



November 27th, 2024

Mr. David Skov
Civil Engineer
City of Knoxville
3131 Morris Ave.
Knoxville, TN 37909

Subject: Boyds Bridge over Holston River Evaluation Report
Knoxville, Tennessee
Gresham Smith Project No. 48881.00

Dear Mr. Skov,

At the request of The City of Knoxville and in lieu of a full bridge inspection report, the following letter serves as an executive summary of the routine bridge inspection, as defined in the USDOT FHWA Bridge Inspector's Reference Manual (BIRM) (Publication No. FHWA NHI 12-049), of the Boyds Bridge located in Knox County, Tennessee at 4078-4226 Boyds Bridge Pike, Knoxville, TN 37914. The purpose of this letter is to provide The City of Knoxville with information on the November 7th, 2024 evaluation approach, findings, results and recommendations. The evaluation was performed by Gresham Smith using staff that meet the bridge inspector qualifications outlined in The *Code of Federal Regulations*, Title 23, Part 650, Subpart C, Section 650.309. Gresham Smith staff on site for the evaluations were Griffin Bedell, EI, NHI and Russell Childs, PE, NHI.

Description and Procedures:

The structure is a ten (10) span, 855'-0" long bridge with a three (3) span continuous steel through truss and seven (7) simple spans of concrete deck girders (Photo 1). A 3'-11" sidewalk was observed on the right side of the bridge for the full length. The bents were observed to be two (2) column bents with a square cap. The piers were observed to be wall piers. Abutment No. 1 (Western) and Abutment No. 2 (Eastern) were observed to be a closed abutment wall. According to our scope of work, this evaluation consisted of a visual observation of the bridge with no full hands-on inspection. The locations observed in the evaluation are observed in locations easily visible and accessible from the bridge roadway or from the ground with binoculars. In accordance with the BIRM, the evaluation of the structure included an arm's length visual evaluation of all accessible areas with an emphasis on the high stress areas of the structure evaluating for signs of distress or deterioration. Photographs were taken of the evaluated elements and findings. No

Genuine Ingenuity

222 Second Avenue South / Suite 1400 / Nashville, Tennessee 37201-2308 / Phone 615.770.8100 / www.greshamsmith.com



Mr. David Skov
November 27th, 2024
Page 2

elevated components were accessed during the bridge evaluation. One lane of traffic control was necessary for the bridge evaluation.

Evaluation Findings:

The previous TDOT inspection/ evaluation findings were confirmed by visual evaluation from locations that were accessible. Areas that were inaccessible include but are not limited to the upper laterals of the truss, bearing devices, pier caps, gusset plates on lower chords or exterior faces, floor beams, and stringers. Abutment No. 1 and the Western approach spans were also inaccessible due to extreme overgrowth of vegetation. The visual evaluation was conducted using binoculars. The observations provided below are reflective of this evaluation method.

The visual aspects of the abutments are generally in fair condition with some deterioration noted where observed. Abutment No. 1 is surrounded by extreme vegetation (Photo 4). Therefore, the abutment is inaccessible to evaluate. Abutment No. 1 and No. 2 are integral abutments (Photo 5). Minor efflorescence was observed on Abutment No. 2 during the bridge evaluation (Photo 5). The utility hanger on the right side of Abutment No. 2 is detached (Photo 7). Some minor erosion at Abutment No. 2 slope was also observed (Photo 6).

The visual aspects of the bents are generally in satisfactory condition with water staining observed (Photos 51 & 53). The visual aspects of the piers are generally in fair condition (Photo 8). The top of Pier No. 1 and Pier No. 2 footings are exposed with moderate drift build-up (Photo 9). Pier No. 2 has minor spalling and popouts (Photo 10). The bearing plates at Pier No. 1 & Pier No. 2 were inaccessible due to the visual limitation of the bridge evaluation. The bearing device at Pier No. 4 is observed to have a tilt to the East (Photo 48).

