**PROJECT BACKGROUND**

Constructed in 1883 by the Minneapolis Union Railway, Bridge 27004 (also known as the Stone Arch Bridge) served as a railroad crossing over the St. Anthony Falls and Mississippi River in downtown Minneapolis until 1982. In 1992, State acquired the bridge and rehabilitated it for pedestrian and bicycle use in 1993. The rehabilitated configuration features a pedestrian and bicycle trail with metal railings, concrete sidewalks, bituminous paving, a lighting system, and a trenched deck drainage system.

In 2006, State selected the Stone Arch Bridge as one of 24 bridges for which State has committed to ongoing preservation and maintenance (the Stone Arch Bridge Management Plan is available through the following link: [http://www.dot.state.mn.us/historicbridges/bridge/27004/management-plan.pdf](http://www.dot.state.mn.us/historicbridges/bridge/27004/management-plan.pdf)). As such, rehabilitation measures for the structure must adhere to Section 106 of the National Historic Preservation Act, Section 4(f) of the Department of Transportation Act of 1966, and the Secretary of the Interior’s Standards for Treatment of Historic Properties (SOI Standards).

From 2017 to 2018, State hired LHB, Inc. to complete a scoping level inspection of the superstructure and substructures (above water portions only), and to provide a report summarizing the inspection findings, identifying structural components for further investigation, and recommending repair types to carry forward into a detail design phase. (See Stone Arch Bridge Condition & Rehabilitation Assessment Report...link here)

**NOTE/FYI:** The construction delivery method for the project has not been determined. State is considering design-bid-build and Construction Manager / General Contractor (CMGC) options. A decision on the delivery method is anticipated in Summer/Fall 2019.

**SCOPE OVERVIEW**

State intends to hire a consultant to perform the following anticipated tasks:

a) Conduct a site visit.

b) Collect and analyze material properties at specified locations.

c) Load rate the structure for State inspection vehicles, emergency vehicles, and pedestrian loads.

d) Investigate pinning methods and verify constructability (expect input from State).

e) Develop repair plans and special provisions for repointing mortar at deteriorated locations, and for replacing and/or re-facing broken stones.

f) Develop plans and special provisions for rip-rap placement, and a scour monitoring system.

g) Produce a photo documentation system capable of 3D renderings of repair locations.

**PROJECT ADMINISTRATION AND MEETINGS**

State will provide a Project Manager to give direction to Contractor’s activities. It will be the responsibility of State’s Project Manager to receive work produced by Contractor, review the work for adequacy and compliance with contract standards, and to recommend payment for such work.

Contractor will conduct the day-to-day administration of the project, including cost and schedule updates for State’s Project Manager, invoicing, and other non-technical work. Contractor will also maintain a
comment log that tracks comments and comment resolution from State, CRU, SHPO, and other entities. The comment log is expected to apply to all tasks included in this scope of services.

No changes in Contractor’s project management, lead design personnel, or stone masonry expert(s), will be permitted without prior written consent from State’s Project Manager.

**Cultural Resources Coordination**

State’s Cultural Resources Unit (CRU) has retained a Historic Architect to assist in developing rehabilitation plans and to review plan details that affect the historic fabric of the bridge. Contractor must collaborate with CRU and the Historic Architect from the onset of this contract through completion of final deliverables to determine the effort needed to ensure that Contractor’s design complies with Secretary of the Interior’s Standards.

CRU and its Historic Architects will work collaboratively with the project team in development of rehabilitation plans and special provisions. It will review proposed testing, repair, and rehabilitation methodologies, including stone and mortar repair techniques, finishes, and selection. It will participate in the stone condition investigations and testing to help inform collaborative efforts and the review of the proposed rehabilitation work under the SOI Standards. CRU will review and comment on the rehabilitation plan submittals at the 30%, 60%, and 90% stages and special provisions for design adherence to SOI Standards. It is anticipated an in-person meeting with the SHPO will occur at the 30% stage, with a formal letter and plans submittal at the 60% stage. 90% plans will be reviewed by CRU and may or may not be submitted for SHPO review and comment depending on developed changes between 60% and 90% plan and special provisions. Forty-five working day review periods are required for CRU reviews, which will include the SHPO reviews. Contractor may continue with design activities during these reviews at its own risk. CRU and SHPO plan review comments must be incorporated into subsequent plan submittals.

