Appendix N.5 – Structural Design Report – Rouge River

Kennedy Road Environmental Assessment between Steeles Avenue and Major Mackenzie Drive

Rouge River Bridge

Structural Design Report

Class EA Study for Improvements to Kennedy Road from Steeles Avenue to Major Mackenzie Drive

Regional Municipality of York

January 26, 2021

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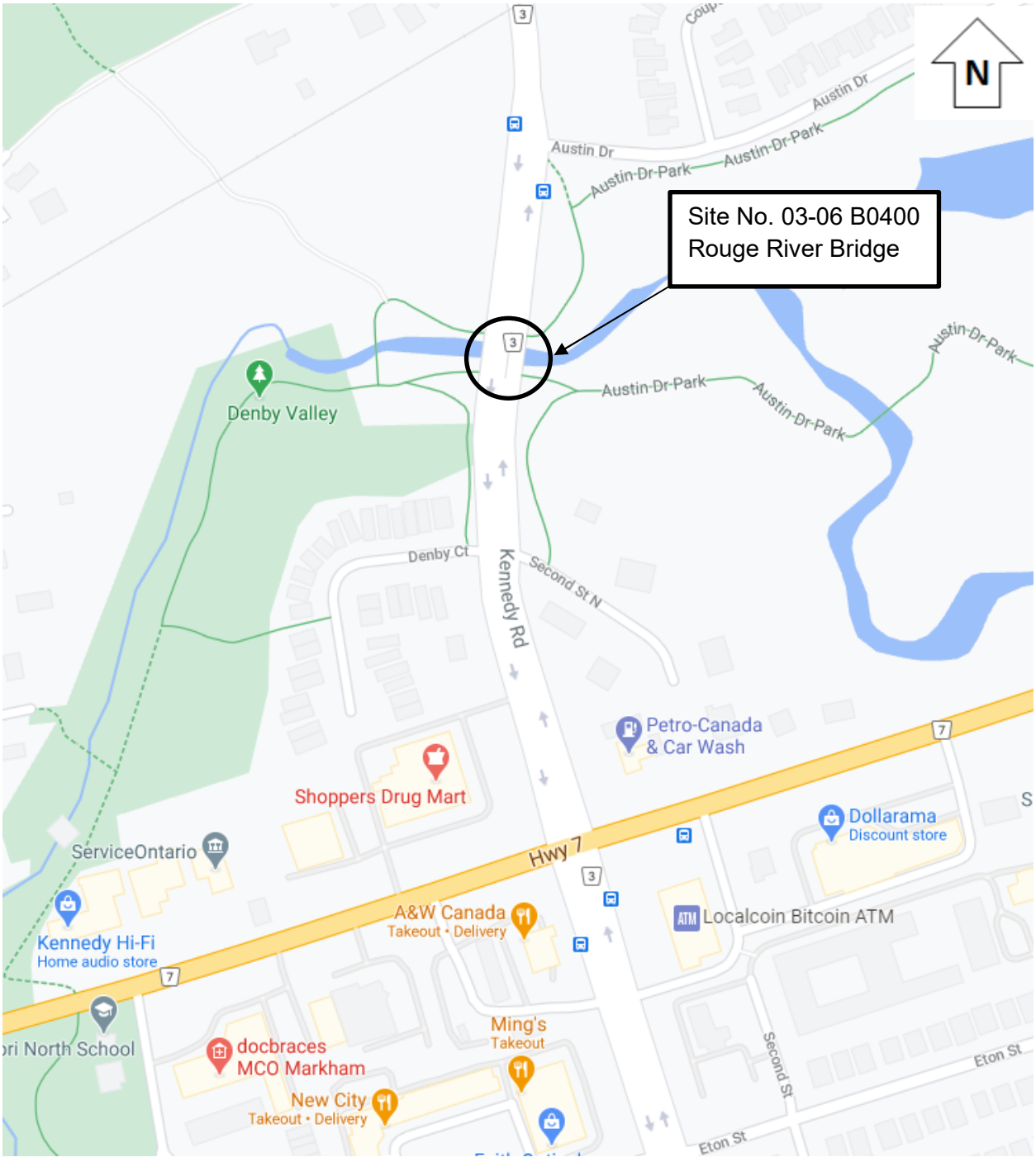
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Site No. 03-06 B0400
Rouge River Bridge
Austin Dr
Austin-Dr-Park
Denby Valley
Denby Ct
Second St N
Kennedy Rd
Hwy 7
Petro-Canada
& Car Wash
Shoppers Drug Mart
Dollarama
Discount store
ServiceOntario
A&W Canada
Takeout • Delivery
Localcoin Bitcoin ATM
Kennedy Hi-Fi
Home audio store
Ming's
Takeout
docbraces
MCO Markham
New City
Takeout • Delivery
Second St
Eton St

1. Introduction

HDR is undertaking the Municipal Class Environmental Assessment Study (Schedule 'C') and the Preliminary Design for the Improvement to Kennedy Road from Steeles Avenue to Major Mackenzie Drive for The Regional Municipality of York (York Region). The recently completed York Region Transportation Master Plan designates this section of Kennedy Road for future widening to 6 lanes as part of the Frequent Transit Network.

