APPENDIX B: TUNNEL OPTION

Hatch Mott MacDonald

Metrolinx
Davenport Diamond Grade Separation
DCN21

Tunnel Option

Issue and Revision Record					
Rev	**Date**	**Originator** (Print) (Signature)	**Checker** (Print) (Signature)	**Approver** (Print) (Signature)	**Description**
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	Signatures:				

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1. Introduction

1.1 Overview

Metrolinx is currently evaluating options for grade-separating the existing Davenport Diamond; an at grade rail-to-rail crossing of CP Rail's North Toronto Subdivision (east-west) and GO Transit's Barrie Rail Corridor (north-south).

Metrolinx is completing a feasibility study to review/evaluate several options for removing the Davenport Diamond, which include variations of the following:

1. Raise GO tracks over CP tracks
2. Lower GO tracks under CP tracks

Hatch Mott MacDonald (HMM) was asked to assist Metrolinx in consideration of an additional option: Lower GO tracks under CP tracks within a tunnel. This option calls for grade separating the Davenport Diamond by placing the GO track underground in a tunnel, with open-cut approaches to the north and south.

1.2 Purpose of Report

Metrolinx has requested that HMM develop a conceptual design, and associated cost estimate, for the tunnel option.

The purpose of this report is to present the conceptual design and cost estimate to be used for comparative purposes in determining the most feasible option for grade separating the Davenport Diamond.

2. Tunnel Conceptual Design

The conceptual tunnel option design is provided in Appendix A.

A description of the tunnel option is as follows:

- Bored Tunnel would extend from 7+000 (330 m south of Dupont Street) to 8+975 (500 m north of St. Clair Avenue West);
- Open-cut approaches extend beyond the extents of the bored tunnel. The proposed south and north approaches are 575 m and 1,450 m, respectively. Therefore, the total length would be:

  4,000 m = 575 m (open cut) + 1,975 m (bored tunnel) + 1,450 m (open cut);
- Secant pile walls with tie-backs would form the support of excavation for the approaches;
- A tunnel boring machine (TBM) would be launched from the south approach cut and extracted from the north approach cut within existing right-of-way (ROW);
- The mined tunnel diameter tunnel would be 11.4 m to accommodate twin track with overhead electrification (cross section discussed in Section 2.3);
- Ballast invert for track installation in bored tunnel and approaches;

- Minimum cover of 5 m maintained above tunnel;
- Existing track would have to be diverted around approaches (temporary easements may be required along portions of the existing ROW); and
- Tunneling would take place below existing live single track.

2.1 Design Constraints

The conceptual design was bound by the following constraints:

1. Impacts to existing roads and structures to be minimized;
2. Existing grade (top-of-rail) to be maintained at Bloor Street and Eglinton Avenue;
3. Tunnel to accommodate twin GO Train tracks and CN freight (on an as required basis);
4. 2% maximum track grade;
5. All clearance envelopes to accommodate electrified GO Train service (overhead power line);
6. 5 m minimum cover between the top of the proposed tunnel and existing roadways/structures; and
7. Maximum allowable grade at overpass approaches (Wallace Avenue and Rogers Road) of 6%.

2.2 Perceived Benefits

The perceived benefits of the tunnel option include:

- Construction operations at tunnel portion would be minimized;
- Reduced operation noise;
- Construction of temporary rail bridges for diversion track over Dupont Street and Davenport Road would not be required. A temporary rail bridge may be required at Rogers Road;
- Dupont Street, Davenport Road, and St. Clair Avenue West would remain open for the duration of the project;
- Alterations to St. Clair Avenue West rail bridge would not be required;
- No impacts to St. Clair Avenue West street car tracks;
- No impacts to bus service on Dupont Street and Davenport Road;
- New grade separation requirements limited to Rogers Road and Wallace Avenue:
    - Rogers Road – is currently at grade and runs below the existing elevated railway (raised on an embankment). The existing railway bridge and embankment would have to be removed and Rogers Road raised approximately 8.5 m. Proposed works at Rogers Road are discussed in more detail in Section 3.4.

  - Wallace Avenue - is currently a level crossing. Relatively minimal work would be required to construct a grade separation and raise the street level less than 1 m. Wallace Avenue would remain open to traffic for the long term. Proposed works at Wallace Avenue are discussed in more detail in Section 3.5.

- 1,975 m of rail would be taken underground and there would be an opportunity to repurpose above grade space. Rail bridges at Dupont Street, Davenport Road, and St. Clair Avenue West could remain in place;
- Alternatively, existing rail bridges could be removed (Dupont Street, Davenport Road, and St. Clair Avenue West) to reduce maintenance costs;
- Existing street crossings could remain as is (Dupont Street, Davenport Road, and St. Clair Avenue West);
- Construction of permanent new rail bridges/widen bridges (Dupont Street, CP North Toronto Subdivision, Davenport Road, St. Clair Avenue West, and Rogers Road) would not be required;
- Minimal temporary and permanent ROW required; and
- Existing utilities at Dupont Street, Davenport Road, and St. Clair Avenue West are expected to be above the proposed tunnel elevation and therefore impacts from tunneling activities should be minimal.

2.3 Tunnel Cross Section

The tunnel cross section was developed based on minimum clearance envelopes specified by CN Maintenance-of-way Standard Practice Circulars (April 2005), with additional clearance included above train envelopes to account for future electrification in accordance with Metrolinx Electrification Project - Electrification Specification (April 2014) and the GO Transit - Lakeshore Electrification Update of 2001 Addendum to 1992 Study.

The proposed tunnel includes provisions for 750 mm wide concrete walkways on both sides, with track ballast placed along the length of the tunnel invert. The proposed tunnel cross section is presented in Figure 1.

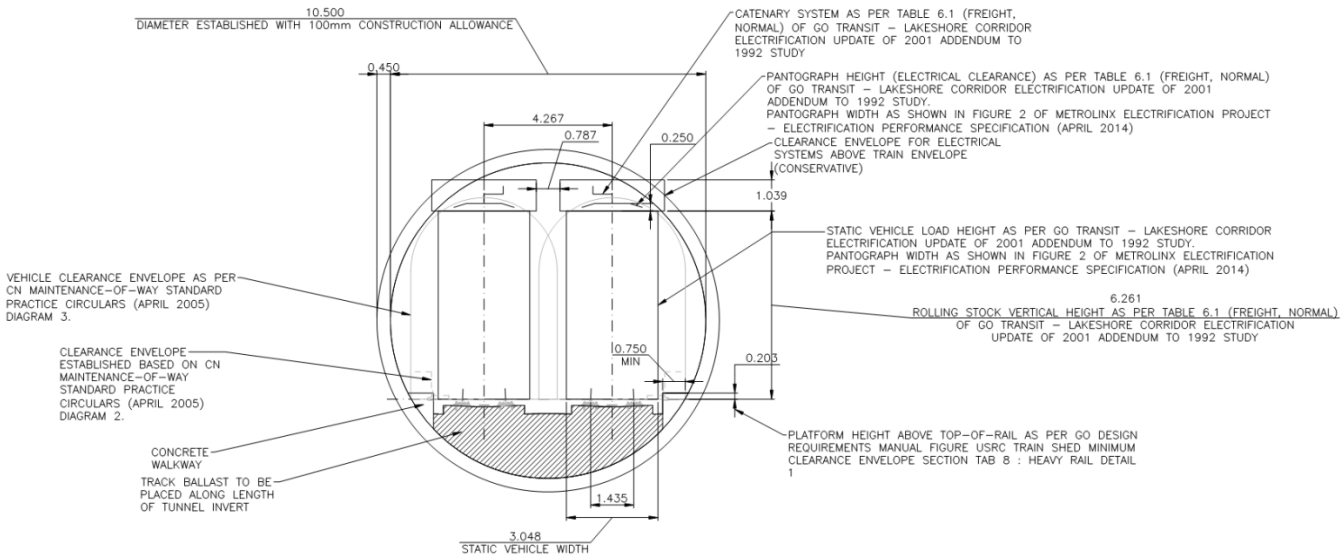

Figure 1: Tunnel Cross Section

3. Construction

During the process of developing the tunnel option conceptual design as part of this task, HMM conducted an internal “Sequence of Construction” design workshop to brain storm ideas for how this option could be constructed. It is important to note that the intent of the workshop was to identify construction challenges and to develop viable solutions to present a constructible design. No cost-benefit analyses were completed to determine what the optimal solutions may be at this stage of design. Therefore, it is stressed that if the tunnel option is developed further, a number of the design elements will need to be investigated in more detail.

3.1 Diversion Track

A diversion track is proposed to be constructed around the north and south approaches only; as close to the east side of the rail corridor as possible. The diversion track would be constructed to match grade of the existing rail line, which will require cutting/filling in different locations along the length of the alignment. For the purposes of this stage of conceptual design it was assumed that the diversion track centerline will be offset 3 m from the proposed approach east walls (see Figure 2). This distance can be reduced but doing so will require the approach wall to be designed to accommodate additional load from the closer track.

Another consideration is whether to create/cut embankments adjacent the proposed diversion track, and obtain temporary easements where extending beyond the ROW, or to construct retaining walls to limit impacts on adjacent properties. The current design does not incorporate retaining walls for the diversion track (see sample cross sections in Figure 2).

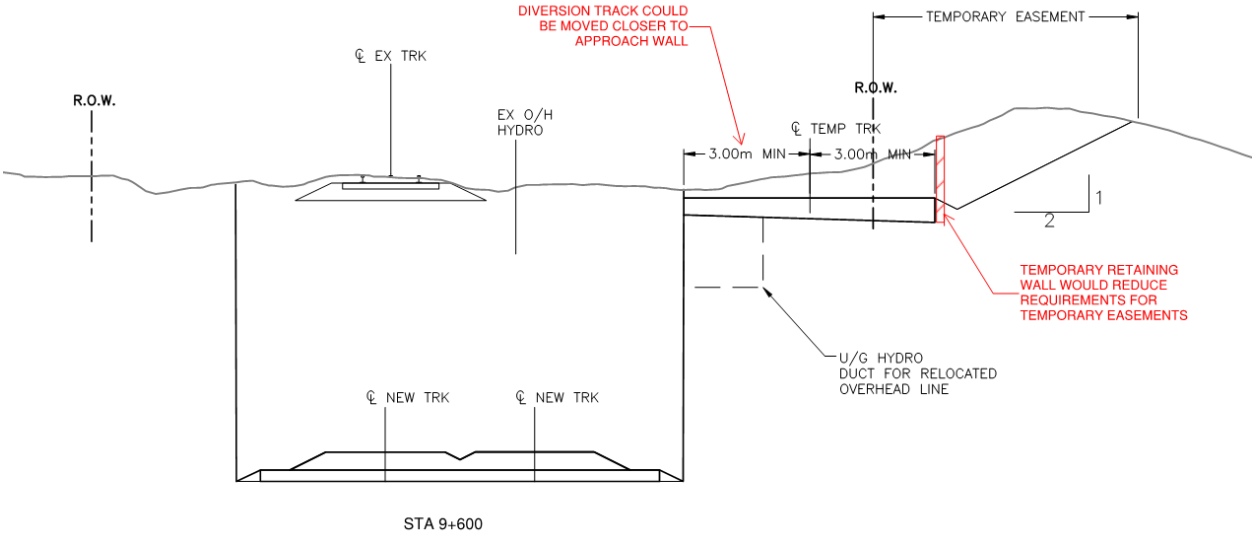

Figure 2: Sample Diversion Track Cross Section

A cost-benefit analysis should be completed during future phases of design to determine the most economical location and support for the diversion track.

3.2 Support of Excavation

Support of excavation at the tunnel approaches is proposed to be secant pile walls with tie-backs where required. An alternative to tie-backs is the use of struts between approach walls. Tie-backs are preferred to struts because they do not impede on the train clearance envelope between approach walls and therefore reduce the unsupported length between supports and do not require walls to be constructed to the full vertical clearance height above rails for their full length (which is the case with struts). Sample photos of tie-backs and struts are provided in Figure 3.

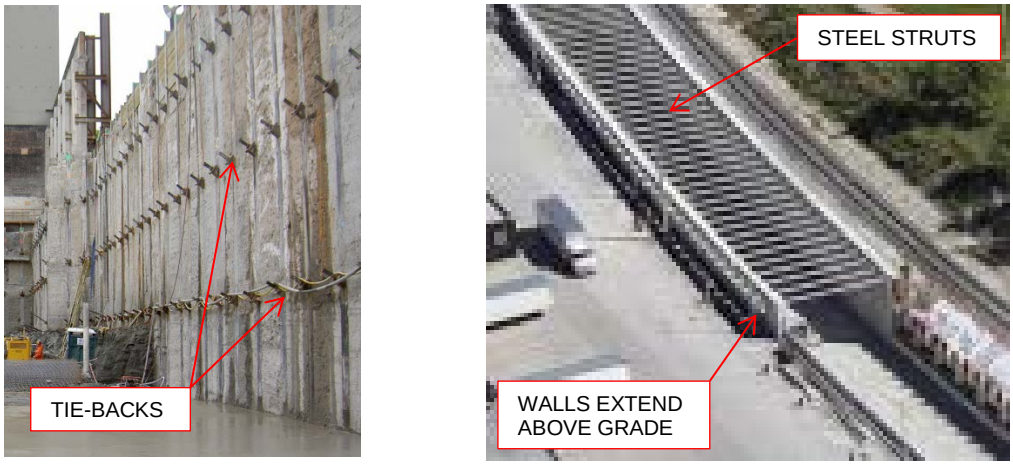

Figure 3: Tie-Backs vs. Struts

Note that insulated wall panels will be installed overtop of secant pile walls (and tie-backs) to provide a layer of insulation and to improve aesthetics.