**Public Outreach Support**

Contractor will provide supporting documents and graphics to assist with Metro District’s public outreach activities, which will be housed under a separate MnDOT contract. Contractor’s attendance at public outreach activities is not anticipated.

**Project Meetings** *(At State’s Bridge Office in Oakdale, MN)*

Contractor will lead all project meetings. At a minimum, the following meetings are anticipated:

I. **Kick-Off Meeting:** Contractor will lead a kick-off meeting to discuss known project issues, establish communication and coordination protocols, and review the project schedule.

II. **Monthly Meetings:** Contractor will meet with State’s Project Manager, CRU, the Historic Architect, and other Bridge Office staff monthly to maintain a common project understanding as Contractor’s activities progress. Contractor will provide meeting agendas and meeting minutes, distributed two days prior to and after meetings, respectively.
III. **PLAN REVIEW MEETINGS (AS NEEDED):** At State’s Project Manager’s request, Contractor will participate in plan review meetings at the 30%, 60%, and 90% stages. Contractor will provide meeting minutes, distributed within two days after these meetings.

IV. **CMGC MEETINGS (IF NEEDED):** If the CMGC delivery method is selected, Contractor must plan for considerable CMGC coordination efforts, including constructability workshops, and Opinion of Probable Costs (OPCC) pricing meetings at milestone plan submittal stages. Assume 100 project management hours for initial CMGC coordination efforts, and if this contract’s notice to proceed is given before State makes its determination of delivery method, then State and Contractor will negotiate an amendment for CMGC-related tasks and services.

**TASK A: SITE VISIT**
Contractor will familiarize itself with the entirety of the 2018 Condition & Rehabilitation Assessment Report, as well as the latest fracture critical, routine inspection, and underwater inspection reports, and conduct a site visit to gain an understanding of the bridge and its surroundings. Contractor must coordinate its site visit with CRU’s Historic Architect, Metro District’s Bridge Inspection Unit, and State’s Project Manager, in order to combine the structural perspective with the Historic Architect’s perspective for the project. In advance of the site visit, Contractor will identify focal areas of the bridge in the 2018 Condition & Rehabilitation Assessment Report to review during the site visit. During the site visit, Contractor will keep track of any differentiation in structural condition from that noted in the 2018 Condition & Rehabilitation Assessment Report. Contractor will present its site visit findings to State in a memo.

**Contractor Deliverables:**
I. Site visit condition update memo
II. Safety equipment for all of Contractor’s personnel on site

**State Deliverables**
I. Boat for viewing from the river
II. Snooper truck (1) for Contractor’s inspection staff

**TASK B: MATERIALS COLLECTION AND ANALYSIS**
Contractor will conduct materials sampling and testing as described herein. Prior to performing any of this work, Contractor will submit the following items:

I. Draft testing plan which describes the sample collection methods, locations, access and equipment requirements, safety requirements, and testing required. Submit draft plan 1 month prior to the date of testing.
II. Final testing plan which incorporates all comments from State. Submit final plan 1 month prior to the date of testing.
III. Any deviation from the final testing plan will be documented and included in a revised Final Testing Plan.
IV. Submit an Investigation Memo within three months of completed testing, detailing the results of all testing performed.
Contractor’s anticipated tasks are:

V. Conduct visual inspection and hammer sounding of stone faces in each span, along the headwall, banding stone, and underside arch regions.