It is HDR's mandate to provide bridge engineering services and preliminary design for the proposed improvement of the bridge and culvert structures along the corridor to accommodate the road widening.

An existing bridge over the Rouge River is located in the corridor. HDR is mandated to analyze and develop structural design options to accommodate the widening of Kennedy Road at this crossing.

This Design Structural Report provides a comparison of the options for the improvement of the Bridge Site No.03-06 B0400. Based on the recommendation and York Region decision, HDR performed a Preliminary Design of the preferred alternative.

2. Location

Rouge River Bridge is located approximately 0.3 km north of the Highway 7, in the City of Markham. It currently carries two northbound and two southbound lanes of Kennedy Road over the Rouge River.

3. Existing Conditions

3.1. General Conditions

The Rouge River Bridge was built in 1981 and is owned by York Region. The bridge has a North-South orientation and comprises a simply supported, single span, cast-in-place concrete topping slab on fourteen precast concrete side by side box girders. The structure has a span length of 30.5m and a width of 15.5m.

The box beams are 1070 mm deep, and the topping slab is 127 mm deep and carries four traffic lanes (15.2 m total) and two 1.83 m sidewalks (including railings).

The substructure consists of reinforced concrete abutments and wing walls supported on steel tube piles.

The existing parapets do not meet current Canadian Highway Bridge Design Code collision requirements and therefore needs to be replaced.

The Rouge River crossing is identified as contributing habitat for Redside Dace, but does not require species at risk permitting during construction as confirmed by MNRF in a meeting on June 27, 2018.

3.2. Alignment and Profile

The horizontal alignment for Kennedy Road are not being adjusted and will match existing, with the recommended option.

The existing vertical profile of Kennedy Road has a sag vertical curve.

3.3. Bridge Condition

An OSIM inspection was carried out on September 15, 2016. The findings of the most recent report showed that the bridge was in good condition, but needed minor repairs, including:

- Wide cracks and delamination on North abutment
- Spalls, stained, and wet areas on Northwest abutment
- Wide cracks, medium raveling, sealed cracks, and pot holes on asphalt road surface
- Spalls and delamination on North concrete end post
- Abrasion damage, unsecured, and missing end caps on railings
- Spalling at girder ends, exposed rebars
- Delamination on soffit, exposed rebar
- Missing blocks on abutment slope protection
- Spalls, cracks, and asphalt patches at top of expansions joints
- Cracking and spalling on sidewalks
- Local rail separation at railing post

Furthermore, as part of his mandate, HDR has carried out a visual inspection on the Rouge River Bridge on June 8, 2017. The inspection report has been submitted to York Region on August 30, 2017. The inspection verified that the 2016 OSIM report findings and recommendations are consistent with the current site conditions, with the additions/exceptions of:

- Cracks on abutments
- Paint peeling off and graffiti
- Spalling of Northwest bearing seat
- Missing cover of Northeast electrical box with spalling
- Dents on Northeast, Northwest, and Southwest guiderails
- Loss of concrete at underside of Northeast expansion joint
- Spalling of guiderail connections at Southwest, Northwest, and Northeast concrete end posts
- Recommendation to replace existing handrails with new TL4 concrete barrier walls with railings
- Bridge found to be in moderate condition

4. Cross Section

4.1. Existing Cross Section

The existing Kennedy Road carries two (2) lanes of traffic in each direction. There is no raised centre median. Sidewalks are located on both sides of Kennedy Road. The existing full bridge

width is 18.9m, including 1.829m sidewalk and 7.62m traffic lane with crossfall of 2% in each direction.

4.2. Proposed Cross Section

At the Rouge River watercourse crossing structure, when the crossing of the GO Transit Stouffville Railway Corridor crossing north of Austin Drive remains at-grade, the proposed cross-section of Kennedy Road will consist of two (2) 3.3m wide traffic lanes and a 3.5m transit/HOV lane in each direction. Two (2) 3.0m wide multi-use path (MUP) will be located on both sides of the roadway. There are 0.35m width to accommodate traffic/combination barrier between the horizontal side clearance and the active transportation facility (Barrier height and railing will accommodate pedestrians/cyclists) and 1.0m horizontal side clearance (on road from edge of Transit/HOV lane) provided on the structure. A centre median (1.5 m) is carried through the structure and achieve the maximum structure width of 31.0m as determined from the hydraulic assessment to minimize adverse impacts to increased flooding. Two (2) 0.3m width parapet walls with railing on both sides of bridge will accommodate pedestrian/cyclist movements.

