DILLON CONSULTING

CITY OF TORONTO

Functional Design Report

Sewell's Road Bridge (No. 812) on Sewell's Road

Rouge Park Bridges Transportation Master Plan

February 2025 - 19-1924

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1.0 Introduction

1.1 Project Description

The City of Toronto (City) has retained Dillon Consulting Limited (Dillon) to complete a Transportation Master Plan (TMP) focused on the development of renewal strategies for the following five municipal bridges located on City rights-of-way within the Rouge National Urban Park (RNUP):

- Maxwell's Bridge on Twyn Rivers Drive (No. 802)
- Stotts Bridge on Twyn Rivers Drive (No. 803)
- Hillside Bridge on Meadowvale Road (No. 806)
- Sewell's (Suspension) Bridge on Sewell's Road (No. 812)
- Milne (Bailey) Bridge on Old Finch Avenue (No. 813).

These bridges have been designated under *The Ontario Heritage Act, R.S.O. 1990, c. O.18* as amended, with the exception of the Milne Bridge, which was listed by the City in 2006 and has not yet been designated.

The Rouge Park Bridges TMP will be completed in accordance with the provisions of the Municipal Class Environmental Assessment (EA) process, Approach #2. The purpose of the TMP is to undertake a comprehensive review, develop and evaluate Alternative Solutions for each of the bridges, including the retention, rehabilitation, or replacement of each, and prioritize the implementation of the recommended solutions.

This Functional Design Report is focussed on bridge engineering factors, with reference to roadway geometrics and other factors as appropriate. This report provides input to the "Rouge Park Bridges Transportation Master Plan Report", which documents the evaluation of alternative solutions from a comprehensive, multi-factored perspective, and identifies a recommended solution, and is supported by other technical and professional studies and reports.

This report summarizes the existing conditions and provides an assessment of alternative solutions for retaining, rehabilitating, or replacing the **Sewell's Bridge on Sewell's Road (No. 812)** from a bridge engineering perspective**.** It also provides functional design recommendations for the recommended alternative.

1.2 Project Location

Sewell's Road Bridge is located on Sewell's Road between Steeles Avenue to the north and Old Finch Avenue to the south, crossing over the Rouge River.

The Rouge River flows west to east at the bridge. For reporting purposes the bridge spans in a north-south direction.

The site location is labelled as site "A" in **Figure 1.**

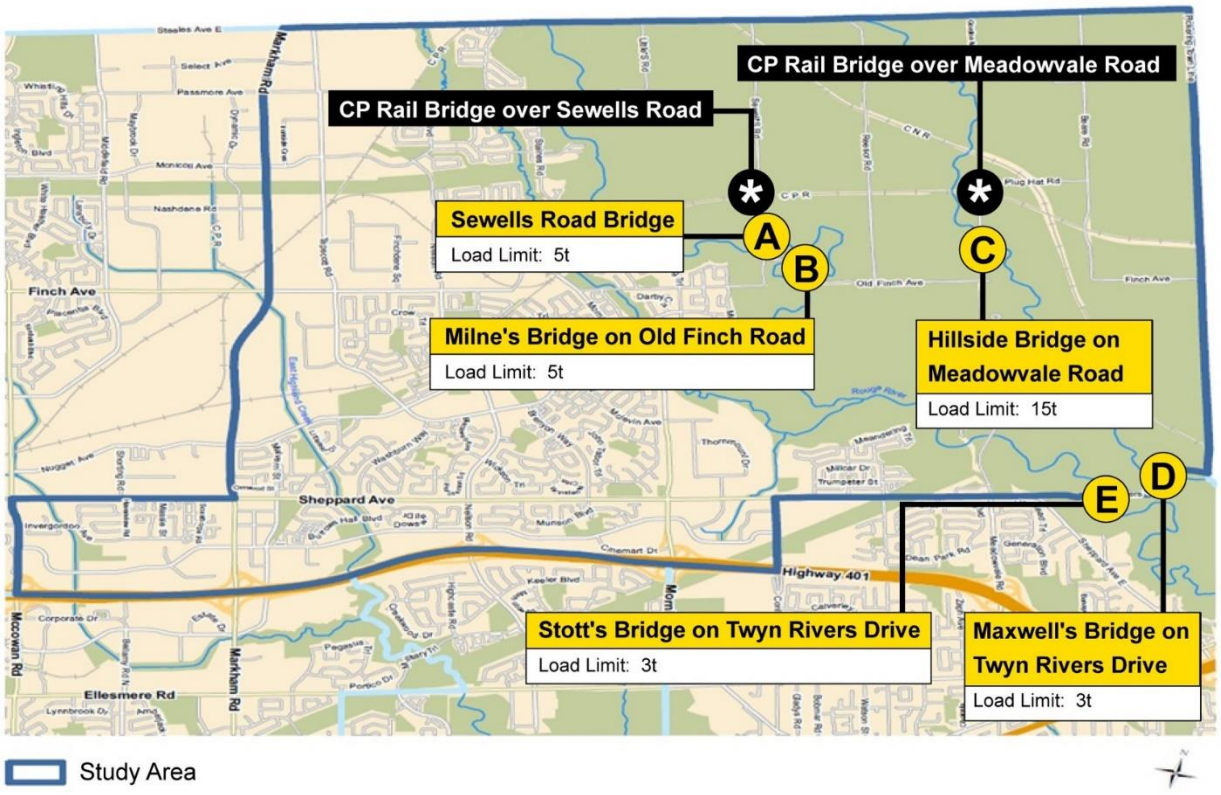


Figure 1: Site location

2.0 Available Information

2.1 Drawings

The following historical drawings are available for reference:

- Drawings 5012-S-1 to 5012-S-5, "Sewell's Road Bridge [Rehabilitation]", Gregg and Edens Limited, 1980.
- Drawing 5012-S-6, "Repairs to Sewell's Road Bridge", Gregg and Edens Limited, 1987.
- Drawing 812-S5012-7 and 812-S5012-8, "812 Sewell's Road Over Rouge River, Bridge Repairs", 2013.
- CP Rail File No. 26218-1, "CP Rail Subway over Sewell's Road, Belleville Subdivision, Mileage 194.05", 1973.

2.2 Reports

The following documents are available for reference:

- City of Toronto, Bridge Inspection Form, Structure No. 812, Structure Name: Sewell's Road Bridge over Rouge River, 2021.
- Multiple Bridge Inspection and rehabilitation in North-East Scarborough, Sewell's Road Bridge over Rouge River (Bridge No. 812), Associated Engineering, 2013.
- Corporation of the City of Scarborough By-Law Number 25152 to designate the Sewell's Bridge Concession IV, Part Lot 8 now designated as Part 1 on Plan 64R-15213 as being of historical and architectural value, 1997.
- "Rouge Park Bridges TMP: Traffic Analysis Memo", Dillon Consulting, April 2021.
- Transportation Assessment Memo, Rouge Park Bridges TMP, Dillon Consulting, May 2021.
- "Hydraulic Report - Rouge Park Bridges Transportation Master Plan", Dillon Consulting, November 2020.
- "Desktop Study Geotechnical and Hydrogeological Assessment. Rouge Park Bridges Transportation Master Plan EA, Toronto, Ontario", Thurber Engineering Ltd, November 2020.

2.3 Relevant Design Guidelines

References for the assessment of feasible alternative solutions for retention, rehabilitation or replacement of the bridge structures included, but was not limited to the following:

- MTO Structural Planning Guideline
- MTO Structural Manual
- Canadian Highway Bridge Design Code (CHBDC)
- MTO Structural Financial Manual
- MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads
- MTO Roadside Safety Manual
- City of Toronto - Road Engineering Design Guidelines
- Accessibility for Ontarions with Disabilities Act (AODA)

3.0 Existing Site Conditions

3.1 Roadway Features & Geometry

Sewell's Road has a two-lane rural cross-section with no paved shoulder, bike lanes or sidewalks. The road is posted with "no trucks" signage at entry points. It is classified as collector road with a posted speed of 50 km/h, except near the bridge, where the regulatory posted speed is 20 km/h. The profile features a sag curve (Minimum K = 8.1) at the bridge, generally having a gradient down to the south, consisting of a 2% gradient on the north approach, 0.3% gradient on the bridge and 5% slope at the south approach. See **Appendix A** for the General Arrangement drawing of the bridge.

The bridge width (approximately 3.8 m between curbs) permits only one lane of traffic at a time, with yield signs posted to accommodate alternating direction traffic. Within the structure limits, the existing horizontal alignment is straight. However, the south approach road is curved (R=46m), creating poor sight lines and a poor angle of approach. The bridge has no skew angle and no crown on the deck.

There is a CP Rail bridge over Sewell's Road (at Mileage 194.05, Belleville Subdivision) located 0.45 km north of the Sewell's Road Bridge. The CP Rail bridge is posted with a 3.5 m vertical clearance limit and limits traffic to an alternating direction, single lane configuration. Further north, there is a CN Rail level crossing.

See **Appendix A** for the CP Rail bridge General Arrangement drawing.

Sewell's Road Bridge has a vertical clearance limit of 4.1 m at the pier sway frames, which would only be vulnerable to northbound traffic, since the CP Rail structure constrains southbound traffic.

There are no trail heads or crossing points near the structure.

3.2 Traffic

A Traffic Analysis Memo was prepared as part of the Rouge Park Bridges TMP, which provided an analysis and overview of the existing and future traffic conditions within the RNUP. The 2021 Annual Average Daily Traffic (AADT) at the structure is 4,800 vehicles per day and the forecasted 2041 AADT is 6,800 vehicles per day. The road is posted with "no trucks" signage at entry points.

