Date: Wednesday, March 12, 2025

From: Kevin Verkindt, Manager, Engineering and Infrastructure

Subject: Structure S-005 Structural Load Analysis

Report#: DEV2025-18

This document and its attachments are public and available in an accessible format upon request.

Recommendation

THAT Council receive Staff Report DEV2025-18, Structure S-005 Structural Load Analysis and consider the following recommendation;

THAT Council adopt Alternative 4 of permanently closing and removing Structure S-005.

Background

In 2024, Pearson Engineering completed the Biennial OSIM Inspections of the Township's bridge and culvert inventory (roadway and trail structures), which included the inspection of S-0005 known as the Keppel-Sarawak Townline Bridge. As part of the 2024 OSIM Inspection Report for S-0005, it was recommended that a detailed load evaluation be completed on the bridge as the structure was noted to be in poor condition.

Keppel-Sarawak Townline Bridge is a single lane, single span structure located between Lot 34, Concession 14 in Keppel, and Lot 28, Concession 1 in Sarawak. The existing load carrying superstructure of the bridge utilizes the steel frame of a flatbed trailer, which spans over an existing concrete T-beam bridge (original structure). The concrete T-beam bridge spans 9.3m and conveys water flow for the Indian creek. The concrete structure has five (5) cast-in-place T-beams. The beams support a cast-in-place concrete deck, and bear on cast in-place concrete abutment walls. Though not visible, it is assumed that the original structure is supported by concrete shallow foundations.

In August 2016, Council approved By-Law No. 77-2016 where the Township entered into a Memorandum of Understanding with the South Bruce Peninsula All-Terrain

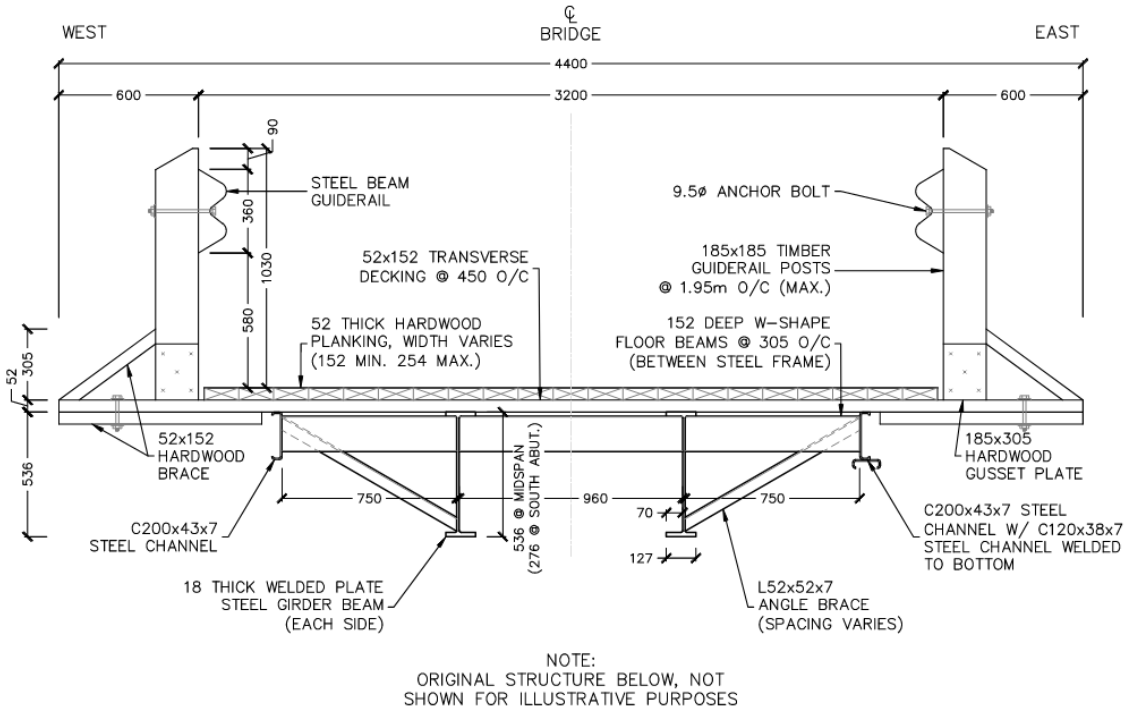
Vehicle (SBPATV) Club for the permission to use the structure to legally enter, establish, maintain, groom, sign, and use that portion of the structure (Attachment 1).

