Appendix B – Trillium Line EA Addendum Ellwood Diamond– VIA Line Grade Separation Alternatives Alignment Study







REPORT

# **Trillium Line Extension**

# Ellwood Diamond – VIA Line Grade Separation Alternatives Alignment Study

Ottawa, Ontario

Presented to:

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# 1. INTRODUCTION

The existing Trillium line alignment between Confederation and Greenboro stations crosses an east-west VIA single track alignment at-grade near Valuation Stationing 30+895 at what is known as the Ellwood Diamond. The Ellwood Diamond in its current configuration is shown in **Exhibit 1**.

Railway track crossings like the Ellwood Diamond commonly add mutual maintenance and operational concerns that tend to compound at progressive rates as traffic volumes increase.

As high maintenance locations, diamond crossings require more onerous inspections. Additional track, signal and vehicle maintenance activities include:

- rail build-up repair welding, grinding;
- the need for additional track surfacing and lining;
- additional track and rail fastening maintenance;
- additional track circuit signal maintenance;
- additional wheel maintenance to address tread impact wear; and
- potentially, additional vehicle suspension maintenance.

Operational concerns include:

- elevated noise and vibration from passing rolling stock;
- compromised passenger ride quality;
- train headway schedule conflicts;
- signal system malfunction and/or signal delay impacts to service; and
- potential signal system malfunction safety concerns.

The proposed expansion of the Trillium line is expected to increase the number of O-Train crossings with longer trains. In addition, VIA has previously indicated its near term intentions to move to more frequent service between Ottawa and Toronto using the route across the Ellwood Diamond.

The City recognizes the need to consider options related to eliminating the existing Ellwood Diamond railway crossing by grade separating the Trillium and VIA lines. The study that is the subject of this report investigates several different alignment options for conceptual layouts.



# 2. ALTERNATIVES AND APPROACH

#### 21 Alternatives Considered

Different alternatives were considered with the focus on making adjustments to the current horizontal and vertical alignment of the Trillium line. Variations in maximum approach grades used to develop the conceptual alignments resulted in the need to develop six (6) primary options as outlined below. The option naming convention developed during the study conception phase are defined below and used throughout this report.

# 2.1.1 O-Train (Trillium line) Over VIA.

Option 1A – The Trillium line goes over VIA with an overpass structure and approach grades that accommodate Freight train movements.

Option 1B – The Trillium line goes over VIA on the existing horizontal alignment with an overpass structure and approach grades that accommodate Diesel-Multiple-Unit (DMU) standards only with a regulatory exemption for Freight.

Option 1C – The Trillium line goes over VIA on a new horizontal alignment with an overpass structure and approach grades that accommodate DMU movements only with the Freight track remaining at-grade on the existing horizontal alignment.

# 2.1.2 O-Train (Trillium line) under VIA.

Option 2A - The Trillium line goes under VIA on the existing horizontal alignment with a tunnel structure and approach grades that accommodate Freight train movements.

Option 2B – The Trillium line goes under VIA on the existing horizontal alignment with a tunnel structure and approach grades that accommodate DMU movements only with a regulatory exemption for Freight.

Option 2C - The Trillium line goes under VIA on a new horizontal alignment with a tunnel structure and approach grades that accommodate DMU movements only with the Freight track remaining at grade on the existing horizontal alignment.

The relative short length of the north approach grade on the Trillium line (due to the proximity of the Bronson Ave overpass) have rendered Options 1A, 2A and 2B untenable. The proximity of the Trillium line Transitway and Sawmill Creek bridges to the south of the Ellwood diamond significantly increase the scope of work for the remainder of the primary options outlined in 2.1.1 and 2.1.2 above.

Additional conceptual alignments were investigated with proposed revisions to the existing alignment of the VIA Line through the Ellwood Diamond. The proposed adjustments to the VIA Line alignment involved considering lowering or raising the line along the existing horizontal alignment with maximum ascending/descending gradients of 2.5% that are each less than 250m in length. These additional options are described and named below.

# 2.1.3 O-Train (Trillium line) Over/Under a modified VIA alignment

Option 1D – The Trillium line follows the existing horizontal alignment and goes over a lowered VIA alignment with an overpass structure and approach grades that accommodate Freight and DMU train movements.

Option 1E - The Trillium line follows the existing horizontal alignment and goes over a lowered VIA alignment with an overpass structure and approach grades that accommodate DMU movements only with a regulatory exemption for Freight.

Option 2D - The Trillium line follows the existing horizontal alignment and goes under a raised VIA alignment with an underpass structure and approach grades that accommodate Freight and DMU train movements.

Option 2E - The Trillium line follows the existing horizontal alignment and goes under a raised VIA alignment with an underpass structure and approach grades that accommodate DMU movements only with a regulatory exemption for Freight.

# 2.2 Study Approach - Objectives and Limitations

This conceptual-level study for Trillium Line-VIA grade separations included staged approaches to design alternatives such that if an alternative became clearly untenable, further work on that alternative was curtailed.

Conceptual alignments that appeared to carry potentially viable options were further developed to establish the bases for comparison purposes.

The study was organized to consider additional operational and regulatory requirements as well as potential benefits. The study approach considers the different alternatives and makes recommendations related to preferred option(s) and a path forward for the City.

The concepts were developed to allow for potential future double track operations on both the Trillium Line and VIA Line and considering:

- a) General grading requirements;
- b) The footprint of developed structure/tunnel concepts clearance from the existing Transitway and Sawmill Creek structure footprints ;

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- c) Potential realignment of the Transitway if considered necessary for tunnel grade separation;
- d) Geotechnical implications;
- e) Regulatory implications;
- f) Implications of raising or lowering the VIA line as a preferred option;
- g) Discussions with VIA have not been initiated;
- h) Signal work requirements;
- i) Property implications;
- j) Constructability and Schedule; and
- k) Review of the 2005 North-South LRT and associated EA.

Environmental impacts of the recommended option will need to be assessed as part of the design development to determine if there are any environmental constraints. Associated mitigation measures as well as environmental permits and approvals will need to be determined.

The development of conceptual alignments and the subsequent options analyses presumes sufficient geotechnical information exists to preclude the need for a borehole program.

As intimated in section 2.1, there are significant differences between the design considerations of railway lines that are appropriate for Freight traffic and those that are suitable for the DMUs that currently operate on the Trillium Line.

In all cases, the Freight requirements exceed those required to operate DMUs with the following key design differences:

- a) Freight system design includes more restrictive maximum gradients, lengths of gradients, changes in gradients and require longer vertical curves. These requirements generally lead to the need for longer grade separation alignments;
- b) Freight system civil structure design considers significantly higher individual axle and consist loadings. These loadings generally require more significant track and civil structure depths;
- c) Freight system design includes larger vehicle clearance envelopes.

The VIA Line is considered equivalent to Freight and, for the options that include VIA Line carrying structures, the same design criteria has been applied.

The grade separation of the Trillium and VIA lines through the Ellwood Diamond is expected to bring operational and maintenance benefits alluded to in the introduction section. Only comments related to a very high level assessment of these benefits are included in this report.



# 3. OPTIONS NARRATIVES

# 3.1 Option 1A – Trillium Line over VIA – Freight and DMU

As discussed previously in section 2.1, the relatively short length of the north approach grade on the Trillium line (due to the proximity of the Bronson Ave overpass) renders Option 1A untenable. Consideration related to potentially raising the existing Bronson Ave. overpass as a path to creating a viable Freight-grade over existing VIA Line option was considered beyond the scope of the current study.

# 3.2 Option 1B – Trillium Line over VIA – DMU only

The conceptual alignment developed for Option 1B follows the existing horizontal alignment of the Trillium Line with a DMU-only negotiable gradient on an elevated guideway.

The conceptual structure design proposed for this alternative consists of a single span bridge, approximately 22.5m long, utilizing a steel I-girder superstructure with a concrete deck and ballasted track. The skew of this structure is approximately 56°, matching that of the existing VIA line beneath. Steel I-girders are most economical as they minimize the structural depth of the crossing. The new superstructure will be built on widened substructures that can accommodate a future dual track. As this option considers DMUonly traffic, the conceptual design only considered the Alstom Coradia LINT 41 design vehicle.

The new elevated structure spans the VIA alignment and includes additional spans for the Transitway and Sawmill Creek south of the VIA line crossing. Due to the raised profile of the Trillium Line, the existing Transitway and Sawmill Creek bridges would need to be demolished entirely and replaced by structures of similar span lengths, as any rehabilitation work done to the existing substructures to raise the bridge to the proposed grade would induce larger loads than the existing foundations can support. Retaining walls between each of these new structures will be constructed to support the additional fill required for the profile raise.

# 3.3 Option 1C – Trillium Line over VIA –DMU only; Freight at-grade

The conceptual alignment developed for Option 1C involves separate alignments for DMU and Freight. The proposed DMU-only horizontal and vertical alignment runs along the east side of the existing Trillium plan alignment over the VIA Line and closely resembles the alignment developed during the 2005 North-South study. While preserving the existing Trillium alignment for Freight service did not appear to be included in the earlier study, it is included in the conceptual alignment developed as part of Option 1C. The final configuration maintains the existing diamond crossing for potential future use by Trillium Line Freight traffic. The requirement to install new turnouts on each end of the proposed new separate alignment may result in a small reduction in the length of the passing siding near the south end of the new alignment. This will require further evaluation if it is selected as the preferred alternative.



The conceptual structure design for this alternative is similar to that developed for Option 1B, with a 22.5 m long single span steel I-girder superstructure with a concrete deck and ballasted track, and a skew angle of approximately 67°. As with Option 1B, the superstructure will be constructed on widened substructures to accommodate a future dual track.

As the Freight service will continue on the existing Trillium alignment, the existing Transitway and Sawmill Creek structures will remain in place. However, new structures over these crossings along the proposed DMU-only alignment will need to be constructed, with intermediate retaining walls to support the fill between the structures.

#### 3.4 Option 1D – Trillium Line over Lowered VIA - Freight and DMU

Option 1D was developed as a variation of primary Option 1A previously assessed as untenable. Option 1D considers following the original Trillium horizontal alignment with Freight-negotiable gradients carrying the Trillium Line over a lowered VIA Line. The existing structure constraints (Bronson Ave. overpass on the Trillium Line; and the Heron Ave. and Airport Parkway bridges on the VIA Line) ultimately limit the amount the two rail lines can be grade separated. The conceptual alignments developed for this option indicate that a feasible solution would require a relatively unique design of shallow track and bridge structure over the VIA Line.

The heavier live load associated with Freight service design suggests a steel throughgirder and floorbeam superstructure as a possible solution that would minimize structure depth, as well as be able to support the required loadings. The track system could either be a ballasted track bed or direct fixation type deck in order to meet the necessary clearance requirements. The conceptual level of design undertaken considered a similar structure width and length as described in Options 1B and 1C. The single span steel through girder structure would be 22.5m long with a skew angle of approximately 56°. As indicated in the previous alternatives, the superstructure shall be constructed on widened substructures to accommodate a future dual track superstructure.