5. Drainage/Stormwater Assessment

5.1. Drainage Assessment

Under the proposed conditions, the existing bridge over the Rouge River needs to be widened in order to accommodate the proposed roadway widening. The span of the bridge will remain at 30.48 m and the crossing length of the structure will be increased to 31.0 m. However, widening the bridge with the existing 2% cross fall will result in a negative clearance under the design flow because of the lowered soffit elevation.

The existing bridge does not meet the clearance criterion, and further reducing the clearance is not recommended. Therefore, replacement of the superstructure with the same superstructure depth and a reduced cross fall of 1% is recommended in order to match the existing soffit elevation. Under proposed conditions, the bridge will meet the freeboard criteria, and the Regional Storm event will overtop the crossing by 1.83m, which is 0.02m less compared to the existing conditions.

A preliminary hydraulic assessment showed that increasing the bridge span will not result in any considerable decrease in the water surface elevation upstream of the bridge. Therefore, to meet the MTO clearance criterion and reduce the Regional flood depth over Kennedy Road, one option would be to raise the roadway profile. However, the hydraulic assessment showed that any raise in the road profile will result in an increase of the upstream Regional flood levels, since Kennedy Road acts as a weir conveying the flow during the Regional storm event. Raising the road profile means raising the weir invert elevation, which will result in an increase in the flow head over the weir. This is not acceptable to TRCA. Therefore, raising the road profile at the Rouge River crossing is not recommended and increasing the span at this bridge will not be beneficial. Based on these results, it is not feasible to meet the MTO design criteria at this bridge. An emergency response plan will need to be developed for this location to close access to this section of Kennedy Road during the Regional storm event, due to the significant depth of flooding at the road sag.

Updates to the hydraulic modelling, floodplain assessment and revisions to TRCA floodplain mapping shall be completed during detailed design to reflect the final design and grading footprint of the crossing. Additional coordination with both the City of Markham and the TRCA shall be carried out to finalize the preliminary design of the bridge and to minimize impacts to the watercourse.
Details of the proposed bridge crossing's hydraulic performance are provided below.

Water Crossing	Type	U/S Invert (m)	D/S Invert (m)	Length (m)	Road Elev. (m)	Water Surface Elev. (m)			Free board (m)	Clear ance (m)	Remarks
						50 Yr	100 Yr	Reg.			
Rouge River	Bridge	167.33 (Channel Inv.)		31.0	172.07	170.73	170.89	173.90	1.18	0.01** (Clearance)	Meets MTO freeboard criterion but not clearance Regional storm overtops road

**Based on lowest soffit elevation of 170.09

5.2. Stormwater Assessment

The proposed stormwater management plan for the project has been developed by examining the opportunities and constraints within the entire study corridor.
Stormwater best management practices, including infiltration trenches and online storage pipes, are proposed for storm water quality treatment, water balance, erosion control, and quantity control of the roadway runoff from the additional pavement areas. The proposed road improvements will result in an additional pavement area of 6.72 ha. As part of the SWM strategy, a total of 6.80 ha of pavement area will receive quality treatment through the proposed infiltration trenches, which exceeds the MECP requirement of providing treatment to the increased pavement area. A total of 6.24 ha of pavement area will receive quantity control through the proposed online storage pipes. Opportunities to implement supplemental BMP measures to provide additional water quality benefits may be considered during the next phases of design in series with the proposed measures.

6. Proposed Structure

Immediately north of the Rouge River Crossing is the crossing of the GO Transit Stouffville Railway Corridor crossing north of Austin Drive. It was determined that to accommodate the future grade separation of the rail and road (identified as the Ultimate Vision subject to a future grade separation study) that replacement of the Rouge River bridge is required. This is because either an Overpass or Underpass at the rail crossing will require raising of the Kennedy Road profile and subsequent raising of the bridge. As such to accommodate the Ultimate Vision grade separation of the crossing of the GO Transit Stouffville Railway Corridor crossing north of Austin Drive, the Rouge River Bridge will be replaced. The requirements for this new structure will be confirmed through the separate Grade Separation Study at the crossing north of Austin as it is dependent on the grade separation recommendation.

In the interim the Recommended Design at the GO Transit Stouffville Railway Corridor crossing north of Austin Drive is to provide an at-grade crossing for the widened Kennedy Road. To accommodate this recommendation also results in widening of the Rouge River bridge to provide two additional traffic lanes and multi-use paths for Active Transportation. The bridge super structure requires full replacement to accommodate the proposed widening with widened abutments.

Modification to the existing bridge is required to accommodate the proposed widening. The superstructure will be fully replaced with a wider structure matching the existing span, depth and elevation of the existing structure. The abutments will be extended to support this wider superstructure and a flatter 1% cross slope will be used. These measures are recommended to minimize increases to the Regional upstream flood levels and overtopping that currently exists with the existing structure.

