

Mr. Wesley Wright, P.E.
Systems Engineering Director
City of Georgetown
300-1 Industrial Ave.
Georgetown, TX 78626

June 29, 2016

Re: Austin Avenue Bridges at the San Gabriel River Assessment

Dear Mr. Wright:

Per your request, on March 21, 2016, Lockwood, Andrews & Newnam (LAN), Inc. conducted a site visit of the North and South Austin Avenue Bridges located at the San Gabriel River in Georgetown, TX. In addition to our site visit, LAN was provided and reviewed the following:

- *WJE's Condition Assessment and Evaluation (Dated 1/12/16)*
- *Barnhart's Bridge Inspection Report (Dated 12/3/13) and Load Ratings (Dated 1/3/14)*

Upon review, we find these documents to be reasonable and acceptable. We have re-evaluated the load rating and recommend several maintenance, rehabilitation and strengthening measures.

Load Rating

The following table outlines the load ratings for this structure.

	From Barnhart Report	LAN's Load Rating*
Inventory Rating	HS 15.9	HS 15.6
Operating Rating	HS 26.5	HS 30.4

*Adjusted rating using concrete strength (i.e.; 4,790 psi in lieu of 2,500 psi) from WJE Report. Assumptions were made for steel yield strength. If the original steel mill report for the bridge is located, higher yield strengths could further increase the load rating.

Condition Rating

We agree with WJE that Barnhart's Bridge Condition Rating of the main longitudinal steel beams (See below) should be reevaluated. Additionally, we agree with the following excerpt from WJE's report. Barnhart's assessment of the pack rust on the superstructure may be less

significant than originally concluded and the gaps reported are likely due to the malfunctioning of the bridge bearings due to rust locking them in place.

Superstructure (Item 59)		Rating	Comments:
0	Main Members - Steel	(1) 5	(1) Steel beams have areas of heavy pack rust on top flanges at deck interface, condition is worst on west exterior beam near south abutment at diaphragm connections and on beams in suspended spans.
0	Main Members - Concrete	-	
0	Main Members - Timber	-	

Figure 1: Barnhart’s North Austin Avenue Bridge (Superstructure) Condition Rating

“In his letter to TxDOT, Mr. Barnhart noted that the gaps observed between some girder ends and concrete decking is likely due to pronounced formation of pack rust between the deck and girders. Based on our review of the construction documents and our site investigation, the gaps were more likely caused by flattening of the lead sheets within steel bearing assemblies and other potential settlement mechanisms including mechanical damage of the concrete under the steel plate bearings. As the girders dropped slightly over time, the deck likely began to bear against the abutment back wall and did not settle uniformly with the girders. Based on the absence of identifiable pack rust on primary girder elements, lack of apparent corrosion at the visible girder-to-deck gaps, and evidence of binding between the deck end and abutment back wall, pack rust formation at girder top flanges appears highly unlikely. While corrosion formation at diaphragm connections has somewhat reduced the net web area at discrete girder locations, the affected regions are exposed to relatively little shear, the primary load resisted by the webs. Therefore, in the absence of widespread structurally significant primary member deterioration, modification of the primary structural member rating to a “6” may be warranted, although we understand from discussions with TxDOT that raising a condition rating is unlikely and not a preferred approach.”

WJE’s Condition Assessment and Evaluation (pg 14)

With a higher Condition Rating for the superstructure, the current load posting requirement is removed (See the attached Off-System Load Posting Policy).

Recommendations

Rehabilitation of the structure is recommended only if the load posting of the structure can be removed. In this case, the Inventory Rating must be increased above HS 20 or the superstructure is to be rehabilitated to a Condition Rating above 5.

As a result of our investigation, LAN recommends both bridges remain-in-place and be rehabilitated and strengthened. The following rehabilitation and maintenance measures are recommended to potentially reach an additional 20 years of Service Life:

Rehabilitation & Maintenance

Several hazards are noted. There is the potential for falling debris, which will be greatest at the location of the slab expansion and sidewalk open joints. The large majority of the defects on the bridge are due to water infiltration through the failed bridge deck expansion joints and open sidewalks joints. To maximize the Service Life of the bridge, resealing and sealing all the joints on the bridge is critical. In addition, LAN strongly recommends resealing the sidewalk construction joints and inspecting the slab expansion joints annually. If the sidewalk joint maintenance recommendation is unfeasible, considerations should be made to break the deck slab back to the first interior beam and reconstruct the slab overhang without construction joints. This alternative would require updating the bridge railing to meet the NCHRP 350 Report. Furthermore, LAN recommends incorporating all other “minimally invasive bridge maintenance strategies” (i.e.; continued inspections, periodic hammer-sounding, and partial-depth concrete repair) recommended on page 16 of WJE’s *Condition Assessment and Evaluation* and listed below.