One potential risk with tie-backs is that adjacent property owners may not agree to provide subsurface easements to accommodate the reach of tie-backs outside of the ROW. At locations where subsurface agreements cannot be formed, struts will likely have to be used in place of tie-backs.

A cost-benefit analysis should be completed during future phases of design to determine the most appropriate method of support of excavation.

3.3 Existing Bridge Piles

HMM has reviewed structural drawings for existing rail bridges at Dupont Street, Davenport Road, and St. Clair Avenue West, which the tunnel will extend below. Conclusions from the review are as follows:

- Davenport Road and St. Clair Avenue West do not appear to be on piles
- Dupont Street appears to be on timber piles (extending down into the proposed tunnel horizon)

It is expected that tunneling could proceed through timber piles once temporary additional support is in place at Dupont Street Temporary supports may consist of additional bridge support at grade on sidewalks. This temporary support would remain in place until trains are diverted into the new tunnel.

3.4 Rogers Road

Rogers Road will need to be reconstructed as part of the proposed tunnel option. This is likely the most challenging aspect of the project due to the regrading required and the resulting impacts to property in the area of the intersection. HMM has proposed to construct a new road overpass to the immediate south of existing Rogers Road in an effort to keep the full width of the road open to traffic during construction. In this scenario a portion of the existing school parking lot at the north would be taken by the new Rogers Road. This could be built as an earth fill approach with retaining walls or as an elevated guideway. The road surface in this area would be up to 7.5 m above grade (higher than the school roof). The existing school driveway would have to be re-routed to the east if possible.

One alternative would be to shift the existing Rogers Road alignment to the south by half the road width. In this case, half of the new Rogers Road alignment would be constructed in what is now the school parking lot and the other half would be constructed over the southern portion of the existing alignment. This would require less school property but would remain challenging in terms of re-grading.

A benefit to shifting Rogers Road south (by the full road width or half) would be that access to the homes on the north side of the road would be maintained over the long-term.

A complete impact analysis will be required at Rogers Road to determine the best path forward if the tunnel option is developed further.

3.5 Wallace Avenue

Wallace Avenue is currently a level crossing. The tunnel option proposes lowering the rail at this location and constructing an overpass to carry traffic over trains passing below. To do so

a full, long term, temporary closure of Wallace Avenue may be required to construct a bridge over the south tunnel approach. The horizontal alignment of Wallace Avenue would be unchanged but the road would be raised slightly; requiring regrading of approaches on either side.

3.6 Existing Utilities

It is believed that existing utilities cross the proposed tunnel/open-cut alignment in a number of locations. At this conceptual stage of design it is believed the following utilities exist at the respective locations as shown on drawings provided in Appendix A. Individual utility locations are discussed in more detail in the following sections.

If the tunnel option is developed further existing utility information would need to be investigated in more detail to identify potential conflicts and evaluate the feasibility of relocating utilities

3.6.1 Utilities Above the Tunnel

The proposed tunnel alignment passes below a number of existing utilities along its length. The tunnel depth is such that these existing known utilities at Antler Street, Dupont Street, the existing Davenport Diamond, Davenport Road, St. Clair Avenue West and Kipping/Lambert Avenue. will be unaffected. As noted previously, avoiding these subsurface utilities is one of the benefits of the tunnel option.

3.6.2 Utilities at Approaches

Many utilities exist at the south approach at Paton Road and Wallace Avenue. The majority of these are gas and water lines, and electrical duct banks which can be relocated relatively easily; buried deeper below the proposed trench or brought across the trench along the proposed bridge at Wallace Avenue. Presenting a greater challenge is the large gravity combined sewer at Wallace Avenue. It may be possible to re-route this sewer to avoid having to relocate it at Wallace Avenue, but more likely the sewer will have to be lowered and reconstructed with a “siphon” arrangement to maintain flow. Constructing sewer siphons is challenging but not without precedent in the City of Toronto; HMM has designed a number which have been constructed successfully in recent years.

At the north approach, there exists a number of utilities below Rogers Road (two combined sewers and a watermain). It is believed that these utilities are below the proposed grade at this location and could possibly remain in place. Further investigation would be required to determine whether or not these utilities would need to be relocated.

3.6.3 Hydro Lines

Existing overhead hydro lines are present within the rail corridor in the north portion of the study area, extending from above the tunnel further north beyond Eglinton Avenue. These hydro lines and supporting towers would need to be buried below ground at the north tunnel approach to allow sufficient clear space within the ROW to construct the proposed diversion track and trenched approach.

As part of this conceptual design the hydro lines would be buried underground for approximately 1.7 km. At Rogers Road the line would be buried using trenchless technology (as opposed to open trench) to locate the line below existing utilities at sufficient depth to

allow for construction of the proposed temporary rail bridge and new road bridge at Rogers Road

3.7 Property Requirements

The extents of temporary and permanent easements expected to be required for the proposed tunnel option are shown on plan drawings provided in Appendix A. A summary of property requirements is as follows:

- Temporary Easements - 9,100 m^2
- Permanent Easements - 1,350 m^2 (excluding houses/property at Rogers Road)
- Permanent Subsurface Easements - 1,700 m^2 (For the tunnel only. Potential subsurface agreements for tie-backs have not been evaluated at this stage of conceptual design)
- Property at Rogers Road - up to eight individual residential lots depending on alignment/grading of Rogers Road

Note that it may be possible to reduce property impacts during future stages of design (i.e. optimize diversion track clearance requirements, tunnel/track alignments and Rogers Road alignment).

3.8 Additional considerations

It was assumed that the majority of the diversion track and open-cut approach construction can be accommodated within the existing ROW. A staging area of approximately 10,000 m^2 will be required close to the proposed south tunnel portal to support tunnel construction activities. One potential location for this staging area would be Campbell Avenue Park (approx. 11,000 m^2).

Tunneling operations would proceed directly underneath the existing live track. Therefore, a settlement analysis would be completed during the design phase of the project and an extensive settlement monitoring program would be required during construction.

Metrolinx indicated that there may be future plans to build stations at St. Clair Avenue West and Bloor Street. The impacts/feasibility of these stations would need to be considered further. That being said, it is believed that it would be possible to construct a GO station on the south side of Bloor Street . It would be very challenging to construct a station at St. Clair Avenue West connecting to the tunnel at this location.

Geotechnical investigations would need to be completed to gain an understanding of the existing conditions at the proposed tunnel horizon. Rock versus soil impacts would need to be evaluated.

4. Updated Cost Estimate

At the request of Metrolinx, HMM has prepared an order-of-magnitude cost estimate for the proposed tunnel option. The estimated cost is $626 million. A breakdown summary is provided in Table 1. A detailed cost estimate breakdown is provided in Appendix B.

Table 1: Tunnel Option Cost Estimate

Description	Cost ($)
Mobilization	6,160,000
Trackwork	19,327,315
Signals	1,971,200
Structures	160,623,071
Tunnel	133,794,951
Property	10,000,000
Contingency	227,250,456
Design and Engineering	67,000,000
Total	**626,126,993**

The main components included in this estimate are:

- Installation and removal of temporary diversion tracks at approaches during tunnel construction;
- Open-cut approaches;
- Utility relocations at open-cut approaches (utilities will not be affected by tunneling);
- Tunnel excavation (including soil disposal) & liner installation;
- New elevated structures at Wallace Avenue and Rogers Road;
- Emergency exit facilities along the tunnel in accordance with National Fire Protection Association 130;
- Ventilation, lighting and pumping facilities for the new tunnel;
- Supply and installation of new track and signaling;
- Contingency to reflect unknowns at the current stage of conceptual design
- Design and Engineering fees

5. Tunnel Option Project Schedule

HMM has developed a conceptual tunnel option project schedule, provided in Appendix C. An overview of the project schedule is as follows:

1. Design - 1 year
2. Construction - 4 years
3. Total Project Duration - 5 years

Appendix A

Tunnel Option Conceptual Design

D SIZE 22" x 34" (558.8mm x 863.6mm)

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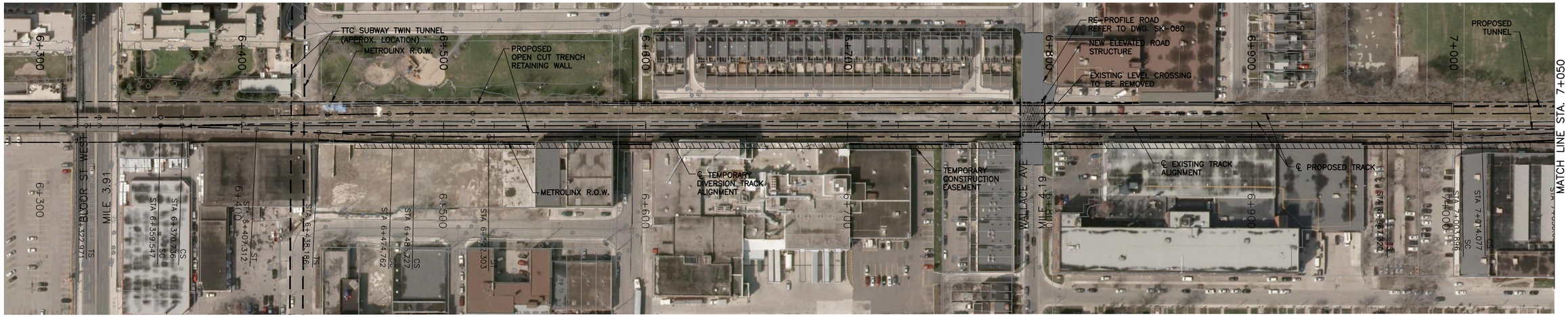

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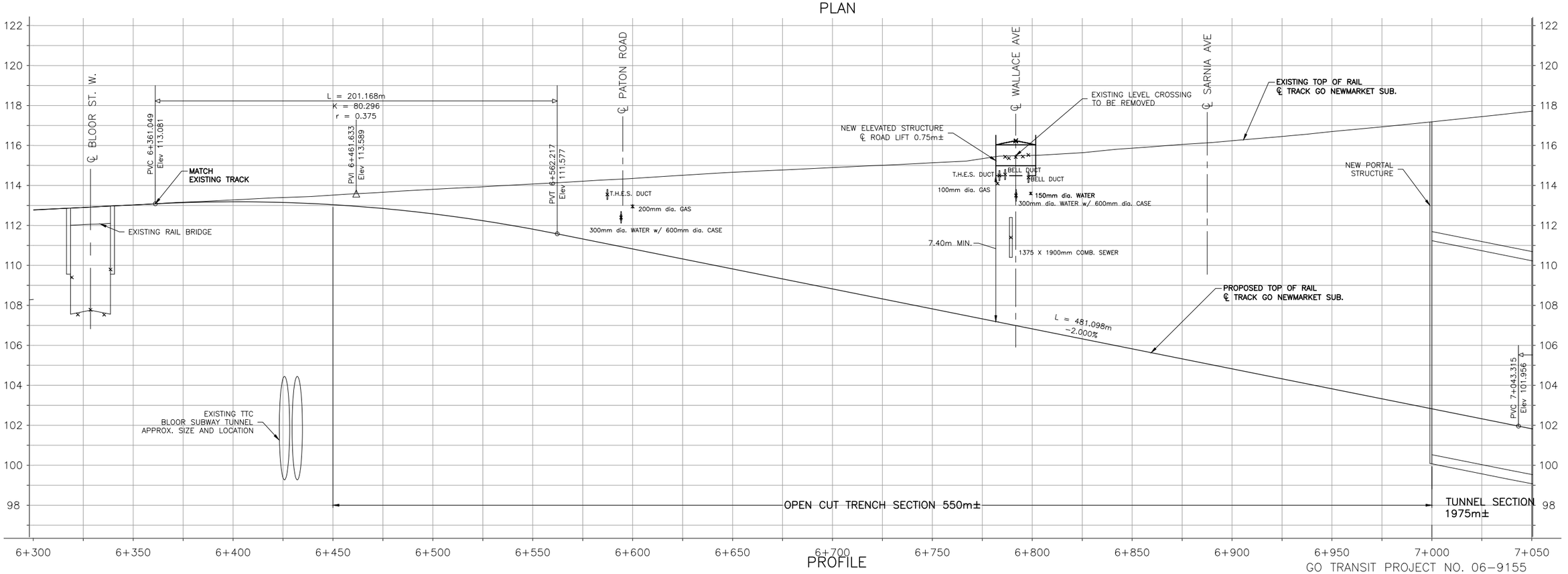

