CITY OF VANCOUVER

CITY CLERK'S DEPARTMENT
Access to Information & Privacy

File No.: 04-1000-20-2018-414

September 18, 2018

s.22(1)

Dear s.22(1)

Re: **Request for Access to Records under the Freedom of Information and Protection of Privacy Act (the "Act")**

I am responding to your request of July 31, 2018 for:

> **Minutes from the meetings of the Working Group for the False Creek Flats Rail Corridor Strategy document (https://vancouver.ca/streets-transportation/false-creek-flats-rail-corridor-strategy.aspx), showing how TransLink, Better Environmentally Sound Transportation, and the Vancouver Area Cycling Coalition were involved and what their input was.**
>
> **Date Range: January 1, 2006 to October 31, 2008.**

All responsive records are attached.

Please note: The Rapid Transit Office confirms there were no meeting notes as the meetings provided comments on the report that was incorporated into the documents attached.

Under section 52 of the Act, and within 30 business days of receipt of this letter, you may ask the Information & Privacy Commissioner to review any matter related to the City's response to your FOI request by writing to: Office of the Information & Privacy Commissioner, info@oipc.bc.ca or by phoning 250-387-5629.

If you request a review, please provide the Commissioner's office with: 1) the request number (#04-1000-20-2018-414); 2) a copy of this letter; 3) a copy of your original request; and 4) detailed reasons why you are seeking the review.

Yours truly,

Barbara J. Van Fraassen, BA
Director, Access to Information & Privacy
Barbara.vanfraassen@vancouver.ca
453 W. 12th Avenue Vancouver BC V5Y 1V4

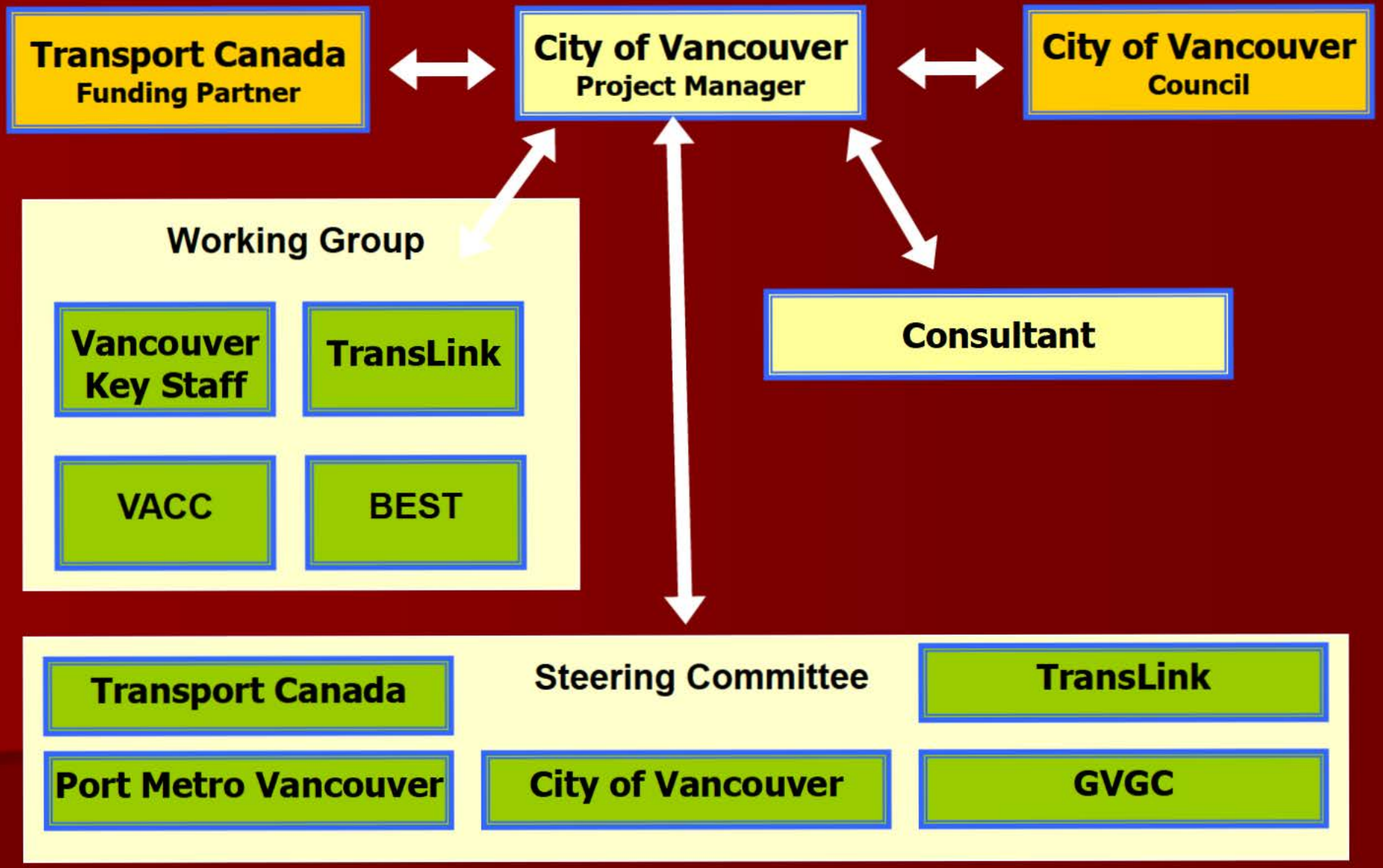
*If you have any questions, please email us at foi@vancouver.ca and we will respond to you as soon as possible. Or you can call the FOI Case Manager at 604.871.6584.