6.1. Bridge Options

Three (3) alternatives were considered for Roger River crossing at Kennedy Road. Descriptions of each alternative along with the estimated structure construction costs are listed below:

6.1.1. Option 1a – Existing 30.5m Span with Widened Structure (2% cross slope)

Existing bridge will be widened on both sides to a width of 31.0 m, matching existing 2% cross slope. Additional width has potential to impact upstream flood levels. The existing box girders and abutments need the rehabilitation based on the detailed inspection and evaluation.

This option results in widening the bridge which maintains the existing span and maintaining the existing 2% crossfall. This option will have minor impacts to the vegetation due to construction. This option has the least structure cost and minor construction impacts, while maintaining the existing fluvial geomorphological requirements. This option meets the fluvial geomorphological recommendation for any upgrades/replacement of the structure to provide a width of approximately 30m.

However, the additional width of the bridge will increase the upstream flood levels. An emergency response plan will need to be developed for this location to close access to this section of Kennedy Road during the Regional storm event, due to the significant depth of flooding at the road sag.

Preliminary cost estimate for Option 1a is $3,516,935.

6.1.2. Option 1b – Existing. 30.5m Span with Superstructure Replacement (1% cross slope)

Superstructure will be fully replaced with a wider (31.0m wide) superstructure, matching existing span/depth/elevation. Abutments will be extended to support this wider superstructure. A flatter 1% cross slope with 1.000m superstructure height will be used to minimize impacts on the upstream flood levels.

This option results in full bridge superstructure replacement with 1% crossfall, widening of the abutments, and maintaining the existing span. This option will have minor impacts to vegetation due to construction. This option has moderate structure cost and minor-moderate construction impacts, while maintaining the existing fluvial geomorphological requirements. This option meets the fluvial geomorphological recommendation for any upgrades/replacement of the structure to provide a width of approximately 30m.

Based on the similar projects and MTO Memorandum on April 29, 2013 (limited the maximum tensile stress for prestressed girder to 0.5*fcr from 1.0*fcr), the existing box girders do not meet the current MTO Structure Manual requirements regards to the tensile stress. Since the cross fall is maintained at 1% and this adjustment has to be carried out in the concrete topping which will increase the dead load. Hence it is proposed to replace the existing box girders.

This option has negligible impact to the upstream flood levels. An emergency response plan will need to be developed for this location to close access to this section of Kennedy Road during the Regional storm event, due to the significant depth of flooding at the road sag.

Preliminary cost estimate for Option 1b is $5,018,005.

6.1.3. Option 1c – Existing 30.5m Span with Full Bridge Reconstruction (1% cross slope)

The bridge will be fully replaced with a wider (31.0m wide) deck, matching existing span/depth/elevation. A flatter 1% cross slope with 1.000m superstructure height will be used to minimize impacts on the upstream flood levels.

This option results in full bridge reconstruction with 1% crossfall, and maintains the existing span. This option will have minor impacts to vegetation due to construction, but greater construction impact then Alternative 1b. This option has moderate structure cost and moderate construction impacts, while maintaining the existing fluvial geomorphological requirements. This option meets the fluvial geomorphological recommendation for any upgrades/replacement of the structure to provide a width of approximately 30m.

This option has negligible impact to the upstream flood levels. An emergency response plan will need to be developed for this location to close access to this section of Kennedy Road during the Regional storm event, due to the significant depth of flooding at the road sag.

Preliminary cost estimate for Option 1c is $5,654,090.

6.2. Discussion

A number of factors play a critical role in the development and evaluation of the alternatives. For the bridge at Kennedy Road, these factors include constructability, vehicular and pedestrian impact, aesthetics, social environment impact, construction cost, and construction schedule.

A comparison of the advantages and disadvantages of the four alternatives are summarized in the table below.

Alternative	Advantages	Disadvantages
1a	• Moderate improvement to perceived safety for pedestrians and cyclists.	• Existing overtopping of Kennedy Road by the Regional storm event . The

