bridge. Specifically, the security camera system may include: two forward looking infrared (FLIR) cameras mounted on standalone poles to monitor either end of the bridge using software analytics to automatically monitor the FLIR images continuously and provide an alarm when a human is detected in specified areas; one standard color Capital Community Television (CCTV) camera with pan tilt zoom mounted on one of the poles with the FLIR camera, and necessary equipment for connection to a fiber connection network to include poles for mounting. CONTRACTOR must review these details with the

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Bridge Office Project Manager to determine which elements are applicable to this project. Further direction will be provided upon execution of this Contract.

15.2.11 Miscellaneous Design

CONTRACTOR will provide design and detailing for miscellaneous bridge elements, including, but not limited to, navigational lighting and roadway lighting (designed by others).

15.2.12 Utility Hanger Design/Coordination

CONTRACTOR will provide coordination and design detailing for hangers and associated details to accommodate utilities.

15.2.13 General Plan and Elevation (GP&E)

This task consists of taking the Preliminary Plan GP&E sheet and modifying it to be compatible with STATE practices for GP&E sheets for final plan sets.

15.2.14 Index and Quantities with Pay Splits

This task consists of developing a plan sheet with an index to the plan set and a table of quantities for the project.

15.2.15 General Notes/Abbreviations/Notation

This task consists of developing a plan sheet containing general project notes, abbreviations, and notations.

15.2.16 Rehabilitation Notes

This task consists of developing a plan sheet containing project notes specific to rehabilitation of the structure.

15.2.17 Geometry Layout Sheet

This task consists of developing the geometry and working points for the bridge layout.

15.2.18 Bridge removal details

Bridge removal details must clearly show plans sheets for disassembly of the truss with cut-lines and expected in-tack truss sections for use in the FHWA load testing research. Refer to TASK L for further information.

15.2.19 Abutment details

This task consists of designing and detailing a new south abutment, modifications to the bridge seat, and repairs to the north abutment.

15.2.20 Pier details

This task consists of designing and detailing new substructures and repairs for piers as noted in the Preliminary Plan.

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15.2.21 Post-tensioning layout and details for south approach post-tensioned slab spans

This task consists of designing and detailing new post-tensioned slab spans on the south approach as noted in the Preliminary Plan.

15.2.22 Framing plan for approach spans

This task consists of development of a framing plan that shows beam spacing, diaphragm spacing, pier locations, bearing types and working point dimensions tied to bearing and beam spacing.

15.2.23 Beam details for spans 3-11 and spans 12-14

This task consists of development, design, and detailing of special design prestressed concrete beams for the approach spans as shown in the Preliminary Bridge Plans for Bridge 5900, unless otherwise approved by STATE. CONTRACTOR will collaborate with STATE, Project Historian, and the CMGC to review design and fabrication requirements for new prestressed concrete beams with local PCB fabricators to investigate reconstruction of these spans utilizing haunched rectangular prestressed concrete beams. CONTRACTOR must investigate constructability, cost of new forms, and consider other alternatives with input from CMGC Contractor, including consideration of replacement in kind construction on falsework and other means presented by CMGC. Final alternative selection will be evaluated with CONTRACTOR provided preliminary analysis, sketches and 3D visualizations of up to 3 alternatives for evaluation with respect to the SOI Standards. Final selection of beam details for these spans will ultimately be included within the summary report for Bridge Rehabilitation Recommendations, provided by CONTRACTOR with direct input from Project Historian.

15.2.24 Beam details for span 15

This task consists of development, design, and detailing of stringer, floor-beam, and girder details for replacement of span 15 as shown in the Preliminary Bridge Plans for Bridge 5900.

15.2.25 Deck details for spans 3-14

This task consists of developing plan sheets for replacement of the existing deck.

15.2.26 Deck details for span 15

This task consists of developing plan sheets for replacement of the existing deck.

15.2.27 Truss details for spans 16 and 17

This task consists of development of the new truss span details for spans 16 and 17, with inclusion of internal load path redundancy for truss members, gusset plates, and pin connections.

15.2.28 Deck details for spans 16 and 17

This task consists of developing plan sheets for replacement of the existing deck.

15.2.29 Refurbished geometry/condition

This task consists of identifying modifications to make to truss and floor beam components to be consistent with final stringer, railing, overhang brackets, and expansion joint details.

