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ORANGEVILLE • FERGUS • GRAVENHURST • HARRISTON

July 21, 2020

Municipality of West Grey
402813 Grey Road 4
R.R. #2
DURHAM, Ontario
N0G 1R0

Attention: Mr. Vance Czerwinski, C.E.T., CRS
Director of Infrastructure and Public Works

RE: Budget Estimate / Engineers Recommendation - Structure 70

Dear Mr. Czerwinski:

Triton Engineering Services has retained the services of Doug Dixon and Associates (DDA) to assist to provide the structural inspection and recommendation for repair of the above noted Structure.

In summary, DDA provides two (2) options to move forward with either timber deck rehabilitation or full deck replacement. Based on DDA recommendations and construction cost, Triton estimates the total project cost including engineering as follows:

Project Budget Estimate Option 1 – Timber Deck Rehabilitation	
TASK	**Estimated Total Cost**
Construction Cost Estimate	$ 293,000.00
Engineering Design/Approvals/Contract Administration/Construction Supervision	$ 30,000.00
Total Budget	**$ 323,000.00**

Project Budget Estimate Option 2 – Bridge Replacement	
TASK	**Estimated Total Cost**
Construction Cost Estimate	$ 1,330,000.00
Engineering Design/Approvals/Contract Administration/Construction Supervision	$ 85,000.00
Total Budget	**$ 1,415,000.00**

Please refer to the attached DDA letter outlining the findings of the July 10, 2020 field inspection and also provides a further breakdown of the construction budgets.

Trust this satisfactory for you current needs, if you have any questions please do not hesitate to contact the undersigned.

Yours truly,

Triton Engineering Services Limited

Chris Clark, M.A.Sc., P. Eng.

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July 16, 2020

Triton Engineering Services Ltd.
The Old Post
39 Elora Street South
Unit 7 to 9
PO BOX 159
Harriston, ON, N0G 1Z0

Attention: **Mr. Chris Clark, M.A.Sc., P.Eng.**

Re: **Bridge #70 West Grey**
Inspection and Recommendation for Repair
Our File WO 20-078

Dear Chris,

As per Triton Engineering Services Limited (Triton) request, staff from Doug Dixon & Associates Inc. (DDA) attended Bridge #70 (see Photograph 1) in West Grey on Friday July 10th, 2020. In the inspection party was the undersigned: Doug Dixon P. Eng., Senior Bridge Engineer and Adam Aubin, Bridge Technician. DDA undertook a visual inspection of Bridge #70 which consists of:

- Inspection of the deck using hammer sounding, visual and drilling ¼" diameter holes up to 4 inches deep in the timber deck;
- Visual inspection of the underside of the deck for the entire south span and the north span as could be seen from the north abutment;
- Visual inspection of the steel in the north pony truss span and the floor beams, stringers and lower chord in the north span and the two girders in the south span; and
- Visual inspection of the abutments and pier.

DDA arrived at the site at 12:15pm and were on site until approximately 2:15pm. Upon our arrival at the site the bridge was closed to traffic.

The following letter will provide:

1. A general description of the bridge;
2. DDA's observations from the July 10, 2020 inspection;
3. Recommended/conclusions on the condition of the existing bridge and the need to maintain the bridge closed;
4. A cost estimate to repair Bridge 70 to re-open at the current load posting; and
5. A budget estimation of the cost of replacing the bridges with a new structure (including the foundation).

INSPECTION

1. Background

Bridge #70 is located on Concession #2 in the municipality of West Grey. The bridge is approximately 180 m north of Highway 89.

According to the OSIM Inspection Form, the bridge was constructed in 1920. The bridge is posted for a maximum loading of five (5) tonnes.

The bridge is a two span structure. The south span length is approximately 40 feet. The south span consists of two main girders (see Photograph 2) with end floor beams and two intermediate floor beams. There are five (5) longitudinal steel stringers that frame into the floor beams. The deck is a laminated timber deck constructed of 2" x 6" sawn timbers (see Photograph 3). The timbers are not believed to be preservative treated.

The north span is approximately 26.5 m long and consists of a pony truss span (see Photograph 4). The floor beams are spaced at approximately 0.7 m centres. There are seven (7) lines of stringers framing between the floor beams (see Photograph 5).

