GHA GEWALT HAMILTON ASSOCIATES, INC.
CONSULTING ENGINEERS
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MEMORANDUM

To: Robert Kosin, VBH Director of Administration
Brian Cecola, VBH Chairman Roads & Bridges

From: Dan Strahan, P.E., CFM
Gewalt Hamilton Associates (GHA)

Date: August 13, 2015

Re: Old Hart Road Bridge Repair

This past month Wiss Janney Elstner Associates, Inc. completed a structural inspection of the Old Hart Road Bridge. While the bridge is in fair condition, the report notes concrete deterioration along the east and west edge of the deck slab and recommends that concrete repairs be performed. The inspection report and photos is attached.

We would recommend that concrete repairs be completed at this location under the Drainage Management portion of the Roads & Bridges budget. Similar repairs were completed at the Green Rail Bridge on Oak Knoll last year for less advanced concrete deterioration in the amount of $17,300. The anticipated cost for the bridge repairs proposed is approximately $35,000-$50,000. If directed by the Roads & Bridges Committee construction documents will be prepared and a bid advertisement issued per the schedule outlined below:

- Bid Advertisement – September 3, 2015
- Bid Opening- September 22, 2015
- Contract Award- September 28, 2015
- Construction- October/November 2015

WJE ENGINEERS ARCHITECTS MATERIALS SCIENTISTS

Wiss, Janney, Elstner Associates, Inc.
330 Pfingsten Road
Northbrook, Illinois 60062
847.272.7400 tel | 847.291.4813 fax
www.wje.com

Via Email: dstrahan@gha-engineers.com

July 29, 2015

Mr. Daniel Strahan
Assistant Village Engineer - Village of Barrington Hills
Gewalt Hamilton Associates, Inc.
625 Forest Edge Drive
Vernon Hills, IL 60061

Re: Old Hart Road Bridge Inspection
Village of Barrington Hills
WJE No. 2015.3685

Dear Mr. Strahan:

Wiss, Janney, Elstner Associates, Inc. (WJE) recently completed the inspection of the Old Hart Road Bridge over Flint Creek. The inspection was performed on July 17, 2015 in accordance with the National Bridge Inspection Standards (NBIS), even though this bridge structure does not meet the NBIS criteria for submittal to the Illinois Department of Transportation (IDOT) based on its clear span of 18 feet.

The bridge is located on Old Hart Road, approximately 300 feet north of Oak Knoll Road. The bridge was constructed using a conventionally reinforced concrete deck slab, approximately 11 inches thick and 21 ft-3 in. wide. The bridge deck is oriented in a north south direction and carries two 10-foot lanes. The asphalt approach pavements are continuous with the asphalt overlay on the bridge deck. Reinforced concrete parapets are located along each edge of the bridge deck. Figure 1 shows the roadway looking south. Figure 2 is an elevation view of the bridge from the creek looking east. The north and south abutments are constructed using reinforced concrete with integral wingwalls, also shown in Figure 2. The year of construction is unknown. At the time of our inspection, the average water depth was approximately 2 to 3 feet.

Condition Survey

Overall the bridge structure was observed to be in fair condition. The soffit of the bridge deck exhibited areas of concrete deterioration, which was typically located along the east and west edges of the deck slab. The most advanced concrete deterioration was noted below the east bridge rail, as the entire eastern edge of the deck soffit is spalled or delaminated for a width of approximately 1 ft-6 in. to 4 ft-6 in. from the edge of the deck. In addition, multiple reinforcing steel bars in this area are exposed and corroded, as shown in Figure 3. The west edge of the bridge deck exhibits similar delaminations and freeze-thaw deterioration that extends between approximately 1 ft-6 in. and 3 ft from the deck edge; however, the concrete has not yet spalled off the deck. The deterioration of along the west edge of the bridge deck is shown in Figure 4. It should be noted that the reinforced concrete parapet is connected to the deck slab with hooked reinforcing steel bars along the edges of the bridge deck. These hooked reinforcing bars were observed to be corroded and no longer effective along the east edge of the deck. The remaining areas of the concrete deck soffit, between the deteriorated edges, were generally sound and no flexural or shear cracks were noted.

On the top surface of the deck, an area of deterioration, or possible impact damage, was observed on the south face of the east parapet. Minor scaling was also noted on the east parapet at the roadway shoulder.