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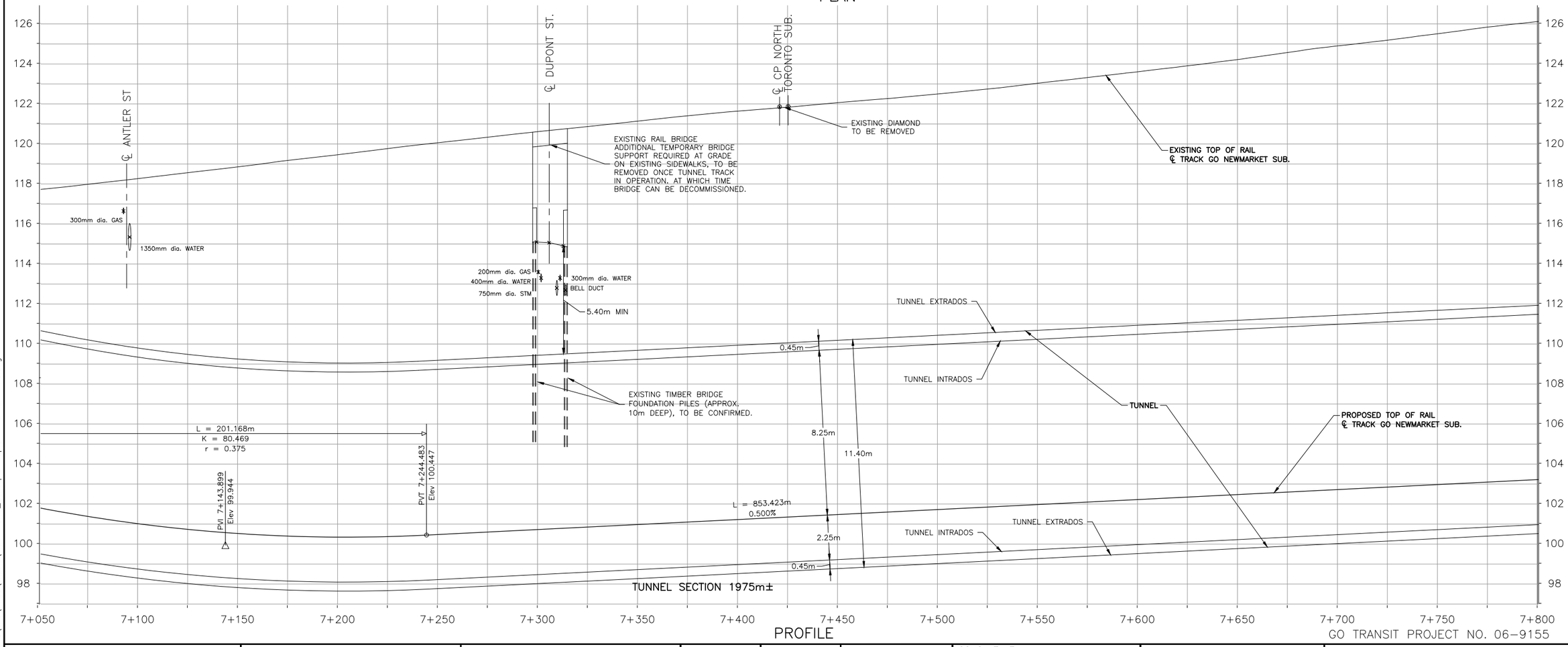

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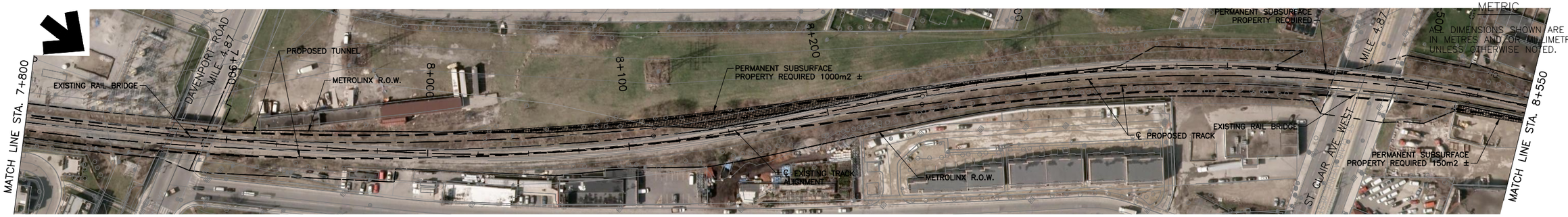

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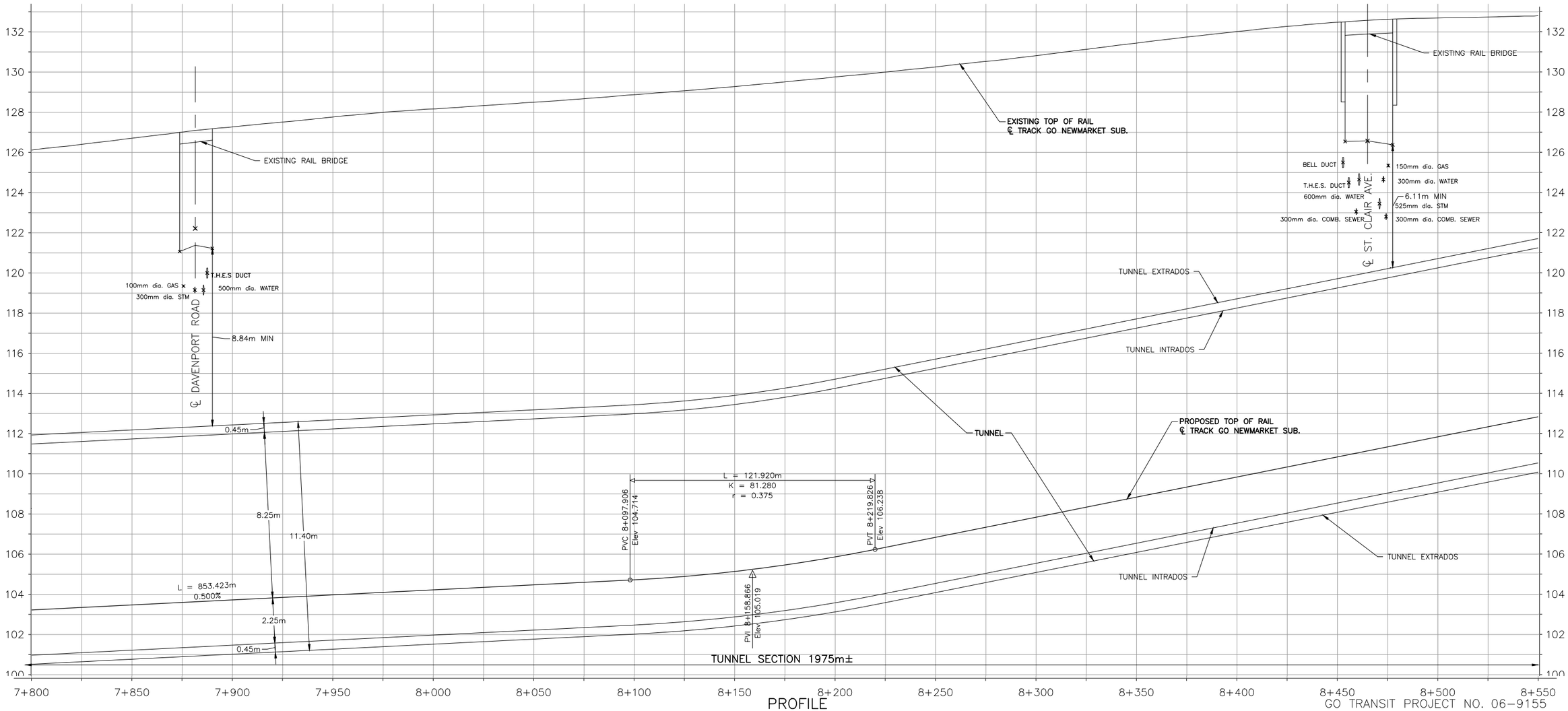

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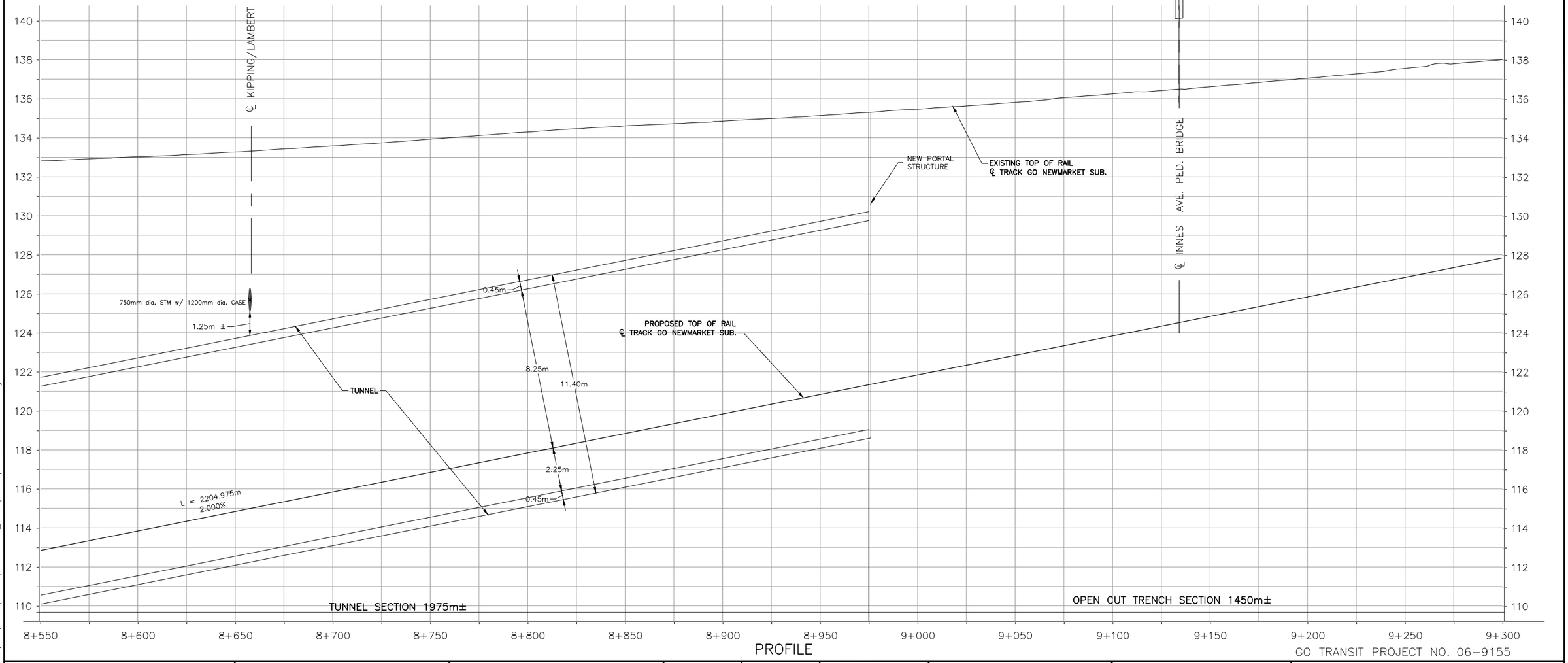

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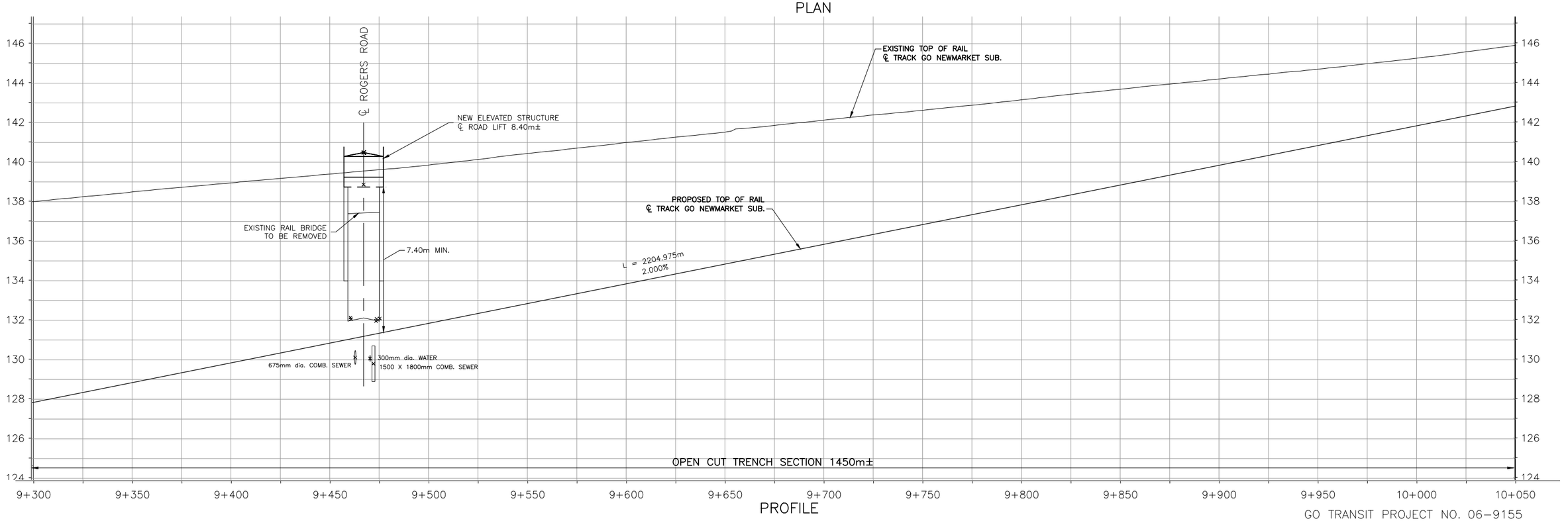