The clear width (between curbs) of approximately 3.8 m restricts traffic to a single-lane, alternating direction configuration.

3.3 Roadside Safety

There is guide rail approaching the bridge and anchored around the end cables in all four quadrants of the structure. The roadway alignment on the south approach has poor sight lines and angle of approach. A detailed road safety audit was not completed.

3.4 Property

The bridge is located on City property, within an approximate 20 m right-of-way. Beyond the 20 m right-of-way limit most of the property is owned by Parks Canada. Additional property owners exist within the boundaries of the park and the extents of these should be determined in preliminary design.

3.5 Utilities

Overhead utility lines run parallel to Sewell's Road at the structure along the west side.

3.6 Water and Sewer

Water and sewer information was not available at this time.

3.7 Posted Signage

The following posted signage was observed at the bridge:

- The bridge has a load posting sign of a maximum load limit of five tonnes.
- Speed limit of 20 km/h.
- Narrow bridge signs are posted at both ends, including yield signs to alternate traffic.
- At each end of Sewell's Road a regulatory Heavy Vehicle Prohibition sign is posted.
- A vertical clearance warning sign of 4.1 m is posted at the bridge.
- Along Sewell's Road warning signs about curves and pedestrian crossings are posted.

3.8 Survey

Existing topographic survey information was obtained from the City. Hydraulic models for the Little Rouge River at the location of the bridge were provided by the Toronto and Region Conservation Authority.

4.0 Existing Bridge

Sewell's Road Bridge, constructed in 1912, is a 48.76 m long three-span (9.14 m, 30.48 m, 9.14 m) "stiffened" suspension bridge with an exposed concrete deck carrying Sewell's Road over the Rouge River. The bridge clear width between curbs of approximately 3.8 m restricts traffic to a single-lane, with yield signs to alternate traffic. The bridge has a load posting of 5 tonnes.

General Arrangement drawings are provided in **Appendix A**, and site photographs are included in **Appendix B**.

4.1 Superstructure

The superstructure is comprised of suspension cables attached to floor beams, stiffening trusses, and an exposed concrete deck. The towers have sway bracing at the top, restricting the vertical clearance to 4.1 m, and are pinned at the base. The main cables connect to deadweight anchors at each abutment, and the vertical cable hangers suspend from the main cables and attach to the floor beams every 1.52 m.

The bridge has three spans of nominal lengths of 9.14 m, 30.48 m and 9.14 m for a total bridge length of 48.76 m. The stiffening trusses are spaced at 4.43 m, with a 1.52 m bay spacing in a truss configuration using counter-diagonals. The stiffening trusses also serve as a railing on each side with concrete curbs. The bridge has a clear width of 3.8 m between concrete curbs on a 200 mm thick bare concrete deck.

There are bridge expansion joints at each pier.

4.2 Substructure

The substructure is comprised of conventional closed concrete U-shaped abutments founded on spread footings.

The main cables are attached to deadweight anchors of unknown size buried behind abutments.

There are two concrete piers supporting the steel towers. The foundation type is not known.

4.3 Maintenance and Repair History

Since the original bridge construction, the Sewell's Bridge was rehabilitated in 1980, 1987 and 2013.

In 1980, the following major rehabilitation work was completed:

- Deck replacement
- Replacement of the main cable
- Installation of new stiffening trusses
- Concrete patch repairs to piers and abutments
- Structural steel was painted silver.

In 1987, the following repair work was completed:

- Repositioning of vertical hangers
- Repairs to trusses.

In 2013, the following work was completed:

- Replace tower base pins
- Recoating portions of hangers and floor beams
- Recoating of stiffening truss
- Selective repairs to truss diagonals
- Patch repair of concrete deck.

See **Appendix A** for the Rehabilitation General Arrangement drawings.

4.4 Condition of Structure

The condition of the structure was determined from a review of available documentation, visual site walk-through surveys of the structure in November 2019 and October 2020, and interviews with City staff.

The 2021 biennial bridge inspection assigned a Bridge Condition Index (BCI) of 71.5, which relates to a bridge in good condition. The abutments and piers were in generally good condition. It should be noted that these inspections are intended to identify repairs required in the next two years and do not address functional obsolescence or long-term considerations.

The structural steel inspection and evaluation completed in 2013 confirmed the 5 tonne load posting.

The stiffening trusses provide the only barrier between the curb and vertical hangers and therefore a crash test approved barrier system in accordance with the CHBDC requirements is not provided. However, any risk is mitigated by the 20 km/h posted speed limit and yield to oncoming traffic condition which result in a significant reduction in the required barrier performance level.

Overall, the bridge appears to have additional service life remaining.

5.0 Heritage Evaluation

In 1997, the City of Scarborough designated Sewell's Road Bridge as being of historical and architectural value or interest under *The Ontario Heritage Act, R.S.O. 1990, Chapter O.18*.

The reasons for designation were given in Schedule B to By-Law Number 25155, as follows:

> "The Sewell's Bridge is recommended for designation for historical and engineering reasons. The bridge, built in 1912, is technically described as a ''stiffened suspension bridge''. In 1911, Frank Barber, C.E. was commissioned to design a bridge to replace an old timber crossing. The Sewell Family occupied large farms in Lot 8 and 9. The road leading past their farms became known as Sewell's Road and the bridge likewise became known as the Sewell's Road Bridge. Besides being one of the oldest bridges in Scarborough, the bridge is believed to be the only remaining suspension bridge on a public road in Ontario."

A monument was installed in 1981, following the bridge restoration.

Heritage conservation is an important consideration in the assessment of bridge alternative solutions, and in the overall evaluation of alternative solutions in the TMP, which are addressed in the "Cultural Heritage Resource Assessment Report" and a "Scoped Heritage Impact Assessment Report" by ASI, to assess the recommended alternative solutions from a heritage perspective.

5.1 Heritage Guideline Options

The "Ontario Heritage Bridge Guidelines" (Ontario Ministry of Transportation, 2008) has been used as a supplementary reference to the primary heritage guide used by the City, "Conservation of Historic Places in Canada" (Parks Canada, 2010). The former guide articulates a series of heritage treatment options to be considered in rank order (from most desirable to least) as follows:

1. Retention of existing bridge with no major modifications;
2. Retention with restoration of missing or deteriorated elements;
3. Retention of bridge with sympathetic modification;
4. Retention of bridge with sympathetically designed new structure nearby;
5. Retention of bridge adapted for alternative use;
6. Retention of bridge as heritage monument for viewing purposes;
7. Relocation of bridge – applicable for smaller, lighter structures; and
8. Bridge removal and replacement with sympathetically designed structure.

Reference will be made to these options throughout this report.

6.0 Identification of Alternative Solutions

Need for a Crossing

At the onset of the project, the need for a bridge crossing at the site was evaluated based on traffic needs, detour route availability, and other factors. It was concluded that the crossing could not be closed and decommissioned permanently. Therefore, **all alternative solutions to be considered require a bridge crossing to be in service for the next 20 years**, representing the study period for the TMP.

Three Alternative Solutions for the bridge crossing have been identified:

- Alternative 1: Retain Bridge
- Alternative 2: Rehabilitate Bridge
- Alternative 3: Replace Bridge

Each alternative is described below, for clarity.

6.1 Alternative 1: Retain Bridge

Retention of the existing bridge means keeping the bridge in its existing configuration with minimal changes, if any. It may include maintenance repairs, or improvements to roadway approaches, sight lines, signage or other ancillary features. However, functional improvements that change the cross-section of the bridge, or strengthening that substantially alters the form and appearance of the structure are not considered in this alternative.

This alternative involves continued operation of the bridge with minimal modifications at the start and no planned repairs in the next 20 years. Normal maintenance and inspections are anticipated. No improvement to functional adequacy would be achieved. Roadside safety would typically not be improved.

This alternative would only be feasible if the level of risk, safety and reliability of continued operations is deemed acceptable.

6.2 Alternative 2: Rehabilitate Bridge

Rehabilitation means strengthening and altering the existing bridge to address deficiencies, and the process may allow improvements to its functional adequacy. This may include adding structural components to supplement the existing ones, replacing components of the structure or other similar improvements. However, significant alterations in form and appearance may occur.

Rehabilitation is defined in the Canadian Highway Bridge Design Code (CHBDC) as a modification, alteration, or improvement of the condition of a structure or bridge subsystem that is designed to correct deficiencies in order to achieve a particular design life and live load level.

Functional adequacy may be viewed as encompassing not only design life and live load levels, but also operational risk, maintenance requirements, geometric constraints, and other factors.

A minor rehabilitation may focus solely on correcting deficiencies without any improvement in functional adequacy. However, corrective actions that require more extensive modifications are considered major rehabilitations.

Major rehabilitations provide the opportunity (and often the obligation) to achieve an acceptable level of functional adequacy. For example, the CHBDC indicates that consideration shall be given to closing bridges that would be posted for a load limit below 7 tonnes. For older bridges, it is often not feasible to strengthen bridges to load levels comparable to a new bridge, thus lower load levels would be targeted. Table 15.1 of the CHBDC provides guidance on target load levels for bridges to be rehabilitated for restricted normal traffic. In this case, bridges carrying emergency vehicles, single unit trucks, school buses and maintenance vehicles should be capable of supporting a CL3-ONT design live load, which relates to a posted load limit of 25 tonnes. (For comparison, a bridge that can support unrestricted normal traffic would be comparable at 63 tonnes.)