Alternative	Advantages	Disadvantages
	• Maintains existing opening size and accommodates fluvial requirements • Accommodates wildlife passage of large mammals • No impact to access to residential areas, institutional and recreational facilities • Minor disruption due to bridge widening and construction duration • Conventional maintenance requirements • Existing maintenance requirements marginally increased due to proposed road widening • Approximate structure Cost: $3,516,935	additional superstructure depth has potential to increase the upstream flood levels. . • Does not have adequate clearance and freeboard and Kennedy Road is overtopped by the Regional storm event. An Emergency Response Plan is required during the Regional Storm Event due to significant depth of flooding at the road sag. It is not feasible to meet MTO design criteria at this bridge.
1b	• Moderate improvement to perceived safety for pedestrians and cyclists. • Maintains existing opening size and accommodates fluvial requirements • Accommodates wildlife passage of large mammals • Existing overtopping of Kennedy Road by the Regional storm event and meets the freeboard criteria. A flatter 1% cross slope with 1.04m superstructure height will have a negligible impact on the upstream flood levels. • No impact to access to residential areas, institutional and recreational facilities • Conventional maintenance requirements • Existing maintenance requirements marginally increased due to proposed road widening • Approximate structure Cost: $5,018,005	• Does not have adequate clearance and Kennedy Road is overtopped by the Regional storm event. An Emergency Response Plan is required during the Regional Storm Event due to significant depth of flooding at the road sag. It is not feasible to meet MTO design criteria at this bridge. • Minor-Moderate disruption due to, replacing the superstructure and widening abutments and construction duration
1c	• Moderate improvement to perceived safety for pedestrians and cyclists. • Maintains existing opening size and accommodates fluvial requirements • Accommodates wildlife passage of large mammals • Existing overtopping of Kennedy Road by the Regional storm event and meets the freeboard criteria. Water surface elevations at the bridge are controlled by the downstream Milne dam. A flatter 1% cross slope with 1.04m superstructure height will have a negligible impact on the upstream flood levels. • No impact to access to residential areas, institutional and recreational facilities • Conventional maintenance requirements	• Does not have adequate clearance and Kennedy Road is overtopped by the Regional storm event. An Emergency Response Plan is required during the Regional Storm Event due to significant depth of flooding at the road sag. . It is not feasible to meet MTO design criteria at this bridge. • Moderate disruption due to widening the ROW, replacing the superstructure and widening abutments and construction duration • Approximate structure Cost: $5,654,090

Alternative	Advantages	Disadvantages
	• Existing maintenance requirements marginally increased due to proposed road widening	

A life cycle cost analysis was also prepared for Option 1a, 1b and 1c. The study period is 50 years and the result of the study is as per noted below. It was determined that when adjusting for the net present value Option 1a widen the existing bridge with 2% cross slope was the most cost efficient. However as Option 1a results in adverse impacts to the hydraulics, Option 1b widen the abutments with 1% cross slope was identified as preferred and cost efficient over Option 1 c – Bridge replacement with 1% cross slope.

It is also noted that bridge replacement is anticipated to be required to accommodate the future grade separation of the rail and road north of Austin Drive (identified as the Ultimate Vision subject to a future grade separation study). This is because either an Overpass or Underpass at the rail crossing will require raising of the Kennedy Road profile and subsequent raising of the bridge. As such to accommodate the Ultimate Vision grade separation of the crossing of the GO Transit Stouffville Railway Corridor crossing north of Austin Drive, the Rouge River Bridge will be replaced. The requirements for this new structure will be confirmed through the separate Grade Separation Study.

	Option 1a	**Option 1b**	**Option 1c**
Net Present Value with Adjustment (year 50)	$ 2,915,576	$ 3,543,172	$ 4,066,997

6.3. Recommended Option

Alternative 1b, Existing 30.5m Span with Superstructure Replacement (1% cross-slope) is recommended. This option requires replacement of the existing superstructure with 1% crossfall with widening of the abutments and maintains the existing span to support the widened road platform. This option will have negligible impacts to the upstream flood levels. An emergency response plan is required at this location to close this section of Kennedy Road to address significant flooding from the Regional Storm event. This option will have minor impacts to vegetation due to construction and has moderate capital construction costs and minor construction impacts.

7. Construction Staging

The construction of the bridge, Alternative 1b, is proposed to be undertaken in multiple stages. During the construction, all four (4) lanes of road traffic will be maintained throughout the construction. A road detour will be required to carry out the construction while maintaining the road traffic.

The first staging is to construct the widening bridges on both sides of the existing bridge and 4 lane traffic will be maintained on the existing girders. The second staging is to shift the 4 lane traffic to the east side of bridge and replace the existing girders and deck slab on the west side. The third staging is to shift the traffic to the west side on the new girders and replace the existing girders and deck slab left. The final staging is the proposed cross section.

8. Geotechnical Investigation

Golder Associates Ltd. carried out a preliminary foundation investigation and design report in April 2019. The following summarizes the findings of the investigation and foundation recommendations. The Preliminary Foundation Investigation and Design Report was issued on April 24, 2019.

In general, the subsurface conditions generally consist of asphalt underlain by a thick layer of fill. The fill is underlain by sequential deposits of sandy silty clay and silty sand and gravel to sandy gravel. A sandy clayey silt glacial till deposit is present beneath the gravelly deposit in Borehole RR-1. Deposits of silty clay and silty sand are present beneath the gravelly deposit in Borehole RR-2.

In the report, both shallow and deep foundations options have been considered for support of the abutments for the proposed Rouge River Bridge (widening structure and full replacement) at Kennedy Road.

