INNOVATIVE CONTRACTING PRACTICES
SPECIAL EXPERIMENTAL PROJECT NO. 14

CONSTRUCTION MANAGER/GENERAL CONTRACTOR
PROJECT DELIVERY METHOD

Zilwaukee Bridge Bearing Replacement
Michigan Department of Transportation
Bay Region

November 15, 2011

Introduction

The Michigan Department of Transportation (MDOT) is planning a rehabilitation project on B03-73112, I-75 over the Saginaw River, or the Zilwaukee bridge, that includes hinge and pier bearing replacement, latex overlay repairs, crack sealing, and barrier repairs. The project is scheduled to be let in July 2012, JN 105176.

The Zilwaukee bridge consists of twin single cell, post-tensioned precast segmental box girders (see Figure 1) erected by balanced cantilever method, with most segments being placed using a launching gantry. The segments are variable depth, and were match cast in a casting facility using the short line method, and steam cured. An epoxy bonding agent along with high tensile strength steel cables post-tensioned into anchor blisters were used to join the segments during construction. The northbound structure is 8,066 feet long, and the southbound structure is 8,090 feet long, with maximum span lengths of 392 feet. 1592 segments make up both spans.

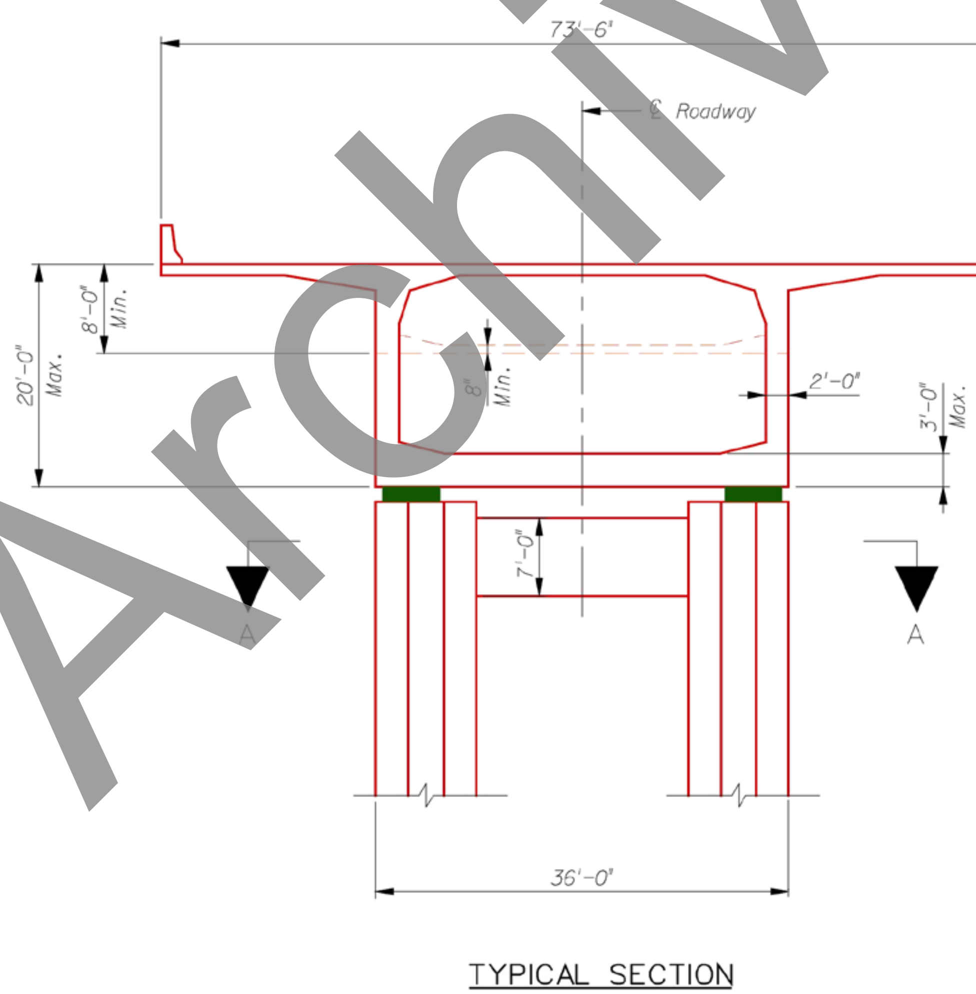

Figure 1 – Typical Segment Cross Section

Ramp H is a single-cell post-tensioned box girder erected by cast-in-place on falsework construction. The structure is 405 feet long, with a maximum span length of 243 feet.

The decks of the mainline box girders are transversely post-tensioned; the deck on Ramp H is not. A latex modified concrete overlay was placed on the deck after the segments were erected.

