

MEMORANDUM

DATE: February 26, 2008

TO: Homayoon Pirooz, P.E.
Manager, Project Management Unit

FROM: Michael G. Nearing, P.E.
Senior Project Manager, Project Management Unit

RE: 2006-2007 Bridge Inspection Program
Reduced Weight Postings for E. Stadium Boulevard over S. State Street
File No. 2006-014.17 (mgn)

We are writing to inform you of the recent investigation and analysis that was performed on the E. Stadium Boulevard Bridge over S. State Street. We are also reporting on the condition of the bridge and providing information regarding possible short- and long-term solutions for the E. Stadium Boulevard Bridge over S. State Street and the E. Stadium Boulevard Bridge over the Ann Arbor Railroad tracks.

Attached, please find a Traffic Control Order (TCO) that recommends a reduction in allowable gross vehicle weights for the E. Stadium Boulevard Bridge over S. State Street in accordance with the limits contained in this memorandum.

Background

On December 29, 2007, our Field Operations forces were called out to the E. Stadium Boulevard Bridge over S. State Street as medium-sized pieces of concrete were falling off of the bottom of one of the box beams that support the roadway. These pieces of concrete were large enough to damage passing vehicles, if they were to strike them. Our Field Operations and Safety Services personnel closed one lane of traffic at a time and removed the remaining loose concrete from the underside of the box beam. No injuries due to the falling concrete were reported.

As a result of the concrete removal, we reviewed the structure again and were concerned about the condition of one of the box beams. In early January 2008, a meeting was held on-site between Project Management Unit, our bridge inspection consultant, and bridge design personnel to review the condition of the bridge and (1) determine what possible courses of action could be taken to help prevent further damage to the bridge and (2) identify possible repair strategies.

We directed our consultants to re-analyze the bridge structure given the section loss that had just occurred. As you may recall, effective January 1, 2008 we lowered the weight limits due to section loss that was discovered during the biennial inspection that was performed in late

October 2007. Based upon the new analysis that was performed in January 2008, it is recommended that we reduce the weight limits on this structure again.

Condition of the bridge

The existing bridge is composed of 16 pre-stressed concrete box beams that are laid side-by-side. They are “tied” together with steel post-tensioning rods that connect pairs of beams together. The beams are overlaid with an asphalt wearing surface. There is a concrete sidewalk that has been cast on top of the two northernmost beams. The bridge does not provide sufficient vertical or horizontal clearances and is considered structurally deficient and functionally obsolete.

One of the box beams has developed a severe longitudinal crack. This is the beam that our field personnel had to hand-chip to remove the spalled concrete in late December 2007. There are other beams that are developing longitudinal cracks, as well. Other beams have several broken pre-stressing strands and the abutments that support the beams are in poor condition. Note that the pre-stressing strands are the primary elements of the bridge beams that provide structural strength. Based on these deficiencies, the bridge, viewed as a whole, is considered to be in poor condition. The beam that is severely cracked is considered to be in serious condition.

Upon review of the “as-built” drawings of the structure, we believe that it is not possible to repair the severely cracked beam in any manner that can restore its structural integrity. This is due to the location of the beam itself, and the location and configuration of the post-tensioning rods that tie the box beams together. The severely cracked beam is the fifth beam in from the south side of the structure. Due to the manner in which the bridge was constructed, it is not possible to replace only this beam. In order to repair the beam, we would have to cut the post tensioning rods on each side of the beam. We would not be able to access the needed areas of the beams to re-install the post-tensioning rods, however, effectively leaving the beams to function individually. This would be unacceptable. There is also one other beam that contains small cracks that currently are not as severe as the beam described above, but we believe that it is likely that it, too, will crack in a similar manner. AS A RESULT, WE BELIEVE IT WOULD BE NECESSARY TO REPLACE AT LEAST FIVE BEAMS ON THE SOUTH SIDE OF THE BRIDGE, AND POSSIBLY AS MANY AS EIGHT.

Exacerbating the problem is the condition of the remaining beams. We believe that it is likely that the tops of these beams have begun to spall. It is apparent to us that salt-laden water has seeped between the asphalt layer covering the beams and the beams themselves. Water routinely leaks around the beams and runs down the abutment walls. Over time, this moisture and salt will cause the concrete to disintegrate. Given the length of time this has been occurring, we have reason to believe that it is possible that the tops of the beams are damaged to the point that they may not be able to be repaired, if we were to attempt it.

We also believe that any attempt at performing a repair itself would be expensive. We do not have detailed costs at this time, but we estimate that it would cost at least \$250,000 to attempt to replace the five to eight south side bridge beams. Also, it would take at least one

month to perform the needed construction.