It is noted that the steel in the pony trusses is riveted, indicative of 1920 construction. So too is the connection of the floor beams to the trusses. We note that all of the stringers appear to be bolted to the floor beams suggesting the floor beams have been replaced at least once. The north span has a similar laminated timber deck, as does the south span.

Anecdotal evidence suggests the timber deck was replaced in 1989 however that cannot be verified.

2. Observations

2.1 Timber Deck

The laminated timber deck is in an advanced state of decay. The exposed deck surface has numerous worn boards (see Photograph 6) as well as boards where a portion of the laminate is missing/broken (see Photograph 7).

DDA staff hammer sounded portions of the deck. The timber over much of the deck area provided an indication of soft, decaying timber. DDA staff drilled ten (10), 6 mm diameter holes in the deck to confirm the sound was decay. Most of the holes met little resistance to drilling (see Photograph 8). In some, the wood recovered was wet and dark. There were some locations with sound wood at depth (50mm plus) which confirmed a noticeably different response to hammer sounding.

There are a number of locations where the laminated deck is decayed to such an extent that the deck deflects noticeably under an inspector's weight (see Photograph 9).

The laminates can be separated using a paint scraper (see Photograph 10). This demonstrates the advanced decay.

From beneath the deck the timber is noticeably wet and dark suggesting areas of through deck decay are present (see Photograph 11).

Drainage from the approaches, particularly from the north end, is running down the grade to the deck and flowing onto the deck. This is resulting in the laminated deck at both ends of the bridge being saturated even with light rainfalls.

2.2 Steel

The DDA steel inspection was a visual inspection as could be completed from the deck and beneath the bridge spans.

The **pony truss** is in fair condition (see Photograph 12). The coating/paint system is no longer providing protection to the truss. The steel has some heavy pitting in areas with some assumed section loss. No field measurements to estimate section loss were undertaken by DDA during this inspection.

Some minor seam corrosion/rusting jacking was observed between built up member components in the truss. Batten plates connecting the bottom chord angles are perforated in several locations. Also, the batten plates at several of the floor beam to truss connections also have perforations (see Photograph 13). We also observed one (1) floor beam web perforation in the second floor beam from the north in the west end (see Photograph 14). The south span girders, floor beams and stringers exhibited no visually obvious defects. No perforations were observed.

The existing barrier on the bridge is from the time of the original construction and does not meet current code requirements.

2.3 Substructure

The two existing abutments appear to be in good condition. The abutments appear to be of more modern construction than the pier. We believe that the north and south abutments may have been rehabilitated since the date of original construction (see Photograph 15).

The pier does appear to be original construction with two more recent modifications to the pier on both the north and south faces under the east girder (for the south span) and beneath the west truss for the north span (see Photograph 16). The west end of the pier has one local area with scaling showing large diameter aggregate. Such aggregate was common for substructures built in the 1920s where aggregate was often sourced on site.

3. Conclusions/Recommendations

Based on our inspection of the timber laminated deck, the deck has a very high risk of local failure if allowed to be re-opened in its current condition. The extensive deterioration is approaching such condition where DDA would expect deck failure even from vehicles meeting the current five tonne posting.

For vehicles that may exceed the posted five tonne limit, this risk of failure would increase. Depending on the load DDA believes that the small span (spacing) between adjacent stringers has allowed the 2x6 laminated deck to remain in service and functional as long as it has. **We would recommend that the bridge remains closed to traffic until such time as repairs to the deck can be made.**

DDA does not anticipate that any sections of the deck can be rehabilitated. Complete replacement of the existing deck with a new laminated timber (with preservative treated timber) is required to restore the existing five tonne posting limit.

4. Scope of Work

Based on DDA's inspection the following would be the preliminary list of tasks to complete the deck replacement and restore the bridge to its current five tonne posting:

1. Suspend debris net or tarps to protect the river;
2. Remove the existing timber deck and the timber nailers from the top flange of the stringers and floor beams where present);
3. Power tool clean & coat on the top flange of the floor beams, girders and stringers with a surface tolerance coating;
4. Repair steel in area of girders, floor beams, stringers and trusses deemed necessary;
5. Install a new 2x6 sawn timber nail laminated deck. The timber should be preservative treated to maximize the feasible service life;
6. Provide wearing surface protection to the deck consisting of wearing boards or a suitable surface treatment;
7. Address the surface runoff from the road approaches that currently directs drainage onto the bridge.