Rehabilitation typically extends the service life of a bridge for 25 to 35 years, which would correlate to no planned repairs during the 20-year planning horizon for this study. Normal maintenance and inspections are anticipated. Roadside safety (e.g. barriers) could be improved in some cases, but it may not be possible to achieve the level of performance possible with new construction.

The benefits of rehabilitation should be evaluated against associated costs, risks and consequences.

Risks may include increasing loads to the substructure (e.g., abutments) beyond acceptable levels, the potential to uncover problems during construction that are much worse than could be known at the beginning, hazards to worker or public safety during the rehabilitation, and other issues.

Consequences include potential impacts to the heritage value and aesthetic appearance of the bridge, and these should be minimized or avoided where feasible. Rehabilitation may involve adding structural components to supplement the existing ones, replacing components of the structure or other significant modifications. Such significant alterations in form, proportion, massing, or materials may be so extensive that the heritage value cannot be appropriately preserved, therefore rehabilitation is not recommended.

Widening of this bridge through a major rehabilitation would require such an extensive dismantling and replacement of the original structure and abutments that it is not considered feasible.

6.3 Alternative 3: Replace Bridge

Replacement of the existing bridge means complete removal of the existing bridge, and replacement with a new structure. This allows the greatest improvement in the functional adequacy of the bridge such as load-carrying capacity, width, and service life. For replacement of heritage bridges, it must be demonstrated that the other alternative solutions are not suitable before replacement is considered.

Replacement would remove constraints such as load limits, span limits, bridge clearance for hydraulics, bridge width, number of lanes, shoulder widths, roadside safety barriers, bicycle lanes, and pedestrian accommodation. It also provides the opportunity to use new materials and structure forms to improve durability. Typically, the design life for a new bridge designed according to the CHBDC is 75 years. Minimal maintenance would be required for the first 20 years after construction.

Replacement would involve removal of the existing bridge span and its abutments, affecting the heritage characteristics of the bridge and its surrounding area. However, the existing bridge superstructure could be removed carefully and adapted for alternate use away from its current location, potentially elsewhere in the RNUP or in the City, providing a degree of heritage conservation.

In many cases the original bridge could be adapted for a new use such as a pedestrian crossing, cycle path or scenic viewing, or retained as a heritage monument for viewing purposes only. The bridge could be relocated to a new site for these purposes.

Retention of the existing bridge on the current site is not considered feasible at this site, due to limitations in right-of-way and span limitations to achieve appropriate hydraulic clearance.

The Ontario Heritage Bridge Guidelines (MTO, 2008) recommends the heritage impact of a bridge replacement could be mitigated using sympathetic design which means making the new structure physically and visually compatible with the heritage attributes of the original. It would be compatible in terms of the massing, size, scale, and architectural features to protect the cultural heritage value of the bridge and its environment.

A commemorative monument, plaque or sign could be erected at the site to recognize the history of the original bridge.

A heritage bridge often has contextual value attached to its cultural heritage value, requiring the scenic characteristics of the river crossing, the roadway alignment, and natural setting be taken into account for any replacement structure that may be considered.

7.0 Evaluation of Alternative Solutions

As part of the broader Transportation Master Plan, alternative solutions are being evaluated against the following six factors:

- Bridge Condition and Function;
- Transportation;
- Heritage and Archaeology;
- Natural Environment & Hydraulics;
- Public Uses in Rouge National Urban Park; and
- Implementation.

This report focuses on the 'Bridge Condition and Function' for each alternative, and the review has been supported by other technical and professional studies. The evaluation of alternative solutions is described in the following sections.

7.1 Alternative 1: Retain Bridge

Alternative 1 is a 'holding strategy' where the existing bridge is retained and maintenance repairs are completed for the remainder of the service life until a major rehabilitation is completed or the structure is replaced.

Repairs would be focused on maintaining the structure in a safe operating condition, but would not include strengthening to address the current 5 tonne load posting. Based on a review of previous inspection and engineering reports, the scope of work is expected to include:

- Localized steel repairs to address severe section loss (particularly at the connections);
- Localized blasting and spot recoating at locations of coating failure (particularly at vertical hangers);
- Installation of guard rails on the existing stiffening trusses to reduce damage from collisions;
- Expansion joint and/or seal replacement as may be required to prevent exposure of substructure and below deck truss components to deicing contaminated water/run-off; and
- Patch repairs to the concrete deck, piers and abutments.

A regular monitoring and maintenance program would be required for the remainder of the service life to address ongoing deterioration at critical locations.

Alternative 1 provides the lowest capital cost alternative and addresses the ongoing deterioration at the site. The reported condition of the structure appears to support retaining it, with minimal alternations to conserve the cultural heritage value.

Truck traffic would continue to be required to use an alternate route which limits nearby residents' access to fire and other emergency services as well as access for other service vehicles, and deliveries such as home heating oil.

Maintaining the single lane, alternating direction traffic configuration would continue to pose a collision risk to all users, including cyclists who share the road with vehicular traffic. Guardrails can be installed to mitigate some of the collision damage on the stiffening trusses, although it is unlikely that a fully crash-tested barrier system can be provided.

The existing soffit elevation meets current hydraulic clearance requirements, but the existing span configuration does not provide any allowance for future meandering. There is evidence of stream bank erosion along the watercourse and stream bank stabilization measures may be required over the 20 year study period.

7.2 Alternative 2: Rehabilitate Bridge

Alternative 2 includes a major rehabilitation with the intent to improve structural performance and extend the service life of the bridge significantly.

The ability to strengthen the structure is limited by the capacity of the original deadweight anchors of unknown size buried behind the abutments. The inclination of the original cable anchorages (above ground) was adjusted to 30 degrees during the 1980 rehabilitation and the cable anchorages were blasted and recoated during the 2013 rehabilitation. However, there are no records of rehabilitating or evaluating the buried portion of the original anchors, since the structure was constructed in 1912.

The current 5 tonne load posting was confirmed in 2013, based on limited evaluation. The assumed capacity of the existing hangers (material grade unknown) governed the load posting. However, this evaluation did not consider the capacity of the existing cables or buried anchorages. It may be feasible to replace the hangers; however, significant strengthening to be able to permit truck traffic would likely require replacement of most of the superstructure elements, detracting from the heritage value of the bridge significantly. Similarly, widening of the bridge would essentially require complete replacement of the superstructure. Therefore, widening of the bridge through rehabilitation is considered impractical and not recommended.

Rehabilitation work would focus on modest strengthening of the structure and extending the service life. Based on a review of previous inspection and engineering reports, the scope of work is expected to include:

- Localized steel repairs to address severe section loss (particularly at the connections) and damages from vehicle impacts (if required);
- Localized blasting and spot recoating at locations of coating failure;
- Replacement of the existing concrete deck;
- Strengthening of cable hangers and other superstructure components;
- Installation of guard rails on the existing stiffening trusses to reduce damage from collisions; and

- Patch repairs to the concrete piers and abutments; and
- Minor road realignment for south approach, to improve sight lines.

The existing exposed concrete deck is reported to be generally in good condition in the 2021 City of Toronto Bridge Inspection Form and the 2013 Predesign Report by Associated Engineering. However, the deck was installed during the 1980 rehabilitation and has been left exposed for more than 40 years. Replacement of the deck is expected to be required during the 20 year study period and is recommended to be completed in this rehabilitation.

Future design phases of this project could consider subsurface investigations to assess the existing cable anchorages. Non-destructive methods such as ground-penetrating-radar may be able to measure the approximate depth and geometry of the dead-weights. Localized excavation with hydro-vac could potentially expose the buried steel components for inspection.

A regular monitoring and maintenance program would still be required for the remainder of the service life, to monitor ongoing corrosion, the inclination of the hangers, and future collision damage.

Alternative 2 is a high cost alternative for extending the service life beyond Alternative 1. The bridge would remain single lane with no functional improvements in terms of allowing truck traffic.

The original design impedes widening or significant strengthening and even modest strengthening and repairs would alter the original form and result in significant loss of heritage value. Strengthening would be completed to improve the load carrying capacity, but it is not expected to be feasible to strengthen the structure to meet current standards without replacing the major structural components (stiffening truss, cables and hangers, anchorages, and potentially pylons) resulting in significant impact to heritage value.

The steel repairs and modest strengthening work proposed would be of high complexity. Short-span suspension bridges are rare and the availability of experienced contractors may be limited.

Truck traffic would continue to use an alternate route, which limits nearby residents' access to fire and other emergency services as well as access for service vehicles, and deliveries such as home heating oil.

Maintaining the single lane, alternating direction traffic configuration would continue to pose a collision risk to all users, including cyclists who share the road with vehicular traffic. Guardrails can be installed to mitigate some of the collision damage on the stiffening trusses, although it is unlikely that a fully crash-tested barrier system can be provided.

Similar to Alternative 1, this alternative maintains the existing hydraulic opening and may not accommodate the future meander belt width for the river.

7.3 Alternative 3: Replace Bridge

Alternative 3 includes complete replacement of the structure. The new bridge would meet current standards which are calibrated for a 75 year design life. Minimal maintenance would be required for the first 20 years after construction.

Alternative 3, complete replacement, provides the most improvements to the safety and overall function of the structure, but also represents the highest initial cost. However, based on the reported condition replacement may not be warranted at this time.

The replacement structure would be designed in accordance with current standards and would provide full access for truck traffic, including emergency vehicles and large service trucks.

The new two lane configuration reduces collision risks and improves access for recreational users.