VI. Perform coring (assume 8 cores per span) of a representative sample of stones from headwall, banding stone, and underside arch regions. Both fractured/cracked stones and intact stones must be represented.
   a) Include coring of a number of stones that hammer sounding reveals to be “unsound,” though the stones do not demonstrate visible deterioration. The intent is to demonstrate the condition of the stone and assist in determining the level of repair needed (or replacement, if necessary).

VII. Assess condition of the pinned veneer at the arch underside regions. In particular, assess the condition of the pinning (tensile) anchors and the bonding agent to determine if supplemental pinning with undercut or similar anchors would be beneficial. Perform pull tests on three anchors and replace them with undercut anchors.

VIII. Assess condition of subsurface waterproofing. Observe for signs of seepage at headwalls and underside arch stones.
   a) Obtain moisture readings from within fill areas.

IX. Obtain samples of grout from representative areas of the bridge (up to 20 locations). Determine properties of suitable replacement grout for specifications.

Contractor Deliverables:
I. Draft Testing Plan
II. Final Testing Plan
III. Investigation Memo (with test results appendices)

State Deliverables:
I. Comments on the Draft Testing Plan

**TASK C: LOAD RATING**

Contractor will complete a load rating of the steel structure by Load and Resistance Factor Rating (LRFR) using the AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges, current edition, the AASHTO Manual for Condition Evaluation of Bridges (MBE), current edition with interims, MnDOT Bridge Load Rating and Evaluation Manual, AASHTO Load and Resistance Factor Design (LRFD) Specifications, and State’s supplemental instructions. For the masonry arches, Contractor will review guidelines in the MBE with consideration of masonry structural conditions. Supplemental materials for Contractor’s review include *Safety of Historical Stone Arch Bridges, Dirk Proske, Pieter Van Gelder*. Contractor’s selected load rating method must be capable of analyzing four-point hinges and the influence of single, large cracks.

For the masonry structural components, Contractor must use a program or analysis methodology that has been experimentally verified.

Contractor will rate for pedestrian loads, State legal loads, emergency vehicles, and State’s inspection vehicles, and provide ratings analysis and load posting recommendations (as applicable). NOTE: There is no existing load rating information for this bridge.
Contractor will perform the following load rating and checking tasks:

I. Review existing information from State’s records, including original plans, rehabilitation and repair plans, bridge inventory sheets, inspection records, and fracture critical inspection records and reports.

II. Rate the entire superstructure (i.e. main spans and approach spans, etc.).

III. Rate the bridge based on its current condition, capacity, and loading of the bridge.

IV. Rate the bridge for loads required by the AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges, and aforementioned trucks. Use a performance ratio to report the pedestrian loading. Also, report operating ratings for the required vehicle load.
   a. The performance ratio \((c/d)\) must be equal to or greater than 1.0.
   b. The desired operating rating is equal to or greater than 1.3.

V. Contractor will facilitate a check-in meeting with State’s Bridge Ratings Engineer to report the performance ratio and rating factors for the vehicle loading.

VI. Check postings for all legal loads at operating level.

VII. Model the bridge using software fully capable of rating the bridge types.

VIII. Contractor must provide an independent check of the load ratings, using a separate software package or rating method (e.g. spreadsheets).

IX. Prepare a draft summary table for all bridge members being rated, to be submitted to State’s Bridge Ratings Engineer at the check-in meeting (see V. above). The summary table will include the performance ratio for the pedestrian loading, operating rating factors for the vehicle loading, legal loads, emergency vehicles, and State’s inspection vehicles, section properties, capacity, dead load, live load (maximums and minimums), impact, etc., at positive moment locations, minimum negative moment locations, and any other controlling locations. Contractor will also submit its final summary table to State’s Bridge Ratings Engineer as a final deliverable for the task.

X. Prepare a load rating report using the two template forms provided by State (Bridge Rating and Load Posting Report” and “Bridge Rating Details”). This report will include summaries of the performance ratio for pedestrian loading, and operating rating factors, locations, and limit states for all unique members and/or member types within the bridge, and a sketch or layout of the bridge that identifies the referenced rating locations.