- Seal or reseal bridge and sidewalk expansion joints
- Partial-depth repair of concrete substructures deterioration at failed bearings
- Replace existing bridge bearings with neoprene bearing pads
- Remove rust and repaint exterior bay steel diaphragms
- Retrofit a drip bead on bridge deck soffit
- For this 3R project, the bridge railing meets minimum height requirements but does not comply with NCHRP Report 350 therefore it can be left-in-place. However, TxDOT recommends replacements of the railing to meet NCHRP Report 350 requirements (See Table A)

Table A : TxDOT Requirements for Upgrading Bridge Railing

3R	If the structure is not widened and if no work affecting the existing railing is done as part of the 3R project.	Replacement of traffic railing not complying with MASH or NCHRP Report 350 is recommended but not required as long as the minimum rail height requirement is met. Existing traffic railing complying with MASH, NCHRP Report 230 or NCHRP Report 350 may be raised to meet the minimum rail height requirement.
3R	If rehabilitation work is scheduled or performed which widens the structure to either side or redecks (full-depth) any complete span of the structure, or if any work affecting the rail is done to the existing structure as part of the 3R project.	All traffic railing on the structure must comply with MASH or NCHRP Report 350. Railing adjacent to pedestrian walkways must comply with requirements in Chapter 3. Exceptions by approval of Design Exception or Design Waiver Request. Exceptions to compliance with MASH or NCHRP Report 350: 1. Design Exception approval required if ADT is greater than 1500 VPD. 2. Design Waiver approval required if ADT is less than 1500 VPD.

Strengthening

Two alternatives could be used to strengthen the superstructure above an Inventory Rating of HS20.

1. Deck Replacement: Partially replacing the existing non-composite deck with a composite deck (i.e.; Spans 2-4 South Bridge and Spans 4-6 North Bridge) will increase the superstructure's load rating, Condition Rating and Service Life. This would require a phased construction which will impact traffic significantly during construction.
2. Strengthen Critical Section: An alternative option with minimal traffic impact is strengthening the critical section (i.e.; Span 3 South Bridge and Span 5 North Bridge) by modifying the load path or by adding material. This can be achieved with the addition of plates or prestress tendons to the steel beams (See Figure 5).

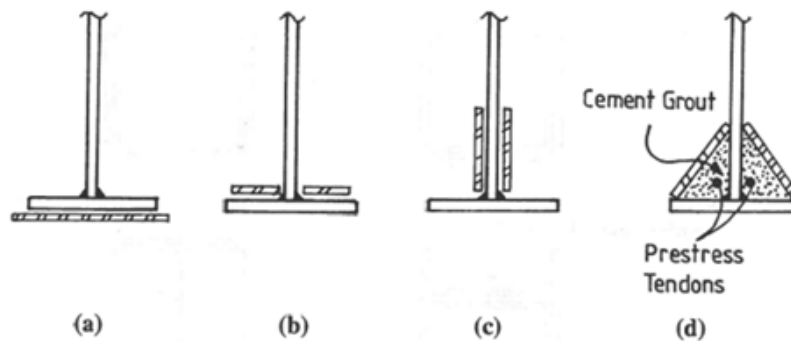


Figure 5. Strengthening Options for a Steel Bottom Flange:
(a) and (b) horizontal plates, (c) two vertical plates, (d) prestress tendons

	Option 1	Option 2*
Inventory Rating	HS 29.6	HS 20.6
Operating Rating	HS 49.4	HS 34.3

*Assumes 1/2" horizontal plates are added to critical section

Mr. Wesley Wright, PE
City of Georgetown
June 29, 2016
Page 5

Conclusion

LAN recommends leaving the bridges in place by performing the recommended rehabilitation, maintenance measures, followed with a routine bridge inspection. If the Superstructure Condition Ratings (ITEM 59) improve due to the rehabilitation, the load posting of the bridge will be removed and the strengthening could be postponed indefinitely. If the measures do not improve the structures Condition Rating, strengthening could be conducted to remove the load posting.

Should we be able to assist you further on this or any other problem, please contact me at 512.338.2745 or jaterrazas@lan-inc.com. We appreciate this opportunity to serve you.

Sincerely,

Johnathan A. Terrazas, P.E.
Bridge Engineering Manager
Lockwood, Andrews & Newnam, Inc.
Texas Registered Firm No. F-2614



Attachments: Preliminary Bridge Load Ratings, TxDOT's Off-System Load Posting Policy, and Rehabilitation Cost Estimate