Strip/Spread Footings: Considering the structural loads required to the support the proposed Rouge River bridge (widening structure and full replacement) structure, strip/spread footings are not considered suitable for support of the bridge foundations (abutments) at this site due to the presence of the relatively weak (soft to stiff) sandy silty clay deposit below the fill. In addition, the existing structure is founded on driven steel tube piles and, therefore, supporting the new structure on shallow foundations could result in unacceptable differential settlement between the existing and new structure elements. In addition, at both abutments the fill extends to about 5.0 to 6.0 m depth below ground surface and the footings would need to extend below the fill and soft sandy silty clay, result in excavations of about 7.0 to 8.6 m deep which is not practical at for the bridge widening. For these reasons, supporting the bridge abutments on spread / strip footings is not recommended and is not discussed further.

Steel H-piles or Pipe Piles: Driven steel H-piles or steel pipe (tube) piles are feasible for support of the abutments and would permit design of conventional abutments, semi-integral abutment (for tube piles) or integral abutments (for H-piles). For the full replacement option, the abutments may be constructed with a pile cap perched above the Rouge River grade; however, this will likely result in a longer span length. Staging options may permit open cut excavations for the pile cap construction, or temporary protection systems may be required, depending on the elevation of the underside of the pile cap. For a widened structure, it is recommended that the pile cap be founded at the same elevation as the existing pile cap; however, for this option cofferdams will be required to permit construction in reasonably dry conditions. Temporary protection systems would be required for the construction of the pile cap at about the same elevation as the existing pile cap.

Pile driving shoes are recommended to protect the pile tips from damage during driving into the very dense silty sand and gravel to hard sandy clayey silt deposits at the abutments.

Drilled shafts (caissons): Drilled shafts are considered feasible for support of the abutments for the proposed new structure or widened structure; however, due to the presence of water-bearing granular soils (i.e., the silty sand and gravel and the interlayers or seems of gravel) care will be required during foundation drilling where it occurs adjacent to the existing structure to ensure that there is not any loss of ground adjacent to and/or below the existing steel pipe piles. Permanent liners filled with water or drilling fluids (i.e., slurry) at all times would be required during caisson installation to control the ground and groundwater within these water-bearing cohesionless zones, which would result in the caisson foundations being less cost-effective than the installation of driven steel H-piles. In this regard, if deep foundations are adopted, the use of driven piles would be preferred as compared to drilled shafts. Depending on the underside of the pile cap elevation at the abutments temporary protection systems may be required. This option would be somewhat more complicated to implement if the structure requires use of integral abutments.

Based on the above considerations, driven steel H-piles are preferred for the support of the new abutments for the widened structure / replacement structure of the Rouge River Bridge.

9. Environmental Constraints

There are no Provincially Significant Wetlands (PSW), and no Natural and Scientific Interest (ANSIs) within 120m of the study area . There are minor impacts to vegetation due to construction of road widening.

10. Miscellaneous

10.1. Design Code

The design of the bridges and retaining walls will be undertaken in accordance with the CAN/CSA-S6—19 Canadian Highway Bridge Design Code (CHBDC), Ministry of Transportation of Ontario’s "Structural Manual", and all other current directives and standards.

10.2. Access to the Site

The site is readily accessible from Kennedy Road. The number of traffic lanes will be maintained on Kennedy Road throughout the construction. A traffic staging plan will be developed during the detailed design in consultation with the City of Markham and York Region.

10.3. Property

Property acquisition is not anticipated on either side of the Kennedy Road within the project limits.

10.4. Utilities

Utility relocation will be reviewed during detailed design. There is a 2400 mm sanitary sewer from west of Rouge River crossing Kennedy Road and continuing east; connects to 2100 mm sanitary sewer west of Rouge River. There is a recently constructed 1500 mm watermain and shaft along Kennedy Road; the watermain was tunneled to provide the necessary clearance with the 2400 mm sanitary sewer.

10.5. Drainage

The proposed bridge is provided with a longitudinal slope from north to south. Catch basin is provided on the north side. Hence the deck drainage is not needed.

Additional coordination with both the City of Markham and the TRCA shall be carried out to finalize the design of the bridge and to minimize impacts to the watercourse. Updates to the hydraulic modelling, floodplain assessment and revisions to TRCA floodplain mapping shall be completed during detailed design to reflect the final design and grading footprint of the crossing.

10.6. Concrete

All cast-in-place concrete will be class C—1 concrete as per CSA A23.I.

10.7. Structural Steel

All main plate girder, web flanges, and bearing stiffeners shall be CSA G40.21 Grade 350 at category 5. Other non-fracture critical members including connecting angles, rolled section diaphragms and all secondary members shall be CAN3-G40.21 Grade 350A. The bearing plates shall be CAN3-G40.21 Grade 300W.

10.8. Reinforcing Steel

Stainless steel reinforcement will be used in areas of the components where their surfaces are within the splash zone, including the front face of the retaining wall, front face of the abutment wall, and the centre pier.

For all other components, black steel (Grade 400W) will be used as specified in Section 12 of the MTO Structural Manual and the MTO Bridge Office Memorandum dated November 22, 2010 “Reinforcing Steel”.