Contractor Deliverables:

I. Draft summary table, due at the check-in meeting

II. Final summary table, due as the final deliverable

III. Final rating report, certified by the engineer who led the load rating effort. This individual must be a registered engineer in the State of Minnesota.

IV. Reference materials for the rating, including copies of computer input and output, hand calculations, MathCAD or Excel worksheets, additional comments, assumptions or explanations, etc.

V. Spreadsheets in electronic Excel format.

State Deliverables:

I. “Bridge Rating and Load Posting Report” and “Bridge Rating Details” template forms

II. Bridge structure inventory sheets

III. Access to all bridges plans and supplemental documents in State’s possession

IV. Posting vehicles and permit rating vehicle information
V. FHWA emergency vehicle information.

**Task D: Develop Repair Recommendations**

Based on the results of Tasks B and C, Contractor will prepare repair recommendations. Determine estimated quantities for each repair type and state any critical sequences for each repair type. Provide 30% complete repair recommendations to the Bridge Office with estimated quantities for concurrence. State will review and provide comments on the 30% recs within 20 working days.

Prepare documents for constructability reviews with construction contractors. Contractor will develop lists of questions concerning access requirements, temperature restrictions for repairs, etc. to aid in constructability and schedule considerations. Contractor will develop temporary de-watering strategies for each pier (see Task D2 for more information). Develop budgetary costs for repair types and critical cost drivers (e.g. access, shoring, and water containment). Compile construction contractor input from constructability reviews, and describe how Contractor will incorporate the input into its repair recommendations and plans. Contractor will present this information to State in a technical memorandum.

Develop final repair types, discuss pay items with Bridge Estimating Unit, incorporate State’s 30% repair recommendations comments, and produce final repair recommendations with estimated quantities. Prepare preliminary estimate based on 90% repair recommendations. State will review the 90% recommendations and return comments within 20 working days.

Contractor will incorporate State’s comments on the 90% repair recommendations and submit certified 100% repair recommendations within 10 working days.

**Task D1: Pinning Methods Investigation and Constructability**

Contractor will perform a literature review and summarize anchorage types and their suitability for this structure. Investigate anchor pinning methods, including long reach undercut anchor pinning for replacement of the underside arch stones in the upper regions. Use of a shallow depth, epoxied anchors—as done in previous veneer replacements—is not recommended due to concerns over long term degradation of the backing stone, to which tension anchors are bonded. Contractor must actively collaborate this task with the Historic Architect.

Contractor Deliverables:
I. A report that documents:
   a. Results from tests from in-place anchors (see Task B, V.)
   b. Anchorage research findings
   c. Recommendations for pinning methods with associated risks and costs
   d. Recommendations for anchor types and manufactured products suitable for short-listing
   e. Mock up and qualification procedure for inclusion in bid documents

State Deliverables:
I. Review comments on Contractor’s report
**TASK D2: WATERLINE REPAIRS**

Contractor will assess means and methods for repairs at or below the water line. This includes determining whether or not de-watering is necessary to perform repairs.

Review existing underwater inspections and sounding data and summarize the maximum depths at which repairs will be needed. Determine space required around repairs in order to execute work. Determine appropriate de-watering systems at each pier. Identify supplemental field information needed to develop design parameters for de-watering systems. Develop schematic sketches showing limits of repairs and de-watering system limits with 30% repair recommendations, and prior to constructability reviews. At 60%, provide a feasible design of de-watering systems for preliminary estimating. At 90%, provide the full design of the system, taking construction contractor feedback into account.

**TASK E: DEVELOP REPAIR PLANS AND SPECIAL PROVISIONS**

Contractor will complete all tasks necessary to: a) produce certified construction plans to repair, strengthen, re-face, and/or replace broken masonry stone, b) repoint mortar at deteriorated locations, c) details for any other required repairs included in the repair recommendations, and d) develop all bridge special provisions for the project.