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15.2.30 Truss rehabilitation details for spans 18-20

This task consists of developing final plan details for repairs to the following truss members:

- a) Removal of sidewalk and sidewalk support brackets;
- b) Details for removal of lattice bracing and pack rust remediation;
- c) Details for removal of truss gusset plates, and pack rust remediation;
- d) Details for rivet replacements and button head bolt installation clearances;
- e) Floor beam connection repairs;
- f) Stringer replacement details and connection repairs;
- g) Final deck details based on previous analysis and selection of deck alternative (as described in TASK D);
- h) Expansion joint details showing fit-up with orthotropic deck and stringers;
- i) Gusset plate repairs (lower chord)
- j) Barrier attachment details to orthotropic deck, rub rail attachment to verticals
- k) Suspended span hanger details
- l) Miscellaneous truss member repairs

15.2.31 Truss details for spans 21 - 24

This task consists of development of the new truss span details for spans 21-24, with inclusion of internal load path redundancy for truss members, gusset plates, and pin connections.

15.2.32 Deck details for spans 21 - 24

This task consists of developing plan sheets for replacement of the existing deck.

15.2.33 Bearings

CONTRACTOR will develop final plan details for new bearings on all substructures, except for piers 18 and 19. CONTRACTOR will develop plan details for rehabilitation of bearings for piers 18 and 19.

15.2.34 New steel component drawings

This task consists of developing final plan details for any new replacement members that are determined to be required.

15.2.35 Bracing

Upper and lower bracing details will be provided on 1-2 plan sheets.

15.2.36 Drainage system

This task includes final design of bridge deck drainage locations and detailed plan development for deck drains, deck drainage system, downspout details, and coordination with others to provide connection of bridge deck drainage components with the final roadway drainage system.

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15.2.37 Expansion joint details

This task consists of developing a plan sheet with details that describe expansion joint components that interface between the approach spans and the deck truss spans.

15.2.38 Railing details

This task consists of detailing railing components for the truss and approach spans on a plan sheet for sections of railing that require repair or replacement.

15.2.39 Bridge lighting details

This task includes development of bridge roadway lighting, bridge navigation lighting, bridge aerial beacon lighting, and bridge aesthetic lighting details in accordance with project requirements. Aesthetic lighting concept design will be provided by others. CONTRACTOR must incorporate aesthetic lighting design concepts into Bridge Lighting Plans for Bridge 5900.

15.2.40 Bridge survey and foundation sheets

This task consists of modifying the existing bridge survey sheets to include test pile locations and pier and abutment footing elevations.

15.2.41 Prepare Special Provisions

This task consists of preparing unique Special Provisions for elements associated with the truss span. Wherever appropriate, standard bridge Special Provisions will be utilized and will be prepared by STATE. Special Provisions associated with metal preparation and coating application to metal components will be prepared by others.

15.2.42 Constructability review

The time associated with this task is to review constructability of the final plans and specifications.

15.2.43 Submit plans and specs to STATE for review

The final plans and specs will be completed with ongoing discussions with the Project Historian and will be first submitted to him/her for review and comment. After addressing these comments the documents will then be submitted to STATE for review. Two hard copies and an electronic copy of the draft documents will be supplied to the Bridge Office Project Manager. Anticipated reviewers are: STATE, District 6, MnDOT CRU (who will submit to the SHPO), FHWA, and the Project Historian. Submittal of 30%, 60%, and 90% plans initiates the CMGC OPCC process (refer to CMGC schedule in Article 15.5).

15.2.44 Revise plans based on review comments

Upon receipt of a single set of draft documents with review marks from STATE, updates will be made to the package. It is assumed that one meeting may be held to discuss the review comments. Plans will also need to be updated based on the review by MnDOT CRU and the SHPO for compliance with SOI Standards.

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15.3 Final Plan Certification

The final plans for each Work Package will be certified by a professional engineer licensed under the laws of the State of Minnesota and as provided for under Minnesota Statute Section 326.12 and the Minnesota State Board of Architecture, Engineering, Land Surveying, Landscape Architecture, Geoscience, and Interior Design. **All plan sheets must be certified.**

15.4 CADD Files

Electronic CADD files of the final certified bridge plan are included in the final deliverables for this Contract. All files must be submitted in MicroStation. Files will be assembled in accordance with the following conventions and procedures:

15.4.1 File Requirements:

- Use the correct file naming convention for all files.
- For each plan set there will be only one file per file naming convention; therefore, merge/copy plan sheets/details or files into one file. (Example: if you have separate files for the north and south abutment details, and/or reinforcement, combine them into one file with the “abt” file extension. If you have separate files for each pier combine them into one file with the “pir” file extension).
- All reference files that are part of the finished plan sheet must be merged into a master file. Reference files are not allowed; therefore, detach all reference files after merging needed files and details.
- Remove all elements that are not part of the final plan sheet; remove all elements that do not reside within the boundaries of the sheet border.
Sheet numbers are to be numeric. The exception is on revised plan sheets where an “R” follows the sheet number.