Encl.

:ag

False Creek Flats Rail Strategy

Organization Chart



Steering Committee

- Provide input and feedback at key points in the study process
- To gain knowledge of some of the benefits and challenges of grade separation
- Comprised of Agencies and potential funding partners

Project Manager

- Ensure linkages to the steering committee
- Provide linkages to other City resources as required
- To monitor project scope and budget
- Explore potential future funding sources

Working Group

- Meets as a group or as a subset to discuss details on specific elements of the rail strategy
- Subgroup could include focus on
  - Cycling/ Pedestrians (Best/ VACC)
  - Transit (BEST/ TransLink)
  - Utilities (Vancouver)
  - Greenway Connections (BEST/ VACC/ Vancouver Greenways Branch)
- City Resources can be pulled in as required

OPUS Hamilton

CITY OF VANCOUVER

RAILROAD CROSSING STUDY

BURRARD INLET LINE

OPUS

OPUS HAMILTON

CITY OF VANCOUVER

RAILROAD CROSSING STUDY

BURRARD INLET LINE

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Prepared by:

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September 2008

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1.0 INTRODUCTION

1.1 General Background

Railways are an essential component of the region's goods movement network. They are vital to the success of port operations in the Greater Vancouver area, as well as the provincial and national economies. The market for Vancouver ports has recently experienced significant volume growth. It is forecast that rapid growth in rail goods movement will continue over the next 15 years. Railways are also a critical element of passenger movement for local, regional, and intraprovincial travel. The VIA, Amtrak, Rocky Mountaineer, and West Coast Express passenger train services are all candidates for future expansion.

Available rail capacity at the south shore terminals is very important to encourage future intermodal growth at these terminals. To accommodate the short term critical needs for rail, CN and CPR have a co-production agreement that the two railways will share key sections of track to improve the fluidity of rail operations over existing infrastructure in the Vancouver area.

Rail modeling analyses currently being undertaken by the Port of Vancouver indicate that this co-production agreement, along with a few minor infrastructure and rail operational improvements, could help to meet the demand for the south shore terminals up to approximately 2012. However, in order to allow for future growth in all commodity sectors, or if this co-production agreement were to end, there would need to be new ways to satisfy the demands for rail in the future.

One of the potential areas for additional rail capacity is the rail yards within the False Creek Flats. However, prior to the CN/CP co-production agreement, rail analysis conducted by the Greater Vancouver Gateway Council identified constraints in the Burrard Inlet rail line ("BI Line") that links the Port to the False Creek Flats. These constraints affect the ability for the False Creek Flats to efficiently provide additional rail capacity to support the Port facilities. The two primary constraints along the BI Line include:

- at-grade road/rail intersections
- the rail/rail intersection with the CP mainline at the Port.