The steel truss has riveted connections at the verticals, diagonals, and the upper and lower chords (Photos 12-14). Some rivet holes are open in the beams on U13L-U14L and U15L-U16L (Photos 24 & 25). Debris/dirt build-up is noted as typical on top of the lower chord/ diagonal connections (Photos 11, 14, 31 & 32). The steel truss members are in poor condition due to the paint failure, minor section loss, and warping typical throughout the bridge (Photos 12 & 13). According to previous inspection/evaluation reports, repainting the bridge has been recommended. Truss 1 portal has collision damage and sign cracking (Photo 15 & 16). Sway frames 2, 3, 4, 6, 23, and 24 have collision damage and misalignment (Photos 17- 23 & 26-30).



Mr. David Skov

November 27th, 2024

Page 3

The top of the deck is in generally fair condition with typical abrasion and cracking across the entire bridge (Photo 34). The joints have typical debris buildup and the membrane of the joint at Bent No. 2 is ripped (Photo 33). The railing above L24R-L25R is observed with corrosion, cracking, and misalignment (Photo 35). The sidewalk was observed to have typical spalling and exposed rebar (Photo 36). A section of the deck at Span No. 8 above Bent No. 7 was observed to have exposed rebar (Photo 37). A section of the railing at Span No. 9 above Bent No. 8 was observed to have exposed rebar. The bottom of the deck is showing signs of moderate deterioration typical across the entire bridge. There is presence of spalling, exposed rebar, efflorescence, cracking, and failed patches (Photos 39-47 & 49-57).

The floor beams are displaying moderate corrosion and paint failure typical across the bottom laterals of the truss (Photos 39-42). The stringers are displaying moderate corrosion and paint failure typical across the bottom laterals of the truss (Photos 39-42 & 44).

The roadway approaches are a single-lane of traffic each way (Photos 2 & 3). The roadway approach alignment is in satisfactory condition.

It is important to note that an unknown bird nest was observed near the midspan of the bridge on the top of the left truss. During immediate and future repairs, environmental considerations will need to be considered to ensure the safety and/ or relocation of the birds nest.

Recommendations:

It is recommended the bridge abide by a regularly scheduled TDOT routine inspection inside a cycle of twenty-four (24) months. During future inspections, the summary of this report should be compared the findings to determine if there is a structural issue and the severity.

The immediate recommendations to address the deterioration of the bridge includes but is not limited to: Vegetation removal under all approach spans, steel handrail repairs, heat straightening of the sway bracing, concrete spall repairs, expansion joint repairs, application of a thin epoxy overlay, sign placement indicating the vertical clearance at both portals, full and partial depth deck repairs, resetting the bearings at Pier No. 2 and replacement of the bridge sign at the West Portal.

Future recommendations would be to clean and repaint the steel truss structure.



Mr. David Skov
November 27th, 2024
Page 4

Opinion of Probable Cost:

The opinion of probable cost is estimated in increments of \$10,000 and the breakdown of cost per repair item is noted in Appendix B.

The immediate recommended repairs would have a rough estimate of **\$930,000.**

The future recommended repairs would have a rough estimate of **\$1,790,000.**

We appreciate the opportunity to perform this bridge assessment. Should you have any questions, I may be reached by email at Braden.Wells@greshamsmith.com or by phone at 615.770.8237.

Braden Wells

Sincerely,

Mr. Braden Wells, P.E.
Project Engineer

Copy: File

Mr. David Skov
November 27th, 2024
Boyd's Bridge



Appendix A Photo Log

Genuine Ingenuity

222 Second Avenue South / Suite 1400 / Nashville, Tennessee 37201-2308 / Phone 615.770.8100 / www.greshamsmith.com



Photo 1: General View of Bridge – Span 4 - 6 Right Side



Photo 2: Truss 1 Portal West End – Approach



Photo 3: Truss 3 Portal East End – Approach



Photo 4: Abutment No. 1 – Extreme Vegetation



Photo 5: Abutment No. 2 (Eastern) – Vegetation and Efflorescence Observed



Photo 6: Abutment No. 2 (Eastern) – Slope Erosion Observed



Photo 7: Abutment No. 2 – Detached Utility Hanger



Photo 8: Pier No. 2 – General View Right Side



Photo 9: Pier No. 3 – Drift Build-up (typ.)