At your request, we could prepare a more thorough and detailed estimate of the repair costs and other possible options that could be implemented should funding for the replacement of the structure not be available in the foreseeable future. This evaluation would cost approximately \$15,000 to retain the services of a structural engineer to analyze and review various options. We also recommend that about \$10,000 be budgeted for our Field Services personnel to assist in the performance forensic investigations on the bridge in order to better determine the extent of deterioration of the existing bridge beams and abutments.

We do not believe that it is possible to repair the bridge over S. State Street cost effectively, however. This is due to the extensive deterioration of the existing beams, abutments, and asphalt-wearing surface. As mentioned previously, the bridge is considered structurally deficient and functionally obsolete. These deficiencies cannot be easily remedied. We will, of course, continue to monitor the condition of the bridge. Should it become necessary, we are prepared to repair the structure in order to allow the bridge to remain in service.

Proposed Short-term Action

In order to help minimize damage to this structure and prolong its life span to the greatest extent possible, we are recommending that the weight limits be lowered. We have prepared the following table that compares the existing and proposed weight limits for the three classes of trucks that can use the structure:

Design Vehicle		Existing Posted Load (since January 1, 2008)	Proposed Posted Load	Reduction in Load carrying capacity
Single Unit Truck		31 tons	19 tons	39%
Two-Unit Truck		39 tons	24 tons	39%
Three-Unit Truck		44 tons	26 tons	41%

The proposed Traffic Control Order (TCO) recommends a reduction in gross vehicle weight for the three types of trucks that can travel on Michigan roadways without special permits. They are one, two, and three-unit trucks. A single-unit truck is any truck without a trailer. A single-unit truck can be any number of common vehicles. Some examples of this would be a school or AATA bus, moving van, or in the worst case, a fully loaded concrete truck. A two-unit truck can be most easily described as a semi-truck with one trailer. Note, a pick-up truck or car pulling an “ordinary” trailer (such as the trailers that lawn maintenance companies would use) would not be considered a two-unit vehicle. Finally, a three-unit truck can be most easily thought of as a semi-truck pulling two trailers. An example of this would be the large sand or gravel hauling trucks that bring materials to construction sites.

The recommended gross vehicle weight reductions are significant. Also, the overall condition of the bridge has declined measurably over the course of the last calendar year. We expect that the condition of the structure will continue to decline as the structure is nearing the end of its useful life. **Based on the rate of deterioration that we have observed over the course of the last few years, we believe that the structure has approximately three to five years in which it will be able to carry trucks.** We also expect that additional weight limit restrictions will be necessary in the future.

Proposed Long-term Actions

As you may recall, we have begun a project to perform the preliminary design of the replacement for this structure, as well as the E. Stadium Boulevard Bridge over the Ann Arbor Railroad tracks. The bridge over the Ann Arbor Railroad tracks is located about 300 feet to the west of the bridge over S. State Street. We believe it makes sense to consider replacing both bridges at the same time, although it is also possible to replace the two bridge structures at different times.

We have not able to move forward on the preliminary design of the bridge over S. State Street or the Ann Arbor Railroad tracks because we are waiting for the 4th Ward City Council members to nominate and confirm a Citizens Advisory Committee to assist us with the public engagement process. It has been our experience with projects of this nature that it is important to consider and review all aspects of the proposed design with the citizens in order to make sure the project that we deliver meets community expectations. This process will also help us to avoid conflicts later in the design process as we will have already confirmed the design approach and aesthetics of the project with the public and City Council. Finally, this preliminary design process will allow us to better estimate the cost of the project based on a more complete picture of all project elements.

We have estimated that it will take about 2 to 3 years to prepare for bridge replacement including the public engagement and internal project review process; the preliminary and final design of the bridges and needed approach work; and the development of a funding plan for the project. We have prepared a tentative schedule for this project such that its construction could be started shortly after the University of Michigan's Football Stadium Renovations are completed. We are also planning and coordinating this project so that it is compatible with the planned improvements along W. Stadium Boulevard. Attached, please find a drawing that we have prepared that locates all of these planned improvements and their anticipated starting and completion dates. Also attached, please find the tentative project schedule that details the required tasks and estimated durations of the required activities to complete the project's design.

Summary

Fortunately, the reduction in weights that we are proposing does not yet affect most of the everyday users of this structure. However, we believe that when it is again necessary to reduce the posted weight limits, both AATA and the Ann Arbor Public Schools will be impacted by this change.

The proposed change will impact the trucking and construction operations that use this corridor as they, most probably, will not be able to route trucks through this portion of the E. Stadium Boulevard corridor between S. Industrial Highway and S. Main Street. These types of trucks will have to find an alternative route around this portion of E. Stadium Boulevard.

We are also working with the Communications Office to prepare a press release notifying the appropriate agencies of the proposed change.

attachments

HP:MGN:mgn (e stadium weight reduction memo 080225.doc)

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