10.9. Parapet Wall and Railing

Parapet wall and railing in accordance with MTO standard structure drawing of SS 110-83 is provided for combination traffic/bicycle rail as shown in GA. Alternatively, since the bridge is being overtopped during flood condition we can consider providing modified four tube railing on multi-use path, TL-4 (SS 110-46) to permit unobstructed flow water.

Prepared by

Geffrey Huang, P.Eng
Bridge Engineer
HDR Inc.

Reviewed by

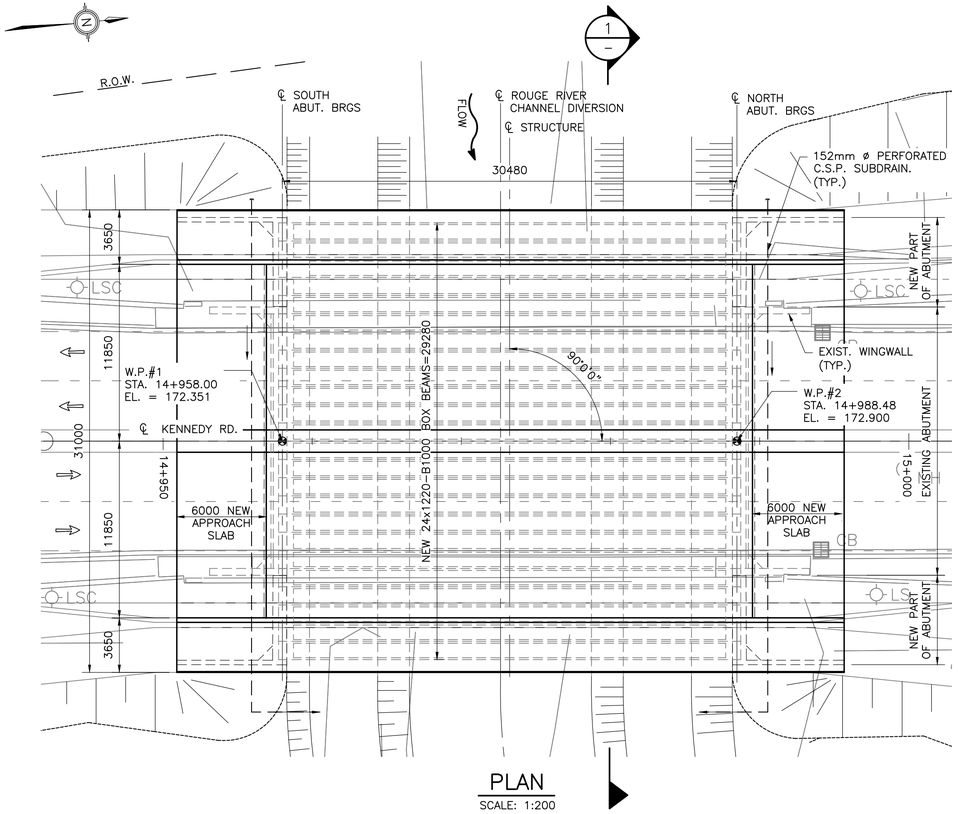
Jared Monkman, P.Eng
Bridges & Structures Lead Canada
HDR Inc.

A

Appendix

hdrinc.com 100 York Boulevard, Suite 300, Richmond Hill, ON, CA L4B 1J8
(289) 695-4600

METRIC



PLAN

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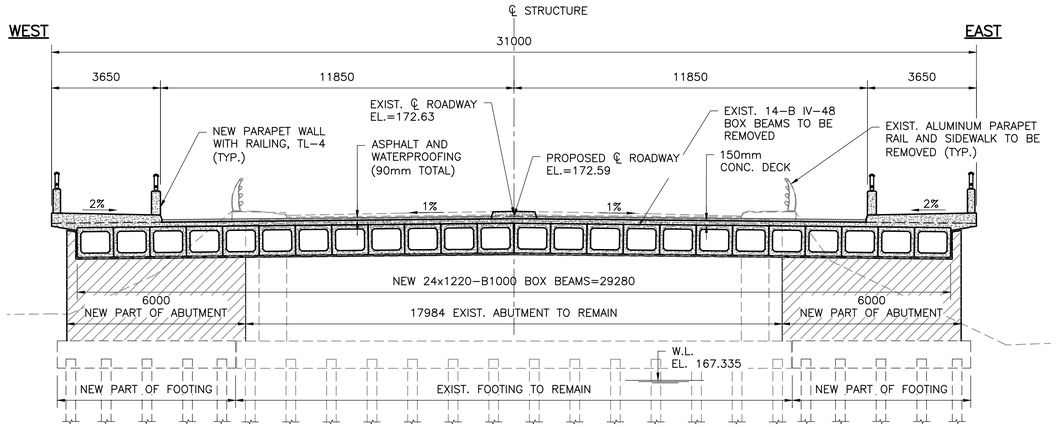