The hydraulic opening would provide increased conveyance and the span would include an allowance for spanning the meander belt or erosion limits of the river.

Minimal maintenance is expected to be required for the first 20 years. Modern structural configurations and materials would be used, resulting in a more durable structure with lower future maintenance requirements.

7.4 Recommended Alternative

Retaining the existing structure (Alternative 1) is recommended at this site. Rehabilitation (Alternative 2) cannot address the safety concerns and functional limitations of the single lane crossing without replacing a large proportion of the superstructure, which would eliminate the bridge's heritage value. Replacement (Alternative 3) does not appear to be warranted at this time, based on the reported condition.

This Functional Design Report is focused on bridge engineering, with reference to roadway geometrics and other factors as appropriate. The evaluation of alternative solutions, from this perspective, is summarized in **Table 1**. A more comprehensive multi-factor evaluation of alternative solutions is included in the TMP report.

Table 1: Evaluation of Alternative Solutions Summary

Criteria	Alternative 1: Retain	Alternative 2: Rehabilitate	Alternative 3: Replace
Bridge Condition and Function	Bridge has remaining service life. Bridge would remain one lane with load posting.	Repairs to address deterioration. Bridge would remain one lane with load posting.	New two lane bridge would meet current standards
Heritage	Cultural heritage value would be maintained.	Rehabilitation has the potential to impact the cultural heritage.	Sympathetic design would be recommended.
Implementation	Low complexity due to limited scope.	Not feasible to strengthen to current standards.	Moderate complexity due to structure type.

7.5 Heritage Conservation Options Review

Heritage conservation options are based on the 'Conservation of Historic Places in Canada;' (Parks Canada, 2010) which provides principles for infrastructure conservation and references the Ontario Heritage Bridge Guidelines (MTO, 2008) for the specific case of bridges. This provides a rank-order approach to heritage bridge conservation options, ranging from least to most heritage impact. The rank-order approach requires each option to be evaluated and found to be non-viable before the subsequent option is considered. (See **Section 5.0** of the report for a complete listing of options.) The rank-order options that were considered are listed in **Table 2** below.

Table 2: Heritage Options Review

Conservation Option	Evaluation Summary
1. Retain existing bridge with no major modifications	Viable for study period based on condition, recognizing it is on a "no trucks" route, it has had proven performance to date, and recognizing that for fire and emergency access to both ends of the bridge is achievable on existing roadways. Ongoing maintenance and monitoring is recommended.
Recommendation:	**Retain existing bridge (option #1)**

Heritage conservation is an important consideration in the assessment of bridge alternative solutions, and in the overall evaluation of alternative solutions in the TMP, which will be addressed in the "Cultural Heritage Resource Assessment Report" and a "Heritage Impact Assessment Report" by ASI, to assess the recommended alternative solutions from a heritage perspective.

8.0 Functional Design (Recommended Alternative)

The recommended alternative has been advanced to an approximate 10% design. Future preliminary and detailed engineering studies will be required to refine the design.

8.1 Recommended Repairs

Specific locations requiring steel repair will be confirmed during future design phases of this project, but are expected to focus on the connections to mitigate pack rust and the effects of 'rust jacking'. Section loss is reported at one hanger connection point, which will be addressed.

The structure was recoated in 2013 and the 2021 Bridge Inspection Form lists the entire coated area as being in excellent condition. However, localized coating failures should be expected and repaired with localized blasting and recoating.

Steel beam guide rail sections can be installed on the existing stiffening trusses to reduce localized impact damage to the truss members. Installation of a proper crash-tested barrier system does not appear to be feasible within the limited roadway width.

The 2021 Bridge Inspection Form lists abrasion at the deck ends, a delamination on the deck soffit, and medium to severe scaling and a spall at the North pier. These locations and any additional areas of medium to severe concrete deterioration will be addressed with partial-depth concrete removals and new patch repairs.

A preliminary general arrangement drawing of the recommended alternative is provided in **Appendix C,** and a cost estimate is provided in **Appendix D.**

8.2 Pedestrian Facilities / Future Bypass Bridge

Sewell's Road is not currently a designated route with signage for cyclists and cyclists who travel the route are required to share the road with vehicular traffic.

Future studies may warrant addition of a separate pedestrian/trail structure. Alternatively, future studies could consider realignment of Sewell's Road to bypass the existing bridge, which could then be converted to a trail/pedestrian facility. This would require a separate environmental assessment, including an archaeological study, as well as significant land acquisition.

The future trail facilities associated with the structure are not included in the estimate.

8.3 CP Rail Bridge over Sewell's Road

The CP Rail crossing over Sewell's Road will continue to present a vertical clearance constraint on truck access, including fire trucks. As an interim solution, until the CP structure is replaced (under a separate study), it is proposed that the roadway be lowered over an approximate length of 30 to 40 m at each approach using retaining walls to increase the clearance. This would require further investigation. The use of foundation insulation is anticipated, to provide frost protection. Based on the existing clearance of 3.5 m, a lowering of the road by 0.6 m to 0.7 m may be sufficient to allow fire trucks and most other vehicles to pass under the CP Rail bridge.

9.0 Other Considerations

9.1 Hydraulics and Hydrology

A Hydraulic Report was provided under separate cover. The key hydraulic design criteria for Sewell's Road Bridge are summarized as follows:

High water level based on 1:25 year design flow is estimated to be 126.51 m. Existing freeboard and clearance are estimated to be 3.95 m and 2.17 m, respectively. These are both well above the minimum freeboard and clearance requirement of 0.3 m for a local road.

9.2 Navigability

The Rouge River is not included on the List of Scheduled Waters under the *Canadian Navigable Waters Act*.

9.3 Access to Site

The site is readily accessible from Sewell's Road.

9.4 Environmental Considerations

This Transportation Master Plan is being completed in accordance with the Municipal Class Environmental Assessment process, using Approach #2, where the level of investigation, consultation and documentation shall fulfil the requirements for Schedule B projects, as a minimum. This includes completion of Phase 1 (problem/opportunity definition) and Phase 2 (evaluation and selection of a recommended solution) of the Class EA process.

9.5 Hazardous Materials

The presence of lead shields at hanger clamps is indicated on the drawings. The presence of lead paint is possible and should be assumed present, or tested to determine its presence.

9.6 Future Study Requirements

Additional studies that should be undertaken as part of preliminary design of the recommended alternative include, but are not limited to:

- Detailed Structure Inspection - to determine/confirm extent of required repairs and facilitate development of maintenance plan to ensure the service life of the structure is extended for 20 years.

It is also recommended future studies be undertaken, as discussed in **Section 8.2**, to consider realignment of Sewell's Road to bypass the existing bridge, which could then be converted to a trail/pedestrian facility (i.e. environmental assessment, including an archaeological study, and land acquisition requirements).

10.0 Closure

The foregoing summarizes the structural existing conditions at **Sewell's Bridge on Sewell's Road (No. 812).** Alternative Solutions for retaining, rehabilitating, and replacing the structure are presented and assessed and a recommended solution is recommended for this bridge project site, one of five bridge project sites considered under the Rouge Park Bridges Transportation Master Plan.

DILLON CONSULTING LIMITED

Reviewed by:

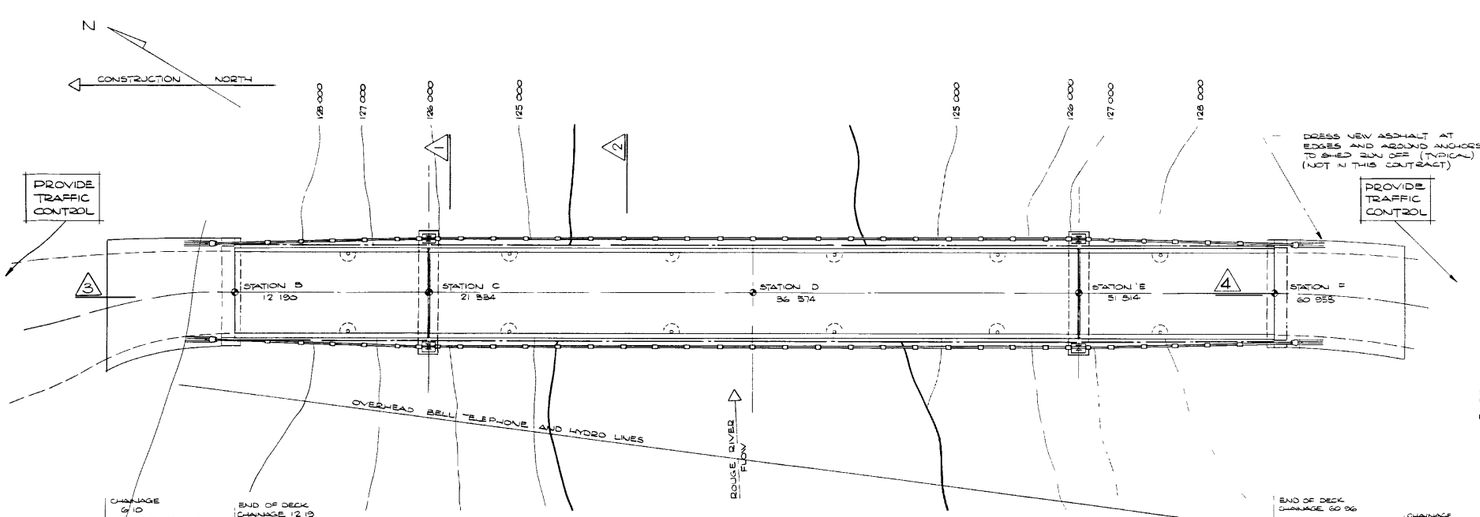
Janette McCann, M. Eng, P.Eng.
Associate, Structural Engineer