Photo 10: Pier No. 4 – Spalling and Popouts



Photo 11: Debris Buildup in Lower Chord L0R-L1R (typ.)



Photo 12: Truss 1, U1R-L0R Corrosion and Paint Flaking (typ. across bridge)



Photo 13: Truss 1, U3R-L3R Corrosion and Paint Flaking (typ. across bridge)



Photo 14: Truss 1, Portal, West Approach – General Overview



Photo 15: Truss 1, Portal - Sign Cracked Through



Photo 16: Truss 1, Portal – Collision Damage at Bottom Right Chord



Photo 17: Sway Frame 2 – Collision Damage at Quarterspan of Bottom Right Chord



Photo 18: Sway Frame 2 - Misalignment



Photo 19: Sway Frame 3 – Collision Damage near Midspan of Bottom Right Chord



Photo 20: Sway Frame 4 – Collision Damage near Quarterspan of Bottom Right Chord



Photo 21: Sway Frame 4 – Misalignment



Photo 22: Sway Frame 6 – Collision Damage near Middle Web on Bottom Right Chord



Photo 23: Sway Frame 6 – Misalignment



Photo 24: Truss 2, Left – U13L Missing Rivets



Photo 25: Truss 2, Left – U15L Missing Rivet



Photo 26: Sway Frame 23 – Collision Damage near Middle Web on Bottom Right Chord



Photo 27: Sway Frame 23 – Misalignment



Photo 28: Sway Frame 24 – Collision Damage near Middle Web on Bottom Left Chord



Photo 29: Sway Frame 24 – Collision Damage near Middle Web on Bottom Right Chord



Photo 30: Sway Frame 24 – Misalignment



Photo 31: Truss 3, Portal – General Overview



Photo 32: Truss 3, Portal – Dirt Buildup in U25R-L26R

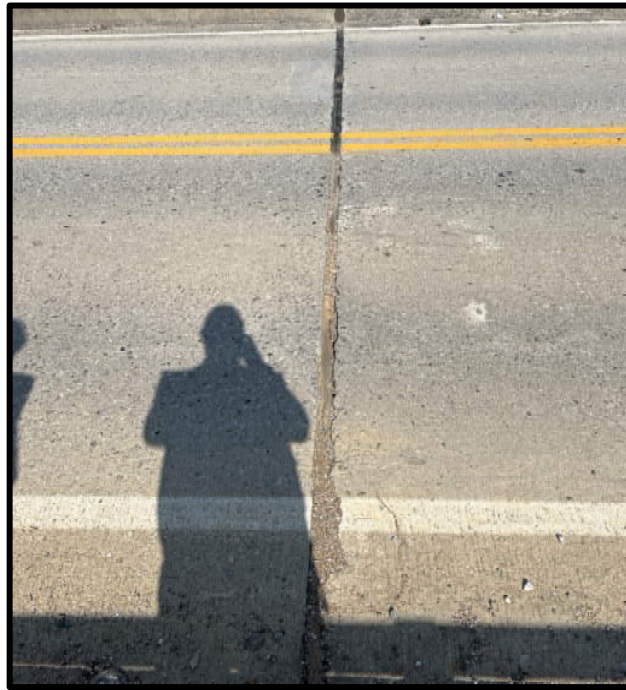


Photo 33: Joint at Bent 2 – Debris Build-up (typ. all joints) and Ripping



Photo 34: Top Deck – Abrasion and Cracking (typ. across bridge)