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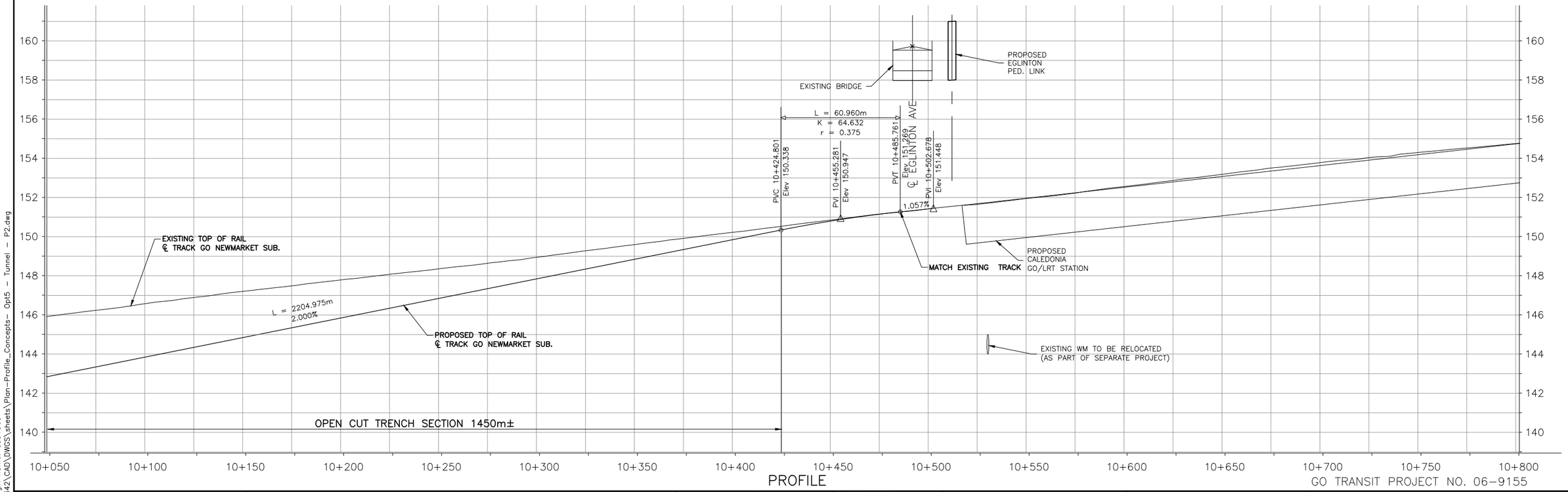

PROFILE

GO TRANSIT PROJECT NO. 06-9155

REFERENCE DRAWINGS		ISSUE			REVISIONS		
					P2	15/09/18	ISSUED FOR REVIEW
					P1	15/08/10	ISSUED FOR REVIEW
DWG NO.	TITLE	REV.	DATE	ISSUED FOR	REV.	DATE	

DRAWN BY: F.D. 15/08/04	DESIGNED BY: F.D. 15/08/04
CHECKED BY: J.P. 15/08/05	APPROVED BY: J.M. 15/08/10
SCALE: 1:1000H FULL SIZE ONLY 1:100V	

CONSULTANT
Hatch Mott MacDonald

A Division of METROLINX

DAVENPORT DIAMOND
CONCEPT ALTERNATIVE 5
PLAN & PROFILE 6
GO NEWMARKET SUB. MILE 4.51

CONTRACT NO.	DWG. NO.	REV.	SHEET
RQQ-2012-RF-068	345106-AU01-SK-073	P2	6 OF 6

Sep 18, 2015 - 5:48pm Login name: du31563
Drawing Name: P:\GO\243342\CAD\DWGS\sheets\Plan-Profile_Concepts- Opt5 - Tunnel - P2.dwg

D SIZE 22" x 34" (558.8mm x 863.6mm)

METRIC

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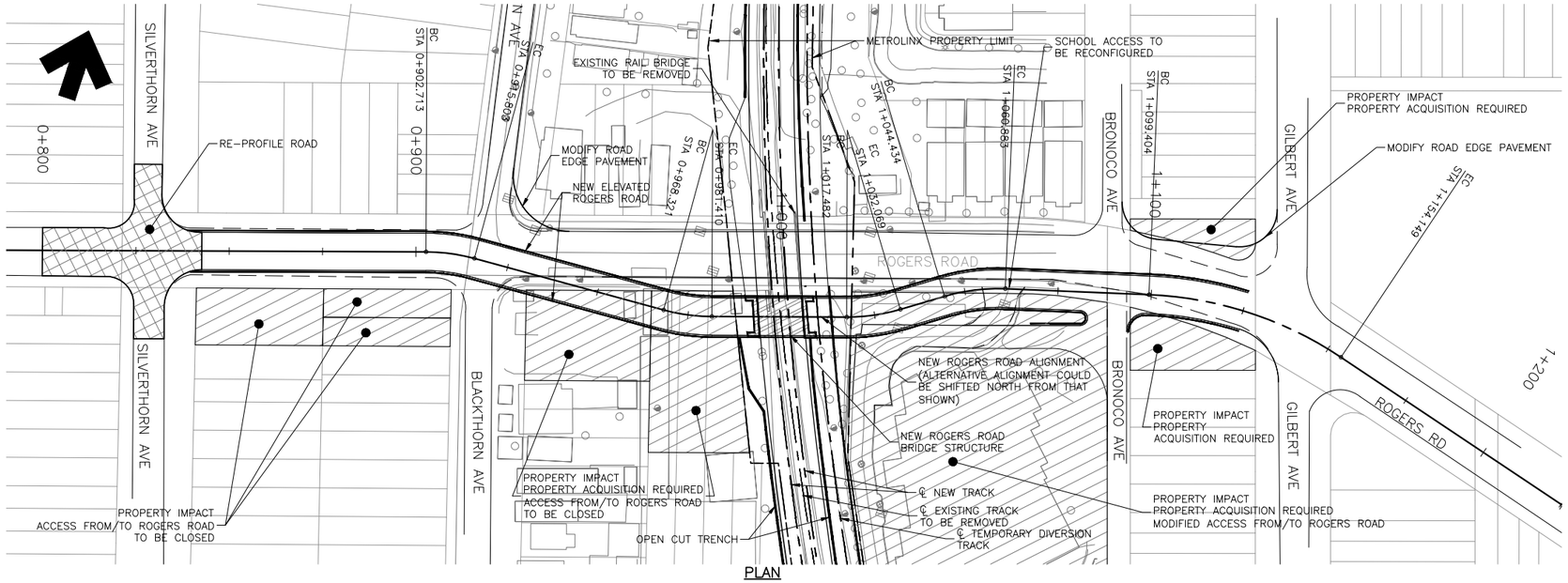
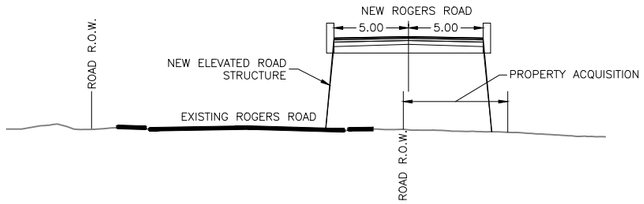
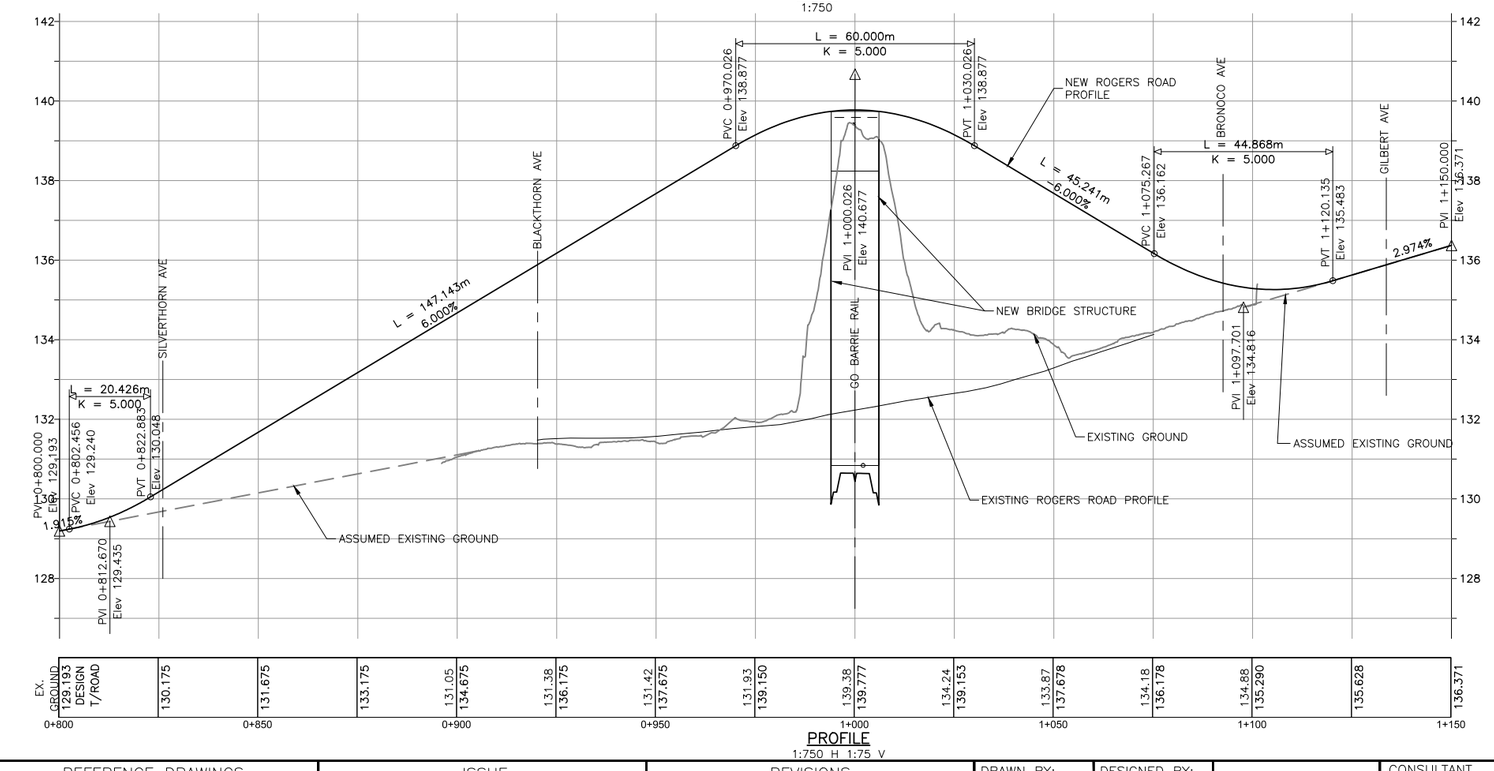


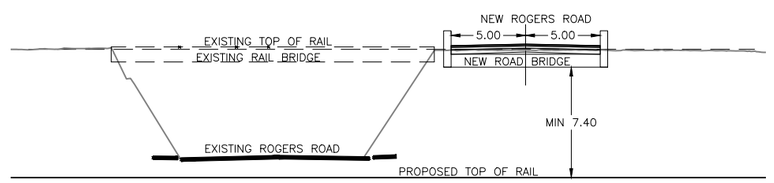
PLAN
1:750



SECTION – STA. 0+950
1:200



PROFILE
1:750 H 1:75 V



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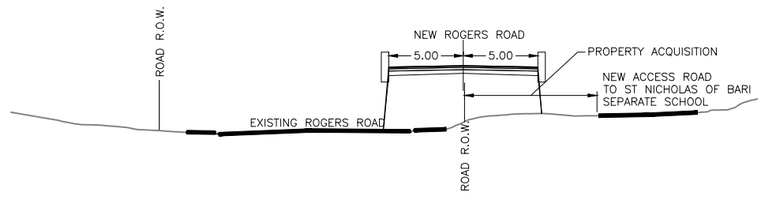

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GO TRANSIT PROJECT NO. 06–9155

REFERENCE DRAWINGS		ISSUE			REVISIONS		
					P2	15/09/18	ISSUED FOR REVIEW
					P1	15/08/10	ISSUED FOR REVIEW
DWG NO.	TITLE	REV.	DATE	ISSUED FOR	REV.	DATE	