15.4.2 File Naming Convention

File name will be: “BR” + “bridge number” + “_” + “file extension.dgn” (Example: BR12345_abt.dgn).

15.4.3 File Extension

New Plans:

- abt Abutment Details and Reinforcement
- det B-Details, Standard Sheets, and As-Built Bridge Data Sheet
- exp Expansion Device Details ***
- pcb Concrete Beam Details ***
- pir Pier Details and Reinforcement
- ral Railing and Median Details ***
- s12 General Plan and Elevation, Bridge Layout, Variable Super Charts, and Quantities
- stl Steel: Beams, Framing Details, etc.***

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- sup Superstructure: Deck Plan, Framing Plan, Integral Diaphragm, Deck Transverse and Longitudinal Sections, and Sidewalk and Median Sheets.
- sur Survey: Plan and Profile
- sys Conduit Systems: Power, Lighting, Phone, Signals, etc.

*** These plan sheets may be included in the “sup” file extension.

15.5 Contract Deliverables Schedule for CMGC Work Packages

CONTRACTOR will assemble and submit work packages one week prior to workshops at the project stages listed below. Work packages will include draft plans, estimated quantities, and draft Special Provisions. The anticipated PDT kick-off meeting date is mid-January 2014.

Contract Deliverables Schedule for Bridge 5900 Work Package 1A:

- 30% Plans (anticipated due date: (1/29/14)
 - Initiates 30% OPCC process
 - Present submittal at OPCC workshop (2/5/14)
 - 3 weeks for CMGC Interim Pricing (OPCC) Milestone process (2/26/14)
- 60% Plans for Scour Mitigation and Pier Pile Evaluation (anticipated due date: 3/26/14)
 - 60% OPCC
 - Present submittal at OPCC workshop (4/2/14)
 - 2 weeks for CMGC Interim Pricing (OPCC) Milestone process (4/16/14)
- 90% Plans for Scour Mitigation and Pier Pile Evaluation (anticipated due date: 5/7/14)
 - 90% OPCC
 - Present submittal at OPCC workshop (5/14/14)
- Final Plans for Scour Mitigation and Pier Pile Evaluation (with completed peer review)
 - Issue for Bid Plan Package (IFB)
 - Present submittal at Final Pre-Bid Plan Review workshop (6/4/14)
 - Target date to begin construction: 7/2/14

Contract Deliverables Schedule for Bridge 5900 Work Package 3:

- 30% Plans (anticipated due date: Dec 2014)
 - Initiates 30% OPCC process
 - Present submittal at OPCC workshop (Jan 2015)
 - 2 weeks for CMGC Interim Pricing (OPCC) Milestone process (Jan 2015)
- 60% Plans (anticipated due date: (April 2015)
 - 60% OPCC
 - Present submittal at OPCC workshop (April 2015)
 - 2 weeks for CMGC Interim Pricing (OPCC) Milestone process (April 2015)
- 90% Plans (anticipated due date: June 2015)
 - Present submittal at OPCC workshop (June 2015)
 - 2 weeks for CMGC Interim Pricing (OPCC) Milestone process (June 2015)
- Final Plans for Entire Bridge (with completed peer review)

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- Issue for Bid Plan Package
- Present submittal at Final Pre-Bid Plan Review workshop (Aug 2015)

CONTRACTOR will assemble submittals for respective Work Packages with notation clearly identifying each submittal. Work Packages for the 30%, 60%, and 90% submittals will include Plans, Special Provisions, and estimated quantities. Each work package will be used to prepare cost estimates by the CMGC, and by others.

The Issue for Bid Plan Package for each Work Package will initiate the development process for the Guaranteed Maximum Price for with the CMGC.

