ASSOCIATION OF CONSULTING ENGINEERING COMPANIES | CANADA
ASSOCIATION DES FIRMES DE GÉNIE-CONSEIL | CANADA

wood.

Canadian Consulting Engineering Awards 2019
Project: [Lansdowne Bridge Span Replacements]
Category: [Category B - Transportation]
April 18, 2019
5:00 pm EDT

Submitted to:
Canadian Consulting Engineer (CCE)
Attention: Doug Picklyk
111 Gordon Baker Road, Suite 400
Toronto, On M2H 3R1

Submitted by:
Karam Albazi, P.Eng
Senior Bridge Lead Engineer
Phone: 416-399-8079
Email: karam.albazi@woodplc.com

Wood Environment & Infrastructure Solutions,
a Division of Wood Canada Limited
3450 Harvester Road, Suite 100, Burlington, ON, L7N 3W5

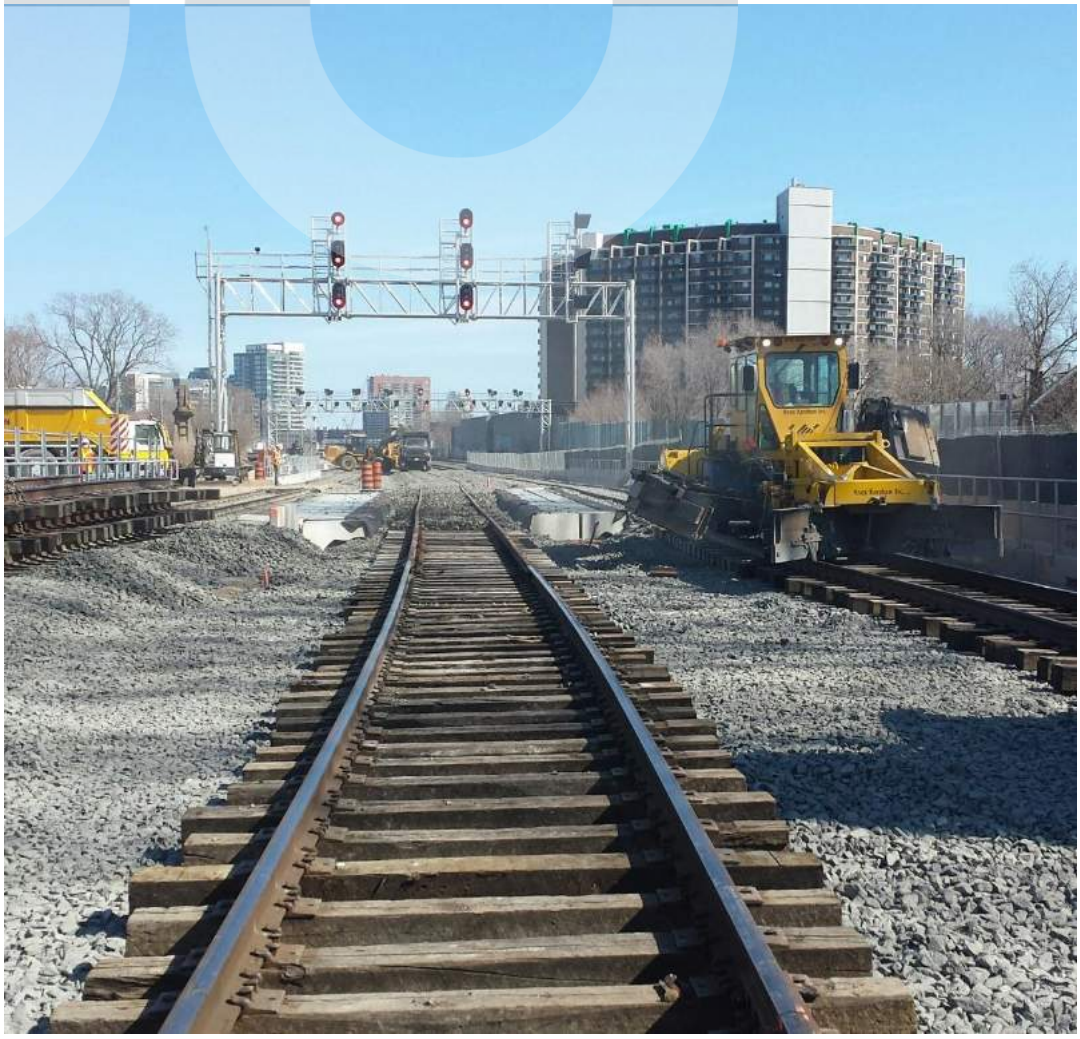

Table of Contents

1.0 Full Project Description

Metrolinx retained Wood for the Rehabilitation of the aging, century old (Constructed in 1906) Lansdowne Bridges at Mile 3.12 Weston and Mile 3.12 Newmarket Subdivisions to avoid potential slow orders.
The proposed infrastructure is in the Metrolinx Kitchener and Barrie Rail Corridors and carries 7 spans over 8 tracks. Wood provided the engineering services and construction support for the replacement of 2 of the original 7 spans with design life of 100 years to accommodate increasing public transit.