DRAWN BY: F.D. 15/08/04	DESIGNED BY: F.D. 15/08/04
CHECKED BY: J.P. 15/08/05	APPROVED BY: J.M. 15/08/10
SCALE: AS SHOWN	FULL SIZE ONLY

CONSULTANT
Hatch Mott MacDonald

A Division of METROLINX

DAVENPORT DIAMOND
CONCEPT ALTERNATIVE 5
PLAN AND PROFILE – NEW ROGERS ROAD
GO NEWMARKET SUB. MILE 4.51

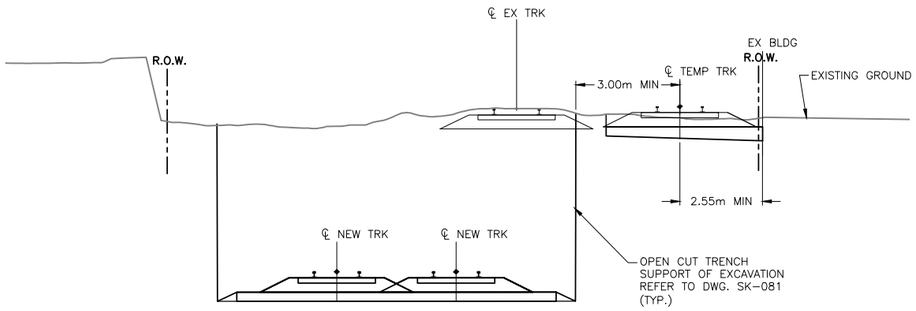
CONTRACT NO.	DWG. NO.	REV.	SHEET
RQQ–2012–RF–068	345106–AU01–SK–074	P2	

Sep 18 , 2015 - 1:37pmLogin name: du31563
Drawing Name: P:\GO\243342\CAD\DWGS\sheets\Road Plan and Profile_Tunnel Option.dwg

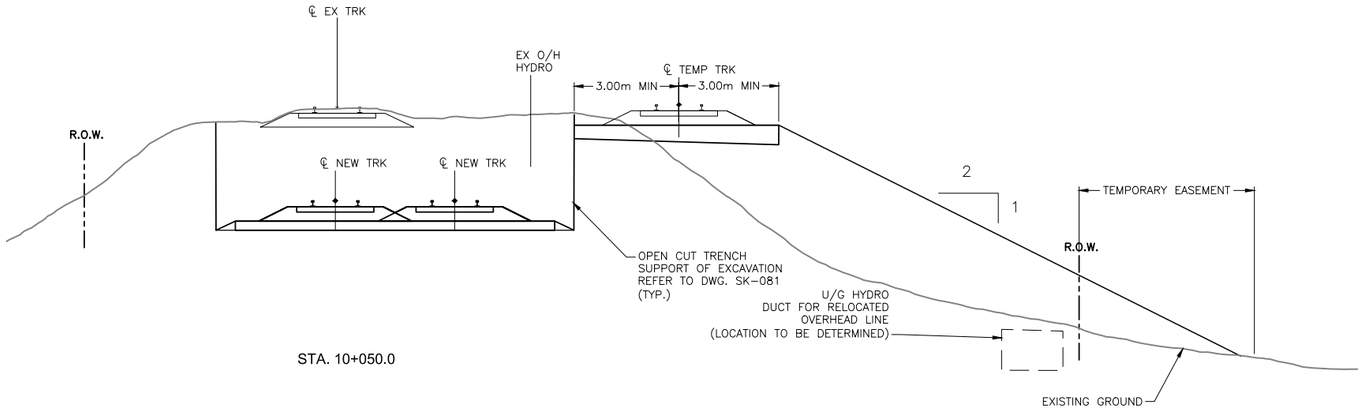
D SIZE 22" x 34" (558.8mm x 863.6mm)

METRIC

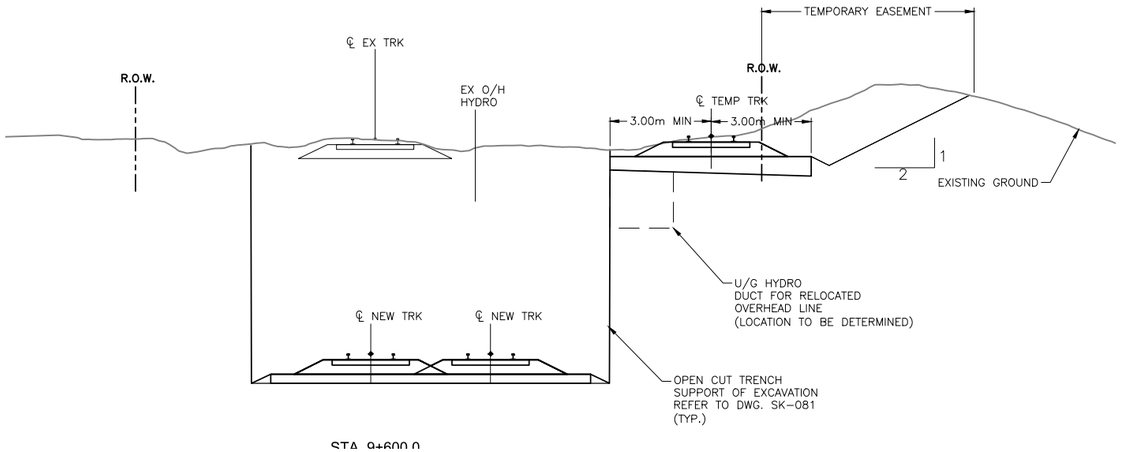
ALL DIMENSIONS SHOWN ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.



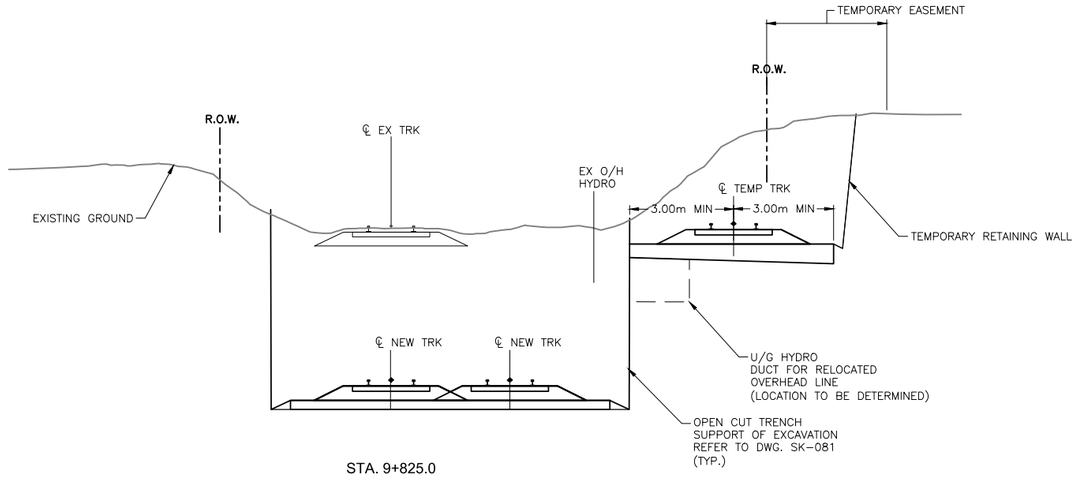
STA. 6+675.0



STA. 10+050.0



STA. 9+600.0



STA. 9+825.0

GO TRANSIT PROJECT NO. 06–9155

REFERENCE DRAWINGS		ISSUE			REVISIONS		
					P1	15/09/18	ISSUED FOR REVIEW
DWG NO.	TITLE	REV.	DATE	ISSUED FOR	REV.	DATE	

DRAWN BY: F.D. 15/08/29	DESIGNED BY: F.D. 15/08/04
CHECKED BY: J.P. 15/09/02	APPROVED BY: J.M. 15/09/04
SCALE: 1:100 FULL SIZE ONLY	

CONSULTANT
Hatch Mott MacDonald

A Division of METROLINX

DAVENPORT DIAMOND
CONCEPT ALTERNATIVE 5
TYPICAL CROSS SECTIONS – OPEN CUT TRENCH
GO NEWMARKET SUB. MILE 4.51

CONTRACT NO.	DWG. NO.	REV.	SHEET
RQQ–2012–RF–068	345106–AU01–SK–075	P1	

Sep 18 , 2015 , 1:55pm Login name: du31563
Drawing Name: P:\GO\243342\CAD\DWGS\sheets\Typ-Sections_Tunnel Option.dwg

D SIZE 22" x 34" (558.8mm x 863.6mm)

METRIC

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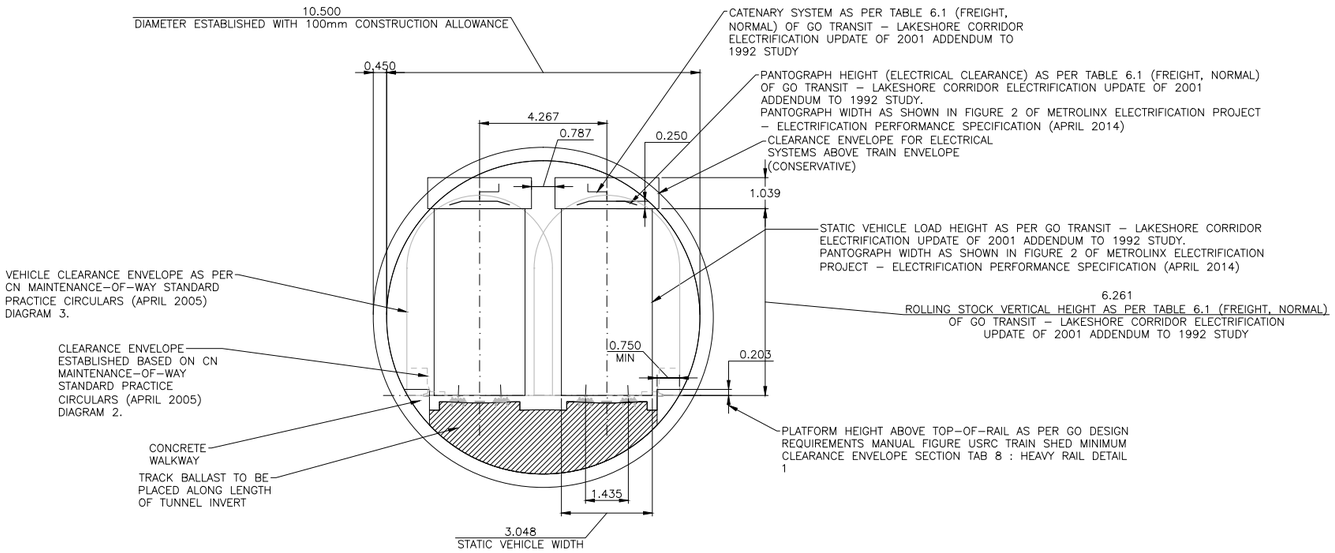
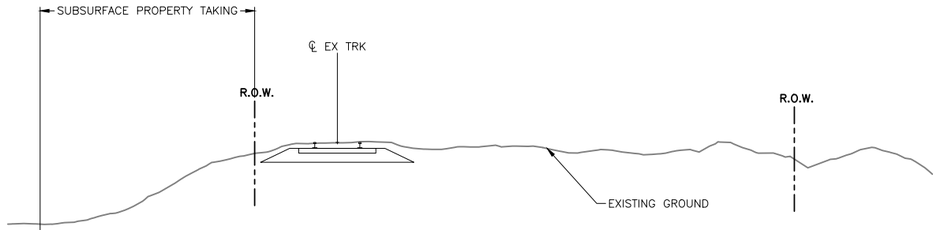


TUNNEL DETAIL



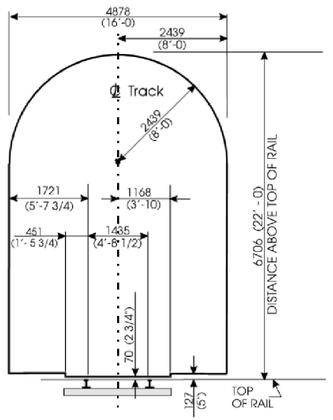


DIAGRAM 3
ALL RAILWAY TUNNELS
CANADA ONLY
not to scale
dimensions in mm (feet-inches)

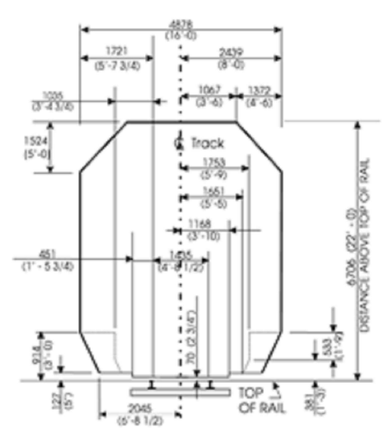
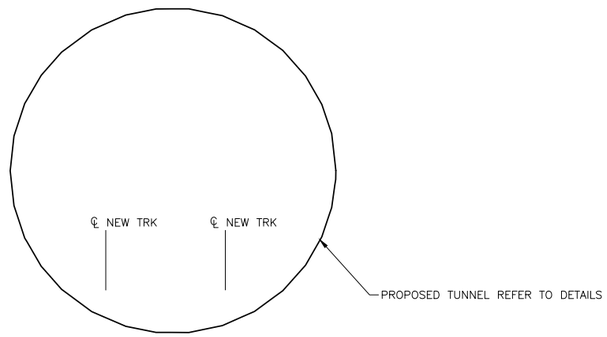