Minor vegetation growth is typical along both bridge rails, at the joint between the asphalt roadway and the concrete bridge rail. A longitudinal crack is present in the asphalt overlay at the centerline of the bridge deck, and several transverse cracks are present in the asphalt overlay, as shown in Figures 1 and 5. In addition, slight depressions were observed in the approach pavement, with the largest being at the south approach pavement, near the east edge, which is also shown in Figure 5. This condition is indicative of movement of fill behind the south abutment. A roadway inspection opening was not made during this inspection, so the asphalt depth and condition of the top surface of the reinforced concrete deck slab could not be determined. The existing bridge rails do not conform to current IDOT standards as there are no approach guard rails or transitions to the bridge parapets.

The northwest and northeast wingwalls typically exhibited freeze/thaw deterioration and cracking with efflorescence, as shown in Figures 6 and 7. In addition, isolated areas of poor concrete consolidation and cracking with efflorescence were observed at various locations on the abutments and wingwalls, as shown in Figure 8. Isolated areas of concrete delaminations are also present on each wingwall, which is also illustrated in Figure 8.

Lastly, a small amount of debris has accumulated in the waterway at the southeast corner of the bridge. Stream migration to the north was noted upstream of the bridge.

Recommendations

The concrete that comprises the bridge deck (superstructure), rails, and substructures exhibit varying degrees of concrete deterioration and freeze-thaw damage. Currently, the deterioration along the east edge of the bridge deck have compromised the load-carrying capacity of the structural slab. Therefore, it is recommended that concrete repairs be performed to the concrete deck soffit along the entire east and west edges of the bridge. A schematic of the repair (Sketch A-1) has been included in Appendix A. The repair sequence for this work would be as follows:

1. Temporarily support/shore the bridge rail above the area to be repaired to stabilize the concrete rail vertically and laterally.
2. Chip existing deteriorated/delaminated concrete slab to the extents shown in the Sketch A-1.
3. Sandblast the exposed reinforcing steel and concrete surfaces.
4. Coat the existing reinforcing steel with an epoxy paint.
5. For the existing reinforcing steel that exhibits section loss, supplement with new #4 or #6 epoxy-coated reinforcing bars. Area of new reinforcing bars shall be at least be equal to the worst case section loss of the existing bars. Total section loss for the three existing reinforcing bars may be added together in order to provide one or two new supplemental reinforcing bar(s). The new epoxy-coated reinforcing bars shall extend a minimum of 18 inches past the area of section loss on each side, but need not exceed a length of 18 feet (clear span of bridge).
6. Epoxy dowel new reinforcing steel bars into the existing deck slab (horizontally) and the bridge rail (vertically), as shown schematically in Sketch A-1.
7. Restore the existing cross-section using shotcrete or a form-and-pour repair with flowable concrete and an adequately sized bird's mouth on the side of the forms.
8. Apply a silane sealer to the new concrete in accordance with the manufacturer's recommendations.

The deterioration of the slab edge has also significantly compromised the connection between the deck slab and the bridge rails, particularly along the east edge. The schematic repair shown in Appendix A provides dowels in an effort to supplement this deteriorated connection. These dowels will help to restore the bridge rail connection; however, the capacity of the repaired bridge rail is not known without performing additional investigation and analysis. It should be noted that a crash tested bridge rail would not be required for this

structure, as the Annual Average Daily Traffic (AADT) is less than 1,000 vehicles. If the proposed repair, shown in Appendix A, will not be performed in the near future, the Village may wish to consider the installation a temporary barrier along the east edge of the deck to protect the east bridge rail from vehicle impact damage.

A total of approximately 175 sq. ft. of deterioration (total) is present along the edges of the concrete bridge deck. The deterioration along the east and west edges of the bridge deck is likely due to moisture entry along the bridge rail. As a result, the application of a hot-applied crack filler/sealer is also recommended along the asphalt/bridge rail joint, as well as in the cracks present in the asphalt overlay.

Other, lower-priority, maintenance items include concrete repairs at each of the wingwalls and the application of a silane sealer to the surfaces of the abutments, wingwalls, and bridge rails. Currently, approximately 20 sq. ft. of concrete deterioration/delaminations are present on the above water portion of each wingwall.

Conditions of stream migration upstream of the bridge should be monitored. The small amount of debris beginning to accumulate in the waterway should also be monitored to prevent the back up of water behind the bridge.

Summary and Conclusions

WJE engineers completed an inspection of the Old Hart Road Bridge over Flint Creek. This bridge structure is in fair condition, but requires short-term concrete repairs to the edges of the concrete deck slab to restore the load-carrying capacity of the bridge deck. This structure does not meet the NBIS criteria for submittal to the Illinois Department of Transportation (IDOT); however, the structure should be inspected routinely to assess its condition.

Please call if you have any questions or require further information.

Sincerely,

WISS, JANNEY, ELSTNER ASSOCIATES, INC.

