

Received Feb 21, 2020

**From:** Fernandes, Bob  
**Sent:** Friday, February 21, 2020 4:09 PM  
**To:** Donahue, Matthew  
**Cc:** Banks, Greg; Marsh, Lee  
**Subject:** WSB Progress Update

Matt,

Attached is the draft letter we discussed. We are still awaiting a few more analysis result before we would want to make this official, but it appears very likely that this is where we are headed. Greg and Barton Newton will look forward to discussing this with you next week.

**Bob Fernandes, PE, SE**  
Vice President

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February XX, 2020

Mr. Matthew Donahue  
Division Director – Roadway Structures  
700 Fifth Avenue, Suite 4186  
P.O. Box 34996  
Seattle, WA 98124-4996

Subject: West Seattle Bridge High Rise (Jeanette Williams Memorial Bridge)  
Assessment and Load Rating  
Contract 16-086, Work Authorization No. 16  
Lane Reduction Recommendations

Dear Mr. Donahue:

We have completed our scope of work to assess the West Seattle Bridge High Rise Bridge and are in the process of drafting the deliverables for the project. This activity will include some final effort to verify analysis results. A key finding of our work is that the bridge fails to comply with the requirements for minimum bonded reinforcement that would permit use of an allowable tensile stress above zero. This effectively results in a service load rating of zero\*. This does not mean that the bridge does not have load carrying capacity, but it is an indication that appropriate measures be taken to reduce loadings on the bridge.

It is our professional judgement, that the observed damage to the bridge has eroded the load carrying capacity of the structure to a degree that the bridge should not continue to be operated as it is currently being operated. This is particularly true considering the uncertainties in the bridge's behavior and active nature of the observed cracking. Based on current observations, the observed cracking is being actively affected by changes in thermal (temperature) loadings and the traffic loadings.

As to traffic, we note that the bridge was originally designed for three lanes of traffic in each direction. The south box girder is currently carrying four lanes of traffic, including a bus lane, and is routinely completely full in morning rush hour traffic. The north box girder carries only three lanes and is rarely completely full in evening rush hour traffic. Field observations have indicated that the cracking is somewhat worse on the south box girder (eastbound) than on the north box girder (westbound), which may correlate with the additional loads the south box girder is being subjected to.

Therefore, until design to strengthen the bridge can be completed and constructed by the City, we recommend the City reduce the number of lanes of traffic on the bridge to two lanes in each direction. We recommend that the two lanes be located to minimize bending in the bridge deck,

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which will minimize bending of the web walls of the box girder. This lane reduction should be accomplished as soon as possible, recognizing that some planning of the necessary lane shifts, tapers and connections to ramps is required. These operational changes will have the following beneficial effects:

1. The reduction in lane loads reduces the maximum total load that the structure can experience and restores a portion of the margin of safety inherent in the original design.
2. The recommended positioning of the lanes minimizes flexural bending of the web walls. This is important because a portion of the web reinforcement provided by the original designers was provided to resist “out of plane” web bending. Our estimates of the load carrying capacity of the structure use all this steel reinforcement for the purpose of resisting the primary shear forces acting in the plane of the web wall.

Notwithstanding the results of any further investigations of the bridge that we will likely recommend, or final review of our current work, those future investigations and ongoing reviews will not change our conclusions about the need to strengthen the structure and the need limit loadings on the structure until those repairs on constructed.

In summary, the process to repair the bridge needs to start now in order to complete repairs as soon as possible. It is our opinion that the work should be completed this calendar year. We have design concepts in mind that have been presented to the City. We need to begin the process of deciding which of those repair concepts the City would like to investigate further and subsequently implement. Once a repair concept has been selected, it should be possible to design and implement the repair in a reasonably short period of time.

Feel free to reach out to me or Greg Banks to discuss.

Sincerely,

Robert L. Fernandes, PE, SE  
Vice President

RLF:dls

\*The AASHTO Manual of Bridge Evaluation Section 6B.5.3.3 states that the  $6\sqrt{f'c}$  allowable tensile stress limit may be reduced to zero if AASHTO Standard Specification §9.15 requirement for bonded reinforcement is not satisfied. AASHTO Standard Specification §9.15.2.2 limits the allowance tensile stress to zero for members without bonded reinforcement.