Contractor will propose design criteria and design methodology for the project. Methodology must consider methods introduced in *Safety of Historical Stone Arch Bridges*, State will review and comment on the design criteria within 20 working days. Contractor will perform detail design in accordance with agreed upon design standards, geometric, material, and procedural requirements for the project as described in this scope of services.

All plan submittals must be made on 11”x17” bond paper or an approved equivalent. Plan sheets must be produced using the current version of MicroStation.

**DESIGN REFERENCES**

I. MnDOT Load and Resistance Factor Design (LRFD) Bridge Design Manual
II. American Association of State Highway and Transportation Officials (AASHTO) LRFD Bridge Design Specifications
III. AASHTO Manual for Bridge Evaluation
IV. MnDOT Bridge Load Rating and Evaluation Manual
V. AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges
VI. MnDOT Bridge Details Manuals
VII. MnDOT Standard Specification for Highway Construction
VIII. MnDOT Computer Assisted Design and Drafting (CADD) Standards
IX. MnDOT Summary of Recommended Drafting Standards
X. MnDOT Bridge Preservation, Improvement, and Replacement Guidelines (as applicable)
XI. Secretary of the Interior’s Standards for the Treatment of Historic Properties (SOI Standards)
XII. Section 106 of the National Historic Preservation Act of 1966
QUALITY MANAGEMENT PLAN (QMP)

Contractor will submit a project specific QMP to State’s Project Manager within five days of notice to proceed with this scope of services. State’s Project Manager will review the QMP and either provide comments and/or revisions to Contractor, or provide written approval of the QMP as-is. Contractor must incorporate any revisions required by State’s Project Manager into its final QMP.

The QMP must specify how Contractor will perform its Quality Control (QC) and Quality Assurance (QA) activities throughout 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 and distribute the QMP to all project team members, including subcontractors. The QMP must include a description of who is performing quality control checks and how the checks will be done.

The QMP must address the following:

I. Design Calculations, Specifications, Report Writing, and Plan Checking: Contractor is responsible for the completeness and accuracy of its work. Design calculations and plan sheets must be independently checked and reconciled prior to submittal to State. Review comments from State on Contractor’s plan review submittals does not relieve Contractor of liability for an inaccurate or incomplete bridge plan.

II. Computer Programs: All computer programs and/or spreadsheets utilized by Contractor must be verified by Contractor’s in-house QA Program.

III. QA Verification: Contractor’s Quality Assurance Manager will review the entire plan design and production process to ensure the completeness and adequacy of Contractor’s work and conformance with Contractor’s QA program and procedures.

PLAN REVIEWS

Contractor will submit plans for State’s review as follows:

I. 30% Plan: The 30% Plan is an early assessment of Contractor’s progress toward plan completion. At a minimum, the 30% Plan will consist of the following:
   a. General Plan and Elevation
   b. Statement of Estimated Quantities (i.e. anticipated bid items)
   c. Staging Plans
   d. Staging Sections
   e. Removal plans, depicting major work items
   f. Proposed Plan and Elevations, depicting major work items
   g. Concept repair details
   h. Concept waterline temporary works, reflective of constructability reviews

Contractor will submit its 30% Plan to State no later than ____________, 2020. CRU will conduct a presentation at the 30% plan submittal stage with SHPO. State will return plan review comments within 20 days. Contractor may proceed with design activities during this State, CRU, and SHPO review.
II. 60% Plan: The intent of the 60% Plan is to verify Contractor’s progress toward plan completion and evaluate the work against project and contract requirements.

The 60% Plan will consist of a full set of in-progress plans developed to at least the 60% level, and will include the following:

a. General Plan and Elevation
b. Statement of Estimated Quantities
c. Staging Plans
d. Staging Sections
e. Existing Sections
f. Removal Plans
g. In-place Elevations and Removals
h. Removal Details
i. Proposed Elevations
j. Stone Masonry Veneer Details
k. Concept waterline temporary works, reflective of constructability reviews

The 60% Plan must include a full set of in-progress plan sheets, and must be submitted to State no later than ______________, 2020. State will return plan review comments within 20 days. CRU will submit the 60% Plan to SHPO to initiate its review. Contract may continue with design activities during this State, CRU, and SHPO reviews.