Douglas D. Crampton, P.E., S.E.
Associate Principal
Licensed Structural Engineer
Illinois No. 6108

FIGURES

Figure 1. View of Old Hart Road Bridge over Flint Creek looking south.

Figure 2. Bridge elevation looking east.

Figure 3. Spalled concrete and exposed reinforcing bars along east edge of deck soffit.

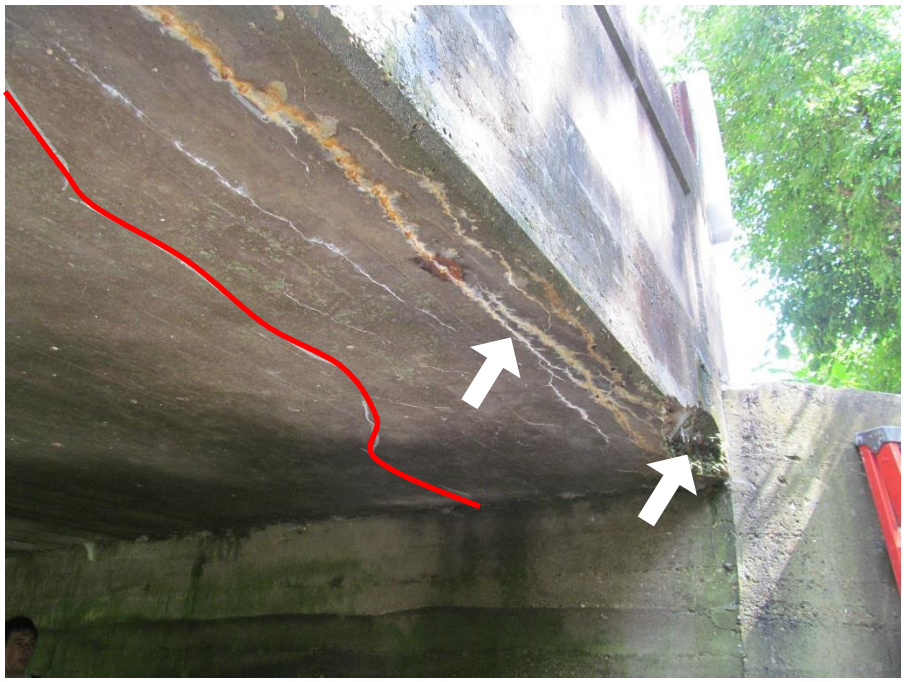


Figure 4. Spalled concrete and efflorescence (arrows) at southwest corner of the deck soffit (red line shows extent of delaminated concrete).

Figure 5. Settlement of approach pavement at the southeast corner of the bridge deck (arrow) and transverse cracking of the asphalt pavement (arrows).