DIAGRAM 2
ALL RAILWAY BRIDGES, SNOWSHEDS AND OVERHEAD TIMBER BRIDGES
CANADA ONLY
not to scale
dimensions in mm (feet-inches)

5. TRACK CENTRES

5.1 Subject to subsection 5.2, all trackage built or rearranged after the coming into force of this Standard shall, comply with the minimum distances between track centre lines with due allowance for superelevation and curvature and shall be as follows:

(a) Main tracks	3.96	m	(13 feet)
(b) Main and siding tracks	4.27	m	(14 feet)
(c) Main or running tracks and parallel yard tracks	4.27	m	(14 feet)
(d) Yard tracks	4.11	m	(13 feet, 6 inches)
(e) Ladder and other tracks	4.57	m	(15 feet)
(f) Parallel ladder tracks	5.49	m	(18 feet)
(g) Freight shed tracks	3.66	m	(12 feet)
(h) Team tracks in pairs	3.66	m	(12 feet)
(i) Passenger station tracks without platform between	3.96	m	(13 feet)



CROSS SECTION AT STA 8+150

GO TRANSIT PROJECT NO. 06–9155

REFERENCE DRAWINGS		ISSUE			REVISIONS		
					P1	15/09/18	ISSUED FOR REVIEW
DWG NO.	TITLE	REV.	DATE	ISSUED FOR	REV.	DATE	

DRAWN BY: F.D. 15/08/29	DESIGNED BY: F.D. 15/08/04
CHECKED BY: J.P. 15/09/02	APPROVED BY: J.M. 15/09/04
SCALE: N.T.S. FULL SIZE ONLY	

CONSULTANT
Hatch Mott MacDonald

A Division of METROLINX

DAVENPORT DIAMOND
CONCEPT ALTERNATIVE 5
TUNNEL CROSS SECTION AND DETAILS
GO NEWMARKET SUB. MILE 4.51

CONTRACT NO.	DWG. NO.	REV.	SHEET
RQQ–2012–RF–068	345106–AU01–SK–076	P1	

Sep 18, 2015 - 2:02pm Login name: du31563
Drawing Name: P:\GO\243342\CAD\DWGS\sheets\Typ–Sections2_Tunnel Option.dwg

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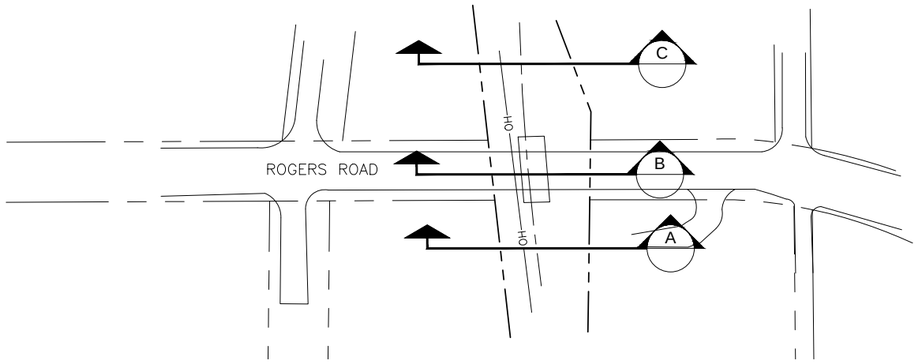
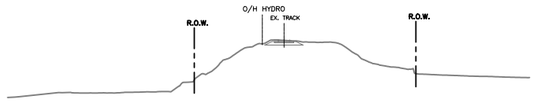
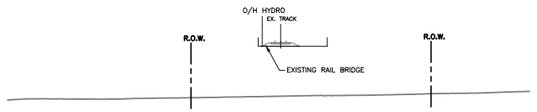
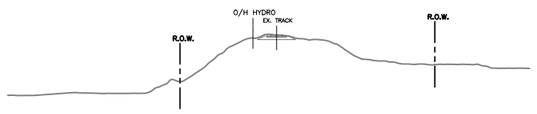




SECTION A



SECTION B



SECTION C

EXISTING

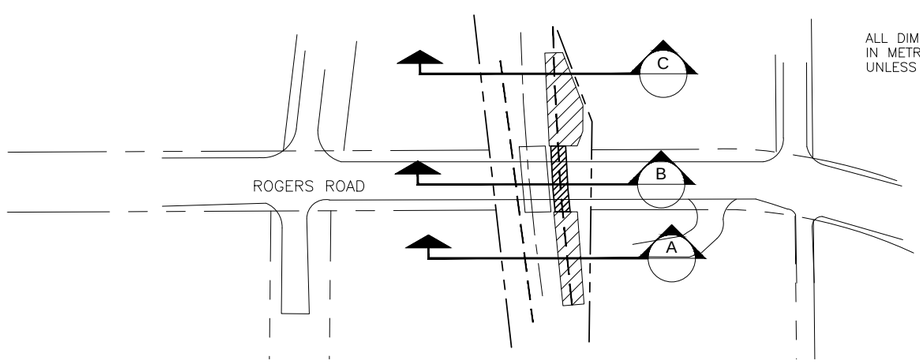
- RAIL BRIDGE OVER ROGERS ROAD FOR DOUBLE TRACKS
- ROGERS ROAD TWO WAY SINGLE TRAFFIC LANE, BICYCLE LANE, SIDEWALK ON EACH BOUND, AND EAST BOUND PARKING LANE
- OVERHEAD HYDRO LINE ALONG RAIL CORRIDOR
- OVERHEAD HYDRO LINE ALONG SOUTH SIDE ROGERS ROAD
- UNDERGROUND UTILITIES ALONG ROGERS ROAD

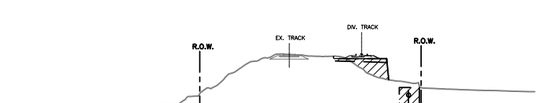
LEGEND

- METROLINX PROPERTY LINE
- EXISTING ROAD EDGE PAVMENT
- EXISTING BRIDGE
- OH — EXISTING OVERHEAD HYDRO
- STREET R.O.W.
- EXISTING TRACK

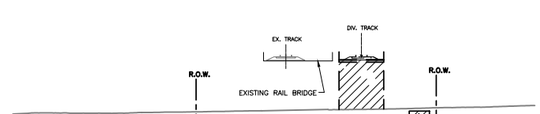
METRIC

ALL DIMENSIONS SHOWN ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.





SECTION A



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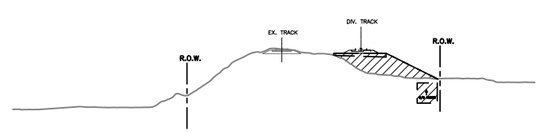

SECTION C

STAGE 1

- RELOCATE OVERHEAD HYDRO LINE AT RAIL CORRIDOR TO UNDERGROUND AS SPECIFIED
- REDUCE ROGERS ROAD TRAFFIC TO 2 LANE AND SIDEWALK ONLY (REMOVE PARKING AND CYCLING LANE)
- CONSTRUCT TEMPORARY DIVERSION TRACK BRIDGE CROSSING ROGERS ROAD
- CONSTRUCT EMBANKMENT FOR TEMPORARY DIVERSION TRACK INCLUDING RETAINING WALL
- INSTALL TEMPORARY DIVERSION TRACK

LEGEND

- METROLINX PROPERTY LINE
- EXISTING ROAD EDGE PAVMENT
- EXISTING BRIDGE
- OH — EXISTING OVERHEAD HYDRO
- STREET R.O.W.
- EXISTING TRACK
- UNDER CONSTRUCTION – AREA
- UNDER CONSTRUCTION – LINEAR

GO TRANSIT PROJECT NO. 06–9155

REFERENCE DRAWINGS		ISSUE			REVISIONS		
					P1	15/09/18	ISSUED FOR REVIEW
DWG NO.	TITLE	REV.	DATE	ISSUED FOR	REV.	DATE	

DRAWN BY: F.D. 15/08/29	DESIGNED BY: F.D. 15/08/04
CHECKED BY: J.P. 15/09/02	APPROVED BY: J.M. 15/09/04
SCALE: N.T.S. FULL SIZE ONLY	

CONSULTANT
Hatch Mott MacDonald

A Division of METROLINX

DAVENPORT DIAMOND
CONCEPT ALTERNATIVE 5
CONSTRUCTION STAGING PLAN 1 – ROGERS ROAD
GO NEWMARKET SUB. MILE 4.51

CONTRACT NO.	DWG. NO.	REV.	SHEET
RQQ–2012–RF–068	345106–AU01–SK–077	P1	

Sep 18 , 2015 , 1:18pm Login name: du31563
Drawing Name: P:\GO\243342\CAD\DWGS\sheets\Rogers Staging_Tunnel Option.dwg

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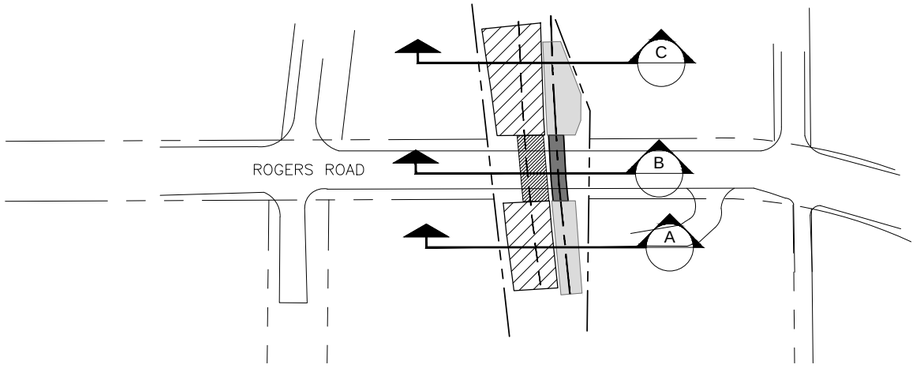

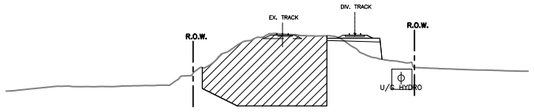

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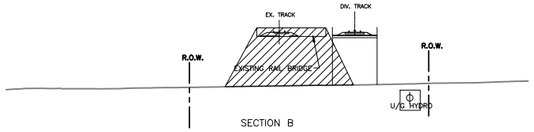

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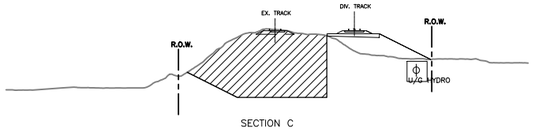


SECTION C

STAGE 2

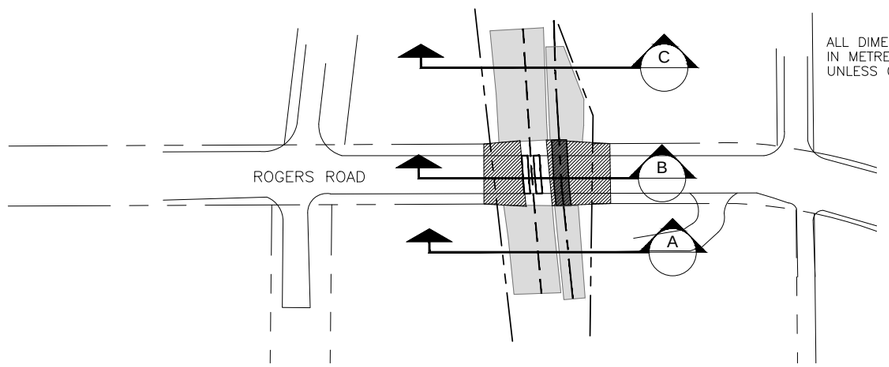
- TEMPORARY DIVERSION TRACK IN OPERATION, DECOMMISSION EXISTING TRACK
- REMOVE EXISTING TRACK
- DEMOLISH EXISTING RAIL BRIDGE
- CONSTRUCT OPEN CUT TRENCH, EXCAVATION AND PILING NORTH AND SOUTH OF ROGERS ROAD

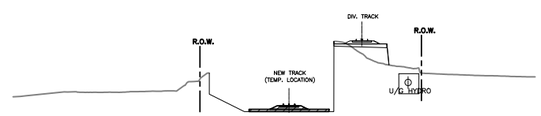
LEGEND

- METROLINX PROPERTY LINE
- EXISTING ROAD EDGE PAVMENT
- EXISTING BRIDGE
- STREET R.O.W.
- UNDER CONSTRUCTION – AREA
- CONSTRUCTION COMPLETED
- UNDER CONSTRUCTION – LINEAR
- TEMPORARY DIVERSION TRACK

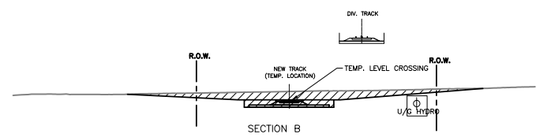
METRIC

ALL DIMENSIONS SHOWN ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.