This option would also likely require replacement of the existing Transitway and a portion of the Sawmill Creek structures to accommodate the elevation difference in existing and proposed profiles. Retaining wall structures will be used intermediately between the bridges to retain fill.

#### 3.5 Option 1E – Trillium Line over Lowered VIA – DMU only

Option 1E was developed as a variation of primary Option 1B previously assessed as tenable. Option 1E considers following the original Trillium horizontal alignment with DMU-only gradients carrying the Trillium Line over a lowered VIA line. The new elevated structure spans the VIA alignment and includes additional spans for the Transitway and Sawmill Creek south of the VIA line.

The conceptual structural design for this alternative is similar to Option 1B, but may accommodate a deeper superstructure depth due to the lowering of the VIA Line, if necessary. Like Option 1B, it consists of a single span steel I-girder structure with a



reinforced concrete deck and ballasted track supported on widened substructures to accommodate a future dual track.

Option 1E differs from Option 1B with its flatter Trillium Line approach grades (3.5% vs 5.0%) and ultimately a shorter overall construction length. As with Option 1D, the existing Transitway and a portion of the Sawmill Creek bridges would require complete replacement with intermediate retaining walls between them, in order to bring the structure up to proposed grade.

# 3.6 Option 2A – Trillium Line under VIA - Freight and DMU

As discussed previously in section 2.1, the relatively short length of the north approach grade on the Trillium line (due to the proximity of Confederation Station and the Bronson Ave. Overpass) precludes the development of a Freight negotiable gradient and renders Option 2A untenable.

# 3.7 Option 2B – Trillium Line under VIA – DMU only

The conceptual plan for Option 2B follows the existing horizontal alignment of the Trillium Line with DMU-only negotiable gradients carrying the Trillium Line through a tunnel under the existing VIA Line.

The conceptual Trillium Line alignment is complicated by the proximity and existing grade of the Transitway and Sawmill Creek to the south. Both the VIA Line and the Transitway are required to cross over the proposed tunnel in this option. The Transitway runs east and south from the existing Trillium Line Bridge and is effectively constrained by its own bridges over Heron Road and Sawmill Creek. The conceptual layout of the Transitway includes moving it closer to the VIA Line to reduce the length and depth of the tunnel structure that would otherwise be required. The existing Transitway profile's sag curve is effectively converted to a crest curve in this conceptual layout. The conceptual level profile developed for this alternative includes modifications to the Sawmill Creek bridge profile that potentially have both environmental and structural implications. Conceptual level design requires this bridge to be replaced.

The underground portion of the Trillium alignment for Option 2B is approximately 420 metres long consisting of a 205 metre north portal retaining structure, 118 metre south portal structure and a 97 metre double cell box passing under the existing VIA tracks. Relocating the Transitway approximately 50 metres north closer to the VIA track alignment allows for a shorter tunnel length. The south portal approach to the Sawmill Creek bridge is only partially in retained cut since the existing Transitway elevation is located below the bottom of portal slab elevation, requiring fill material to provide the required grade until the alignment enters the southern Transitway embankment. The tunnel height provides 5.4m of clearance from top of rail to underside of roof slab to facilitate DMU vehicles only. The deepest portion of the tunnel is approximately 7 metres below original grade with the tunnel roof supporting roughly 14 metre long sections of the existing VIA tracks and the relocated Transitway.

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The construction of the underground alignment considers cut and cover methods using a secant pile wall for temporary earth support and temporary groundwater cut off, mitigating the need for intensive groundwater dewatering. Mining under the VIA tracks with ground treatment was considered too risky and expensive for this short reach of tunnel and the size of the double box section precluded installation of precast segments using jacking methods. The double box section and U-Section retaining structure for the portals will be cast-in place reinforced concrete with a sheet waterproofing membrane applied to the outside face of the structure. The double cell box and portal widths are sized to protect for future dual tracks with an interior baffle wall in the tunnel isolating the tracks. NFPA 130 requires an engineering analysis to determine the need for emergency mechanical ventilation in underground trainways longer than 61 metres and shorter than 305 metres. The study conservatively assumed that mechanical ventilation is necessary for the tunnel, with 2 jet fans located in each cell at the north and south portal entrances to the tunnel resulting in a total of 8 jet fans. Two pairs of jet fans were assumed in each cell to provide ventilation redundancy in the event one pair of fans at a portal are disabled during the emergency incident. These fans can also be used to ventilate diesel exhaust from the DMU's. A pump station is also required at the low point of the tunnel to collect surface runoff from the portals.

# 3.8 Option 2C – Trillium Line under VIA – DMU only; Freight at-grade

The conceptual plan for Option 2C is based on developing a new (under VIA) alignment for DMU traffic while maintaining the existing Trillium Line alignment through the Ellwood Diamond for Freight service. The proximity and elevation of the Transitway and Sawmill Creek to the south of the diamond suggests only two different approaches as tenable, with the new DMU alignment on either the west or east side. The new alignments would need to be positioned at least 150m from the Trillium Line to accommodate a tenable Transitway profile. The length of the tunnel structure associated with either of these two conceptual alignment approaches was estimated to be too high to warrant further investigation.

# 3.9 Option 2D – Trillium Line under Raised VIA – Freight and DMU

Option 2D was developed as a variation of primary Option 2A previously assessed as untenable. Option 2D considers following the original Trillium horizontal alignment with Freight-negotiable gradients carrying the Trillium Line under a raised VIA Line. The structure constraints (Bronson Ave. overpass pile caps on the Trillium Line; and the Heron Ave. and Transitway Bridges on the VIA Line) ultimately limit the amount the two rail lines can be grade separated and the need for a shallow track and tunnel roof structure.

The conceptual Trillium Line alignment is further complicated by the proximity and existing grade of the Transitway and Sawmill Creek to the south. Both the VIA Line and the Transitway are required to cross over the proposed tunnel in this option. The Transitway runs east and south from the existing Trillium Line Bridge and is effectively constrained by its own bridges over Heron Road and Sawmill Creek. The conceptual layout of the Transitway includes moving it closer to the VIA Line to reduce the length and depth of the tunnel structure that would otherwise be required. The existing





Transitway profile's sag curve is effectively converted to a crest curve in this conceptual layout. The conceptual level profile developed for this alternative includes modifications to the Sawmill Creek bridge profile that potentially have both environmental and structural implications. Conceptual level design requires this bridge to be replaced.

The underground portion of the Trillium alignment for Option 2D is approximately 420 metres long consisting of a 200 metre north portal retaining structure, 118 metre south portal structure and a 102 metre double cell box passing under the raised VIA tracks. Relocating the Transitway approximately 50 metres north closer to the VIA track alignment allows for a shorter tunnel length. The south portal approach to the Sawmill Creek bridge is only partially in retained cut since the existing Transitway elevation is located below the bottom of portal slab elevation, requiring fill material to provide the required grade until the alignment enters the southern Transitway embankment. The tunnel height provides 7m of clearance from top of rail to underside of roof slab to facilitate freight traffic. The deepest portion of the tunnel is approximately 6 metres below original grade with approximately 1.3 metres of cover between tunnel roof and the raised VIA tracks.

The construction of the underground alignment considers cut and cover methods using a secant pile wall for temporary earth support and temporary groundwater cut off, mitigating the need for intensive groundwater dewatering. Mining under the VIA tracks with ground treatment was considered too risky and expensive for this short reach of tunnel and the size of the double box section precluded installation of precast segments using jacking methods. The double box section and U-Section retaining structure for the portals will be cast-in place reinforced concrete with a sheet waterproofing membrane applied to the outside face of the structure. The double cell box and portal widths are sized to protect for future dual tracks with an interior baffle wall in the tunnel isolating the tracks. NFPA 130 requires an engineering analysis to determine the need for an emergency mechanical ventilation in underground trainways longer than 61 metres and shorter than 305 metres. The study conservatively assumed that mechanical ventilation is necessary for the tunnel, with 2 jet fans located in each cell at the north and south portal entrances to the tunnel resulting in a total of 8 jet fans. Two pairs of jet fans were assumed in each cell to provide ventilation redundancy in the event one pair of fans at a portal are disabled during an emergency incident. These fans can also be used to ventilate diesel exhaust from the DMU's. A pump station is also required at the low point of the tunnel to collect surface runoff from the portals.

# 3.10 Option 2E – Trillium Line under Raised VIA – DMU only.

Option 2E was initially conceived as a variation of primary Option 2B initially assessed as untenable. Further design work on Option 2B resulted in a tenable solution. Option 2E considers following the original Trillium horizontal alignment with DMU only gradients carrying the Trillium Line under a raised VIA Line. The structure constraints (Heron Ave. and Airport Parkway Bridges on the VIA Line) ultimately limit the amount the two rail lines can be grade separated. The conceptual Trillium Line alignment is further complicated by the proximity and existing grade of the Transitway and Sawmill Creek to the south. Both the VIA Line and the Transitway are required to cross the proposed tunnel in this Option. The Transitway runs east and south and is effectively constrained by its bridges over Heron Road and Sawmill Creek.



Option 2E includes VIA Line grading work that is not required with Option 2B.

# 4. GEOTECHNICAL AND ENVIRONMENTAL IMPLICATIONS

# 4.1 Geotechnical

Available borehole sheets from historic geotechnical investigation in the area along the existing rail transit about 0.3 km to 0.5 km southwest of the intersection of Bronson Avenue and Heron Road was reviewed.

At the existing VIA crossing, two historic boreholes in this vicinity were considered. The general subsurface conditions consist of silty clay of some 33 m thick underlain by 4 m of glacial till over shale bedrock. The first 3 m to 4 m of the silty clay appears to be a weathered crust. The silty clay is firm to stiff in consistency and sensitivity up to 25. The silty clay contains organics and silt or sand seams and become siltier at the bottom near the glacial till. Glacial till range from dense to very dense and contains cobbles and boulders. Bedrock was encountered at about 38 m below ground surface. Rock quality appears to be good based on RQD results. However, Rock strength was not assessed at the time of this investigation.

At the existing rail carrying bridge over the Transitway about 70 m southeast of the existing VIA crossing, two historic boreholes in this vicinity were considered. Based on the borehole information, about 1 m of sand and gravel fill was encountered over silty clay of some 29 m thick underlain by 2 m to 3 m of sandy silt to silty sand over 10 m of glacial till over shale bedrock. The first 2 m to 4 m of the silty clay appears to be a weathered crust. The silty clay is firm to stiff in consistency with sensitivity up to 17. The silty clay contains organics. Glacial till ranges from loose to compact and contains occasional cobbles. Bedrock was encountered at about 37 m to 42 m below ground surface. Rock quality appears to be very poor to poor based on RQD results. However, Rock strength was not assessed at the time of this investigation.