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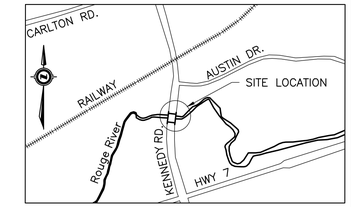

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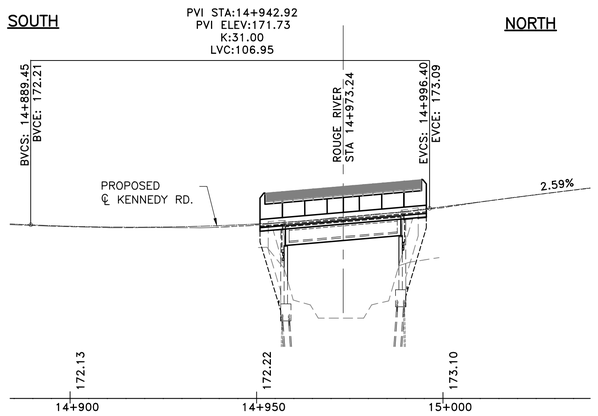
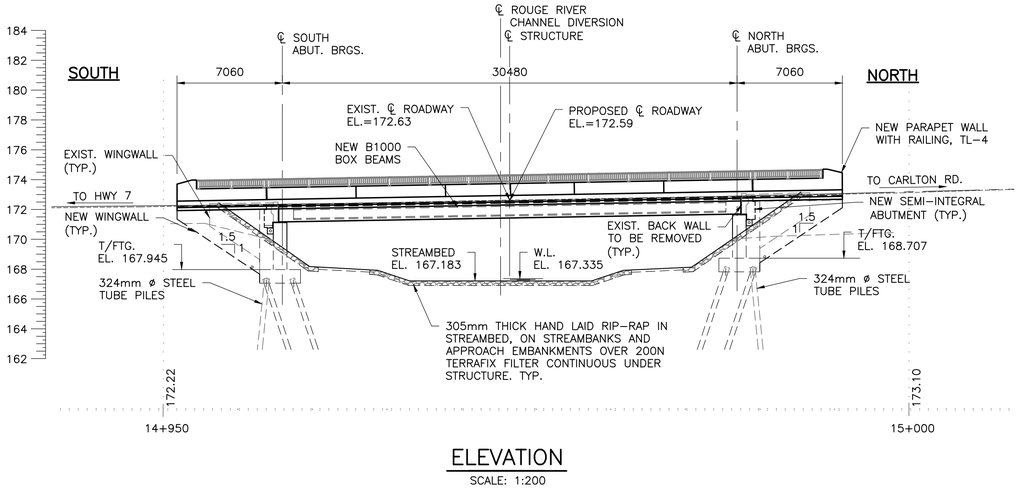


PROFILE ALONG ℄ KENNEDY RD.

N.T.S



ELEVATION

SCALE: 1:200

LIST OF ABBREVIATION:

ABUT.	DENOTES ABUTMENT
BRGS.	DENOTES BEARINGS
B.H.	DENOTES BOREHOLE LOCATION
CONC.	DENOTES CONCRETE
FIX.	DENOTES FIXED
FOOT.	DENOTES FOOTING
E.B.L.	DENOTES EASTBOUND LINE
EXIST.	DENOTES EXISTING
EXP.	DENOTES EXPANSION
SHLD.	DENOTES SHOULDER
T/FTG	DENOTES TOP OF FOOTING
W.B.L.	DENOTES WESTBOUND LINE
W.P.	DENOTES WORKING POINT
E.P.	DENOTES EDGE OF PAVEMENT
F.F.	DENOTES FRONT FACE
T/P	DENOTES TOP OF PAVEMENT
O.G.L.	DENOTES ORIGINAL GROUND LINE
TYP.	DENOTES TYPICAL

NOTES:
THE LOCATION OF UTILITIES IS APPROXIMATE ONLY. CONSULT THE RESPECTIVE MUNICIPAL AUTHORITIES AND UTILITY COMPANIES TO DETERMINE THE EXACT LOCATION OF THEIR UTILITIES. THE CONTRACTOR SHALL VERIFY THE LOCATION OF UTILITIES AND SHALL ADEQUATELY PROTECT AND SUPPORT THEM DURING CONSTRUCTION.

NOT FOR CONSTRUCTION

HDR
100 York Blvd., Suite 300,
Richmond Hill, ON, L4B 1J8
Phone (289) 695-4600
Fax (289) 695-4601

No.	DATE	REVISIONS	BY
1	11/16/2020	PRELIMINARY DESIGN	G.H.

York Region Transportation Services

DESIGN	G.H.
DRAWN	V.R.
CHECKED	J.M.

KENNEDY ROAD
ROUGE RIVER BRIDGE

GENERAL ARRANGEMENT

DWG. NO.	
CONT. NO.	
SHEET NO.	S001