16.0 FINAL LOAD RATING ANALYSIS BRIDGE RATINGS MANUAL

CONTRACTOR will perform a final load rating analysis for the entire Bridge 5900, including all modifications to truss members and gusset plates for the rehabilitated spans 18, 19, and 20. Work under this task will include development of inventory and operating rating factors using design loadings and permit vehicle loadings. This task also includes development of a Bridge Rating Manual. The final operating rating factor will be shown in the design data block on the bridge plans. The ratings will be in accordance with the following design criteria:

- a) The Manual for Bridge Evaluation, AASHTO, (current edition);
- b) MnDOT LRFD Bridge Design Specifications;
- c) The CEB/FIP Model code for Concrete Structures, 1990 (For time Dependent Behavior of Concrete) or other model as agreed upon in design criteria;
- d) Other applicable criteria as defined in the Project's Design Specifications.

CONTRACTOR Tasks:

Each separate component, segment, or type within the overall bridge will be rated and reported. At a minimum, CONTRACTOR will rate for:

- a) Moment and shear at the tenth points of each span.
- b) Design live loads placed on one or more design lanes with the appropriate multiple presence factor for the number of lanes occupied.

Prestressed concrete beam (PCB) approach spans:

CONTRACTOR will rate PCB based on the MBE, current edition. CONTRACTOR must rate PCB spans using VIRTIS software. CONTRACTOR will also be required to provide VIRTIS input files for PCB spans. The entire beam span structure must be rated for each unique span. PCB spans will not be required as part of the bridge ratings manual.

Steel plate girder spans with floor beams and stringers

CONTRACTOR will rate steel plate girders based on the MBE, current edition. CONTRACTOR must rate steel plate girder spans using VIRTIS software. CONTRACTOR will also be required to provide VIRTIS input files for steel plate girder span spans. The floor beams and stringers must also be rated use VIRTIS software. Steel plate girder spans will be required as part of the bridge ratings manual.

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Truss spans with floor beams and stringers and gusset plates

CONTRACTOR will rate floor beams and stringers in the truss spans using VIRTIS software.

CONTRACTOR will also be required to provide VIRTIS input files for floor beams and stringer spans.

The trusses will be rated using 2D and 3D software calibrated as described in above (refer to section 10, TASK H).

Gusset Plates will be rated per new AASTHO agenda items that we approved as per:

- a) 2013 AASHTO Agenda Item 25 (Revision 1) – *(Revisions to gusset plate design)*
- b) 2013 AASHTO Agenda Item 41 (Revision 1) – *(Revision to MBE for gusset plate rating)*

Design criteria for truss spans will be based on the preliminary load rating criteria for truss spans 18, 19, and 20 as described above (see section 10, TASK H), updated as agreed upon by STATE's Bridge Ratings Engineer.

For design loadings, CONTRACTOR will rate for:

- a) HL-93 loading for single lane and 2-lane loadings across the entire bridge;
- b) HL-93 loading for 1 lane with inspection vehicle on bridge;
- c) Include appropriate corresponding multiple presence factor;
- d) Rating analysis will include consideration of the most critical loading for both transverse and longitudinal analysis.

This portion of the analysis includes rating using the HL-93 loading, with rating factors reported for both inventory and operating rating.

For permit loadings, CONTRACTOR will rate for:

- a) Five different MnDOT overweight permit vehicles, each analyzed individually and placed on one or more lanes with the appropriate multiple presence factor for the number of lanes occupied.
- b) Each permit vehicle with a uniform lane load equal to 200 lbs. per linear foot placed on each lane, plus the addition of Minnesota legal loads shown in Appendix 15-D and Appendix 15-E (MnDOT LRFD Bridge Design Manual, current edition) placed on the remaining lanes of the bridge.
 - i. The permit vehicle and lane load will have a multiple presence factor of 1.00 and the Minnesota legal loads will have the appropriate multiple presence factor for the number of lanes occupied.
 - ii. If CONTRACTOR can demonstrate that use of the HL-93 loading does not result in substantial inefficiencies, STATE may permit the use of HL-93 loading in lieu of legal loads (combined with permit vehicle loads).

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- c) Rating analysis will include consideration of the most critical loading for both transverse and longitudinal analysis.
- d) This portion of the analysis includes rating using the HL-93 loading, with rating factors reported for the operating rating.
- e) Rate all bridge types using LRFR method.

16.1 Operating Rating

CONTRACTOR will provide an operating rating factor. The operating rating will be included in the Design Data in the bridge plans.

17.0 Inventory Rating and Rating Report

CONTRACTOR will provide a Bridge Rating and Load Posting Report. A standard form will be provided by STATE. The overall rating will be the lowest rating of any individual component, segment, or type. The final rating and each component rating will be accompanied by the location of the rating, the limit state, and the impact factor. The minimum inventory rating factor will be 1.0.

