Mr. Dean Michalko  
Hennepin County  
701 4th Ave. S., Suite 400  
Minneapolis, MN 55415  

Reference: Bridge L8901 Evaluation and Load Rating

Dear Mr. Michalko,

We performed a Physical Inspection of the above referenced bridge on April 29, 2016, for the purpose of determining the bridge condition along with a representative load rating and associated recommendations. This bridge is typical of the older existing Midtown Greenway corridor bridges which are 3-span concrete deck girder superstructures on concrete substructures. At the time of the inspection the bridge load posting signs indicated limits of: 11 Tons for a single unit vehicle and 19 Tons for a combination vehicle (semi).

**Scope of Inspection**

The inspection was conducted from the ground, bridge deck, and a ladder. All of the bridge elements were adequately viewed without the use of a snooper truck. No formal testing was done as part of this inspection, as all observations were visual or based on tapping with a hammer or prying with a screwdriver. The observations obtained by these methods were sufficient to gather the intended information necessary to complete an accurate load rating and provide recommendations.

**Summary of Observations**

The overall condition of the bridge superstructure concrete is very poor. Extensive areas of concrete have spalled and fallen off resulting in widespread exposed reinforcing steel, and much of the concrete that remains is delaminated. Beneath the delaminations, the intact concrete is unsound, not solid, and is poor quality. Based on brief observations of nearby original bridges, the concrete on this bridge appears worse than average. Based on our experience inspecting concrete bridges, the worse than average concrete deterioration on this bridge results from a combination of de-icing chemical intrusion, moisture intrusion along with freeze/thaw damage, and in combination with lower quality concrete incorporated into the original construction. The concrete deterioration is severe in localized areas, along with section loss from rust on the steel reinforcing bars.

The substructure concrete is in a condition similar to the superstructure, but is somewhat less advanced and less severe than the superstructure concrete. However, the wingwalls are not stable and have...
separated away from the main abutments, especially noticeable with the very wide cracks in these areas (abutment/wingwall transitions). The substructures do not affect our load rating determination, the severe deterioration in the superstructure controls the bridge capacity.

**Load Rating Determination**

The load rating is based on Physical Inspection, abbreviated calculations, and judgment, because it is difficult to do complete and accurate calculations for unreinforced concrete that is in poor condition. In addition, the available plan for this bridge does not have complete rebar information. Abbreviated calculations were completed for the concrete beams (deck girders) to conclude with reasonable confidence that the beams are not the governing element. For these calculations, field observations and measurements (of rebar that is exposed), combined with rebar information on the plans for similar, nearby bridges were used to estimate the capacity of the beams, and these abbreviated calculations accounted for rebar deterioration.

Based on abbreviated calculations and the Physical Inspection of the bridge, it was determined that the governing element condition on the bridge is the concrete deck in localized areas of advanced, serious deterioration. The most severe deterioration noted was on the west side of the first beam west of the bridge (road) centerline, in the center span. This area of concern extends about 3.5’ in length – basically the deck has no effective transverse (main) reinforcing over this length because all reinforcing bars have rusted completely through. A deck reinforcing sheet from the 1st Avenue bridge (this bridge does not have one) was referenced and it shows that the transverse bottom deck reinforcing is at 6” spacing (confirmed in the field for Bridge L8901) and that with the bottom reinforcing ineffective the deck is essentially unreinforced in the direction of the deck span, because there is no top transverse reinforcing between the beams. In regard to thickness of the concrete deck, it is difficult to decipher the plans, but it appears the deck thickness is between 8” or 9”. The previous load rating stated 7”. It appears the bituminous thickness in this area is about 5”.

Abbreviated calculations were then also done for shear capacity of the concrete deck to determine if the bridge remaining open is safe. Assuming the posting is obeyed, a bridge load posting was estimated from the abbreviated concrete shear calculations, but ultimately the final load rating determination was made based on the Physical Inspection and Engineering judgment. Although the deterioration is severe, inspection did not reveal indications of distress or impending failure. Sudden deck failures are possible with no deck reinforcing and severely deteriorated concrete, but for the recommended load posting and current condition of the bridge sudden failures will not occur if the load posting is obeyed.

**Summary of Load Rating Results**

The bridge should be load posted using MnDOT standard sign R12-1a: Bridge Weight Limit 6 Tons.

Existing bridges are normally assigned an “HS” rating. The “HS” truck is a design vehicle and Inventory Rating HS 20.0 would indicate a sufficient design. For information, the HS Ratings determined are:
Inventory Rating: HS 2.0 (design level, frequent use)
Operating Rating: HS 3.5 (load posting level, less frequent use)

Recommendations

Our recommendations resulting from the inspection of this bridge and subsequent analysis are as follows:

1. At minimum, load post the bridge as specified above.
2. Consider closing the bridge if it is not considered an undue hardship for local traffic. The bridge should also be closed if there is not confidence that the load posting is being obeyed.
3. The load rating was determined primarily by Physical Inspection. Therefore, the bridge should be monitored regularly for the load rating to remain valid and the bridge remain open. A minimum of one intermediate inspection between annual safety inspections is recommended.
4. Short term localized repair options could be studied consisting of adding reinforcement to the deck (such as large, thick steel plates), but substantial study would be required to confirm that the repair is economically feasible (sufficient gain in bridge capacity for the cost) as another element may limit large increases in the bridge capacity, and that larger problems resulting from removals associated with repairs would not be created (for example, disturbance caused by removing the bituminous wear course may weaken the concrete deck further).
5. A course of action needs to be determined for the long term solution at this crossing. Because of the historic aspects of the bridge and setting, repair must be considered in a study of alternatives.
6. Based on our inspection of Bridge L8901 and brief observations of nearby original bridges, it appears that other bridges should be considered candidates for preservation and this bridge simply replaced as soon as possible (not repaired) because of its very advanced deterioration and difficulty in making effective repairs that will remain stable and sound.
7. Prior to replacing the bridge, the hazard of concrete falling off of Bridge L8901 onto the heavily used trail below also needs to be considered while the bridge remains in place (when considering inspection scheduling) and as part of the study mentioned above to determine what to do with the bridge and when to do it.