1.1 Innovation

Initiated by the Bridges and Structures group of Rail Corridors to address the issue of structure condition, Metrolinx retained Wood for Rehabilitation of the Lansdowne Bridges at Mile 3.12 Weston and Mile 3.12 Newmarket Subdivisions.

The proposed infrastructure is in the Metrolinx Kitchener and Barrie Rail Corridors and includes an eight-track corridor – six (6) tracks for the expanded Weston Subdivision, of which two (2) are connecting to the Newmarket Subdivision, and two (2) tracks for the existing Galt Subdivision.

Wood provided engineering services for the Lansdowne Bridges replacement at Mile 3.12 Weston Subdivision and Mile 3.12 Newmarket Subdivision – the double-track single span TPG on the Kitchener line was replaced with two single-track BM-span superstructures, and the single-track single span TPG superstructure supporting the Barrie line was replace with a BM-span superstructure. The existing bridge structure at Lansdowne Avenue was constructed in 1906.

The Newmarket Subdivision Mile 3.12 bridge structure was a single span TPG structure with timber open deck and has a total length of 75'. This bridge has the same vintage as the Weston structure and was recommended to be replaced in concurrent or before replacement of the Weston structure.

Wood provided added value in the design of the bridges and tracks by considering different factors such as economic, future maintenance, and minimizing disruption to existing railway operations.

The conventional way of design and construction of similar span replacements is to divert the railway traffic to the adjacent spans, modify the existing (remaining) substructure, install the new pre-fabricated superstructure and install the ballast and rail and open for traffic. However, since the traffic diversion was not feasible at this location, Wood had to propose a design for the modification of the substructure, bearing installation, span replacement all in two separate weekends that were prescribed in the contract. Newmarket Subdivision span was installed in one weekend and subsequently the Weston Subdivision span was installed. The modification of the substructure to accommodate the new spans was completed by introducing precast elements and connecting them to the existing. Heavy machinery, intense labour work, detailed hourly scheduling, instant on-site engineering solutions and modifications to the original design were implemented to successfully replace the spans. Proprietary concrete products (high early strength concrete) were used to adjust the differences in the existing and proposed elevations.

Figure 1: New span being lifted into place by crane during a weekend closure.

1.2 Complexity

The main challenge in this project was to replace all three spans in two weekends. These weekend closures were prescribed in the contract through extensive coordination between the Client and GO Operations prior to the tendering of this project. All weekend activities included:

- Removal of existing span including tracks
- Removal of parts of the existing substructure (abutment ballast walls)
- Installation of precast substructure components
- Installation of bridge span
- Installation of tracks including ballast

Wood reviewed and approved a detailed hourly schedule provided by the contractor in order to successfully complete all activities without interruption and delays to railway traffic.

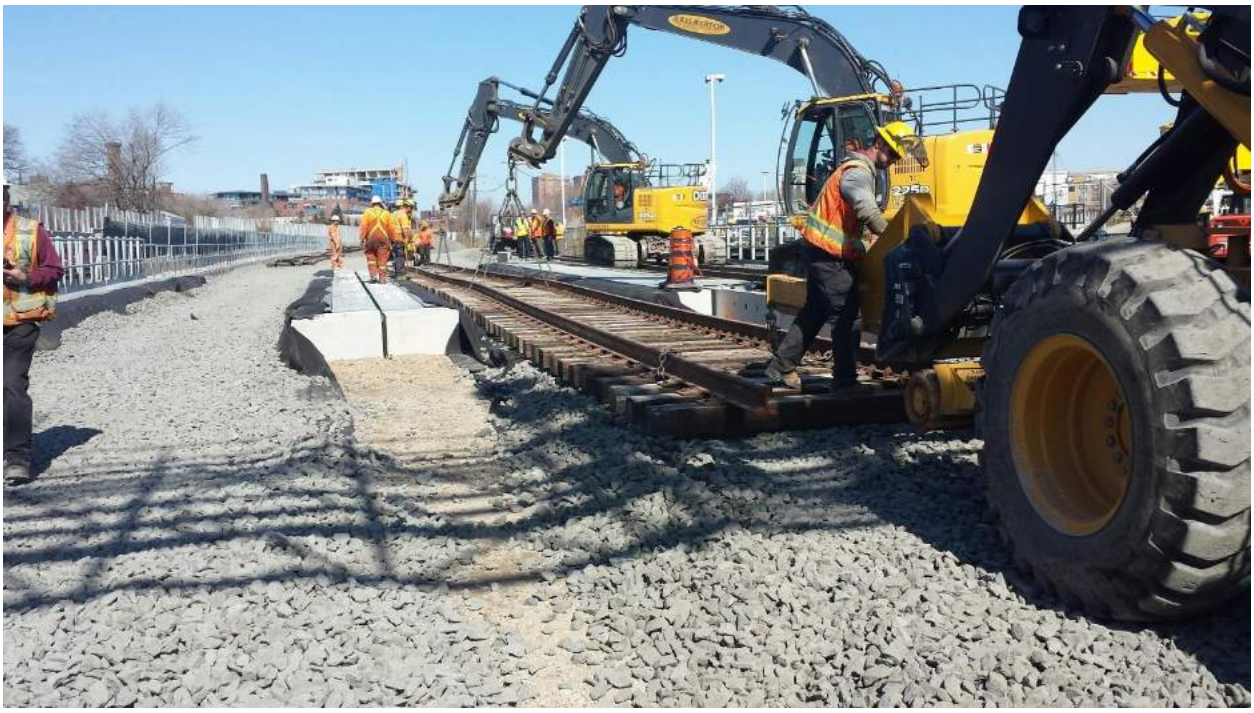

Figure 2: Track panel being installed on top of pre-ballast following a weekend span replacement.