Reviewed by:

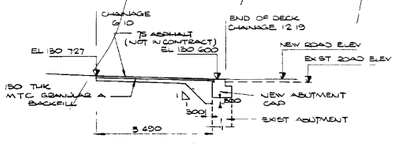
Chris Haines, P.Eng.
Project Manager, Structural Engineer

Appendix A

Drawings of Existing Bridges



PLAN
SCALE 1 100



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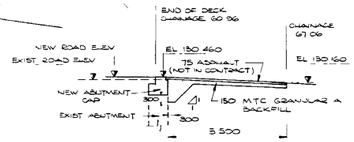

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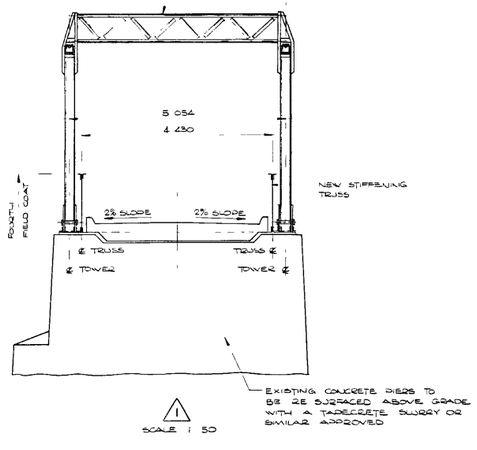

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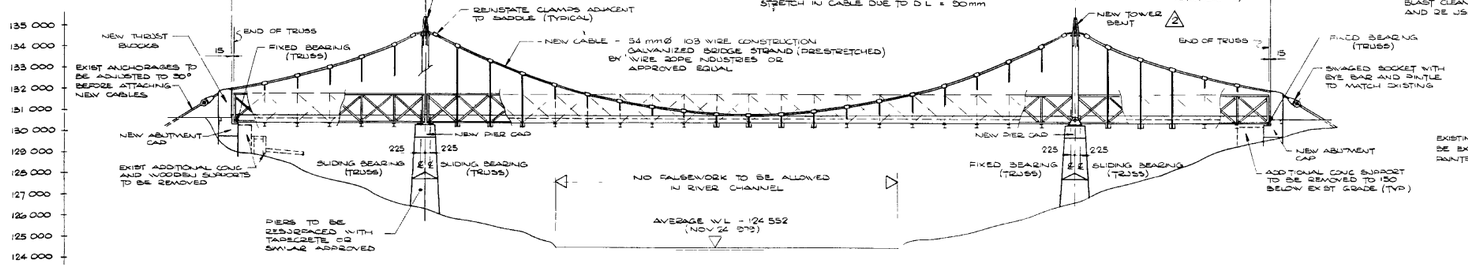
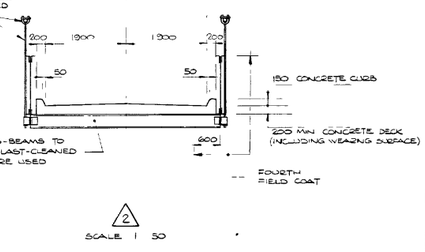
SCALE 1 50



ELEVATION
SCALE 1 100



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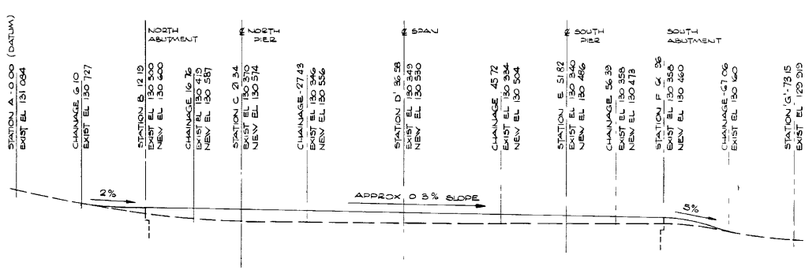
SCALE 1 50



PROFILE OF FINISHED PAVEMENT AT CENTRE LINE OF ROAD
SCALE - 1 200 HORIZ 1 50 VERTICAL

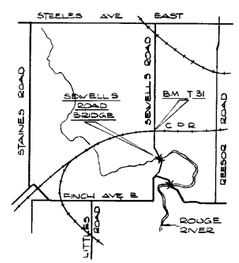
NOTE ELEVATIONS TAKEN FROM B.M. T 31 - 150 865 AT C.P.R. BRIDGE NORTH OF SITE
CHAINAGES TAKEN FROM STATION A 12 19 m NORTH OF BRIDGE ON ROAD ℄

METHOD OF CONSTRUCTION

1. ERECT FALSEWORK TO SUPPORT EXISTING STEEL AND CONCRETE DECK
2. DEMOLISH AND REMOVE EXISTING CONCRETE DECK
3. DISMANTLE AND REMOVE EXISTING SUSPENSION CABLES STIFFENING TRUSSES AND APPURTENANCES AS CALLED FOR ON THE DRAWINGS OR AS DIRECTED BY THE ENGINEER
4. DISMANTLE AND REUSE EXISTING CABLE CLAMPS AND SUSPENSION RODS
5. DISMANTLE, REPAIR AND RE-ERECT NORTH AND SOUTH TOWERS ON REPAIRED CONCRETE PIERS
6. REPAIR AS DIRECTED AND SUPPLY AND WELD SHEAR CONNECTORS TO DECK CROSS-BEAMS
7. REPAIR CONCRETE ABUTMENTS
8. SUPPLY AND ERECT NEW SUSPENSION CABLES STIFFENING TRUSSES AND APPURTENANCES, INCLUDING RE ASSEMBLY OF EXISTING CABLE CLAMPS AND SUSPENSION RODS AS CALLED FOR ON DRAWINGS OR AS DIRECTED BY THE ENGINEER
9. WHEN ALL STEELWORK IS ASSEMBLED AND IN PLACE INCLUDING BOTH EXISTING AND NEW COMPONENTS PLACE NEW 200 mm MINIMUM CONCRETE DECK AS DIRECTED
10. BLAST CLEAN AND PAINT STEELWORK
11. REMOVE FALSEWORK SUPPORTING STEELWORK AND CONCRETE DECK AND ADJUST SUSPENSION RODS AS DIRECTED BY THE ENGINEER

NOTE OTHER CONSTRUCTION PROCEDURES WILL BE CONSIDERED FULL DETAILS OF ALTERNATE METHODS MUST BE SUBMITTED AT TIME OF TENDER AND BE APPROVED IN WRITING BY THE ENGINEER BEFORE WORK COMMENCES

00410 V01



KEY PLAN

5012-S-1

GENERAL NOTES

1. ALL DIMENSIONS TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR
2. CLASS OF CONCRETE 20 mm AGGREGATE ABUTMENTS & PIERS CONC DECK & CURB
3. CLEAR COVER TO STEEL UNLESS NOTED DECK TOP BOTTOM
   REMAINDER
4. TO ACHIEVE A MINIMUM CONCRETE COVER DECK THE TOP REINFORCING LAYER SHALL BE TIED CONCRETING TO A COVER OF 75 ± 10
5. REINFORCING STEEL 400 MPa BAR NOTED IN CSA G30.18 SHALL BE EPOXY COATED BARS
6. NEW STRUCTURAL STEEL SHALL UNLESS NOTED OTHERWISE BE IN ACCORDANCE WITH CSA G40.20
7. ALL WELDING SHALL BE IN ACCORDANCE WITH CSA STD S16.1 (LATEST EDITION)
8. STEEL TESTING
   100% - VISUAL INSPECTION
   100% - RADIOGRAPHIC OF WELDS IN
   10% - MAGNETIC PARTICLE
   50% - MAGNETIC PARTICLE ON
9. THIS BRIDGE HAS BEEN DESIGNED FOR HS25 LIVE LOADING APPLIED IN ACCORDANCE WITH THE LATEST REQUIREMENTS OF CAN/CSA-S6-M88 AS MODIFIED TO SPECIFIC

NO	DATE	ISSUES AND REVISIONS	BY
2	1980 DEC 15	TOWER BENTS REVISED	BD
1	1980 DEC 10	ISSUED FOR TENDER	BD

All measurements must be checked on the job by the contractor Drawings must not be scaled

All drawings and specifications are the property of the Consultants and must be returned at the completion of the job

Gregg and Edens Limited
engineers planners economists

REGISTERED PROFESSIONAL ENGINEER N MOTRAN PROVINCE OF ONTARIO

CIVIL J T GREGG PROFESSIONAL ENGINEER PROVINCE OF ONTARIO

PROJECT TITLE

SEWELLS ROAD BRIDGE

SCARBOROUGH ONTARIO

SHEET TITLE

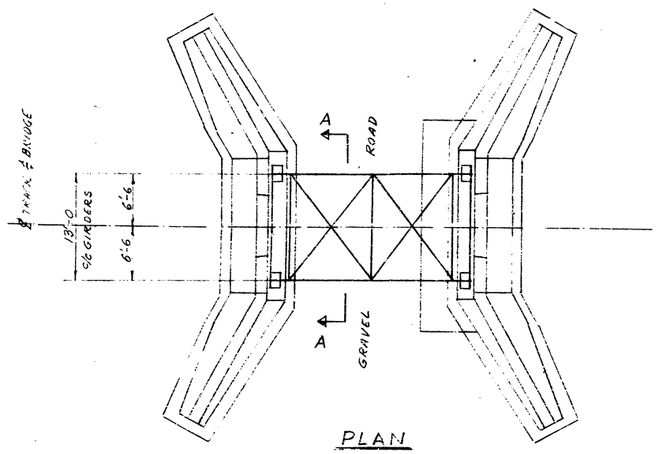
GENERAL ARRANGEMENT

SURVEYED BY D.K.	DATE NOVEMBER '79
DESIGNED BY N.M.	CHECKED BY J.T.G.
DRAWN BY B.D.	CHECKED BY N.M.
SCALE AS NOTED	DATE MARCH 1980