Section 3 states the local ATV club shall maintain the bridge to be used in reasonably good condition. This includes but is not limited to the installation of a steel deck over top of the existing concrete structure to ensure required loading can be accommodated, the installation of guardrails, signage, approach and exit ramps, and lockable gates.

It is believed that due to the poor condition of the original concrete structure, the SBPATV Club elected to install a flatbed trailer over the bridge to remove the live loading from the concrete deck. As the elevation of the bridge structure was increased after the installation of the flatbed trailer without any adjustments to the roadway vertical alignment, the approaches leading up to the bridge are considered very steep.

During the installation of the flatbed trailer, it appears that additional timber planks were installed over the deck to reinforce the riding surface of the bridge. The reinforced timber deck is composed of longitudinal decking which span over transverse boards. The transverse deck boards located below the longitudinal decking are used to support both the timber deck, and the steel beam barrier system.

Figure 1 outlines the general cross section of the existing bridge structure.



Analysis

Pearson Engineering completed a Structure Load Analysis (Attachment 2) and found the following deficiencies:

- The wood deck is exhibiting significant deterioration causing an uneven and dangerous riding surface.
- The construction methodology of the steel beam barrier system does not appear to be structurally adequate to support vehicle or pedestrian loading.
- The roadway approaches appear to be very steep and not constructed in conformance with the geometric standards for Ontario roadways. This safety concern is amplified by the bridges narrow roadway width (±3.0m) and the lack of guiderail systems at each corner of the bridge.
- There is no signage on the roadway indicating a narrow roadway, narrow bridge or one lane traffic.

The Canadian Highway Bridge Design Code (CHBDC), the lowest load posting established utilizing an Evaluation Level 3 loading condition is 7 Tonnes. However, the MTO Structural Manual Rev.60 (January 2024) states that for low volume roads (AADT < 400) a lower load limit may be posted than outlined in the CHBDC.

Based on Pearson's review, the floor beams have the capacity to support a 4 Tonnes vehicular load.

Pearson Engineering has identified four preliminary alternatives.

Do Nothing

The bridge will further deteriorate and will eventually result in the Township closing and removing. Pearson Engineering has provided a recommendation that the bridge be closed March 31, 2025.

Rehabilitate the Bridge – Minor Rehabilitation

The proposed minor rehabilitation of the structure involves the complete replacement of the steel beam barrier and wood deck system. The construction process will include removing the existing wood deck system and steel beam barrier system to permit the installation of a new laminated wood deck. A new steal beam barrier system would also be installed with a construction methodology that meets the Canadian Highway Bridge Design Code (CHBDC). No changes to the roadway approaches would be completed.

This design alternative allows the bridge structure to be re-opened to pedestrian and recreational traffic only. Due to the limited load carrying capacity of the existing steel

superstructure, a restricted load limit of 4 tonnes would be established over the bridge. Permanent signage would be installed to designate the roadway over the bridge as a trail system. The remaining service-life of the bridge structure would be increased to 5 to 10 years, which could be extended based on the condition of the existing steel superstructure and original concrete structure below.

By rehabilitating the structure, the Township maintains the water crossing within the NEC regulated area, which is also part of a Hydro One maintenance corridor and the OFSC trail system.

Rehabilitate the Bridge – Major Rehabilitation

The proposed major rehabilitation of the structure includes the full replacement of the steel superstructure, wood deck, and barrier system. This design alternative requires the completion of a topographic survey to accurately record the existing conditions of the site. The construction process will include removing the existing steel frame superstructure including the wood deck top and steel beam barrier system. After removals are completed, a new prefabricated steel girder superstructure would be installed with a laminated wood deck and steel beam guiderail system. Consideration would be given to replacing the precast block foundations buried in the approaches directly supporting the steel superstructure (beyond limits of original concrete structure). Minimal changes to the roadway grading at approaches would be completed.