At the existing rail carrying bridge over Sawmill Creek, two historic boreholes in this vicinity were considered. Based on the borehole information, about 2 m of sand and gravel fill was encountered below the existing track ballast elevation over 6 m of silty clay fill and some 20 m of silty clay underlain by 3 m to 4 m of fine sand to silty sand over 4 m to 8 m of glacial till over shale bedrock. The first 1 m to 2 m of the silty clay was weathered crust. The silty clay fill is soft to firm in and the silty clay is firm to stiff in consistency and sensitivity up to 17. The silty clay contains organics and clayey silt seams. Sand to silty sand is loose to dense in consistency. Glacial till range from dense to very dense and contains cobbles and boulders. Bedrock was encountered at about 34 m to 38 m below ground surface. Rock quality appears to be very poor to good based on RQD results. However, rock strength was not assessed at the time of this investigation. The first 1 m of bedrock was highly weathered.

Water level was reported at a depth of less than 1 m.



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Fill placement should be limited to 2 m based on a 50 m wide embankment. Fill placement in excess of 2 m will induce significant settlement. Light weight fill may be used if a grade raise of more than 2 m is required.

For preliminary guidance, spread footings appear to be a feasible option for supporting retaining structures, underpass tunnel or bridge retaining walls, depending on applied loads and confirming fill stability. The spread footing could be found on native silty clay or weathered crust. Silty clay consistency is nearly constant with depth, thus resistance gain with depth may be negligible.

However, spread footings may not be practical for the Sawmill Creek Bridge site due to the presence of 6 m of silty clay fill. Fill materials beneath the footings should be replaced and compacted. Therefore, deep excavations are anticipated for this site due to the anticipated removal of existing fill and replacement with properly compacted clean materials.

Alternatively, deep foundation, using steel H-Piles (310x110), could be considered for bridges and underpass tunnel structures. Practical refusal may be achieved on glacial till due to the obstruction of boulders or on sound bedrock surface past the weathered soft portion, subject to the confirmation of supplementary geotechnical investigation.

# 4.2 Environmental

An environmental impact assessment was not completed for this initial study assessing the feasibility of various Trillium Line and VIA Rail alignments at the Elwood Diamond. It must be noted however that two of the options presented, i.e. Options 2B and 2D, may have an impact on the waterway opening under the Trillium Sawmill Creek Bridge to the south of the Diamond as described in more detail below. This will need to be assessed further as the short list of options are further investigated with VIA, additional design work is undertaken and a preferred option has been selected.

Option 2B conceptual alignment, consisting of the Trillium Line under VIA for DMU only loading, may require the top of rail on the north end of the existing structure to be lowered by up to 2m. This would be offset slightly by the DMU only designed superstructure which would likely not be as deep as the current structure however the result would still be a smaller waterway opening.

Option 2D conceptual alignment, consisting of the Trillium Line under VIA for freight and DMU loading, may require the top of rail on the north end of the existing structure to be lowered by up to 0.5m. The superstructure depth for this design is expected to be comparable to the current structure that exists today.

# 5. OPERATIONAL AND REGULATORY REQUIREMENTS

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# 5.1 Ellwood Diamond Operations

The Ellwood Diamond is part of the Ellwood Interlocking. The interlocking is essentially defined as the limits of the two crossing track sections that are bound by wayside opposing signals. Signals 23 and 28 are the interlocking limits on the Trillium Line and are ~460m apart. Signals 35 and 36 represent the interlocking limits on the VIA Line and are ~110m apart. The signals govern movements by traffic through the interlocking ensuring there are no conflicts. It is important to also appreciate that the track sections to the next signals outside of the interlocking signals (approach blocks) are also affected by the interlocking. The interlocking with all of its signals on both the Trillium and VIA Lines is remotely controlled and operated as automatic.

Interlockings, as a rule, must be controlled by a single operator. The City, through its designated third party rail traffic controller, remotely dispatches and operates the Ellwood Interlocking. While the interlocking is operated on a first-come first-served basis, the agreement also provides for a longer interlocking signal approach block that favours the VIA Line. The preference for longer signal approach blocks on the VIA Line is almost certainly related to the higher operating speeds and longer stopping distances associated with VIA trains.

# 5.2 Transport Canada

Capital Railway operates the existing Trillium line service on the Ellwood Subdivision between Greenboro and Bayview Stations and, as a federal railway, is subject to Transport Canada regulations. The only non-DMU traffic that operates on the Ellwood Subdivision today runs between Walkley Yard and the south limit of the current track system between Lester and Leitrim roads. The service between Walkley Yard and the National Research Council (NRC) facility at 2320 Lester Road involves the relatively infrequent shuttling of freight cars by a CN Locomotive (local switcher). Importantly, the existing current Freight operation on the Trillium Line does not traverse the section of the Ellwood Subdivision that is the subject of this report. The Transport Canada regulations require that the Trillium Line maintain its ability to accommodate Freight service on the portion of the Ellwood Subdivision that includes the Ellwood diamond.

As outlined in Section 2, Freight design criteria generally leads to less economical grade separation alignment and structure designs than required to accommodate DMU traffic. For this reason, options were considered that would preclude having Freight service operate on the Trillium Line through the proposed grade separations; four options precluded Freight service altogether while another two options considered preserving the existing at-grade crossing for Freight only. Four additional options were considered that would permit Freight and DMU to share the same track of the new grade separation alignments. The conceptual design work that was undertaken as part of this study reduced the total number of tenable options from ten to six, with half of those precluding Freight service.

Three of the four alignment options considered that preclude Freight service operating on the Trillium Line through the Ellwood Diamond require the City to apply to Transport Canada and the Canada Transportation Agency for an exemption in this regard. As

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these discussions have not been formally initiated with the federal authorities, the likelihood of this application proving successful and the associated length of time required to conclude the process are not known.

#### 5.3 **Canadian Pacific and Canadian National**

The City purchased the "Ellwood Diamond Lands" from CP and the St. Lawrence and Ottawa Railway Company under an agreement that was signed March 21, 2005 that is referred to as the "City-CP Agreement". Under this agreement, the City also assumed CP obligations for the continued operation and maintenance of the Interlocking and Diamond.

The City-CP Agreement includes the City's agreement to ensure that VIA, CN and CP continue, in perpetuity, to have common crossing rights at the Ellwood Diamond Lands at all times, including without limitation, in the event of termination of the Agreement or if the City constructs a grade separation crossing. The grade separations that are the subject of this report ensure that those crossings rights are preserved.

VIA operations across the Ellwood Diamond are considered in section 4.4.

The CN currently has a separate track to the south of the Ellwood Diamond that also crosses the Trillium Line at what is known as the Walkley Diamond. To be clear, the Walkley Diamond is not part of or at all related to the Ellwood Diamond Lands discussed in other sections in this report. Today, the numbers of movements of non-Trillium line traffic across the Walkley Diamond is considerably less than the number of movements across the Ellwood Diamond.

#### 5.4 VIA Rail

VIA currently operates 9 (nine) trains in each direction on weekdays and 6-7 trains in each direction on weekends that cross the Ellwood Diamond.

The City-CP Agreement discussed in 4.3 has the most significant implications on current VIA Line operations. In addition to the current operating arrangements and the City's obligation to preserve common crossing rights described in the previous sections, the City-CP Agreement also addresses maintenance. Ellwood Interlocking signals and track maintenance limits do not coincide and are considered separately.

VIA is responsible for maintaining, repairing, replacing and upgrading their respective interlocking signals located on their line (further described in 4.1) in order to comply with all applicable standards and guidelines for signal works. Costs associated with interlocking signal testing, maintenance, repair, replacement and upgrade are required to be equally shared between the City and VIA.

The City is responsible for the inspection, maintenance, repair and replacement of the Ellwood Diamond track infrastructure to ensure a minimum crossing operating speed of 35 mph. The portions of track outside of the actual diamond crossing are to be maintained by the respective railways.



Clearly, VIA stands to benefit from any of the grade separations proposed as part of this study. The options that completely eliminate the Ellwood Interlocking should offer VIA the greatest operations and maintenance benefits. Furthermore, the options which preclude the need to make adjustments to the VIA Line profile are likely to be preferred by VIA. All of the options considered in this report will obviously require construction work coordination that is likely to have some level of service disruption. Service disruptions envisioned at this early stage are likely to include temporary shoefly alignments and work zone speed restrictions that would not require VIA Line service to be suspended.

Three of the six options developed as part of this report require adjustments to be made to the existing VIA Line profile; one of the options requires the profile to be lowered to go under a Trillium Line structure and two require the VIA Line profile be raised. Of the three options that don't require adjustments to the VIA Line profile, two do not eliminate the Ellwood Interlocking. Option 1B is the only alternative that does not require an adjustment be made to the VIA Line profile and, with the appropriate Transport Canada exemption, eliminates the need for the Ellwood Interlocking.

As outlined in Section 2, the design criteria applied to the VIA Line are the same as those as applied to maintain Freight service.

Discussions with VIA have been initiated. The following conditions are required as part of this project. Additional information including special provisions, insurance and flagging costs can be found in Appendix A.

- 1. No train cancellation on the VIA line will be permitted.
- 2. If the VIA Rail track is to be modified in alignment and/or grade, the maximum grade shall be 2% and the new alignment shall permit a track speed of 60 MPH with a 4" unbalance equipment.
- 3. Any change to the track or diamond shall not increase the trip time along VIA from the current condition once the project has been completed.
- 4. Any modification to the CTC system shall keep priority to VIA Rail route.
- 5. If the diamond is to be modified, the minimum track speed over the diamond shall remain 35 MPH, or greater.
- 6. The Contractor shall be responsible for locating and protecting the utilities during construction, if required. There are fiber optic lines running on both sides of track in the vicinity of the diamond.
- 7. The City or Contractor shall communicate ahead of time all activities which would disturb nearby residents and manage any resident complaints.
- 8. If the VIA track is re-aligned, the use of a dynamic stabilizer is required in order to reduce the extent of the temporary slow order.



- 9. Inside of the working VIA Rail schedule, there may be some small work blocks of 20 minutes to 2 hours available for work to be performed. All trains stop running around 23:00 PM, at which time work may be performed until reopening of the lines (05:30 AM Mon.-Fri., 06:45 AM Sat., and 09:15 AM Sun.). Note that the last train may be late and arrive later than the stated 23:00 PM.
- 10. Special Provisions provided by VIA Rail (in Appendix A) must be taken into account within the project Right-of-Way.

# 5.5 Environmental Assessments

In 2005, the City of Ottawa completed both an individual provincial Environmental Assessment Report and a federal CEAA Screening Report for the Ottawa North-South Corridor LRT Project. Approval was received for the EAs in 2006. The Recommended Plan included a grade separation at the Ellwood Diamond to carry the LRT tracks over VIA tracks. The bridge proposed for the LRT was a 15 m single span structure with associated 2x315 m retaining walls. This plan for the Ellwood Diamond also required crossings over the Southeast Transitway and Sawmill Creek. The North-South Corridor LRT Project was never constructed.