III. 90% Plan: The 90% Plan is for State to verify that the plan is acceptable for the State Bridge Engineer’s signature. The 90% Plan must be complete in all areas to the extent that it can be certified by Contractor, though a certification signature is not required until after this review is complete. The 90% Plan and special provisions must be submitted to State no later than ______________, 2020/21. State will return plan review comments within 20 days. CRU will submit the 90% Plan to SHPO, if necessary, to initiate its review.

At this stage of design, State anticipates that CRU will issue a memo of concurrence on the design. If necessary, the plans will be sent to SHPO for the required 30 day review. Contractor must verify this process with CRU and the Historic Architect.

IV. Final Certified Bridge Plan: Contractor will submit its Final Certified Plan to State no later than ______________, 2020/21.

Contractor Deliverables:
I. Project specific QMP
II. Design criteria and methodology
III. 30% Plan
IV. 60% Plan
   a. Draft design calculations
   b. Draft Special Provisions
V. 90% Plan  
   a. Completed design calculations  
   b. Final Special Provisions  

VI. Final Certified Plan  
   a. Certified special provisions  
   b. Certified design calculations

State Deliverables:  
I. QMP review comments  
II. Design criteria and methodology comments  
III. 30% Plan review comments  
IV. 60% Plan review comments  
V. 90% Plan review comments

**TASK F: DEVELOP PLANS AND SPECIAL PROVISIONS FOR RIP-RAP PLACEMENT AND SCOUR MONITORING**

The Stone Arch Bridge is a scour critical structure. State has extensive hydraulic documentation for the bridge, which will be made available to Contractor upon notice to proceed. This includes 3D scans of every pier, the rip rap repair plan from 1997, underwater inspections reports, and other source materials.

Contractor will review State’s materials and assess rip rap repair needs for each pier, identifying repair locations, estimating repair quantities needed, and assessing the applicability of using Geobags as a scour protection method. The rip rap size must match that used in the 1997 repair project. Contractor must present its rip rap assessment and findings to State’s Project Manager and the Bridge Office Waterways Unit and incorporate any required revisions or additions into its assessment. State’s concurrence on the repair locations is required.

State owns a scour monitoring system, housed with the Metro District’s Bridge Maintenance division. Contractor will review the equipment and system specifications and determine if the equipment can be used on the bridge. Contractor will recommend a system mounting location to State’s Project Manager, the Bridge Office Waterways Unit, and Metro District Bridge Maintenance staff, and collaboratively the group will determine a final location for mounting the system. Contractor will then develop the system and its supporting communications network, and produce plans and special provisions for use during construction.

Contractor Deliverables:  
I. Rip rap assessment and findings  
II. Scour monitoring system mounting plans and special provisions

State Deliverables:  
I. 3D scans of piers  
II. 1997 rip rap repair plan  
III. Underwater inspection reports  
IV. All other available hydraulic information for the bridge
**TASK G: CONSTRUCTION SUPPORT**

During the construction phase of the project, Contractor will respond to Requests for Information (RFIs) and provide supporting design analysis as needed. If these services are needed, State’s Project Manager will send the RFIs to Contractor, and Contractor will direct its responses back to State’s Project Manager. Assume 240 hours for construction support.

State’s anticipated prioritized list of repairs is as follows:

I. Tuck pointing and stone repair within 5 ft. of either side of the waterline, including construction means to complete the repairs  
II. Anchoring loose stone  
III. Tuck pointing unsound mortar and stone repair and/or replacement (above waterline)  
IV. Replace incompatible mortar  
V. Fix water drainage path  
VI. Scour monitoring system install  
VII. Other recommendations from the 2018 Condition & Rehabilitation Assessment Report

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