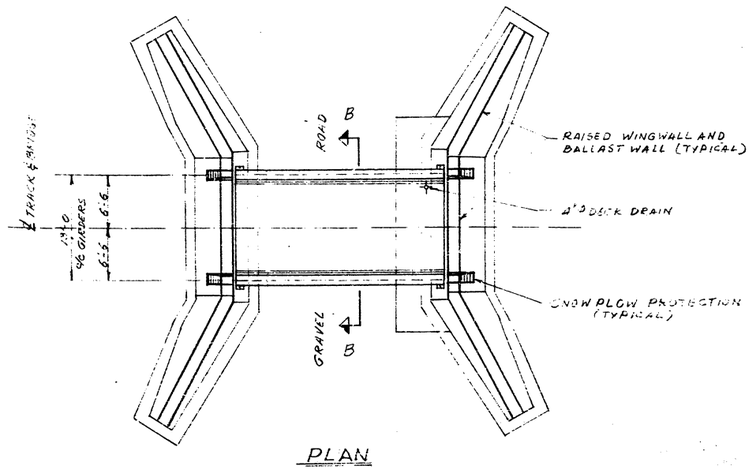
PROJECT AND DRAWING NUMBER

7919-S1

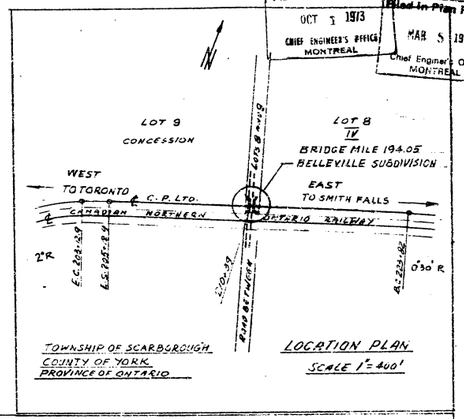
DWG 157-A



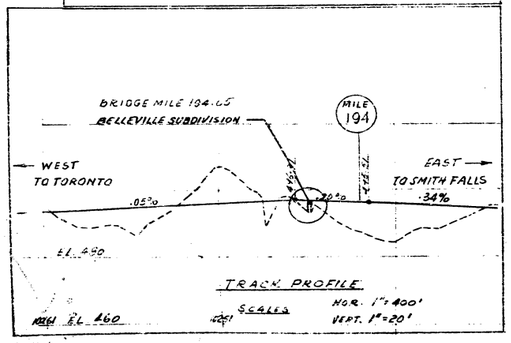
PLAN

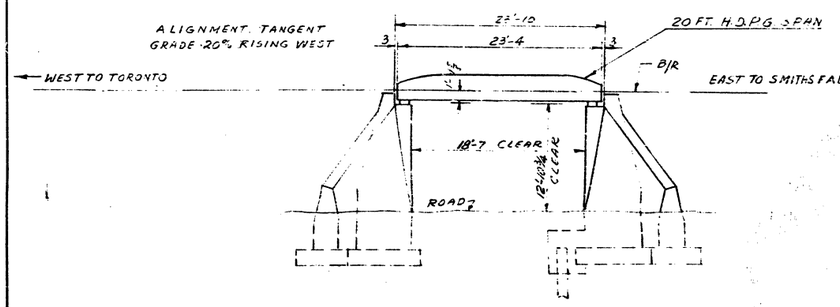


PLAN

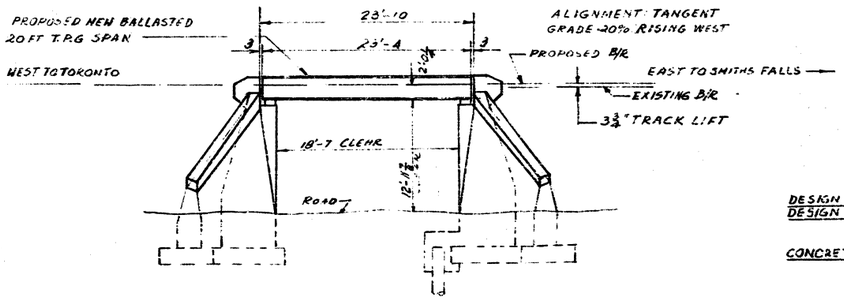


ORIGINAL BRIDGE CONSTRUCTED UNDER AUTHORITY OF BOARD ORDER No 17456 DATED SEPT. 12, 1912.

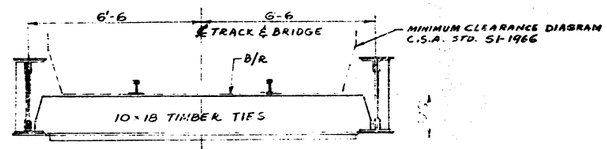




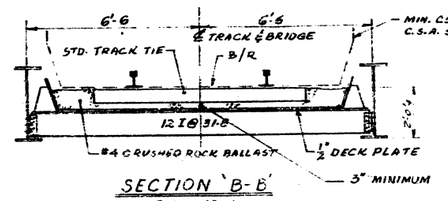
ELEVATION OF EXISTING BRIDGE
SCALE $\frac{3}{8}$"=1'-0



ELEVATION OF PROPOSED BRIDGE
SCALE $\frac{3}{8}$"=1'-0



SECTION 'A-A'
SCALE $\frac{3}{8}$"=1'-0
SYMMETRICAL ABOUT ℄ TRACK & BRIDGE



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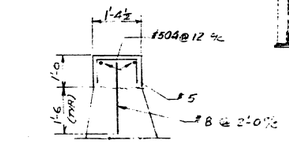
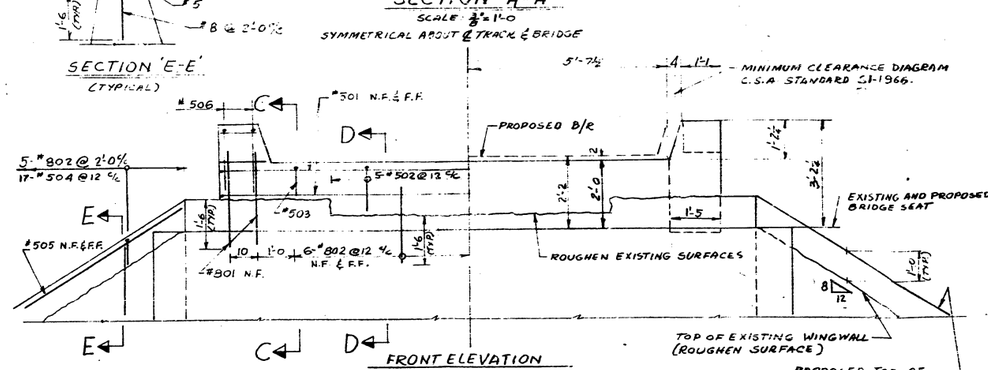
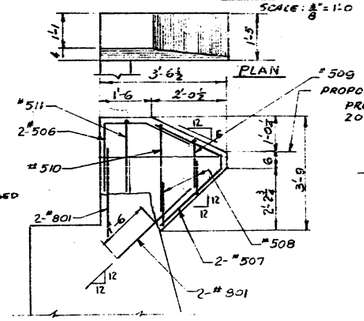


SECTION 'E-E'
(TYPICAL)

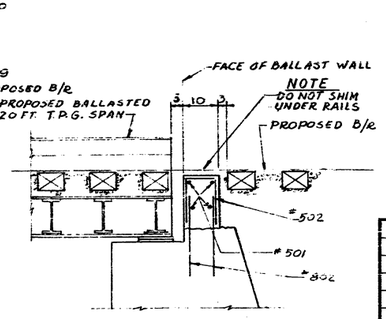


FRONT ELEVATION

DETAIL OF MODIFICATIONS TO EXISTING ABUTMENTS
SCALE $\frac{1}{4}$"=1'-0



SECTION 'C-C'



BALLAST WALL DETAIL FOR NEW BALLASTED T.P.G. SPAN

SECTION 'D-D'

GENERAL NOTES

DESIGN LOADING COOPER'S E 72 WITH DIESEL IMPACT.
DESIGN SPECIFICATIONS C.S.A. STANDARD S1-1953.
A.W.S. SPECIFICATION D2.0 LATEST EDITION

CONCRETE: TO BE IN ACCORDANCE WITH C.P.R. BRIDGE SPECIFICATION No 221, DATED NOV. 22, 1972. ALL CONCRETE TO BE NORMAL PORTLAND CEMENT CONCRETE WITH A COMPRESSIVE STRENGTH OF 4,000 P.S.I. IN 28 DAYS.
MAXIMUM SIZE OF AGGREGATE TO BE $\frac{3}{4}$"
CHAMFER ON EXPOSED EDGES TO BE $\frac{1}{4}$"

REINFORCING STEEL TO BE IN ACCORDANCE WITH C.S.A. STANDARD G30.1, INTERMEDIATE OR HARD GRADE. OR C.S.A. STANDARD G30.12, USING DEFORMED BARS. RAIL STEEL OR HARD GRADE BILLET STEEL SHALL NOT BE USED IN BENT BARS.
MINIMUM CONCRETE COVER OF REINFORCING STEEL TO BE 2" AT FORMED SURFACES.