In 2016, the City of Ottawa completed a provincial Planning and Environmental Assessment Study documented in an Environmental Project Report (EPR), in accordance with O.Reg. 231/08, for the Trillium Line Extension. This EPR was limited to an extension of the existing diesel-powered Trillium main-line from its current terminus at Greenboro Station to a new terminus near Bowesville Road with a link to the Ottawa MacDonald-Cartier International Airport. The main-line extension followed the corridor approved in the N-S LRT EA. It did not however include a grade separation of the Ellwood Diamond.

A grade separation at the Ellwood Diamond would be considered a change to the project as described in the Trillium Line Extension EPR. In order to implement such a change, the recommended option would need to be assessed to determine if the change is significant or not and an addendum prepared to the EPR to document the change, impacts and mitigation measures. If the change is significant, public notification is required in accordance with O.Reg. 231/08; if not significant, no public notification is required.

Any of the options that require the issuance of a federal permit or approval, may be subject to a CEAA 2012 Section 67 determination. When consulting with federal authorities such as VIA Rail, Transport Canada and the Canada Transportation Agency discussion of their requirements under CEAA 2012 should be included to determine whether a Section 67 environmental effects evaluation is required.

# 6. OPERATIONS AND MAINTENANCE BENEFITS

The introduction section provides a list of the maintenance and operations benefits that are expected to be derived from a grade separation of the Trillium and VIA lines. And, while all of the viable options presented in this report offer benefits, clearly the options



that completely eliminate the need for a diamond crossing offer the most significant benefits.

The Ellwood Interlocking represents a complex part of both the Trillium Line and VIA Line infrastructure and signal system. And while the maintenance and potential for service disruptions and interruptions increases with higher levels of service, the complexity of the system is unchanged even with a very low level of service. Two of the options considered in this study look at maintaining the existing Ellwood Diamond and the interlocking for Freight service. And while today there is no Freight service operating on the Trillium Line through the Ellwood Interlocking, this portion of the line would essentially be preserved for Freight traffic that could materialize in the future.

Freight railways with diamond crossings that have very infrequent service often replace conventional diamonds with specialized units referred to as "One-Way Low Speed" (OWLS) or Jump Frog crossings. OWLS and Jump-Frog crossings provide for higher speeds (in this case along VIA's route) with generally lower impacts and subsequently, lower maintenance requirements. The Freight route along the Trillium Line would need to be reduced to the speeds authorized by the Special Trackwork Supplier (typically less than 10 mph).

In the event Freight service is not anticipated through the Ellwood diamond for a period of more than 12 months, additional measures may be considered. With a notice period of between 1-3 months (season dependent) prior to the commencement of Freight service on the Trillium Line, consideration could be given to straight-railing the diamond crossing. The signaling system for the interlocking would be preserved but the crossing diamond portion of the track infrastructure would be removed and staged for reinstallation. This approach would effectively preserve the Freight service route but replace ongoing diamond inspections and maintenance with associated diamond installation works.

# 7. OPTIONS ANALYSES AND RECOMMENDATIONS

# 7.1 Analyses Commentary

The conceptual alignments developed for Options 1B,1D, 1E, 2B and 2D included in this report purposely follow the existing Trillium Line tangent horizontal alignment in an effort to develop proposed alignments that minimize grading and construction work and maximize operating and maintenance efficiencies. Only Options 1C and 2C consider introducing a new horizontal alignment to effectively create separate DMU and Freight tracks.

The conceptual vertical alignments developed for all of the options are based on existing corridor constraints as well as the different limits that are appropriate for the traffic concerned.

While the level of conceptual design undertaken as part of this report is sufficient to develop alignments and operational concerns for each of the options considered, the alignments and level of design investigation should not be perceived as optimal. In



addition, economies and/or unforeseen costs that could be derived from further evaluating any of the options presented in this report are considered beyond the current scope.

Potential value engineering opportunities that may be worth further exploration and/or development include:

- Investigating opportunities to salvage portions of existing Freight Line design Transitway and/or Sawmill Creek substructures for new DMU only design superstructures (Options 1B, 1E, 2B);
- 2. Consideration of more shallow depth track and bridge or tunnel superstructures for DMU-only traffic designs (Options 1B,1E, 2B);
- 3. Consideration of alternative tunneling construction methods to conventional Cut & Cover methods (Options 2B, 2D);
- 4. The use of bridge structures to carry VIA and the Transitway over the Trillium Line as more economical alternatives to tunnels considered in this study (Options 2B, 2D);
- 5. Consideration of a Transitway alternative alignment (bypass) that does not require a tunnel structure and the associated grading and roadwork (Options 2B, 2D);

# 7.2 Recommendations

While cost is a major factor, the additional considerations included in this analyses involve the potential implications of the operational and regulatory requirements and the potential benefits alluded to in Sections 4 and 5, respectively. While the conceptual alignments developed during this study represent the most likely scenarios that may be used to effect grade separation of the Trillium and VIA lines, the selection and conceptual design of structures requires further investigation.

As discussed in preceding sections, there remain key questions related to the feasibility of applying for and securing a Transport Canada exemption in the timeframe needed to include the implicated options (Options 1B, 1E and 2B). In addition, Option 1E also involves making changes to the VIA Line profile and those discussions have not yet been initiated.

The matrix shown below captures the key concerns related to each of the conceptual designs developed and considered during this study. The highlighted sections indicate concerns that require additional investigation.

The City should consider the following as courses of action:

1. Use this report to initiate discussions with Transport Canada, highlighting Option 1B as a potential preferred option if an appropriate regulatory exemption can be consummated prior to the anticipated commencement of Stage 2 Trillium Line contract award.

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- 2. Use this report to further investigate the potential for Capital Railway to be permitted to temporarily "straight-rail" the diamond as mitigation measure in the event Option 1C is selected as the preferred option.
- 3. Use this report to initiate discussions with VIA Rail to :
  - a. highlight that Option 1C does not eliminate the Ellwood Interlocking;
  - b. highlight that with the exception of Options 1B and 2B, which require regulatory exemptions, all of the feasible options that eliminate the interlocking require adjustments be made to VIA's vertical alignment.
- 4. Use this report to consider bridge structures as more economic alternatives to the tunnels proposed in Options 2B and 2D.
- 5. Use this report to consider further evaluating Option 2D. Option 2D is similar to Option 1D in that it does not require a regulatory exemption. The conceptual level design did not consider a simpler underpass design that would require a tighter plan layout of the Transitway and a more compact structure. The conceptual level design did not consider separate structures for VIA and the Transitway that could also result in a more economical solution.



Alternative	Freight / DMU compatible	Ellwood Interlocking Elimination	VIA Line Profile Adjustments	Transitway Alignment Adjustments	Notes
Option 1B - Trillium over VIA	No - requires TC exemption	Yes	Not required	Not required	
Option 1C - Trillium over VIA	Yes - separate tracks	No	Not required	Not required	2005 North- South study alignment
Option 1D - Trillium over VIA	Yes - shared track	Yes	Required to be lowered, VIA discussion initiated	Not required	Conceptual Design May Not Be The Most Economical
Option 1E - Trillium over VIA	No - requires TC exemption	Yes	Required to be lowered, VIA discussion initiated	Not required	Portion of Sawmill Creek structure can be retained
Option 2B - Trillium under VIA	No – requires TC exemption	Yes	Not required	Horizontal and Vertical	Conceptual design may not be the most economical
Option 2C - Trillium under VIA	Yes – separate tracks	No	Not required	Horizontal and Vertical	May result in shorter passing siding
Option 2D - Trillium under VIA	Yes – shared track	Yes	Required to be raised, VIA discussion initiated	Horizontal and Vertical	Conceptual design may not be the most economical

Matrix 1 - Summary of Alternatives and Constraints

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Exhibit 1: Existing Ellwood Diamond Track Plan

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Exhibit 2: Option 1B - Trillium Line over VIA - Freight and DMU







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OPTION 1B - TRILLIUM LINE OVER VIA - DMU







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OPTION 1B - TRILLIUM LINE OVER VIA - DMU





**Exhibit 3:** Option 1C – Trillium Line over VIA Line – DMU-only. Freight at-grade.







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OPTION 1C - TRILLIUM LINE OVER VIA - DMU ONLY. FREIGHT AT-GRADE







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OPTION 1C - TRILLIUM LINE OVER VIA - DMU ONLY. FREIGHT AT-GRADE





Exhibit 4: Option 1D - Trillium Line over Lowered VIA Line - Freight and DMU







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The lo determine concernence of the local state of	No.	of utilities is approximate ye consulting the mulcidpa The contractor shall prove for adequate protection fro PRELIMINARY REF CO	only, the exact locating lauthorfles and utility the location of utilities m damage. Description NCEPT DRAWING - 1	n should be companies and shall be		By Contraction of the second s		



OPTION 1D - TRILLIUM LINE OVER LOWERED VIA - MIXED USE FREIGHT AND DMU









OTTA TRI	WA LIGHT RAIL	_ TRANSIT P MOND GRAE	ROJECT DE SEP	F	)#	<b>71</b> A W
				Contract N	<u>) (ll</u>	Dwg. No.
					N/A	
				Asset No.	eet Z	. 01 2
	N/A	N/A		Asset Grou	N/A	
м	anager - Division	Project Mai	nager	Des.	" N/A	nk'd.
				J. St Dwn.	RBLIN	J. OLSO nk'd.
				E. WATER Utility Circ.	No. In	J. OLSC dex No,
				N// Const. Ins	ector	N/A
				Scale:	N/A	
				0 <u>m 1</u>	HORIZON 0 20	TAL 40
NOTE:	n of utilities is approximate	only, the exact location	should be	0m	1 VERTICA	
NOTE: The locatio determined concerned, responsible No. A OS SNA	n of utilities is approximate by consulting the municipa The contractor shall grove for adequate protection fro PRELIMINARY REF COL	only, the exact location I authorIdes and utility of the location of utilities a on damage. Description NCEPT DRAWING - FC	should be companies and shall be		By	2 Date (dd/mm/y) 31/03/17
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OPTION 1D - TRILLIUM LINE OVER LOWERED VIA - MIXED USE FREIGHT AND DMU





Exhibit 5: Option 1E – Trillium Line over Lowered VIA Line – DMU-only.