In-depth study is not included in the scope of this concise report. However, our initial preliminary conclusions based on our inspection observations and our experience with older concrete bridges is that neither short nor long term repairs are feasible for Bridge L8901 due to the overall very poor condition of the bridge concrete. Short term repairs are likely not to be cost effective and the disturbance caused by removals may create additional problems. Repairs with an expected longer life are probably not attainable as removal of unsound concrete is essential to assure an extended life of the concrete repairs, but the limits of unsound concrete on this bridge are not easily defined and there is likely minimal sound and solid concrete remaining. In addition, in studying the feasibility of long term repairs, further evaluation must be done of the existing rebar to define with certainty what the load capacity of this
repaired bridge would be, considering that there is no plan showing steel reinforcing for this specific bridge. A final note related to repair study – if preserved bridges have load restrictions (posting) an overall (big picture) evaluation of traffic patterns and emergency vehicle access needs to be made to make certain that adequate unrestricted routes exist crossing the Midtown Greenway corridor.

If there are any questions on the load rating, the inspection of the bridge, or the recommendations please do not hesitate to contact us.

Sincerely,

Ron Benson, PE
Bridge Engineering Manager
(952) 540-4851

Attachments: Photos, Load Rating Report
Looking north, note the posting sign at the time of the inspection on south approach to bridge.

Looking south, note posting on north approach to bridge and truck parked on bridge.
West Elevation view of bridge.

East Elevation view of bridge.
General view of north span underside showing widespread exposed steel reinforcing.

Showing deeper deterioration (4” deep hole) on north span beam.
General view of center span underside showing widespread exposed steel reinforcing.

Severe deck deterioration in center bridge span near centerline road.
Area of deck that governs new load rating, west side of beam just west of road centerline, center span.

Close up view of above picture, all of the rebar shown are broken, dark strips on concrete are stains.
Major structural crack at NE wingwall, but does affect the new load rating recommendation.

Major structural crack at SW wingwall, new wall may add some support.
Severe concrete loss from beam in north span.

Advanced steel reinforcing section loss, beam in south span.
Bridge located 3 blocks east of L8901 appears original (train exhaust stains), less severely deteriorated.

Bridge 5 blocks east of L8901 better candidate for preservation; appears painted, has moisture stains.
**Bridge Location and Description**

- **Hwy. No.** MUN 1030
- **Bridge No.** L8901
- **Over** Midtown Greenway
- **Year Built** 1913
- **Year Remodeled** NA
- **County** Hennepin
- **Ref. Pt.** NA
- **Description** 30'-31.5'-30' continuous spans of cast in place concrete deck girder, 30.0' road width, approx. 5" bit. w.c., 8.0' sidewalks each side with concrete parapet railing edge of deck, concrete substructures
- **Location** 0.1 miles North of Lake Street on Fremont Ave S. in the City of Minneapolis

**Data for Basis of Report**

- **Bridge Inventory File**
- **Previous Bridge Rating and Load Posting Report**
- **Bridge Plans**
  - New
  - Repair/Reconstruction
  - Other Dead Load Modifications
- **Bridge Inspected by** Ronald Benson
  - **Date** 4-29-2016
- **Damaged Component** broken deck rebar center span
- **Deteriorated Component** superstructure extensive deterioration
- **Types of Analysis**
  - Manual
  - Computer*
  - BARS
  - Virtis, V.
  - Other*

**NBI Condition Ratings**

- **Deck** 3
- **Superstructure** 3
- **Substructure** 3

**Method of Rating**

- **Load Factor (LF)** Assigned Load Ratings
  - Design Load Unknown
- **Allowable Stress (AS)** Load Testing
  - Design Method Unknown
- **Field Eval./Doc. Engineering Judgment**

**Summary of Rating and Load Posting Analysis**

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I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

**Signature:** Ronald Benson

**Date:** 5-4-2016

**Name:** Ronald Benson

**License No.:** 22737

**Employed by:** Stonebrooke Engineering, Inc.

My signature below indicates that I have read and fully agreed with the load rating report.

**Program Administrator's Signature:**

**Date:**
Problem leading to this physical inspection rating: Severe rust of the main deck reinforcing with major section loss.

Describe bridge: Spans, lengths, widths, depths, deck, wearing course, etc.
30'-31.5'-30' continuous spans of concrete deck girder (girder depths are variable)
30.0' road width
Concrete deck thickness approximately 8" and bituminous w.c. thickness approximately 5"

Describe Bridge Condition: The bridge is in very poor condition due to widespread advanced concrete and rebar deterioration, especially significant on the superstructure. The deterioration and loss of girder concrete is a concern, as well as section loss from the girder rebar, but the girders do not govern the bridge rating. The bridge load rating is governed by main deck reinforcing that is broken, several bars over a 3.5' length of deck.

Other Remarks: The deck rebar in the center span is the most critical. At least one location has bars with major section loss. The governing location is on the west side of the first girder west of bridge (road) centerline. Six rebar were confirmed to be ineffective (rebar at 6 inch spacing) and other rebar appeared to have severe section loss with minimal remaining capacity, all over a 3.5' length of the deck. This area should be closely monitored until repairs or bridge replacement can be accomplished.

Bridge Sketch