1.3 Social and / or Economic Benefits

The increasing demand for public transit in the City of Toronto is pushing the client increase service to and from the downtown core resulting in a higher volume of train traffic through their rail corridors of one train in each direction every fifteen minutes. As such, the existing structures need to be rehabilitated or replaced in order to accommodate this increase in train traffic in terms of safety and reliability. In the case of the Lansdowne span replacements, the superstructures were completely replaced with three new spans, and the substructure was rehabilitated to accommodate the span replacements. The structure deterioration of the Lansdowne bridge needed to be addressed due to its aging condition and the completion of the span replacement now means less maintenance will be required. This is important as the increasing train volume will limit the amount of work block maintenance that can occur. The spans were designed with a 100-year life so there will be no need for any major replacement or rehabilitation works in the near-future which is imperative to ensure the client can accommodate the ever-growing demand from public transportation to and from the City of Toronto and ensure the safety of all passengers and workers will using this service. There were service adjustments during this project to cancel GO and UP Express service during the weekend closures, but all the work was completed in the allowed 58-hour work block windows.

Figure 3: Track panels connected to the west following span replacement.

1.4 Environmental Benefits

The three spans were designed to blend well with the adjacent five spans that were replaced prior to these spans. Throughout the project, materials were reused where possible to help reduce the amount of waste being removed from site. All contaminated material such as existing timber ties and ballast were removed and disposed as a contaminated material. The existing rail material to be removed was salvaged and used as the guard rails on the new track to reduce the amount of waste coming from the project. Where possible, the old rail was also used for transition rails and temporary rail before being salvaged in the client's storage yard. Another environmental consideration of this project was the decision to do a span replacement as opposed to a bridge rehabilitation. The replacement option eliminated the need of sandblasting and painting of the existing structure which prevented the generation of excess waste from this project.

Figure 4: Deterioration of the existing structure. This material was recycled following its removal.

1.5 Meeting Client's Needs

The client's main project goals were to replace the remaining two Lansdowne aging spans with a new three spans, 100-year service life structure while causing the least amount of impact to revenue train service. This goal was able to be met by utilizing 58-hour continuous work blocks during weekend closures of the rail corridor. This was possible through close schedule coordination with the client, contractor, GO and UP Express which saw activities laid out in hourly intervals. Only two weekends were available to complete the three span replacements including modifications of the substructure. The design was completed in such way to accommodate the replacement of the single span of the Newmarket Subdivision and replace the other two spans in a subsequent weekend. The scheduling was proposed in such a way to have lessons learned from the first weekend for the one span replacement and address the challenges in the subsequent two span replacement weekend. The client also required that utility protection be implemented for rail signals, fibre optic cables, and Bell 360. This was able to be met through close coordination with utility owners and a thorough work plan approval review process which provided a high level of detail as to how utilities would be located and protected. All client's needs and requests were able to be met ultimately due to our teams experience and understanding of work within this rail corridor.

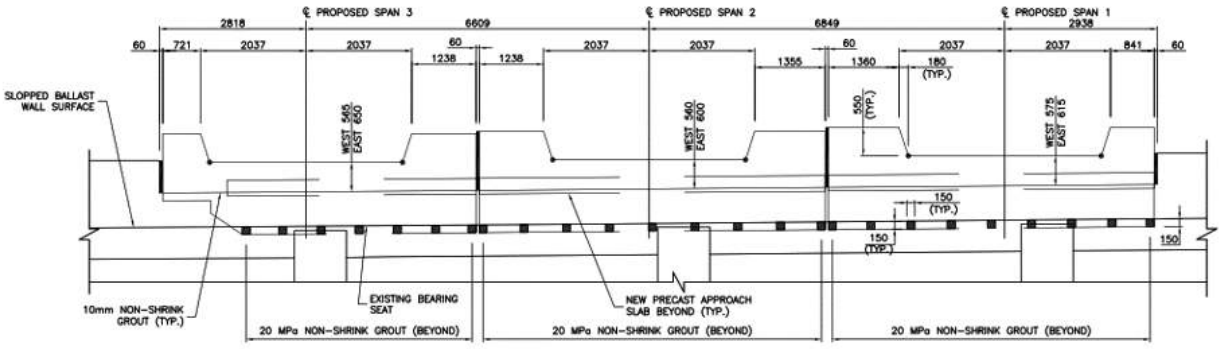

Figure 5: Cross section of the final bridge configuration over Lansdowne Avenue.