During balanced cantilever erection, temporary post tensioning bars, along with the alignment keys in the webs and flanges were used to hold the segments in place, and control tensile stresses in the concrete until the tendons were installed and stressed. The primary load-carrying members of the superstructure are the concrete and post-tensioning tendons. At service load levels, the post-tensioning tendons pre-compress the concrete segments together minimizing the tensile stresses. At ultimate load levels, the post-tensioning tendons carry the tensile stresses and the concrete resists the compressive stresses. The deck distributes the live loads transversely within the box girder.

The post-tensioning tendons consist of high-strength steel strands encased in ducts placed internally in the concrete and anchored at the tendon ends. Location of the tendons in each segment varies depending on the location in their span.

<u>Cantilever Tendons:</u> Pier segments contain a large number of cantilever tendons that originate close to the top flange, and web-flange interface, then drape downward into successive segments in the cantilever. These are used to control tensile stresses due to negative moment during erection, and handle the live load tensile stresses as well. Cantilever tendons are symmetric about the pier segment, and terminate at the individual segments heading towards midspan.

<u>Continuity Tendons:</u> Midspan segments contain continuity tendons located in the bottom flange and drape upward into successive segments heading towards the piers. These are used to control tensile stresses due to positive moment during erection, and handle the live load tensile stresses as well. Continuity tendons are symmetric about the cast in place closure pour at the midspan of each span, and terminate at the individual segments heading towards the intermediate supports.

As the tendons were stresses to specification, each duct was filled with cement grout to protect the steel strands from corrosion.

Superstructure loads are transmitted to the pier shafts and abutments through large pot bearings. Shear forces are also transferred across intermediate hinges within expansion joint spans from the end of a suspended cantilever through pot bearings to the adjacent supporting cantilever. The pot bearings transfer vertical loads from the superstructure to the piers and across the hinge segments and allow the superstructure to rotate freely over piers or cantilever ends (at expansion joints). Sliding bearings allow the superstructure to expand and contract without significantly displacing the piers. Fixed bearings transfer horizontal forces to the substructure by a fixed restraint between upper and lower bearing elements. Sliding and fixed bearings are employed over the piers, and only sliding bearings are used at expansion joints.

Despite problems during construction, and an August 1982 accident that shutdown construction for almost two years, the NB portion was open in 1987, and the SB portion was open in 1988. Due to the very specialized nature of the structure, in depth engineering inspections are done every fours years in addition to the required bi-annual routine inspections.

As part of the first engineering inspection in 1989, and every successive inspection since, the condition and operation of the large pier and cantilever bearings has been a topic of discussion and concern. As a result, in 2007, MDOT moved forward with a bearing replacement project.

The project was let in September 2007 (JN 88349) via low bid for the 2008 construction season. Installation of the new hinge expansion bearings required removal of concrete from the supporting cantilevers. Due to both MDOT, and contractor inexperience rehabilitating such a complex structure, several tendons and critical corbel reinforcement were damaged during core drilling of the first cantilever on the NB structure. As a result, the focus of the project immediately shifted to emergency repair. The NB structure was closed to traffic for most of the spring and summer of 2008, including the busy Memorial Day weekend. The repairs were completed, and NB was re-opened to traffic in October 2008. The repairs compensate for the loss of internal post tensioning force as a result of the damage during core drilling. This was done by applying an external post tensioning force to the damaged hinge segment via multiple dywidag bars anchored in successive segments. The structure is safe.

There were many lessons learned from that project, and MDOT gained considerable experience working on the structure, but realized that specialized technical expertise would be needed on future projects on the bridge. Many mitigation measures were discussed, and implemented for the current bearing replacement project, as they still require replacement.

As part of the current contract, MDOT selected an experienced consultant to design the project, and will retain an independent experienced consultant to review the design, and assist during the construction phase. Due to the very specialized nature of this structure, and to further ensure a successful project; MDOT is proposing to use the Construction Manager/General Contractor (CMGC) project delivery method for this project.

This will allow MDOT to engage a contractor early in the design process, and draw upon their construction expertise to provide constructability reviews, discuss means and methods for the work involved, and minimize the risk experienced on the previous project.

MDOT will draft a Request for Qualifications (RFQ), and select the CMGC via a qualifications-based selection process. The RFQ will be provided to the Michigan Division of the FHWA for review and approval.

MDOT has had some success on the CMGC delivery method on the M-222 slope stabilization project along the Kalamazoo River in the city of Allegan, Southwest Region. This will be on a much larger scale, and on a very specialized structure. MDOT feels the success of the project must involve the creativity of an experienced design and construction partnership to address the potential challenges and risks involved with the construction.

Purpose

The purpose of this proposal is to engage the construction industry during the design phase via an RFQ, and quality based selection process. The end result will be a CMGC that will be engaged during the design phase, and carry the means and methods developed during design into the construction phase. Due to the specialized nature of the Zilwaukee bridge, and the strong strategic significance of this asset, the low bid delivery method would not be the most effective, and may involve undesirable risk, as was experienced as part of the 2008 project.