DDA would recommend that the steel conditions be inspected at the time the timber deck is removed. The Contractor would be requested to provide for one day of time for the inspection for Engineers in his schedule. Alternatively, the inspection could be complete prior to detailed design. Cost for access is more extensive for such a procedure. This would allow an assessment of the condition of the steel in detail prior to tender. In addition, an evaluation could also be complete following the inspection to assess the load capacity and the possibility of increasing above 5 tonnes.

5. Budget Estimate

Our estimate for the budget cost to complete the scope of work identified in 4 (above) is as follows:

Task	Cost Estimate
Bonding, Insurance, Site Facilities	$20,000.00
Debris nets/access	$10,000.00
Remove existing timber deck	$25,000.00
Power tool clean top flange (700 sq ft)	$8,000.00
Supply, Install 2100 sq ft of 2x6 nail laminated timber deck	$140,000.00
Protective wearing surface (boards assumed)	$30,000.00
Contingency 25% (for steel repairs, road approach treatment)	$60,000.00
Total (excluding engineering & taxes)	**$ 293,000.00**

We estimate that the life expectancy for the existing bridge, with a new deck would be approximately 12 – 15 years assuming the new timbers were preservative treated.

6. <u>Replacement Cost</u>

For budget purposes, the cost estimate to replace this bridge with a wide two-lane structure would be:

Removal of existing	$150,000.00
New bridge (40x9x$3000.00/$m^2$)	$1,080,000.00
Approach work	$100,000.00
Total Days (excluding engineering & taxes)	**$1,330,000.00**

A replacement bridge would have a life expectancy of 75 years with normal rehabilitation. It would be able to carry all legal load vehicles.

If you have any questions regarding the above, please do not hesitate to contact the undersigned.

Yours Very Truly,

Doug Dixon, P. Eng.
Senior Bridge Engineer

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Photographs of Bridge #70 West Grey Inspection
Photographs 1 – 16

Photograph 1 – East elevation of Bridge #70

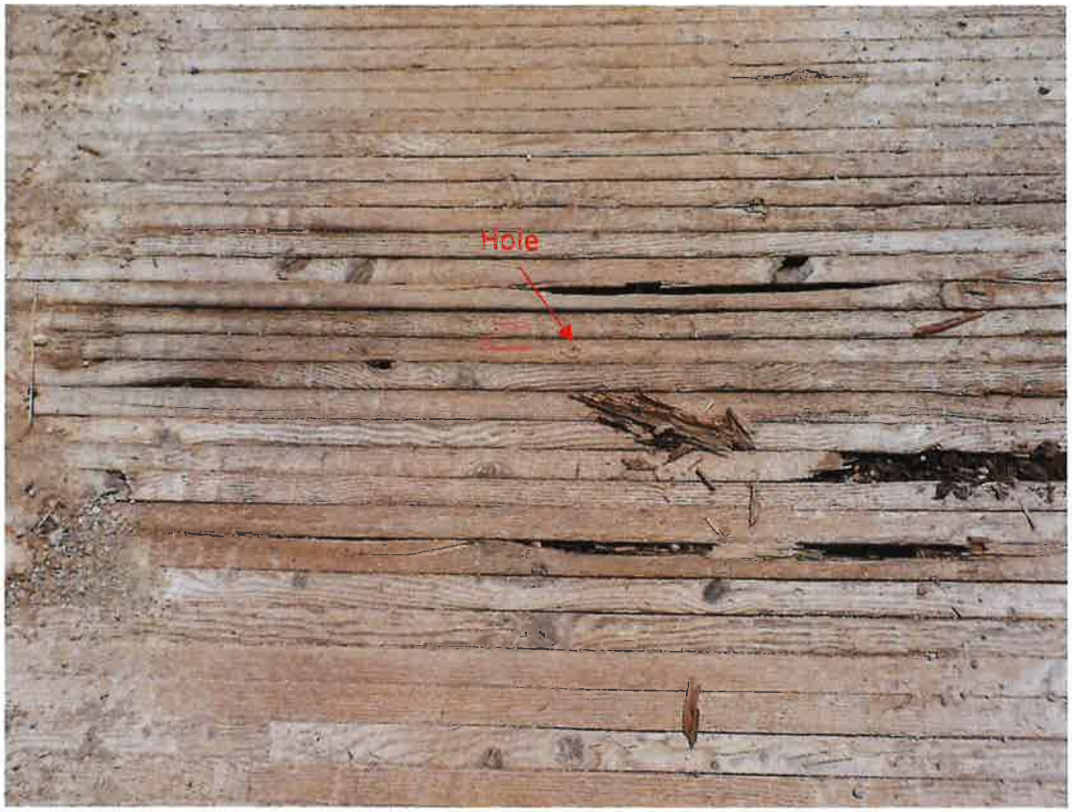
Photograph 2 – Two main girders of the south span