This design alternative allows the bridge structure to be re-opened to pedestrian and recreational traffic. As the full superstructure is being replaced, the load carrying capacity of the structure can be increased to 10 tonnes, which would permit maintenance vehicles from the Township, Hydro One and OFSC to also utilize the bridge structure. The remaining service-life of the bridge structure would be increased to 10 to 15 years, which could be extended based on the condition of the original concrete structure below.

By rehabilitating the structure, the Township maintains the water crossing within the NEC regulated area, which is also part of a Hydro One maintenance corridor and the OFSC trail system.

Permanently Close and Remove the Existing Bridge

This alternative involves the permanent removal of the structure and the reinstatement of the creek embankments. Full removal will require the disposal of the steel beam barrier system, wood deck, and steel frame superstructure, as well as the partial removal of the original concrete T-beam frame structure. Environmental protection measures including the installation of a debris platform would be installed to permit the removal of the bridge structure while maintaining creek flow. Prior to the completion of

construction, new dead-end barricades and signage would be installed at each bridge approach.

The permanent removal will require the completion of a topographic survey to accurately record the existing conditions of the site. Permit approvals would need to be obtained from the Grey Sauble Conservation Authority and the Niagara Escarpment Commission (NEC). The structure is currently located within the Niagara Escarpment Commission (NEC) regulated area. Therefore, if the Township completes a full removal of the bridge structure, there is a possibility that a new structure would not be able to be installed in the future.

By removing the structure, the Township will incur a significant construction cost initially but will eliminate ongoing maintenance / replacement costs from their asset management plan in the future.

The following alternatives are summarized in the table below.

Alternative	**Structure D-007 Alternative**	**Estimated Construction Cost** **(Excluding HST and Engineering)**	**Summary**
1	Do Nothing	$0	Do nothing will result in the bridge closure and eventually the need for the removal of the bridge.
2	Minor Rehabilitation	$50,000 - $75,000	+/- 5–10-years extended service life Maintain 4 Tonnes Load Limit. Construction duration is short (2 to 3 weeks)

3	Major Rehabilitation	$100,000 - $125,000	+/- 10-15 years extended service life Load limit increased to 10 Tonnes. Construction duration is short (3 to 5 weeks)
4	Permanent Closure and Removal	$150,000 - $175,000	This option could be implemented in a relatively short timeframe with an approved budget for removal. Construction duration is long (4 to 6 weeks)

Financial Impact

The 2025 budget included $150,000 for design and engineering costs of this bridge in 2025. Any financial requirement in excess of the proposed budget would need to be approved by Council.

Strategic Priorities

Enhancing Service Delivery

Enhancing Environment and Infrastructure

Conclusion

Given the current condition of the bridge and the results of the detailed load evaluation, it is recommended the Township take the following steps:

- Close the bridge March 31, 2025 to all vehicular and pedestrian traffic. Roadway closure signage and barricades should be installed at each end of the bridge.
- The Township should begin budgeting for the permanent removal of the structure in the next 1 – 5 years.

Although the rehabilitation of the current bridge structure may be possible, the costs associated with the rehabilitation work are not considered cost-effective.

The replacement of the bridge deck and barrier system may allow the bridge to be reopened for another ± 10 years, but a restricted single load posting of 4 Tonnes would still be required. Given that most of the vehicles utilizing the bridge crossing would weigh more than 4 Tonnes (including the trail groomers used by the local snowmobile club), the reopening of the bridge is not recommended.

Permanently closing the bridge provides the Township with the best opportunity to ensure the safety of the public, while still considering the potential economic, social and environmental impacts.

Respectfully Submitted:

Kevin Verkindt, Manager, Engineering and Infrastructure

Report Approval Details

Document Title:	Structure S-005 Structural Load Analysis.docx
Attachments:	- Attachment 1 - Memorandum of Understanding with South Bruce Pen ATV Club.pdf - Attachment 2 - S-0005 Load Evaluation Report .pdf
Final Approval Date:	Mar 4, 2025

This report and all of its attachments were approved and signed as outlined below:

Michael Benner, Director of Development and Infrastructure

Niall Lobley, Chief Administrative Officer