0	ΓΤΑ\ TRII	VA LIGHT RAIL LIUM VIA DIAL OPTI	_ TRANSIT F MOND GRA ON 1E	PROJECT DE SEP	C	Ott	a	wa
					Contract N	lo. N/A		Dwg. No.
					Sh	eet 1	1	of 2
			1		Asset No.	N/A		
	Me	N/A anager - Division	N/A Project M	۱ lanager	Asset Grou	JP N/A	ι.	
					Des. J. SE	ERBLIN	Chk'	J. OLSON
					Dwn. E. WATER	HOUSE	Chk'	J. OLSON
					Utility Circ. N//	A No.	Inde:	KNO. N/A
					Const. Insp	pector N/A	4	
					Scare.	HORIZO	NTA	L
					0m 1	0 20		40
					VIII	VERTIC	CAL	-
NO	1 E.							-
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The dete con resp	e location ermined cerned. consible	n of utilities is approximate by consulting the municipa The contractor shall prove for adequate protection fro	only, the exact location a authorities and utility the location of utilities m damage. Description	on should be y companies s and shall be		Ву		Date (dd/mm/yy) 31/03/17
The dete conv resp SNO	No.	n of utilities is approximate by consulting the municipa The contractor shall prove for adequate protection fro PRELIMINARY REF COI	only, the exact locatic al authorities and utility the location of utility m damage. Description NCEPT DRAWING - I	on should be y companies s and shall be FOR DISCUSSION	N ONLY	Ву		Date (dd/mm/yy) 31/03/17
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	No. A	n of utilities is approximate by consulting the municipa- the contractor shall prove for adequate protection fro PRELIMINARY REF CO	only, the exact locatit I authorities and utility im damage. Description NCEPT DRAWING - I	on should be y companies s and shall be	N ONLY	By Contract of the second seco		Date (ddmm/y) 31/03/17



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#### DESCRIPTION:

OPTION 1E - TRILLIUM LINE OVER LOWERED VIA LINE - DMU ONLY





	TRIL	VA LIGHT RAIL LIUM VIA DIAI OPTI		Otta	TWC		
					Contract N	o. I/A	Dwg. No.
					Sh	eet 2	of 2
			1		Asset No.	N/A	
	Me	N/A anager - Division	N/A Project Ma	nager	Asset Grou	p N/A	
					Des. J.SE	RBLIN	k'd. J. OLSOI
					Dwn. E. WATER	HOUSE Ch	k'd. J. OLSOI
					Utility Circ. N//	No. Inc	lex No. N/A
					Const. Insp	ector N/A	
					Scare.	HORIZONT	AL
					0m 1	20	40
						VERTICA	L
conco respo	erned onsible	The contractor shall prove for adequate protection fro	the location of utilities and amage.	and shall be			T
	No.		Description			Ву	Date (dd/mm/yy)
SNO	No.	PRELIMINARY REF CO	Description	OR DISCUSSION	ONLY	By	Date (dd/mm/yy) 31/03/17
	No.	PRELIMINARY REF CO	Description NCEPT DRAWING - F0	DR DISCUSSION	ONLY	By	Date (dd/mm/yy) 31/03/17
REVISIONS	No. A	PRELIMINARY REF CO	Description	DR DISCUSSION	ONLY	By	Date (dd/mm/yy) 31/03/17
REVISIONS	No. A	PRELIMINARY REF COL	Description NCEPT DRAWING - F(	DR DISCUSSION	ONLY	By	Date (dd/mm/yy) 31/03/17
REVISIONS	No. A	PRELIMINARY REF COL	Description	OR DISCUSSION	ONLY	By	Date (dd/mm/yy) 31/03/17
REVISIONS	No. A	PRELIMINARY REF CO	Description	DR DISCUSSION	ONLY	By	Date (dd/mm/yy) 31/03/17
L REVISIONS	No.	PRELIMINARY REF CO	Description NCEPT DRAWING - Fr	DR DISCUSSION	ONLY	Ву	Date (dd/mm/yy) 31/03/17
REVISIONS	No.	PRELIMINARY REF CO	Description NCEPT DRAWING - FC	DR DISCUSSION	ONLY	Ву	Date (dd/mm/yy 31/03/17
LEARING	No. A	PRELIMINARY REF CO	Description NCEPT DRAWING - FC	DR DISCUSSION	ONLY	Ву	Date (dd/mm/yy 31/03/17
Levisions		PRELIMINARY REF CO	Description NCEPT DRAWING - FG	DR DISCUSSION	ONLY	By	Date (dd/mm/yy 31/03/17
Levisions		PRELIMINARY REF CO	Description NCEPT DRAWING - FG			By	Date (dd/mm/yy 31/03/17
L REVISIONS		PRELIMINARY REF CO	Description NCEPT DRAWING - FG			By	Date, (dd/mn/y) 31/03/17
Level Revisions		PRELIMINARY REF CO	Description NCEPT DRAWING - FC		ONLY	By	Date. (dd/mn/y) 31/03/17



OPTION 1E - TRILLIUM LINE OVER LOWERED VIA LINE - DMU ONLY





Exhibit 6: Option 2B - Trillium Line under VIA Line - DMU only







MATCHLINE 30+850.000

01	TTA\ TRIL	VA LIGHT RAIL LIUM VIA DIAN OPTIC	C	)tt	a	wa		
					Contract N	lo. N/A		Dwg. No.
					Sh	eet 1	1	of 2
			T		Asset No.	N/A	、 、	
	Ma	N/A anager - Division	N// Project M	A fanager	Asset Grou	JP N/A		
					Des. J SI	ERBLIN	Chk'	d. J. OLSON
					Dwn. E. WATER	HOUSE	Chk'	d. J. OLSON
					Utility Circ. N/	A No.	Inde:	x No. N/A
					Const. Ins	pector N/A	۹.	
					Scale.	HORIZO	NTA	L
					0m 1	0 20		40
						VERTIC	CAL	-
NO	TE:							-
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OPTION 2B - TRILLIUM LINE UNDER VIA LINE - DMU ONLY







0	TTA\ TRIL	VA LIGHT RAIL LIUM VIA DIAN OPTIC	C	)t	ta	IWA		
					Contract N	lo. N/A		Dwg. No.
					Sh	eet	2	of 2
			1		Asset No.	1	N/A	
	Ма	N/A anager - Division	N/ Project N	4 Manager	Asset Gro	n dr	N/A	
					Des. J. S	ERBLIN	l Chk	'd. J. OLSON
					Dwn. E. WATEF	HOUS	E Chk	'd. J. OLSON
					Utility Circ	No. A	Inde	N/A
					Const. Ins	pector	N/A	
					ocare.	HORIZ	ZONTA	NL
					0m 1	0	1	40
						VER	RTICAL	
NO	TE:							_
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OPTION 2B - TRILLIUM LINE UNDER VIA LINE - DMU ONLY



Exhibit 7: Option 2D – Trillium Line under raised VIA Line – Freight and DMU







MATCHLINE 30+850.000

01	ΓΤΑ\ TRII	VA LIGHT RAI LIUM VIA DIA OPT	C	Otta	лж		
					Contract N	р. І/А	Dwg. No.
					She	eet 1	of 2
			1		Asset No.	N/A	
	Ма	N/A anager - Division	N/A Project M	anager	Asset Grou	p N/A	
			T		Des. J. SE	RBLIN	hk'd. J. OLSC
					Dwn E. WATER	HOUSE	hk'd. J. OLSC
					Utility Circ. N/A	No. In	idex No. N/A
					Const. Insp Scale:	ector N/A	
					0	HORIZON	TAL
					0m 1	) 2u 1	40
					1	VERTIC	AL -
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NO the cond resp SNOISINEN	DTE: location ermined cerned. consible	of utilities is approximat by consulting the municip The contractor shall prov for adequate protection fi PRELIMINARY REF CC	e only, the exact locate a) authorities and utility te the location of utilities form damage. Description DNCEPT DRAWING - I	n should be r companies s and shall be <sup>2</sup> OR DISCUSSION	I ONLY	Ву	Date (dd/mm/yy 31/03/17
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OPTION 2D - TRILLIUM LINE UNDER RAISED VIA LINE - FREIGHT AND DMU







01	TTA\ TRII	VA LIGHT _LIUM VIA	° Rail 1 Dian Optic	TRANSIT 10ND GR )N 2D	PROJEC ADE SEP			tc	TWA	
						Contrac	t No. N/A		Dwg. No.	
						5	Sheet	2	of 2	
						Asset N	0.	N/A		
	Ma	N/A anager - Division		l Projec	UA Manager	Asset G	roup	up N/A		
						Des.	SERBL	IN Chi	k'd. J. OLSON	
						Dwn. E. WAT	ERHOU	SE Chi	k'd. J. OLSON	
						Utility C	rc. No. N/A	Ind	ex No. N/A	
						Const.	nspecto	N/A		
						Coard.	HOR	IZONT.	AL	
						0m 0m	10	20	40	
NO The dete	TE: location armined	1 of utilities is app by consulting the	proximate or municipal	nly, the exact loc: authorities and ut	ition should be lity companies		VE	RTICA	-9	
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OPTION 2D - TRILLIUM LINE UNDER RAISED VIA LINE - FREIGHT AND DMU





**APPENDIX A:** 





#### GENERAL CONDITIONS

Contract Form GENERAL CONDITIONS OF THE CONTRACT and all sections of these tendering documents apply equally to this section of the Specifications.

## PART 1 - GENERAL

#### 1.1 GENERAL

- .1 Windows for Work are to be as follows:
  - .1 Work may take place at times of contractor's choice to optimize productivity. Working hours shall be consistent. Contractor will be required to stop work, stop machinery, secure machinery and work site, as required, and to exit from machinery on instruction from VIA's on-site supervisor during the passage of trains.
  - .2 The Contractor will be permitted to work on the track between trains upon authorization from flagman. Between these hours, there are "windows" of varying durations according to the location. Train schedule is available on VIA Rail website at www.viarail.ca. The window durations are theoretical and will vary depending on whether each train is on time or late.
- .2 Overarching Principle:
  - .1 Tenderers should be aware that the absence of any specific activities in these documents, which are required to meet the requirements of Canadian National Railway's Engineering Track Standards or recommended methods or AREMA Guidelines bearing on 'the Work", to satisfy the provisions of the Railway Safety Act or in keeping with good railway engineering practice is not valid reason for the work to be omitted.
  - .2 Should there be some concern with respect to any omission not covered by the above Overarching Principle, it should be brought to the attention of VIA or its designated agent.
- .3 Note CN Engineering Track Standards that are in effect are dated as of March 2017.
- .4 Although not included in these Tender Documents, the following standards form an integral part of these specifications.
  - .1 AREMA Manual for Railway Engineering (last current edition)
  - .2 Ontario Provincial Standard Specifications (OPSS)
- .5 Except as where indicated otherwise surplus material shall become the property of the Contractor and shall be removed promptly, as the material becomes surplus, at the cost of the Contractor and in manner acceptable to VIA and according to environmental restrictions that may be imposed by all governing bodies. A Certificate of disposal shall be provided to VIA. Distribution of and/or removal of track material from VIA's right-of-way may be permitted during day light hours



under flagging protection as it does not interfere with the continued safe movement of rail traffic.

- .6 The Contractor shall obtain any necessary permits and approvals required for executing the Work.
- .7 The Contractor shall arrange for road protection and access, as and if required. The Contractor must abide by the Railway Association of Canada (RAC) Circular No. 13 (Oct. 01, 2004) Recommended Practices for Manual Protection of Highway/Railway Grade Crossings.
- .8 The Contractor shall provide certification that a Professional Engineer licensed in Ontario will be employed throughout the length of Work. The Contractor's Professional Engineer shall take the responsibility for the Work performed by the Contractor within these specifications.