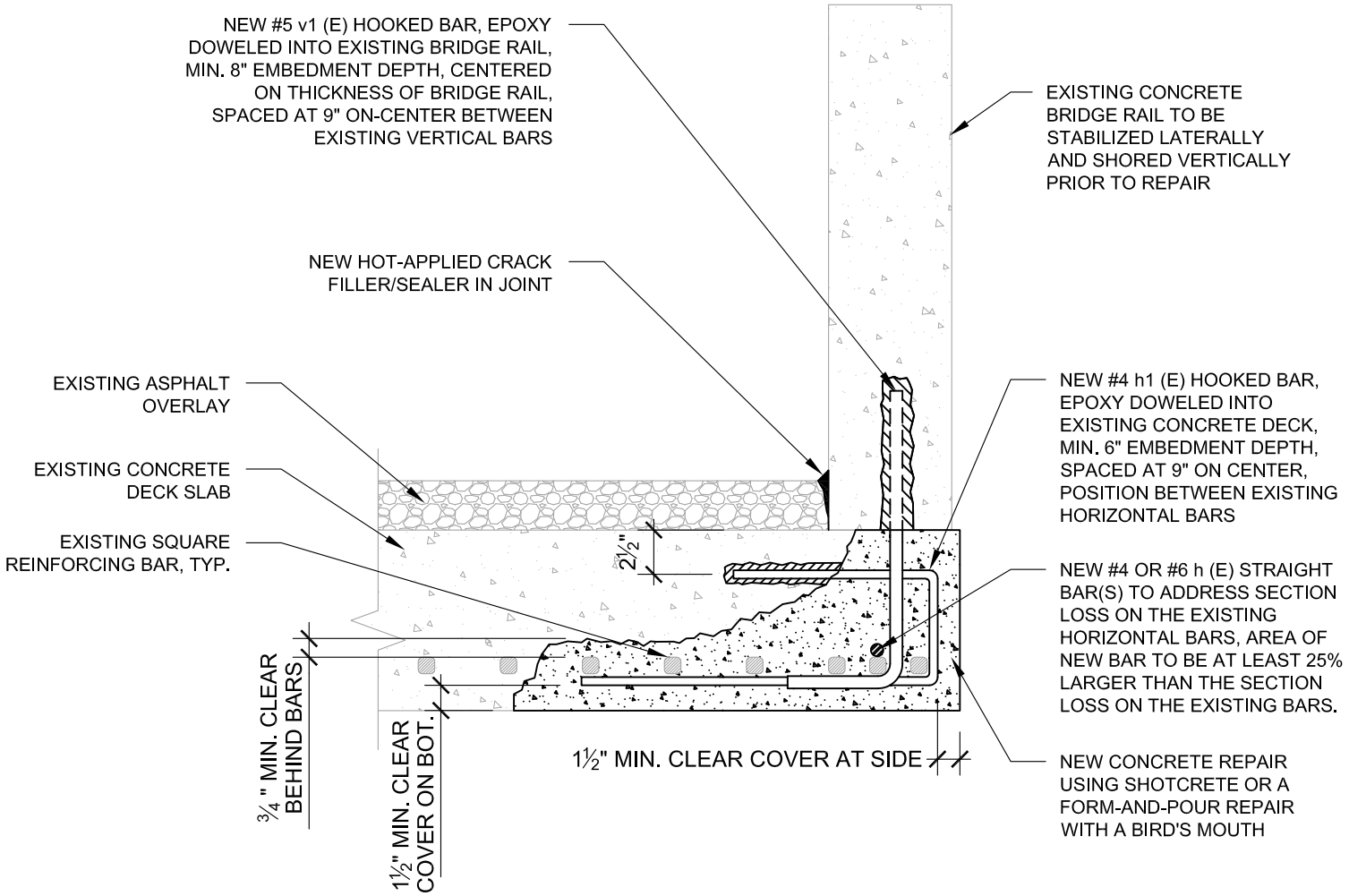
Figure 6. Freeze/thaw damage on the northwest wingwall, including cracking with efflorescence.

Figure 7. Freeze/thaw damage at the top of the northeast wingwall highlighted by cracking with efflorescence.

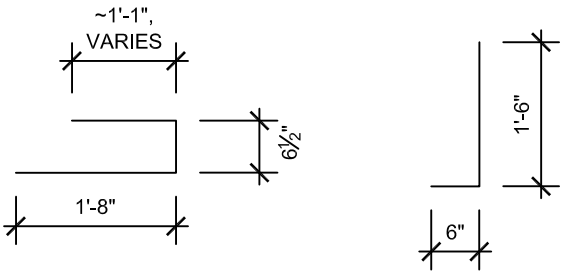
Figure 8. South abutment showing areas of efflorescence (arrows) and delamination (circle).

WJE ENGINEERS ARCHITECTS MATERIALS SCIENTISTS

APPENDIX A - CONCRETE REPAIR SCHEMATIC FOR THE DECK EDGE



A-1 SECTION THROUGH SLAB EDGE
SCALE: 1" = 1'-0"



BAR h1 (E)

BAR v1 (E)

BILL OF MATERIALS

Bar	No.	Size	Length	Shape
h (E)	4*	#4,#6*	18'-0" *	
h1 (E)	48	#4	3' - 4"*	
v1 (E)	48	#5	2' - 0"	
Concrete Repair			Sq. ft.	175
Reinforcement Bars Epoxy Coated			Pound	315

" * " INDICATES THAT THE EXACT DIMENSIONS ARE UNKNOWN UNTIL THE CONCRETE DETERIORATION IS REMOVED AND THE REPAIR PROFILE IS DETERMINED. APPROXIMATE DIMENSIONS AND QUANTITIES SHOWN.

NOTES:

1. ALL WORK SHALL BE IN ACCORDANCE WITH THE ILLINOIS DEPARTMENT OF TRANSPORTATION *STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION* , CURRENT EDITION
2. ALL MATERIALS AND PROCEDURES SHALL BE APPROVED BY THE ENGINEER PRIOR TO STARTING THE WORK.
3. REINFORCEMENT BARS DESIGNATED (E) SHALL BE EPOXY COATED.
4. EXISTING CONCRETE SURFACES AND REINFORCING BARS TO BE SANDBLASTED CLEAN PRIOR TO REPAIR.
5. EXISTING REINFORCING BARS SHALL BE PAINTED WITH AN EPOXY PAINT AFTER SANDBLASTING.
6. NEW REINFORCING BARS TO BE ASTM A615 GRADE 50.