ANCHOR BOLTS. HOLES FOR ANCHOR BOLTS TO BE DRILLED AFTER SPAN IS LOCATED ON THE BRIDGE SEATS AND ANCHOR BOLTS TO BE GROUTED IN PLACE, UNLESS OTHERWISE APPROVED BY THE CHIEF ENGINEER.

LIST OF PLANS

B-1-3097-1	GENERAL ARRANGEMENT (THIS PLAN)
B-1-3097-2	BALLASTED 20FT. T.P.G. SPAN
RS-1-3097-1	REINFORCING BAR SCHEDULE

REFERENCE DRAWINGS

49611	MASONRY PLAN - DATED JULY 20, 1913
49477-2	PLAN DATED SEPT. 26, 1913, AS CONSTRUCTED
49747	EXISTING 20FT. H.D.P.G. SPAN
B-1-2842-1	RECONSTRUCTION OF THE EAST ABUTMENT, DATED SEPT. 11, 1964
	BRIDGE INSPECTION SKETCH No 1265 DATED DEC. 4, 1972
291-9	TRACK PROFILE

ESTIMATED QUANTITIES

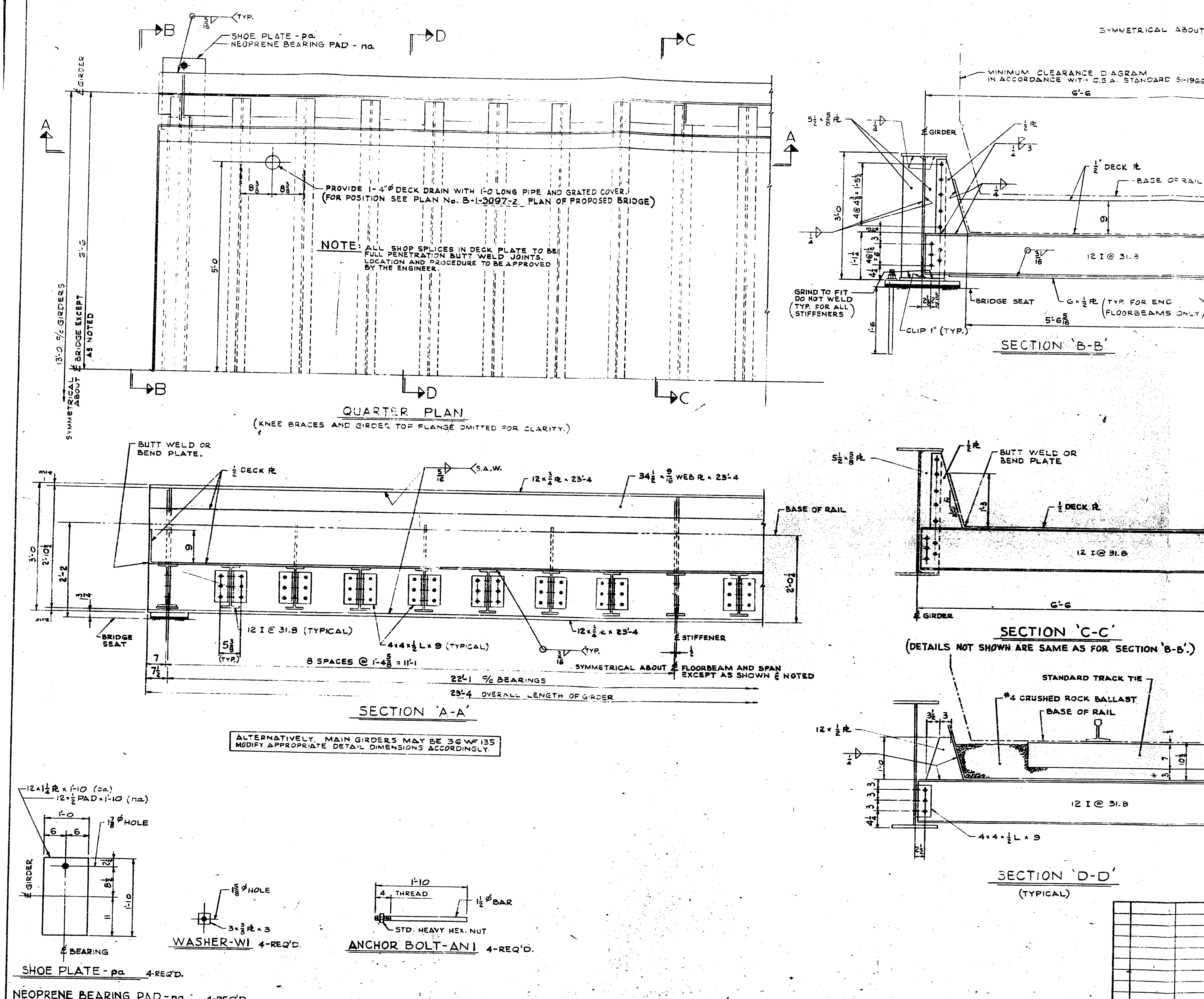
CONCRETE	7 CU YDS
REINFORCING STEEL	1,220 LBS.
STRUCTURAL STEEL	21,500 LBS.

Canadian Pacific Limited

EASTERN REGION - TORONTO DIVISION
BRIDGE 194.05 BELLEVILLE SUBDIV.
REPLACEMENT OF SPAN
GENERAL ARRANGEMENT

NO.	DATE	REVISION	BY
	AUGUST 24	SIGNED & ISSUED	
	MARCH 2, 1973	PRELIMINARY	

APPROVED BY
ENGINEER OF BRIDGES AND STRUCTURES
CHIEF ENGINEER
OFFICE FILE NO. 6-326-194.05
PLAN NO. B-1-3097-1
SCALE AS NOTED



GENERAL NOTES

DESIGN LOADING: COOPER'S E75 WITH DIESEL IMPACT.

SPECIFICATIONS: C.S.A. STANDARD S1-1966. A.W.S. SPECIFICATION D2.0-LATEST EDITION.

STEEL: TO BE IN ACCORDANCE WITH C.S.A. STANDARD G40.11, GRADE 'B' OR APPROVED EQUIVALENT. IMPACT PROPERTIES OF FLANGE AND WEB PLATES OF MAIN GIRDERS TO BE REQUESTED FROM MILL "FOR INFORMATION ONLY". A COPY OF MILL CERTIFICATES IS TO BE SENT TO C.P. LTD. PRIOR TO FABRICATION. IF REQUESTED BY C.P. LTD., THESE PLATES ARE TO BE NORMALIZED AT C.P. LTD. EXPENSE.

ALTERNATIVE SECTIONS: SECTIONS SHOWN ARE MINIMUM, BUT FABRICATOR MAY PROPOSE HEAVIER OR ALTERNATIVE SECTIONS FOR APPROVAL.

CLEANING OF STEEL: ALL STEEL TO BE CLEANED IN ACCORDANCE WITH S.S.P.C. SPECIFICATION SP6-63, 'COMMERCIAL BLAST CLEANING'.

ERECTION MARKS: TO BE PAINTED IN PLACES NOT READILY VISIBLE AFTER ERECTION.

HOLES: TO BE 15/16" DIA., UNLESS NOTED OTHERWISE.

BOLTED CONNECTIONS: TO BE MADE USING 7/8" DIA. HIGH-STRENGTH STEEL BOLTS, TO A.S.T.M. SPECIFICATION A325-WITH ATMOSPHERIC CORROSION RESISTING PROPERTIES. BOLTS TO BE INSTALLED IN ACCORDANCE WITH C.P.R. BRIDGE SPECIFICATION No. 231, ISSUE No. 1-"SPECIFICATION FOR THE ASSEMBLY OF STRUCTURAL JOINTS USING HIGH-STRENGTH STEEL BOLTS", DATED MARCH 26, 1969. ONE WASHER PER BOLT.
ALTERNATIVELY, 7/8" DIA. "HUCK" FASTENERS MAY BE USED.

WELDING: ALL FLANGE TO WEB FILLET WELDS AND 25% OF ALL OTHER WELDS TO BE CHECKED BY THE MAGNETIC PARTICLE TEST METHOD. WELD METAL SHALL HAVE CORROSION RESISTING PROPERTIES COMPARABLE TO THOSE OF THE PARENT METAL.

NEOPRENE BEARING PADS: TO BE IN ACCORDANCE WITH A.R.E.A. SPECIFICATION-CHAPTER 8, PART 18. 60 DUROMETER HARDNESS. PADS TO BE BONDED TO SHOE PLATES WITH AN EPOXY ADHESIVE, APPROVED BY THE ENGINEER.

FINISH: ALL STEEL TO BE LEFT UNPAINTED.

DECK PLATE TREATMENT: ALL TOP SURFACES OF ½" DECK PLATE TO BE ZINC METALLIZED IN ACCORDANCE WITH C.S.A. STANDARD G189-LATEST EDITION. MINIMUM THICKNESS OF ZINC COATING TO BE 6 MILS.

SHIPMENT: SPAN TO BE SHIPPED ASSEMBLED.

WEIGHT OF STEEL: 21,500 LB.

* 3" IS THE MINIMUM REQUIREMENT.

Canadian Pacific Limited

EASTERN REGION-TORONTO DIVISION
BRIDGE 194.05 BELLEVILLE SUBDIV.