SECTION A



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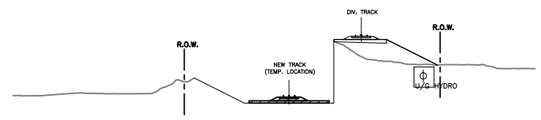

SECTION C

STAGE 3

- CONSTRUCT PERMANENT TRACK WORK
- INSTALL DOUBLE NEW TRACKS IN TRENCH, SINGLE TRACK ONLY THROUGH ROGERS ROAD AS TEMPORARY LOCATION
- RE–PROFILE ROGERS ROAD TEMPORARILY TO PERMANENT TRACK LEVEL
- INSTALL TEMPORARY LEVEL CROSSING AT ROGERS ROAD

LEGEND

- METROLINX PROPERTY LINE
- EXISTING ROAD EDGE PAVMENT
- STREET R.O.W.
- TEMPORARY DIVERSION TRACK
- UNDER CONSTRUCTION – AREA
- CONSTRUCTION COMPLETED
- UNDER CONSTRUCTION – LINEAR
- TEMPORARY LEVEL CROSSING

GO TRANSIT PROJECT NO. 06–9155

REFERENCE DRAWINGS		ISSUE			REVISIONS		
					P1	15/09/18	ISSUED FOR REVIEW
DWG NO.	TITLE	REV.	DATE	ISSUED FOR	REV.	DATE	

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CHECKED BY: J.P. 15/09/02	APPROVED BY: J.M. 15/09/04
SCALE: N.T.S. FULL SIZE ONLY	

CONSULTANT

Hatch Mott MacDonald

A Division of METROLINX

DAVENPORT DIAMOND

CONCEPT ALTERNATIVE 5

CONSTRUCTION STAGING PLAN 2 – ROGERS ROAD
GO NEWMARKET SUB. MILE 4.51

CONTRACT NO.	DWG. NO.	REV.	SHEET
RQQ–2012–RF–068	345106–AU01–SK–078	P1	

Sep 18 , 2015 , 1:18pm Login name: du31563
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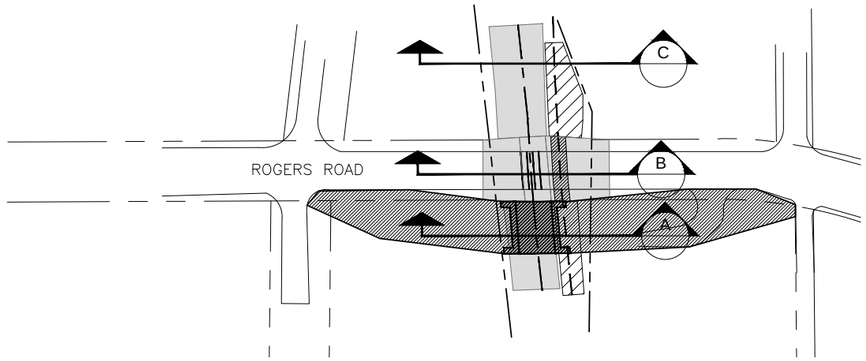
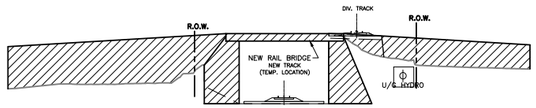
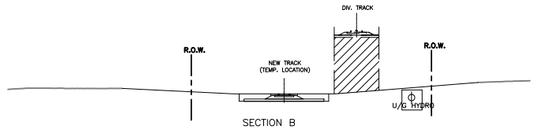
D SIZE 22" x 34" (558.8mm x 863.6mm)





SECTION A



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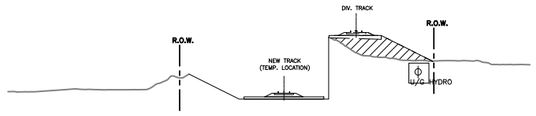


SECTION C

STAGE 4

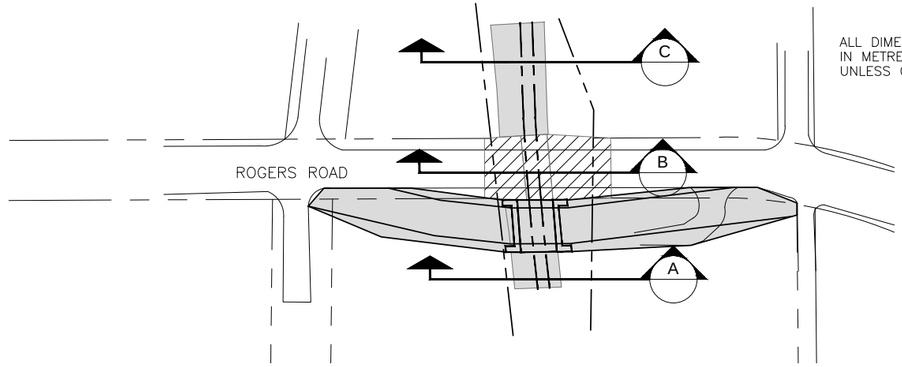
- CONSTRUCT NEW ROGERS BRIDGE WEST ABUTMENT
- DECOMMISSION TEMPORARY DIVERSION TRACK, NEW TRACK AT TEMPORARY LOCATION IN OPERATION
- REMOVE TEMPORARY DIVERSION TRACK
- REMOVE TEMPORARY WORKS TO REINSTATE SITE AS REQUIRED
- DEMOLISH TEMPORARY RAIL BRIDGE
- CONSTRUCT NEW ROGERS BRIDGE EAST ABUTMENT
- CONSTRUCT NEW ROGERS ROAD WORK INCLUDING GUIDE WAY STRUCTRUES, EMBANKMENT, GRADING AND UTILITIES
- CONSTRUCT NEW ROGERS BRIDGE SUPER STRUCTURE

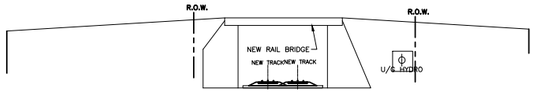
LEGEND

- METROLINX PROPERTY LINE
- EXISTING ROAD EDGE PAVMENT
- STREET R.O.W.
- UNDER CONSTRUCTION – AREA
- CONSTRUCTION COMPLETED
- TEMPORARY LEVEL CROSSING
- NEW TRACK
- UNDER CONSTRUCTION – LINEAR

METRIC

ALL DIMENSIONS SHOWN ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE NOTED.





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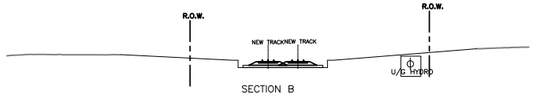

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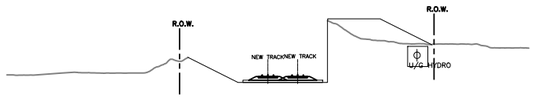

SECTION C

STAGE 5

- DECOMMISSION EXISTING ROGERS ROAD, TRAFFIC TO NEW ROGERS ROAD IN OPERATION
- REMOVE TEMPORARY LEVEL CROSSING
- SHIFT NEW TRACK FROM TEMPORARY LOCATION THROUGH ROGERS ROAD TO PERMANENT LOCATION
- INSTALL SECOND TRACK AS PERMANENT LOCATION THROUGH ROGERS ROAD
- REINSTATE OLD ROGERS ROAD WITH LEVEL CROSSING AS REQUIRED OR DEAD END ON EITHER SIDE OF NEW PERMANENT TRACKS

LEGEND

- METROLINX PROPERTY LINE
- EXISTING ROAD EDGE PAVMENT
- STREET R.O.W.
- UNDER CONSTRUCTION – AREA
- CONSTRUCTION COMPLETED
- NEW BRIDGE
- PERMANENT TRACK

GO TRANSIT PROJECT NO. 06–9155

REFERENCE DRAWINGS		ISSUE			REVISIONS		
					P1	15/09/18	ISSUED FOR REVIEW
DWG NO.	TITLE	REV.	DATE	ISSUED FOR	REV.	DATE	

DRAWN BY: F.D. 15/08/29	DESIGNED BY: F.D. 15/08/04
CHECKED BY: J.P. 15/09/02	APPROVED BY: J.M. 15/09/04
SCALE: N.T.S.	FULL SIZE ONLY

CONSULTANT

Hatch Mott MacDonald

A Division of METROLINX

DAVENPORT DIAMOND

CONCEPT ALTERNATIVE 5

CONSTRUCTION STAGING PLAN 3 – ROGERS ROAD
GO NEWMARKET SUB. MILE 4.51

CONTRACT NO.	DWG. NO.	REV.	SHEET
RQQ–2012–RF–068	345106–AU01–SK–079	P1	

Sep 18 , 2015 , 1:18pm Login name: du31563
Drawing Name: P:\GO\243342\CAD\DWGS\sheets\Rogers Staging_Tunnel Option.dwg

D SIZE 22" x 34" (558.8mm x 863.6mm)

METRIC

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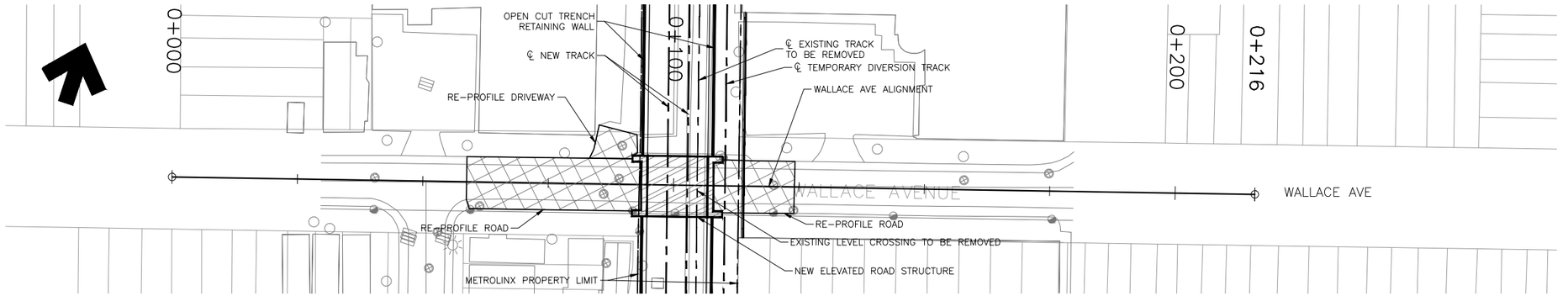
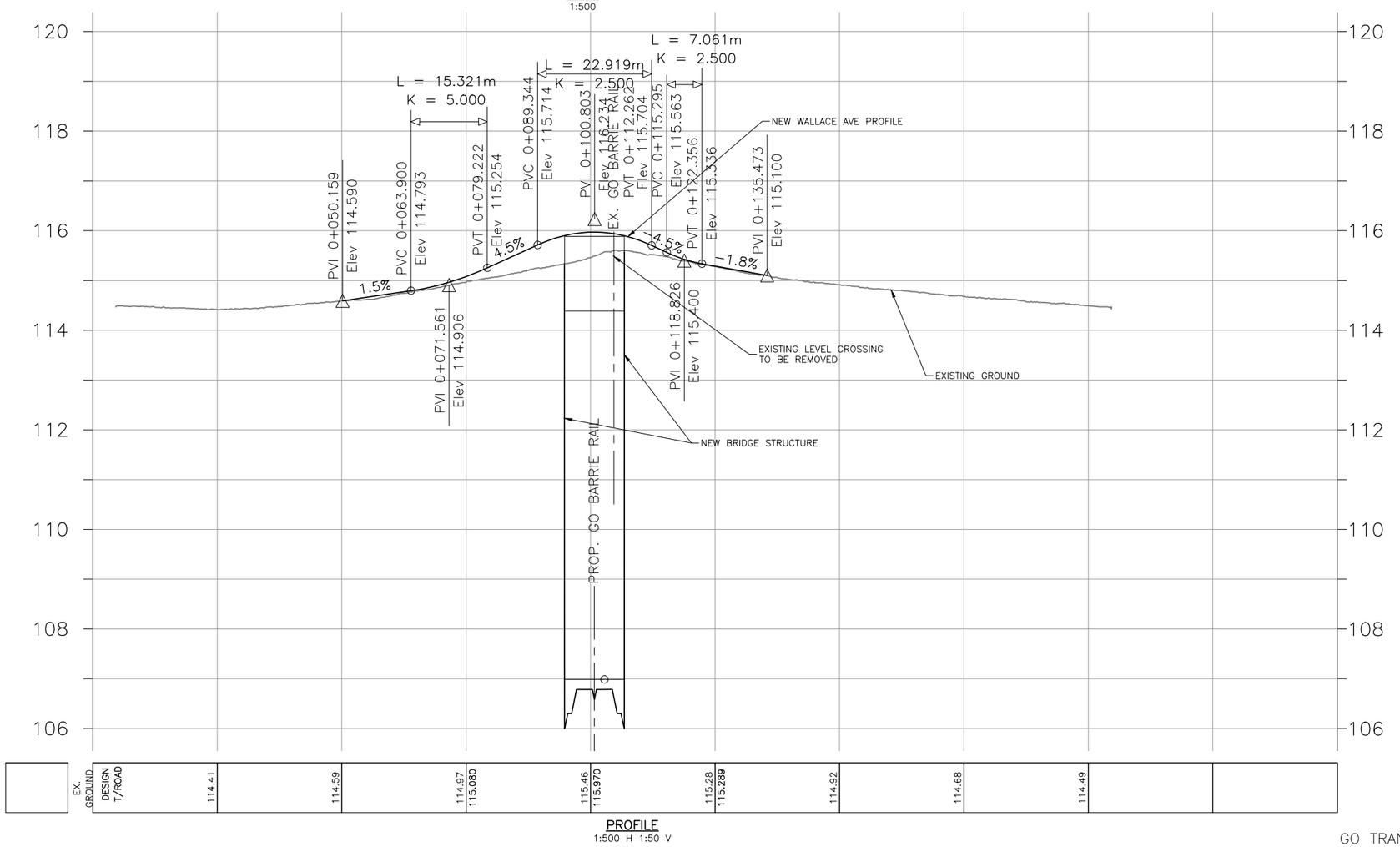