Photograph 3 – Deck made of 2"x6" sawn timbers (transverse laminated)

Photograph 4 – View of the north span looking north

Photograph 5 – Stringers running along deck soffit to floor beams and pier

Photograph 6 – Worn and deteriorating wooden deck surface



Photograph 7 – Deck surface with broken/deteriorating laminate

Photograph 8 – Drilling into wooden deck to confirm state of decay indicated by hammer sounding

Photograph 9 – Area which deform noticeably under the weight of an inspector

Photograph 10 – Laminate deck can be easily separated with a paint scraper

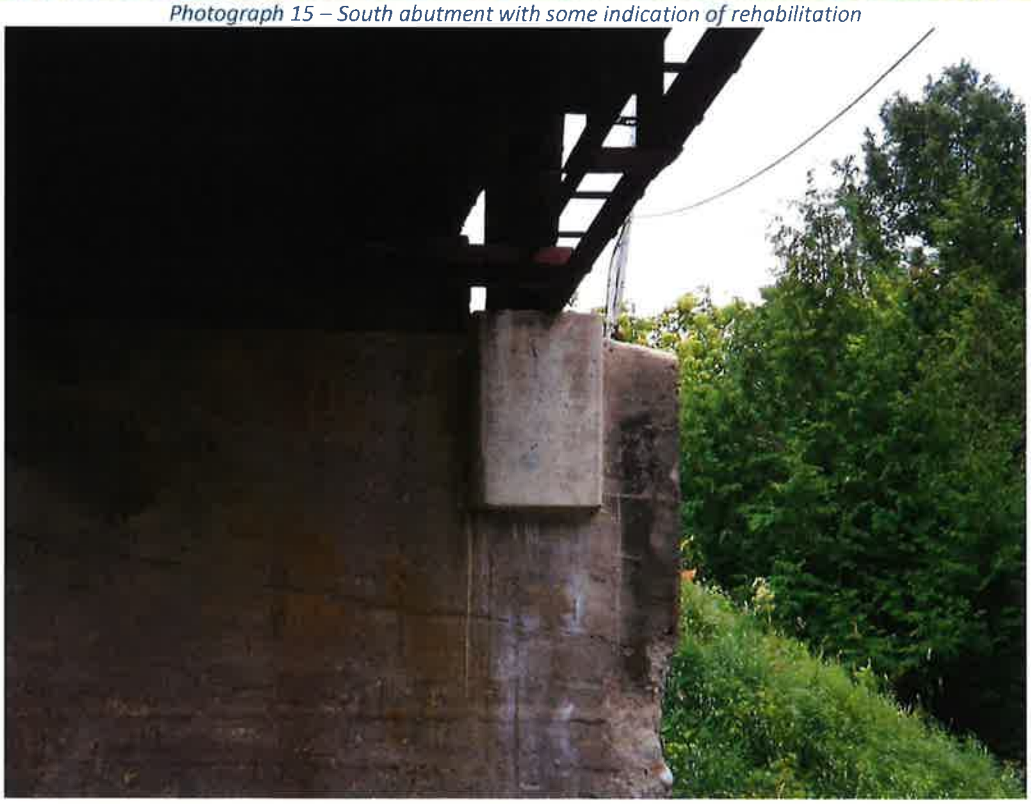
Photograph 11 – Areas of deck soffit with noticeably wet and dark areas indicating decay is present

Photograph 12 – East pony truss

Photograph 13 – Corroded/perforated connection plate on bottom chord

Photograph 14 – Perforation in floor beam web in NW corner

Photograph 15 – South abutment with some indication of rehabilitation



Photograph 16 – Corbel indicating some modifications to the pier (north face west of end pier)