Photo 35: Railing above L24R-L25R – Corrosion, Cracking and Misalignment



Photo 36: Span 8, Sidewalk – Exposed Rebar and Spalling Left Shoulder



Photo 37: Span 8 above Bent 6, Top Deck – Exposed Rebar



Photo 38: Span 9 at Bent 7, Sidewalk – Exposed Rebar



Photo 39: Truss 1, Bottom Deck Section 1-8 – General Overview and Corrosion, Spalling, Paint Peeling



Photo 40: Truss 2, Bottom Deck Section 9-18 – General Overview and Corrosion, Spalling, Exposed Rebar, Paint Peeling



Photo 41: Truss 3, Bottom Deck Section 19-23 – General Overview



Photo 42: Truss 3, Bottom Deck Section 19 – Exposed Rebar, Spalling, Corrosion, and Paint Peeling



Photo 43: Truss 3, Bottom Deck Section 21 – Exposed Rebar, Spalling, Corrosion, and Paint Peeling



Photo 44: Truss 3, Bottom Deck Section 22 – Exposed Rebar, Spalling, Corrosion, and Paint Peeling



Photo 45: Truss 3, Bottom Deck Section 24-26 – General Overview



Photo 46: Truss 3, Bottom Deck Section 24 – Exposed Rebar, Spalling, Paint Peeling



Photo 47: Truss 3, Bottom Deck Section 25 – Exposed Rebar, Spalling, Corrosion, Paint Peeling



Photo 48: Truss 3, Bearing Device – Tilted East

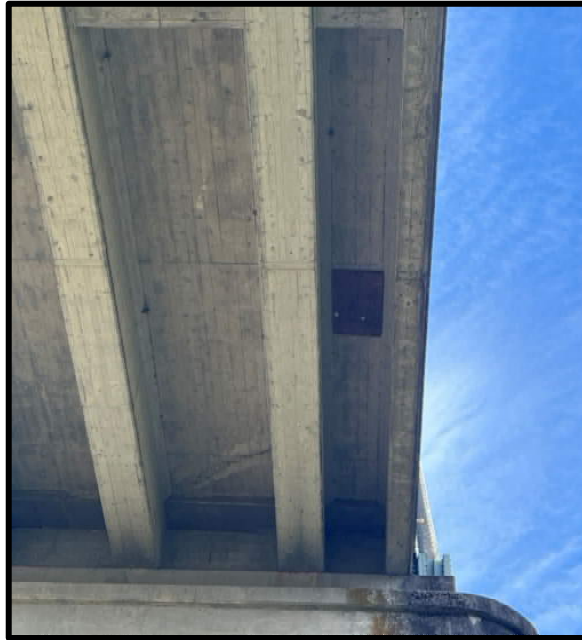


Photo 49: Span 7, Beam A & B – Patched Spall with Plywood, Beam B & C – Crack near Pier 4



Photo 50: Span 7, Beam B & C – Crack and Efflorescence near Bent 5



Photo 51: Span 8, Beam A & B – Spall Around Drain near Bent 6, Beam B & C – Crack near Bent 6



Photo 52: Span 8, Beam C & D – Patched Spalls with Plywood near Bent 5



Photo 53: Span 8, Beam C & D – Patched Spall with Plywood near Bent 6



Photo 54: Span 9, Beam A & B – Patched Spalls with Plywood near Bent Midspan



Photo 55: Span 9, Beam B & C & D – Efflorescence near Bent 7



Photo 56: Span 10, Beam B & C – Crack near Bent 7



Photo 57: Span 10, Beams B & C & D & E – Efflorescence near Abut. 2

Mr. David Skov
November 27th, 2024
Boyd's Bridge



Appendix B
Opinion of Probable Cost

Genuine Ingenuity

222 Second Avenue South / Suite 1400 / Nashville, Tennessee 37201-2308 / Phone 615.770.8100 / www.greshamsmith.com

Opinion of Probable Cost								
Phase:	Pay Item No:	Description:	Unit:	Quantity:	Unit Cost:**	Total Cost:	Photo Reference:*	Footnote:
Future Repair Plans	603-02.01	Repaint Steel Structure (Truss)	LS	1	\$ 787,50	00.0 1,787,500	0.1031 & 6	(1)
Future Repair Subtotal:						1,787,500.0		