PLAN
1:500



PROFILE
1:500 H 1:50 V

GO TRANSIT PROJECT NO. 06-9155

REFERENCE DRAWINGS		ISSUE			REVISIONS		
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DWG NO.	TITLE	REV.	DATE	ISSUED FOR	REV.	DATE	

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CHECKED BY: J.P. 15/08/05	APPROVED BY: J.M. 15/08/10
SCALE: FULL SIZE ONLY	
AS SHOWN	

CONSULTANT
Hatch Mott MacDonald

A Division of METROLINX

DAVENPORT DIAMOND
CONCEPT ALTERNATIVE 5
PLAN AND PROFILE – NEW WALLACE AVE
GO NEWMARKET SUB. MILE 4.19

CONTRACT NO.	DWG. NO.	REV.	SHEET
RQQ-2012-RF-068	345106-AU01-SK-080	P1	

Sep 18, 2015 - 1:37pm Login name: du31563
Drawing Name: P:\GO\243342\CAD\DWGS\sheets\Road Plan and Profile_Tunnel Option.dwg

D SIZE 22" x 34" (558.8mm x 863.6mm)

METRIC

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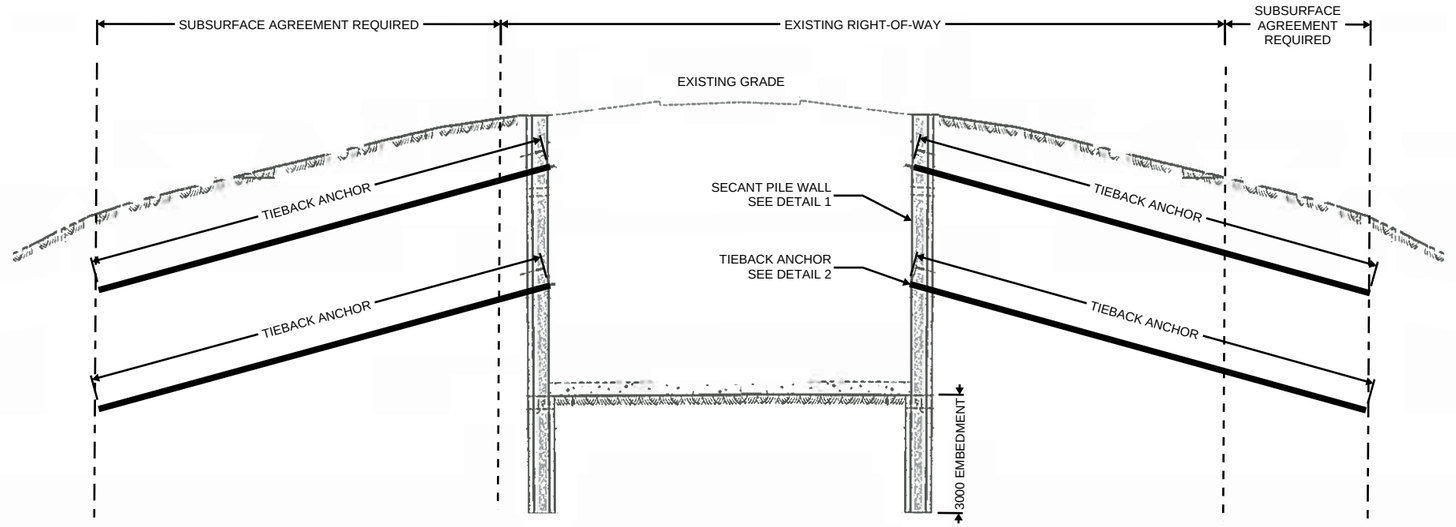
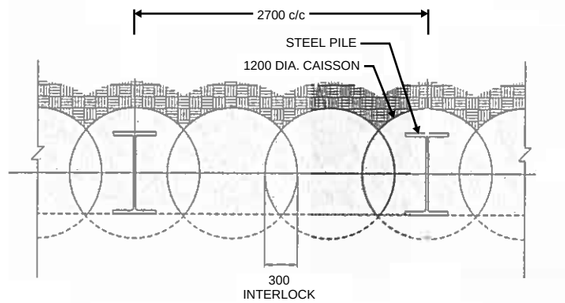
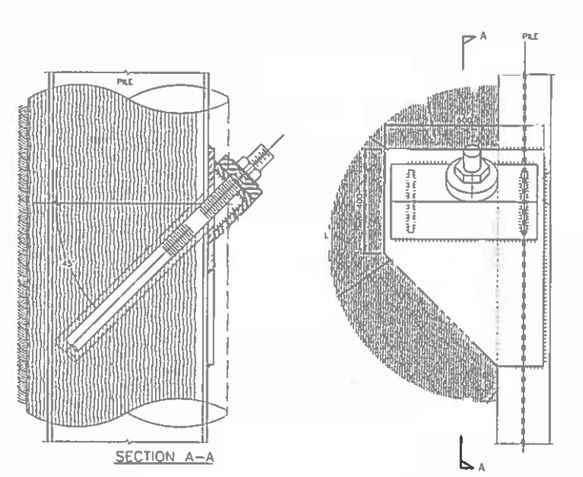
NOTE: SUPPORT OF EXCAVATION SKETCHES ARE FOR REFERENCE ONLY.



SUPPORT OF EXCAVATION PROFILE



DETAIL 1
TYPICAL SECANT PILE WALL SUPPORT OF EXCAVATION



DETAIL 2
TYPICAL TIEBACK CONNECTION DETAIL SUPPORT OF EXCAVATION

GO TRANSIT PROJECT NO. 06–9155

REFERENCE DRAWINGS		ISSUE			REVISIONS		
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DWG NO.	TITLE	REV.	DATE	ISSUED FOR	REV.	DATE	

DRAWN BY: F.D. 15/09/17	DESIGNED BY:
CHECKED BY: J.P. 15/09/17	APPROVED BY: J.M. 15/09/18
SCALE: N.T.S. FULL SIZE ONLY	

CONSULTANT
Hatch Mott MacDonald

A Division of METROLINX

DAVENPORT DIAMOND
CONCEPT ALTERNATIVE 5
OPEN CUT TRENCH SUPPORT OF EXCAVATION DETAIL
GO NEWMARKET SUB. MILE 4.51

CONTRACT NO.	DWG. NO.	REV.	SHEET
RQQ–2012–RF–068	345106–AU01–SK–081	P1	

Sep 17, 2015 - 6:01pmLogin name: du31563
Drawing Name: P:\GO\243342\CAD\DWGS\sheets\Trench Wall Detail_Tunnel Option.dwg

Appendix B

Tunnel Option Cost Estimate

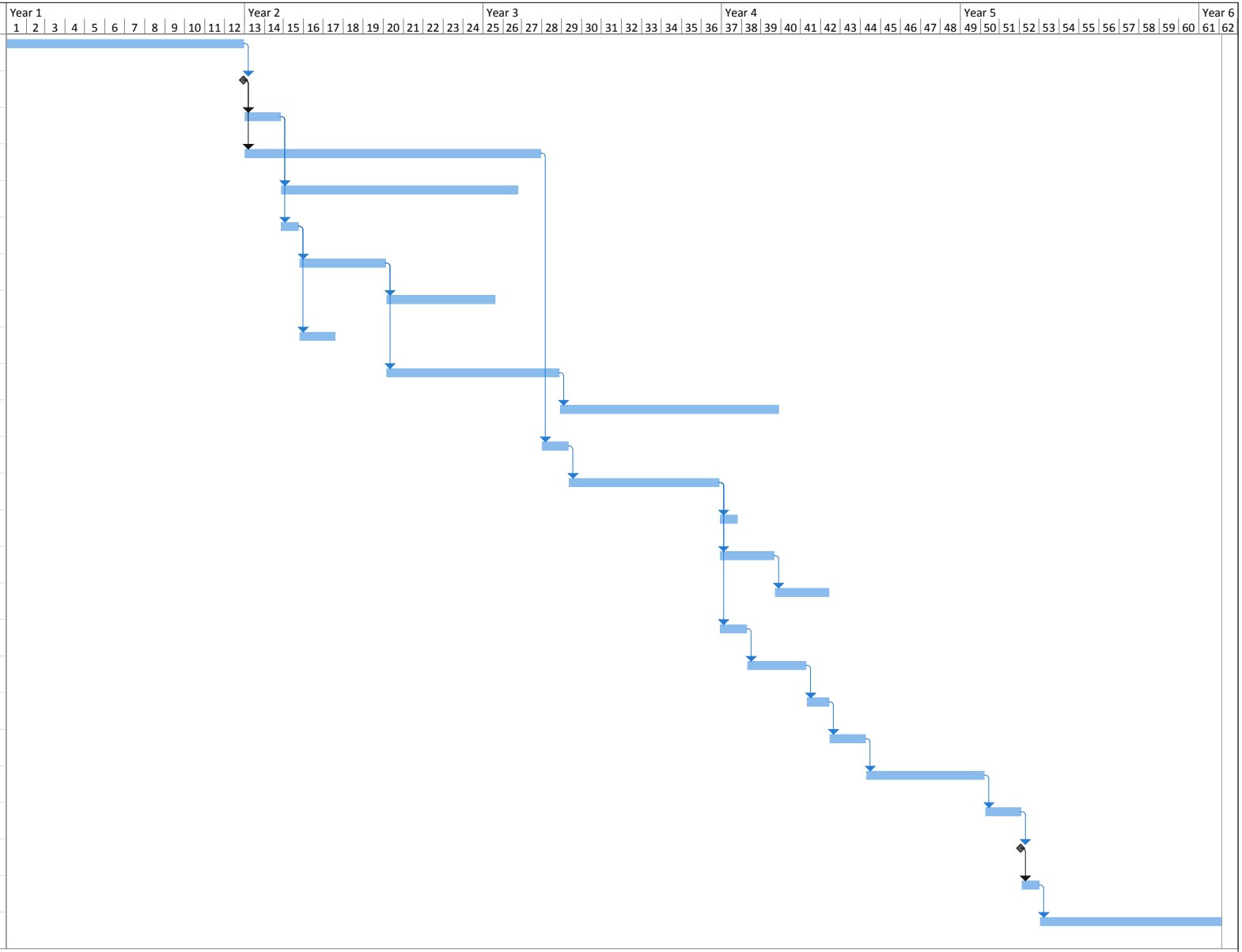
DAVENPORT DIAMOND GRADE SEPARATION
TUNNEL OPTION
Mi. 3.9 to 6.5 CN's NEWMARKET SUB UNDER CP'S NORTH TORONTO SUB
ORDER OF MAGNITUDE COST

Description	Cost ($)
Mobilization	6,160,000
Trackwork	19,327,315
Signals	1,971,200
Structures	160,623,071
Tunnel	133,794,951
Property	10,000,000
Contingency	227,250,456
Design and Engineering	67,000,000
Total	**626,126,993**

Appendix C

Tunnel Option Project Schedule

ID	Task Name	Duration
1	Design and Tender	260 days
2	NTP	0 days
3	Mobilisation	40 days
4	TBM Acquisition	325 days
5	Tunnel Lining Manufacture	260 days
6	Divert track (south)	20 days
7	Install secant piles (south)	95 days
8	Excavate (south)	120 days
9	Divert track (north)	40 days
10	Install secant piles (north)	190 days
11	Excavate (north)	240 days
12	Set up TBM	30 days
13	Tunnelling	165 days
14	Remove TBM	20 days
15	Construct portal (south)	60 days
16	Construct portal (north)	60 days
17	Tunnel clean up	30 days
18	Tunnel walkway	65 days
19	Tunnel subballast	25 days
20	Install permanent track	40 days
21	Install E/M	130 days
22	Install signals	40 days
23	Move trains to permanent track	0 days
24	Remove Diversion Track	20 days
25	Construct Rogers Road Bridge	200 days



Project: Davenport Tunnel
Date: Wed 9/23/15

Task Split Milestone Summary