### PART 2 – SPECIAL PROVISIONS

### 2.1 GENERAL REQUIREMENTS

- .1 Each Contractor must make himself personally acquainted with the location of the proposed work and must inform himself, by such means as he may prefer, as to all conditions of the site and all other factors which may affect his tender and the performance of the work, and shall not claim at any time after tendering that there was any misunderstanding in regard to conditions at site.
- .2 Prior to any performance of work, the Contractor shall supply a schedule, which highlights the scheduled start-up date to meet the completion date.
- .3 Arrange for final inspection by VIA upon completion. Give 48 hours advance notice when work is ready for inspection.
- .4 Regular bi-weekly progress meetings will be held at times and locations approved by VIA and the PROFESSIONAL. The PROFESSIONAL will notify parties concerned of meetings to ensure proper co-ordination of the work. Designated parties shall take required action on decisions made at meetings. The PROFESSIONAL will prepare the minutes to be accepted by VIA and distribute to parties prior to next meeting.
- .5 In addition, perform work in accordance with The Building Code of Ontario containing the Building Code Act and O. Reg. 416190. (OBC), or the Code de construction de Quebec Chapitre 1 Batiment et code national du batiment Canada 2005 modifies, the National Building Code of Canada (NBC), the Ontario Electrical Code, Canadian Electrical Code, or Code electricite du Quebec 2010, CSA Standards and any other code of local application provided that in the case of conflict or discrepancy, the more stringent requirements shall apply. Meet or exceed requirements of specified standards, codes and referenced documents.



- .6 Observe and enforce construction safety measures required by the National Building Code (2005) Part 8. Provincial Government, Workers Safety and Insurance Board, and municipal statutes and authorities.
- .7 The Contractor shall conform with the Occupational Health and Safety Act, or Code de sécurité pour les travaux de construction S-2.1, r.6 18 mars 2008 and Regulations for Construction projects and Industrial Establishments relating to the performance of this project.
- .8 The Contractor shall have a complete set of current Material Safety Data Sheets (MSDS's) for all WHMIS controlled products on site. These MSDSS must be available on the site for the Contractor's employees.
- .9 The Contractor is required to provide a first aid kit at the site.
- .10 The Contractor is required to provide a spill kit on all machinery.
- .11 All work shall be carried out with the approval and to the satisfaction of VIA.

### 2.2 SITE CONDITIONS

- .1 The Contractor must ensure that all train operations can be maintained with minimal disruption.
- .2 Some portions of the work may have to be scheduled outside daylight working hours and may include working on weekends in order to minimize the impact on VIA operations.
- .3 Existing property and adjacent public and private property must be protected at all times.
- .4 The Contractor must verify all site dimensions and conditions.
- .5 Meet with VIA Project Manager and the PROFESSIONAL, on site, to discuss the project schedule, how to mitigate impact on train operations, discuss safety procedures for the protection of the public at the crossing, flagging operations, job briefings, and any other safety or operational issues.
- .6 Prior to any performance of any work within 10 metres (33 feet) of the nearest track VIA must be notified 5 days in advance. A flag person will be required to protect trains from the Contractors activities. VIA will provide flagging protection and all charges shall be the responsibility of the Contractor.
- .7 Provide flagging protection to protect vehicular and pedestrian traffic as prescribed in the Railway Association of Canada Circular NO 13 titled "*Recommended Practices for Manual Protection of Highway/Railway Grade Crossings*" if it will be necessary to have automatic warning devices operating or caused to be out of service during any stage of the project. Contractor is to ensure all field personnel have a demonstrated knowledge of this circular and its procedures and instructions. If it will be necessary to have a crossing declared out of service the Contractor shall coordinate with VIA to place a GBO into effect. VIA shall have the sole responsibility to place a GBO into effect.



- .8 The Contractor, through appropriate authorities, prior to commencing work, shall locate all utilities and services. The cost for all locates and permits will constitute part of the Contractor responsibility. Damaged utilities and services shall be repaired immediately at the Contractor's expense, to the satisfaction of VIA and the utilities involved.
- .9 Prevent movement, settlement or damage of adjacent structures, VIA property and area of work. Any damage of same shall be repaired immediately at the Contractor's expense, to the satisfaction of VIA.
- .10 The Contractor to advise VIA immediately should any materials of a hazardous or toxic nature is encountered during construction.
- .11 The work site must be secured at the end of each day prior to the Contractor leaving the site.
- .12 The Contractor shall maintain the work site in a tidy condition and free from the accumulation of waste products and debris, other than caused by VIA, other Contractors and their employees. Waste shall be disposed of in the appropriate waste receptacles provided by the Contractor and removed on a daily basis and disposed of in a safe and legal manner off-site.

## 2.3 CO-OPERATION

- .1 The Contractor shall co-operate with all other contractors, VIA representative, Maintenance-Of-Way Contractor, utility companies and road authorities carrying out work in the area so that all the work to be performed under this Contract shall be completed not later than the date named in tender document.
- .2 The Contractor shall be prepared to schedule his work so as to cause as little inconvenience as possible in the operation of the VIA's facilities and operations in the area. In case of dispute, VIA's ruling regarding respective rights shall be accepted as final.

## 2.4 CO-ORDINATION

- .1 The Contractor shall co-ordinate Work with other contractors to ensure that all requirements of the specifications are met and that the track structure is safe for normal train movements at all times.
- .2 The Contractor shall ensure that the integrity of any existing signal plant, including crossing protection, is maintained and safe for normal train movements at all times.

## 2.5 FLAGGING

- .1 VIA will provide flag person(s) at the Contractor cost to for one 10 hour shift per day (see Flagging Cost-OCI document). If the Contractor requires additional flag persons for their operations, these extra flag persons will be provided, if available, at a cost. The Contractor shall submit a detailed schedule of work ahead of time so the Maintenance-Of-Way Contractor could organize their staff against the schedule work. VIA will provide one (1) flag person for the duration of the Work. Extra flag persons may not be available at all times and the Contractor may have to reschedule some work in future shifts.
- .2 The Construction Schedule shall specify the numbers of days in the field to perform the Work from the Mobilization to the Demobilization.



- .3 The Contractor will be responsible for ensuring that construction operations are carried out without interfering with the continued safe movement of rail traffic. VIA reserves the right to quantify the cost of train delays and the cost of any repairs to rail, ties, ballast, signal appliances required as a result of damage caused by the Contractor and to assess this liability to the Contractor at VIA's sole discretion.
- .4 Give VIA at least five (5) working days notice of the hours within which work is to be carried out in order that protection may be provided. Time wasted unnecessarily by the VIA personnel due to the Contractor will be charged against the Contractor.
- .5 Ensure that a responsible person is present at all times to whom the Railway personnel will issue orders regarding work near the tracks. Comply immediately with such orders and instructions.
- .6 The Contractor shall consider approximately 30% downtime to permit the passage of trains on the adjacent tracks. The Contractor shall have no claims for additional payment for delays.

## 2.6 WORKING WITHIN THE VIA RIGHT-OF-WAY

- 1 <u>INTRODUCTION</u>
  - 1. The purpose of this special provision is to outline VIA's rules, policies, standards and procedures that the Contractor will be expected to abide by while working within the VIA right-of-way (ROW).
  - 2. Railway facilities and operations can be dangerous places for people who do not have a railroad background. It is important that proper measures be taken to ensure that access to VIA property is controlled and the safety of all people is assured. The Contractor shall be responsible for reviewing the appropriate health, safety and regulatory documents and for determining their applicability in relation to the contract work prior to its use. The Contractor is solely responsible for ensuring compliance with this special provision.
  - 3. All Contractor, and Sub-Contractor, personnel shall read and comply with the requirements of this special provision.

## 2 <u>GENERAL REQUIREMENTS</u>

- .1 The vertical construction clearance of 22 feet above the top of the highest rail and the horizontal construction clearances of 8 feet 6 inches from the centerline of tangent track, and 10 feet from the centerline of curved track, must be maintained at all times.
- .2 The Contractor shall maintain positive drainage of VIA's property for the duration of the work. Any dewatering of the site requires prior VIA approval. After construction is complete, VIA's property shall be restored to the satisfaction of VIA. Any fencing removed to facilitate construction shall be restored and any temporary drainage facilities shall be removed.



- .3 The Contractor shall minimize the storage of any material or equipment on VIA's property. If required, they need to be stored as far as possible from the track at a location accepted by the railway protecting flagman. Equipment or vehicles shall be situated in a location so as not to block the sight lines and automatic warning devices at level crossings nor to block railway signal lights.
- .4 Metal measuring tapes or other metal appliances must not come into contact with the rail of any track. Walking or stepping on a rail, switch, interlocking machinery or connection is prohibited.
- .5 Red colour shall not be used for safety helmets, safety vests, apparel, or survey markers. Other highly visible colours, such as orange, are acceptable.
- .6 Any object waved violently by anyone on or near the tracks is a signal for trains to stop. The Contractor shall be liable for all costs, direct and indirect, incurred by VIA as a result of damage, disruption or inconvenience to VIA's operations, property or infrastructure, caused by the Contractor's operations.
- .7 The Contractor shall note that, from time to time, VIA or other work in the vicinity of the project limits may result in cancellation or reduced hours of rail traffic protection (flagging) and/or track closures scheduled for this contract. The Contractor shall have no claims for additional payment for delays in this regard.
- .8 The Contractor shall be liable for all costs, direct and indirect, incurred by VIA due to the settlement of track(s) or any other problems related to VIA's operations, property or infrastructure, that occur as a result of the Contractor's operations, for a period of one (1) year from the date of completion of the work.
- .9 The Contractor shall be responsible for all costs associated with delays or inconvenience to the Contractor's operations as a result of:
  - .1 VIA's requirements;
  - .2 Failure by the Contractor to provide sufficient notification to VIA as outlined in this special provision;
  - .3 VIA's inability to provide a VIA flagperson, notwithstanding the Contractor providing sufficient notification as outlined in this special provision;
  - .4 Stoppage of work within the ROW, by VIA;
  - .5 Delay or shortened duration of the reduced minimum clearances by VIA; or
  - .6 Cancellation, delay, or reduced hours of the track closure(s), by VIA, or stand-by time during the track closure to allow train passage.
- .10 Where any individual(s) in the employment or under the responsibility of the Contractor, or Sub-Contractor, is in violation of VIA's safety rules, policies, standards, or procedures, or instructions / direction given by VIA personnel, this shall result in the immediate removal of the Contractor, and/or the offending personnel from VIA property, stoppage of all work within the ROW, and closure of the site until the situation is corrected. Repeat offences shall result in the Contractor being prohibited from continuing all contract work within the ROW and from working on VIA property in the future.
- .11 All accidents / incidents that occur on VIA property, or adjacent to VIA property with risk to rail operations, shall be reported to the railway protecting flagman immediately, and to the VIA Contact Person as soon as practical. All such incidents



shall be fully investigated by the Contractor, with a written report sent to VIA within seven (7) days detailing the nature of the incident, the cause(s), regulatory authorities notified, and a specific action plan to prevent recurrence.