Immediate Repair Plans	201-053.1	VeitgeaotneRm ovla	SL	\$	1	20,700.0	20,700.0	
	602-08.01	Jacking Structures (Steel Truss)	LS	1	\$ 15,837	5.0 157,837.50		(2)
	602-101.2	ireBaneDvg i(eeR icpa)r	SL	\$	1	39,675.00	48 39,675.00	(2)
	602-102.0	oBlst	hcaE		\$ 5	\$6900.03,4500.0	24 & 25	(3)
	602-108.1	iargSth Htetenaing	SL	\$	1	290,129.3 2 30,129.3		(4)
	604-10.30	Bridge Deck Repairs (Full Depth Of Slab)	S.Y.	\$	\$ 116	183,4926.2 1,5764.0		(5)
	604-104.4	npixsEaonJoi eRnip tar	SL	\$	1	4,000.0	33 4,000.0	(6)
	604-10.50	Bridge Deck Repairs (Partial Depth Of Slab)	Y.S.	\$	\$ 233	143,2382.4	6152.8	(7)
	604-105.4	eoreReintp Ccasr	F.S.	\$	69	\$ 5022.2	34,4018.4	(8)
	617-040.1	Typ1e Th ipnEoy xO velrya	Y.S.	\$	2328	\$ 4699	109,3903.9 34	(9)
	713-162.0	Sig(ennV) llsceiaCtrra eac	hcaE	\$	2	4314.3 \$	8628.7	(10)
	N/A	Remove and Replace Historic Sign(Sign on West Polat)r	hcaE	\$	\$ 1	1,2000.0	1,2000.0 15	(11)
Immediate Repair Subtotal:						928,413.9		

* Note: See Appendix A - Photo Log for the Photos referenced above.

** Note: Unit Cost are from the TDOT Average Unit Prices - 01Jan2024 thru 30Jun2024 Awarded Contracts with a 15% added contingency unless noted otherwise.

Footnotes:

- (1) Item No. includes cost of all the containment and disposal of the existing paint and the labor and material to clean, prime, and paint the entire steel truss. Item number unit price was not used for this estimate.
- (2) Item No. includes cost of all labor and material to jack the steel truss and reset the two (2) bearings at Pier No. 4
- (3) Item No. includes cost of all labor and material to replace 5 missing/ deteriorated rivets and nut assembly connection on Truss.
- (4) Item No. includes cost of all labor and material to heat straighten all truss sway bracing and the West portal that is warped/deformed.
- (5) Item No. includes cost of all labor and material to perform full depth deck repairs on approx. 5% of the bridge deck (visual estimate). Actual measurements would be determined by contractor by means of chain dragging entire deck.
- (6) Item No. includes cost of all labor and material to replace the joint membrane at Bent No. 2. Item number unit price was not used for this estimate.
- (7) Item No. includes cost of all labor and material to perform partial depth deck repairs on approx. 10% of the bridge deck (visual estimate). Actual measurements would be determined by contractor by means of chain dragging entire deck.
- (8) Includes cost of all labor and materials to place high-early strength concrete or a polymer modified cementitious structural patching material depending on the depth of repair.
- (9) Item includes cost of all labor and materials to clean the existing bridge deck, prepare the surface for the application of the Type 1 Thin epoxy overlay, and apply the thin epoxy overlay for the entire bridge width and length using a TDOT QPL epoxy product.
- (10) Item includes cost of all labor and materials to install post mounted vertical clearance warning signs at each bridge approach.
- (11) Item includes cost of all labor and materials to replace the cracked historic stamped steel sign at the West portal. No TDOT item number is applicable for this estimate.