18.0 Post-Letting Activity: Rating Manual

CONTRACTOR will proceed with the development of a rating manual upon written authorization from STATE. CONTRACTOR will provide the load rating in VIRTIS software format, using system input. If VIRTIS is unable to rate the bridge type, another commercially available bridge rating software – accepted by STATE – may be used. The software must be capable of running overweight vehicles as described herein. CONTRACTOR will submit the computer files with the rating.

For any bridge type that is not compatible with VIRTIS, CONTRACTOR will provide a rating manual. This manual will include methods, – which use influence lines and surfaces – instructions, and examples of how to rate the bridge for any type of future permit vehicles. Such vehicles may range up to 600,000 lbs., have as many as 25 axles, two to eight tires per axle to a width of 20 feet, and length up to 200 feet. A rating manual example will be provided by STATE upon request.

NOTE that if CONTRACTOR uses same software as MnDOT Bridge Ratings Office, then electronic input file with instructions may supplant portions of the bridge ratings manual. If the software used is not available in the Bridge Office, then those portions must be included in the Bridge Rating Manual.

16.4 Peer Review Coordination

CONTRACTOR will coordinate the peer review for the load rating with PEER REVIEWER.

19.0 CONSTRUCTION SUPPORT

STATE anticipates that the following Engineer of Record support activities will be required during the construction phase of the project:

- a) Design office support administration and coordination
- b) Maintenance of project status

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- c) Respond to Requests for Information (RFIs)
- d) Shop drawing and bridge submittals reviews
- e) Evaluate effects on structure from temporary loads placed by the CMGC, such as paint containment

STATE intends to negotiate the fee for these construction support activities upon completion of design.
Do not include costs associated with this effort in RFP responses.

20.0 DELIVERABLES

18.1 STATE deliverables (refer to documents in Article 1.0)

- a) Draft Preliminary Plans Bridge 5900
- b) Geometric Layout for the Project
- c) Bridge 85851 Preliminary Bridge Plans
- d) Bridge 85851 Study Report (June 2013)
- e) Bridge 5900 2012 Fracture Critical Bridge Inspection Report
- f) Plans and shop drawings for Bridge 5900 (12 sets from 1941 to 2010)
- g) Preliminary Scoping Study Reports
- h) Programmatic Agreement between STATE and SHPO
- i) Pile driving records
- j) Sample load rating manual per request

18.2 CONTRACTOR deliverables:

- a) Reports: See section 2.5 and TASKS C, D, F, and K
- b) Work Package 1A 30%, 60%, 90%, and Final IFB Work Package 1A (6 hard copies, 1 electronic copy)
- c) Work Package 3 30% Bridge Plan (6 hard copies, 1 electronic copy)
- d) Work Package 3 60% Bridge Plan (6 hard copies, 1 electronic copy)
- e) Work Package 3 90% Bridge Plan design computations (electronic copy)
- f) Final Issue for Bid Work Package 3 Bridge Plans, Quantities, Special Provisions (6 sets, 1 electronic copy)
- g) Visualizations for MnDOT CRU, SHPO (as necessary)
- h) Draft Special Provisions (electronic copy)
- i) Certified Final Bridge Plan (1 hard copy, 1 electronic copy)
- j) Special Provisions (1 electronic copy)
- k) Final Design Calculations (1 bound set, 1 electronic copy)
- l) Final Quantity Calculations (1 bound set, 1 electronic copy)
- m) Electronic file of Final Bridge Plan (MicroStation)
- n) Electronic file of Special Provisions (Microsoft Word)
- o) Final bridge load rating report and load rating manual.

21.0 ADDITIONAL PROJECT INFORMATION

CONTRACTOR is advised that the status of the NEPA process is incomplete. STATE anticipates completion of the Finding of No Significant Impact (FONSI) by January 1, 2014. Prior to completion of

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the National Environment Policy Act (NEPA) process, no commitment will be made as to any alternative under evaluation in the NEPA process, including the no-build alternative. CONTRACTOR's work will be limited to those preliminary design activities that will not bias the outcome of the NEPA process.

Upon notice to proceed, CONTRACTOR may proceed with Preliminary Design and development of the 30% Plan, including all work and all submittals specified for the 30% Early Foundations Work Package.

No commitments will be made to any alternative being evaluated in the NEPA process and that the comparative merits of all alternatives presented in the NEPA document, including the no-build alternative, will be evaluated and fairly considered, prior to proceeding with Final Design.

CONTRACTOR will not proceed with final design until specifically authorized in writing by STATE.

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