## .3 <u>CONTRACTOR SAFETY ORIENTATION</u>

1. The Contractor shall ensure that all personnel working within the ROW, including Sub-Contractors, complete the VIA safety orientation course, available on the Internet at the following address:

#### www.contractororientation.com

- 2. The objective of this course is to outline VIA's safety guidelines /policies, and shall not be considered as a substitute for the applicable government regulations. These guidelines are the minimum requirement and must be exceeded where the hazard or government regulations warrant.
- 3. The Contractor shall register each person that has completed the course, and will receive a qualification card and sticker for each person within ten (10) days of registration. The sticker shall be affixed to the employee's hardhat in a location where it is easily visible. The qualification card shall be carried on each employee, and each employee must have his/her name labelled on the front of his/her hard hat.
- 4. The cost of the course is \$15.00 US per person (price subject to change). Qualification is valid for three (3) years after the date of completion. On or before the expiration date, the employee shall register and repeat this course.

#### .4 <u>SUBMISSIONS</u>

- .1 One (1) week prior to work within the ROW, the Contractor shall submit the following to the Contract Administrator for VIA's review and approval:
  - Detailed shop drawings (designed, signed and sealed by a Professional Engineer) for:
  - .1 Shoring / formwork / falsework / scaffolding.
  - .2 Temporary supports / jacking systems at piers.
  - .3 Track protection / debris containment system for deck / pier / abutment removal, designed to prevent possible damage to the rail, ties and fastenings and, excavated / removed material from fouling the ballast and sub-ballast.
- .2 At least one (1) week prior to the commencement of work within the ROW, the Contractor shall provide written notice for the requirement of a VIA flagperson. The Contractor shall make all arrangements for the flagperson through the VIA Contact person. Failure by the Contractor to provide the specified notification of any proposed work requiring flagging protection may result in no flagperson being provided and the work not being permitted to proceed until such time as a flagperson is available.
- .3 At least one (1) week prior to the commencement of work within the ROW, the Contractor shall submit a request for the arrangement of VIA cable locates. The



Contractor shall have a representative on site to accompany the VIA Signals & Communications Supervisor while locates are being provided.

- .4 Prior to commencement of work within the ROW, the Contractor shall submit the following documents to VIA. The Contractor shall retain a copy of these documents on site at all times, and available for review by VIA personnel.
  - .1 Signed copy of the "Release of Liability and Permit for Applicant"
  - .2 Signed copy of the "SCP-1005, Instructions to Excavators for the Protection of Underground S&C Cables"
  - .3 Proof of VIA Safety Orientation qualification
  - .4 Proof of insurance as per Clause 11 of the Contract
  - .5 Completed Risk identification form
  - .6 Work schedule in MS-Project format showing main activities with material supply lead times.
- .5 During the work within the ROW, the Contractor shall submit the following:
  - .1 Provide a weekly updated schedule measured against the baseline in MS-Project format
  - .2 Provide a weekly request of working hours/days as to plan for railway flagperson and site supervision.

#### .5 MAJOR WORK BLOCKS THAT CAN AFFECT RAILWAY OPERATION

.1 The Contractor will be allowed to work within the ROW only with approved major work blocks. A Major Work Block is a period for which the VIA expects that there will be no railway traffic on a specific part of the track. The Contractor shall submit a major work block request to VIA, at least one (1) week before the execution of the work, so as to obtain a major work block for the upcoming period. Due to VIA peak business operation, <u>no</u> major work block will be accepted on long week-ends with statutory holidays.

HOLIDAY
New Year's Day
Family Day
Good Friday
Victoria Day
Canada Day
Civic Holiday
Labour Day
Thanksgiving
Christmas Day



- .2 While establishing major work blocks, the Contractor shall prepare a phasing of the work to be done within a specific work block. This planning shall include a schedule of the work to execute for each working team, at 15 minutes intervals for the duration of the major work block. The schedule will need to provide the contingency time and also the mitigation plan in case something goes not as expected.
- .3 The detailed phasing of the major work block shall be approved by the VIA before the starting of the work planned for the block. Once approved, the work block schedule must be respected; no overrun of the schedule will be tolerated. The Contractor shall note, however, that work blocks could be reduced or cancelled due to railway operations or maintenance. All operations disruption costs associated with the failure of the Contractor to abide by the approved work block will be at the Contractor's expense.
- .4 One (1) week prior to the work scheduled during major track closures, the Contractor shall **SUBMIT A DETAILED DESCRIPTION OF THE AVAILABLE RESOURCES AND METHODOLOGY** used specifically during the track closures, including back-up equipment, if required.
- .5 Three (3) days prior to the commencement of each major track closure, the Contractor shall call upon all key personnel executing the work to attend an organized meeting with VIA to review:
  - 1. all the activities to be executed during that specific track closure;
  - 2. the methodology and equipment to be used;
  - 3. conduct an audit to verify that all materials at the storage site are on hand and discuss loading and unloading procedures;
  - 4. discuss with all participants the expected progress;
  - 5. review all safety compliance procedures.
- .6 The Contractor shall present a contingency plan for any Major Work affecting the railway operation such as extra equipment, stand-by bus, etc part of his submission of a Major Work block request.
- .7 Contractor's Work Blocks schedule shall be established in consideration of the typical train time based on current train schedule available at www.viarail.ca. Notwithstanding, the Contractor's costs and schedules shall make allowances for shortened or cancelled work blocks precipitated by VIA's operations.
- .8 This train time of VIA Rail website hereto is provided as a guideline only and may differ depending of the day of the week. The Contractor shall be aware that traffic tends to increase at the end of the week on account of extra trains. There always the possibility that VIA may add a special train on a specific date. These special train schedules will be shared with the Contractor for his scheduling of work as they come up.



- .9 This table indicates that the best work block is at night, subject to train operations and resulting work stoppages.
- .10 A railway flagperson must be present at all times when work progresses within the ROW, unless otherwise approved by VIA. The presence of a flagperson in no way relieves the Contractor from liability for damage or disruption to VIA property, infrastructure or rail traffic caused by his operations.
- .11 The Contractor shall revise and reschedule his proposed works as may be reasonably required so as to minimize flagging costs and maximize utilization of the VIA flagperson. Utilization of the flagperson shall be done in one block of time, if possible, as opposed to intermittent flagging, for which VIA cannot guarantee availability. At least forty-eight (48) hours notice is required for cancellation of the flagperson. Rescheduling of the flagman shall be subject to the requirements of Item .2 of the "Submissions" section of this special provision.
- .12 The Contractor shall have a responsible person present on site at all times to whom VIA personnel can issue orders or give direction regarding work within the ROW. All instructions from VIA personnel shall be obeyed without dispute immediately by all personnel within the ROW.
- .13 The Contractor's responsible person shall attend a daily briefing session with the railway flagperson prior to the commencement of any work within the ROW. The responsible person shall be required to identify all personnel on site, including all Sub-Contractors, and to discuss the scope of work that is to progress that day. A subsequent briefing shall be required for new conditions or personnel within the ROW, not identified in the original briefing. The responsible person shall inform all personnel of all topics discussed in the briefings.
- .14 Work may be ceased under the authority of the railway flagperson at any time to accommodate train movements. There are approximately 24 trains per day at this location.
- .15 The railway flagperson may be required to leave the job site at any time, without notice, to provide emergency services at other locations. In this event, the Contractor shall cease all work within the ROW and immediately exit VIA property prior to the VIA flagperson leaving the site. The Contractor shall not enter onto VIA's property until such time a flagperson is present. VIA's Winter Operating Plan is in effect from November 15 to April 15 (dates are subject to change). During this time the flagperson is on call to provide emergency snow / ice removal services at critical locations such as station platforms and switches.



- .16 VIA has the right to place a flagperson on site at any time, for any length of time, if there is reason to believe that the work is progressing unsafely and / or the Contractor is not adhering to VIA's requirements, as outlined in this special provision, "Safety and Related Requirements and Instructions for Work on Railway Right-of-Way ("VIA Right-of-Way") by Non-VIA Personnel" and "Instructions to Excavators for the Protection of Underground S&C Cables". VIA shall be the sole judge of unsafe work and non-adherence to VIA regulations for all work within the ROW. All costs for VIA flagging protection in this regard shall be borne by the Contractor.
- .6 <u>CROSSING TRACKS</u>
  - .1 The Contractor shall not be permitted to cross the track(s) with vehicles or equipment, except on a VIA approved temporary construction crossing.
  - .2 The Contractor shall obtain a License for Temporary Crossing from VIA. The license fee for a temporary crossing is \$500, and the cost for VIA to install and remove the crossing is \$5,000 per single track crossing plus \$3,000 per additional track crossing OR supervise the installation of the crossing by the Contractor is \$1,000, for which the Contractor shall supply a certified cheque to VIA. All other costs associated with the construction, maintenance and removal of the crossing shall be the responsibility of the Contractor.
  - .3 The crossing shall be constructed at a location and to a standard acceptable to VIA. The Contractor shall submit details for the crossing to VIA for approval at least two (2) weeks prior to work commencing within the ROW.

The crossing shall:

- .1 Have a level gradient on either side for a distance of 8m or not less than the maximum length of vehicle using it.
- .2 Have approach grades not greater than 5%.
- .3 Have a crossing surface of suitable material extending at least 0.5m beyond the travelled width on both sides measured at right angles to the roadway.
- .4 Be of an overall safe width suitable for the use intended.
- .4 The Contractor shall:
  - .1 Supply and install gates and stop signs at 13 feet from the gauge side of rail on each side of the tracks.
  - .2 Supply and install temporary fencing as required by VIA.
  - .3 Supply the following material, to be installed by VIA: OR the Contractor, under the supervision of VIA:
    - .1 Filter fabric, Terrafix 360R or approved equivalent. Filter fabric must be placed underneath the planks for the full length of the crossing, including the 8 foot space between tracks (for 2 or more tracks), and for a minimum distance of 1 metre on each side of the crossing.
    - .2 Crossing planks, 7" x 10" Spruce / Eastern Hemlock (7 planks per track). Alternatively, supply and install 6" x 10"s with 1" plywood shims. Height of the crossing surface shall be level with the height of the rail.



- .3 4"x4" flangeway timbers (2 per track). The width of the flangeway shall not be less than 63mm and shall not be greater than 120mm. The depth of the flangeway shall not be less than 47mm and shall not be greater than 76mm.
- .4 Lag screws, 12" x <sup>1</sup>/<sub>2</sub>", 3 per 20' plank.
- .4 Supply, place and compact granular material or clear stone (as directed by VIA) within the 8 foot space between tracks (for 2 or more tracks). Granular material / clear stone shall be placed on top of filter fabric in order to prevent ballast contamination.
- .5 Construct and maintain the crossing approaches, culverts and ditches as required.
- .6 Maintain the crossing surface and keep the flangeways clear at all times.
- .7 Remove the crossing, approaches and all associated materials upon completion of construction.
- .8 The Contractor shall be responsible to provide and install any required protection of VIA's underground cables at the approaches to the crossing, as directed and supervised by VIA.
- .9 Use of the crossing shall be done only in the presence of a railway flagperson. The crossing gates shall be secured, with a VIA lock, at the end of each working day.
- .10 Steel tracked equipment shall not come into contact with the rails at any time when traversing the crossing, as this could result in malfunction of VIA's train signal system. The Contractor shall supply and place rubber matting / wood planking to protect the rails during use of the crossing by steel tracked equipment.
- .11 The Contractor shall make all attempts to ensure that the track ballast remains free of contamination from the deposit of mud, soils and other fines from construction operations. The presence of fines in the track ballast traps water, which results in poor track surface and necessary train speed reductions, which will not be tolerated by VIA. Should ballast contamination be evident upon removal of the temporary track crossing, the Contractor shall be responsible for all costs for VIA to repair the track structure.