BALLASTED 20FT. T.P.G. SPAN
STEELWORK DETAILS

APPROVED BY
ENGINEER OF BRIDGES AND STRUCTURES
CHIEF ENGINEER

NO.	DATE	REVISION	BY
	MARCH 1, 1973	SIGNED & ISSUED	

6-326-194.05 PLAN No. B-1-3097-2 SCALE: 1"=1-0

26218-½

Appendix B

Site Photographs

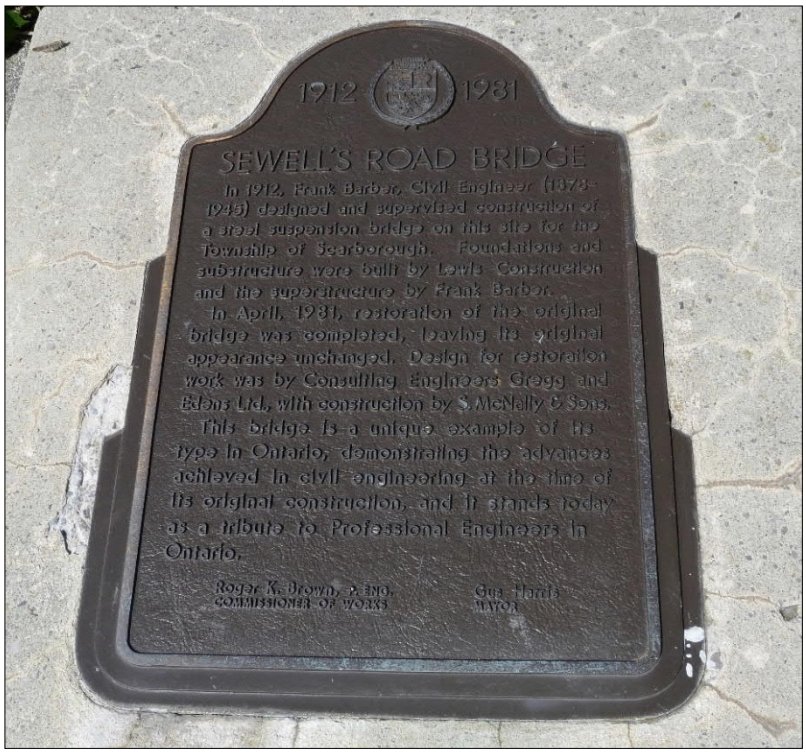
South Approach

South Approach at Bridge

Bridge Deck, Looking North

Bridge Deck Looking South

North Approach



Bridge Plaque

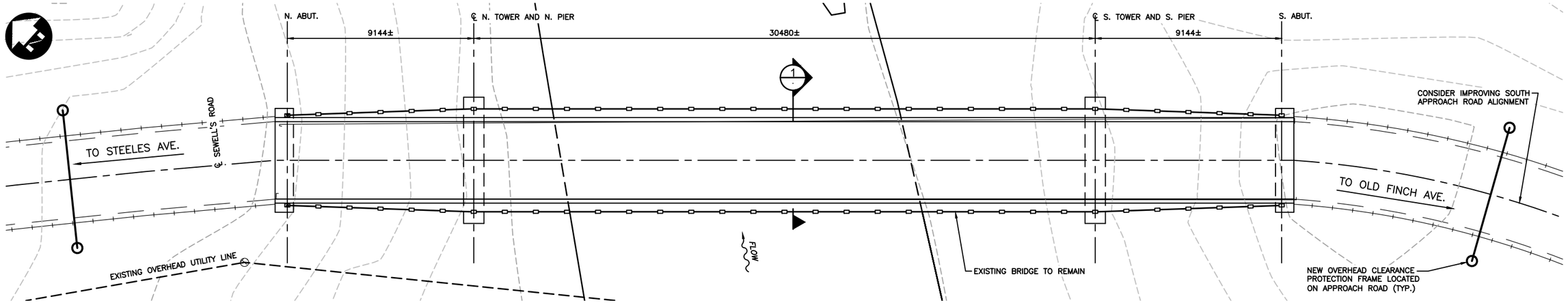
CP Rail Bridge over Sewell's Road, Looking South

CP Rail Bridge over Sewell's Road, Looking North
(note abandoned bridge abutments in foreground)

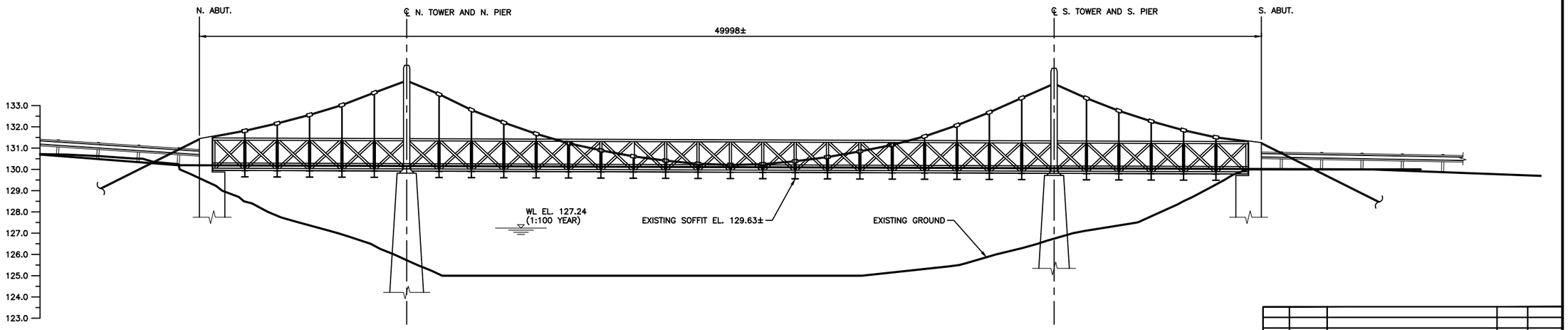
Appendix C

General Arrangement Drawing for the Recommended Alternative

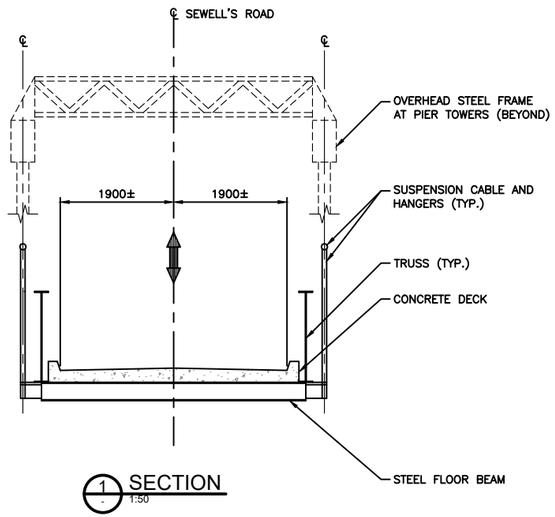
DILLON CONSULTING



PLAN
1:100



WEST ELEVATION
1:100



1 SECTION
1:50

PRELIMINARY

No.	DATE	REVISIONS	INITIAL	SIGNED

DILLON CONSULTING
235 Yorkland Blvd., Suite 800, Toronto, ON M2J 4Y8
Phone: (416) 229-4646 Fax (416) 229-4692

APPROVED _____

SIGNATURE _____
NAME (PRINT) _____
DATE _____

ROUGE PARK BRIDGES TRANSPORATION MASTER PLAN

SEWELL'S ROAD BRIDGE (No. 812) ON SEWELL'S ROAD OVER ROUGE RIVER

DESIGN	---	DRAWN	SJM	CHECKED	---	JOB No. 19-1924
SCALE:	AS NOTED				DWG:	
DATE:	DECEMBER 2023				SHEET	OF

Appendix D

Cost Estimate

Rouge Park Bridges Transportation Master Plan Sewell's Road Bridge (Site ID 812) Recommended Alternative (Replace Bridge)					
No.	Item Description	Unit	Quantity	Unit Price	Total
1	(Provisional) Realignment of south approach road	lump sum	1	$ 200,000	$ 200,000
2	(Provisional) Clearance beam on approaches	lump sum	2	$ 25,000	$ 50,000
3	(Provisional) Lowering road at CP Rail bridge (Meadowvale Road)	lump sum	1	$ 150,000	$ 150,000
4	Contingency allowance				$ 100,000
				Construction:	$ 500,000
				Environmental & Preliminary Design (5%):	$ 25,000
				Detailed Design (15%):	$ 75,000
				Contract Administration (15%):	$ 75,000
				TOTAL:	$ 675,000

Notes:

1. Costs in 2023 dollars. Taxes and permits additional.

Rouge Park Bridges Transportation Master Plan Sewell's Road Bypass Bridge (concept) Recommended Alternative (Replace Bridge)					
No.	Item Description	Unit	Quantity	Unit Price	Total
1	Roadway (clearing and new road construction)	m	500	$ 5,500	$ 2,750,000
2	Bridge (60 m span, 12.5 m wide deck, slab-on-girder)	m2	750	$ 6,000	$ 4,500,000
3	Contingency allowance (25%)				$ 1,820,000
				Construction:	$ 9,070,000
				Environmental & Preliminary Design (5%):	$ 450,000
				Detailed Design (10%):	$ 910,000
				Contract Administration (10%):	$ 910,000
				TOTAL:	$ 11,340,000

Notes:

1. Costs in 2023 dollars. Taxes and permits additional.
2. Property acquisition costs not included.