Scope

The innovative contracting method proposed in this application – Construction Manager/General Contractor varies from the standard low-bid process.

MDOT proposes to select the contractor using a Qualifications Based Selection. The contract will be awarded to the contractor who meets or exceeds the qualifications as dictated in the Request For Qualifications letter. Statements of Qualifications (SOQ's) will be submitted and scored based on the criteria in the RFQ.

The selected CMGC will review and provide input during the design phase regarding constructability, means and methods, availability of materials, schedule, etc. After the plans are substantially complete (60% to 90%), the CMGC will negotiate a final price with MDOT for the construction costs. The final price is expected to include a Guaranteed Maximum Price (GMP) and contingency items.

Subject to MDOT's acceptance of the final price, the CMGC will be awarded the construction phase of the project, and thereby will be responsible to complete the construction while performing at least 40% of the work. As part of this contract, the GMCG agrees to construct the project inclusive of specific performance criteria developed during the design phase.

If a final price is not negotiated to MDOT's satisfaction, the project can revert back to a traditional Design-Bid-Build method, and the project can be opened for bids when the plans and specifications are completed. This provides MDOT an outlet if an agreement cannot be reached with the CMGC on the price by breaking the CMGC contract into two parts: (1) pre-construction services and (2) construction services. The CMGC would also be allowed to bid on the project if a final price could not be agreed on.

PRE-CONSTRUCTION PHASE SERVICES BY THE CMGC

The CMGC will be compensated for their pre-construction services. The pre-construction service costs will be based on an estimated number of hours, actual wages, and other expenses required by the CMGC. The CMGC's overhead rate will be determined by an audit, or by applying a 35% overhead rate per section 109.07B of MDOT's 2003 Standard Specifications for Construction. During the Pre-Construction Phase the CMGC is expected to:

- Provide expertise in construction methods, alternate design concepts, materials and innovations relevant to the project during the design phase.

- Provide detailed cost estimates and knowledge of marketplace conditions.

- Provide project planning and construction scheduling.
- Provide assistance in determining construction phasing and scheduling, and maintenance of traffic staging to minimize interruption to traffic operations.
- Provide constructability reviews and recommendations
- Advise Owner on ways to gain efficiencies in project delivery
- Negotiate GMP and any contingency items with MDOT

CONSTRUCTION PHASE SERVICES BY THE CMR

The CMGC will be compensated for their construction phase work. During the design phase of the project the CMGC and MDOT will negotiate a price for the work. This negotiation will include identifying work that will be performed at the CMGC's sole risk, as well as items that may be paid for on a unit price and actual quantity basis. Contingency items may also be identified during the negotiations. During the Construction phase, the CMGC will:

- Complete the construction of the project
- Bid, award, and manage all construction related contracts while meeting the Owner's DBE and other requirements.
- Provide and execute quality control plan
- Bond and insure the construction
- Address and adhere to all federal, state, and local permitting requirements.
- Maintain a safe work site.
- Self Perform at least 40% of the work

Schedule

This project is scheduled to be constructed in the 2012 construction season. The contract is expected to be let in July 2012, depending on funding availability. The contract will be awarded by January 2012, following the CMGC selection process and in accordance with MDOT standard contracting processes.

MDOT will develop the RFQ immediately after approval of this SEP-14 proposal. MDOT will consult with the contracting industry in an open and unbiased manner during the development and advertisement of the RFQ, to help prepare the industry for the innovative selection and contract administration processes.

Measures

The effectiveness of the CMGC and qualification based selection process will be measured by:

1. The number of SOQ's received (was industry willing and able to successfully respond to this type of contract?).

2. The quality of the SOQ's received.
    a. Past experience on construction and rehabilitation of precast concrete segmental structures.
    b. Number of innovative ideas proposed by all responders to the RFQ.
    c. Number of statements including criteria that exceeded the qualifications in the RFQ.

3. Analysis of the overall selection process.
    a. Issues in executing the selection process.
    b. Comparison of final negotiated price (Guaranteed Maximum Price + Contingencies) to Engineer's Estimate.

The effectiveness of the CMGC contracting process will be measured by:

1. CMGC engagement during design phase, and achievement constructible, high quality plans and specifications.

2. Administration of CMGC contract during construction phase, and overall ability of CMGC to effectively perform contract work according to specifications, and within project timeframe.

Reporting

MDOT will prepare two reports of this innovative contracting proposal.

An interim report will be prepared upon completion of the design phase, near the time of the guaranteed maximum price proposal submission. This will outline the interaction of the CMGC with the design team, and the effectiveness of solutions to design and constructability issues.

A final report will be prepared within six months after completion of the project work and will address the entire project, contract administration, and the implementation of solutions developed during the phase to address design and constructability issues