#### .7 <u>TEMPORARY SHORING FOR TRACK PROTECTION NEAR EXCAVATION</u>

- .1 Temporary shoring for track protection near excavation shall be installed where a slope of 1.5:1 measured ten (10) feet from the gauge side (inside) of the nearest rail, measured perpendicular to the rail, cannot be maintained.
- .2 The Contractor shall design temporary shoring system in accordance with AREMA Manual, Chapters 8 and 15, with live loading Cooper E90 + Diesel Impact, and VIA Drawings F1, F2 and F3.
- .3 Active pressure coefficients can be used for the design of temporary shoring unless its stiffness prevents the mobilization of active pressure. The active pressure coefficient shall not be less than 0.5.
- .4 All excavations deeper than 5' (1.525 m) must be tied-back with soil or deadman anchors. The use of struts or rakers will not be permitted.
- .5 Timber lagging shall be designed taking into consideration soil and water conditions as well as train surcharge using the Theory of Elastic Analysis. Design calculations shall be included in the design notes.



- .6 If there is risk of groundwater building up behind a lagged wall, or of washing in or soil particles, gaps should be left between the boards to allow drainage, and these gaps should be packed with straw or synthetic filter material to prevent loss of soil.
- .7 Lateral displacement of shoring to be within the limits set out by AREMA. Settlement or lateral movement of the track(s) shall be minimized and shall not be greater than 5 mm unless otherwise approved by VIA.
- .8 The Contractor shall submit detailed calculations along with the shop drawings (signed and sealed by a Professional Engineer) for review by VIA.
- .9 The Contractor may be required to install a track monitoring system during the installation and function of the shoring system.

#### .8 <u>SLOW ORDER PENALTIES</u>

- .1 If as a result of the Contractor's operations or negligence other than a normal speed restriction for a specific Work approved by VIA, VIA is unable to maintain normal operating speed and a slow order is issued, the Contractor shall be liable for the cost of train delay including but not limited to alternate transportation of passengers affected by the delay or train cancellation.
- .2 Where remedial work is to be completed by VIA, the duration of the slow order shall be dependent on the availability of VIA to supply the necessary material, labour and equipment to complete the work. The Contractor shall be responsible for the cost of repairs to the track and signal plant required as a result of damage caused by his/her operations in addition to the slow order penalty assessed above.

#### .9 UNDERGROUND & OVERHEAD VIA or CN OWNED & MAINTAINED CABLES

- .1 There are buried and overhead cables within the ROW. These cables are conveyors of high technology information. Disruption of this service is costly to repair and most importantly, causes severe loss of revenue and inconvenience to VIA/CN and its customers. In addition, the cables carry high voltages that could cause serious injury or fatality. Therefore, it is important that Contractors use extreme caution when working in the vicinity of any signals and communications cable.
- .2 Prior to mobilization within the ROW, the Contractor shall make a joint inspection with VIA, while VIA locates their underground cables by means of markers and / or fluorescent paint. The Contractor will be required to sign VIA's locate form. This form is only valid for thirty (30) days.
- .3 The Contractor shall be responsible for the cost of cable locates, at a flat rate cost of \$150.00 (plus G.S.T.) per hour on site, with a minimum charge of four (4) hours.
- .4 The Contractor shall ensure that prior to any excavation within the ROW, the VIA locate sheet is current. If the locate sheet is more than 30 days old, the Contractor shall be responsible to arrange for new cable locates.
- .5 The Contractor will be required to provide the current locate sheet to the railway flagperson before the railway flagperson will permit any excavation within the ROW.
- .6 Contact the "Call Before You Dig Centre" at 1-877-865-6193 to arrange for Bell Canada (360 Networks) fibre optic cable locates and On1Call at 1-800-400-2255 for all other utilities.



- .7 The Contractor shall carry out all excavation operations in accordance with "Instructions for Excavators, Underground S&C Cable, SCP-1005". A copy of the bulletin is attached to these specifications. The Contractor shall take every conceivable precaution to ensure that the cables are not damaged.
- .8 Prior to commencing any excavation work or any work near and around the fibre optic cables, the Contractor shall receive authorization from VIA that CN's Network Management Centre has been notified at (800) 661-3687, and provide confirmation of authorization to the Contract Administrator.
- .9 When working within one (1) metre (distance may be changed at the discretion of CN) of CN's underground cables, the Contractor shall expose the underground cables using an approved hydro-vac service only. The Contractor may also be required to provide hydro-vac services for the purpose of positive identification of cables. All hydro-vac work shall be done in the presence of the VIA site supervisor and/or VIA Signals and Communications maintainer.
- .10 When working within one (1) metre from the outer edge of the Bell Canada (360 Networks) duct system/cables, the Contractor shall perform this work under constant monitoring by an approved Bell Canada (360 Networks) representative.
- .11 When working within two (2) metres from the outer edge of the Bell Canada (360 Networks) duct system/cables, the Contractor shall perform any excavation work under constant monitoring by an approved Bell Canada (360 Networks) representative.
- .12 In the case that the buried cables have less than one (1) metre of ground cover, and when it is necessary to cross over VIA or CN's underground cables with heavy equipment (including at the approaches to a temporary construction crossing) the Contractor shall expose the cable(s) using a hydra-vac, and install protection (steel plate / steel troughing) as directed by and under the supervision of VIA. The cables shall have at least one (1) metre of cover, or greater depth, as dictated by ground conditions and as determined by VIA. Material used for cover shall be approved fill and separated from the ballast shoulder by means of heavy filter fabric, supplied and installed by the Contractor. The Contractor shall restore VIA's roadbed to its original condition and elevations on completion of work within the ROW.
- .13 Any damage to a signals or communications cable shall be reported promptly to the railway flagperson, VIA Project Manager and the VIA Signals and Communications maintainer. The Contractor shall make no attempt to repair damaged cables.
- .14 The Contractor shall be held liable for all costs related to repairs and loss of revenue as a result of disruption to the cable network caused by the Contractor's operations.

#### \*\*\* END OF SECTION \*\*\*

## **ARTICLE 1- INSURANCE**

1.1 Upon execution of this Agreement and without restricting the generality of Article 10, the City shall obtain and maintain for the term of this Agreement the following insurance policy coverage:

- (a) Commercial General Liability Insurance, preferably an "occurrence" form, covering the liability of the City, its contractors and representatives for bodily injury, including death and property damage for a minimum amount of twenty five million dollars (\$25,000,000.00) per occurrence with a global policy aggregate of no less than fifty million dollars (\$50,000,000.00). Such insurance shall not allow subrogation claims by the insurer against VIA, and shall include VIA as an additional insured but only with respect to the City, its contractors and representatives' services on behalf of VIA under this Agreement, and shall provide for (i) liability for premises, goods and operations; (ii) cross liability; (iii) contract liability; (iv) civil contingent liability; (v) liability for products and work completed and operations for a duration of twelve (12) months from the date of completion of the work; and (vi) non-owned automobile insurance. The City covenants and represents to VIA that the insurance policy shall not contain any railroad or rail operations exclusions of any form and kind.
- (b) Automobile Liability Insurance covering the liability of the City, its contractors and representatives for bodily injury, including death, and property damage caused by or attributable to the use or operation of vehicles owned, leased or operated by or on behalf of the City, its contractors and representatives, for a minimum limit of Five Million dollars (\$5,000,000.00) per occurrence.
- (c) All Risk Contractors' Equipment Insurance covering construction machinery and equipment used by the City, its contractors and representatives for the performance of the Work, and shall be in a form acceptable to VIA and shall not allow subrogation claims by the insurer against VIA.

1.2 Prior to the commencement of this Agreement, the City shall provide VIA with certificates of insurance issued to VIA, dated and signed by an authorized representative of the City insurance companies and evidencing all requirements mentioned above. The insurance policies shall include endorsements whereby VIA shall be provided with a ninety (90) days advance written notice in case of modification or termination of the insurance coverage. New insurance certificates evidencing renewal of the required insurance policies shall be submitted to VIA within thirty (30) days after renewal. The acquisition and maintenance in force of the above insurance coverage by the City shall in no manner be construed as to restrict or waive the liabilities, responsibilities or obligations of the City, its contractors and representatives pursuant to this Agreement. The insurance coverage described above shall be maintained continuously until ten (10) days after the final completion of the Construction Works as determined by the City and VIA.



# Appendix III – Flagging and Cable locate / Protection costs

Flag person and signal maintainers are billed at fixed rates, based on the amount of time the employee spends at the work site. The rates charged include employee travel time, expenses and vehicle charges – applicable taxes are not included.

Rates charged for flag persons also include time required to install equipment needed to protect against railway movements, in accordance with the *Canadian Rail Operating Rules* (CROR) or any other VIA safety rule (flags indicating protected zone). As certain types of protection require a permit of fixed duration to be issued by the Rail Traffic Controller (RTC), a flagman must remain on the work site until said permit expires, even if the work has been completed.

Flagging (per hour on site)	\$150/hr
Minimum daily charge – 4 hours	\$600
Maximum hours on site / day	7 hours
Each hour in excess	\$225
10 days' notice is required for flagging	

## Charges (work done during the day, from Monday to Friday)

Cable Locates (per hour)	\$150/hr
Minimum daily charge – 4 hours	\$600
Maximum hours on site / day	7 hours
Each hour in excess	\$225
10 days' notice is required for cable locates	

A minimum 48 hours' notice is required for cancellation of these services. Any shifts canceled within 48 hours of the planned start time will be subject to this charge.

Employees assigned to flagging protection cannot do overtime work. The regular 8 hours shift includes the travel time from and back to his office. Only under exceptional circumstances, and with approval obtained from the Railway during the approval stage of the proposed work, will flag protection be permitted beyond this period or on the weekend. In this case, a flag person will be invoiced at \$225 per hour in accordance with the same conditions previously described (travel included, min 6 hours, etc.)

<u>Note:</u> One-half  $(\frac{1}{2})$  hour will be charged as full hour and will not be prorated.

- Example 1: Friday, September 5, 2014, a flag person remains at the work site for 3 hours; the amount invoiced will be \$600.
- Example 2: Wednesday, September 10, 2014, a signal maintainer remains at the work site for 6.5 hours; the amount invoiced will be \$1200.

Cable locates are valid for thirty (30) days only.

It is the responsibility of the Applicant to arrange for protection and locates of all other company's utilities.

\* These fees are subject to annual change without notice