The City of Vancouver supports increases in goods movement by rail, as rail is a more sustainable mode of transport than truck. The City reports that recent statistics from the Rail Association of Canada indicate that goods movement by rail is nine times more efficient than by truck in terms of overall energy consumption, and creates over 60 percent fewer greenhouse gas emissions.

In order to examine ways to remove the constraints along the BI Line, the City of Vancouver applied for funding through Transport Canada under the Transportation Planning and Modal Integration Initiative for the False Creek Flats Rail Corridor Strategy. In June 2006, the City's proposal was accepted by Transport Canada. This report is the summary of the work completed by Opus Hamilton and EarthTech to develop and evaluate a grade separation concept of the BI Line corridor for that Rail Corridor Strategy.

This study follows several other studies summarized in the *Phase 2 Application for a Contribution from the Asia Pacific Gateway and Corridor Initiative Transportation Infrastructure Fund for 'Waterfront to False Creek Flats Rail Grade Separation* (City of Vancouver, 2007). The City's document summarized its future vision for the False Creek Flats area, as well as previous rail analyses (including the *Lower Mainland Rail Infrastructure Study* and the *False Creek Flats Analysis*) that formed the basis for this study.

1.2 Purpose and Objectives of This Study

To facilitate rail growth and mitigate the conflicts of rail and other transportation modes at existing at-grade crossings, grade separation or rail priority may be considered at a number of key rail crossings. A review of preliminary concepts, potential cost implications and benefits, and the potential to enhance existing pedestrian and bicycle networks, will assist the City in prioritizing grade separation projects as funding becomes available. Accordingly, the purpose of this study is to assist the City of Vancouver in developing a grade separation strategy for the BI Line rail corridor between the waterfront and False Creek Flats. The objectives of include:

- Develop preliminary grade separated concepts for five locations (FIGURE 1.1) with consideration of:

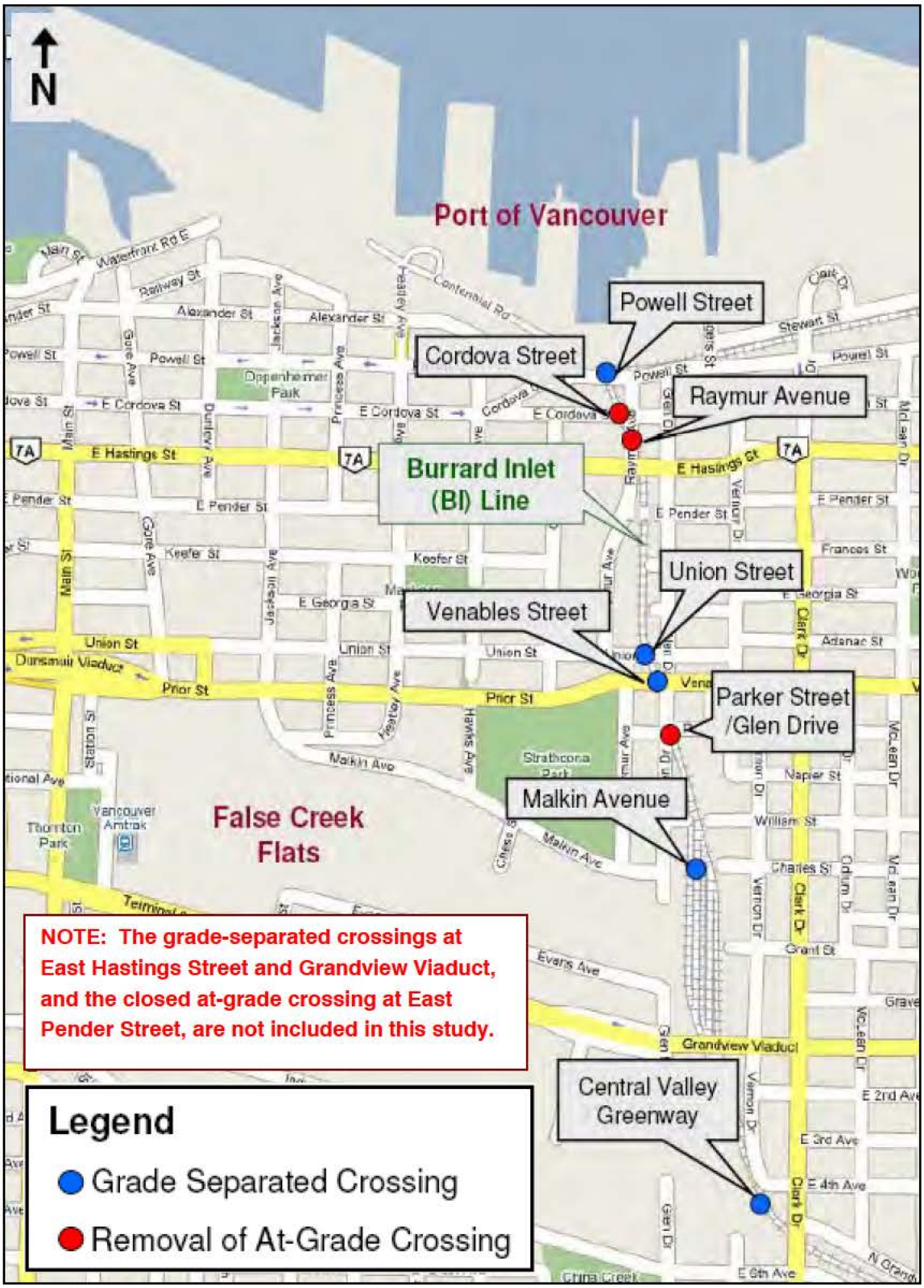

FIGURE 1.1 STUDY AREA AND LOCATIONS

- the impact on surrounding land use;
- the design of structures in relationship to surrounding community context;
- the impact on adjacent road networks and TransLink's Major Road Network;
- the potential to enhance existing pedestrian and cycling networks by accommodating such facilities into any new overpasses.

- Determine changes that could be made to provide rail priority and improve security at three locations (shown in FIGURE 1.1), with consideration of minimizing impacts on adjacent road networks.

- Determine property acquisition requirements and cost estimates for the proposed concepts. All costs estimates are "order of magnitude" estimates based on typical structure costs only. Property acquisition, signalization, and utility relocation are not included in the estimates.

- Assess current and future benefits for different modes, including pedestrians, cyclists, transit and general traffic, and the safety of all modes, through quantitative and qualitative evaluation. For the evaluation, the existing situation at each crossing has been compared with the proposed concept for each crossing, focusing on potential operational benefits/disbenefits (for pedestrians, cyclists, transit, goods movement, general traffic, and the Major Road Network (MRN)) and potential safety impacts (for pedestrians, cyclists, and motorized traffic). All crossings were evaluated except the Central Valley Greenway (CVG). For the CVG, no direct comparison with existing facilities could be made, since the CVG segment will be a new facility that does not directly replace or upgrade a single existing comparable facility.

- Develop a high level conceptual plan for a north-south cycling facility adjacent to the BI Line rail corridor.

- Perform a multi-modal transportation and safety audit for existing at-grade crossings, focusing on three crossings (Powell Street, Venables Street and Union Street) and identifying specific issues for pedestrians, cyclists, general traffic, transit and commercial vehicles. The results of this audit

have been reported separately. Due to the low volumes of trains currently using the BI Line rail corridor, it was not anticipated that findings from the audit would change the construction priority for removing any of the audited at-grade crossings. The audit findings may be revisited if the volume of trains along the corridor increases.

This study has been completed with input from the following stakeholders:

- Vancouver Fraser Port Authority
- Vancouver Gateway Council
- TransLink
- Transport Canada
- Better Environmentally Sound Transportation
- Vancouver Area Cycling Coalition.

2.0 PRELIMINARY DESIGN OF STRUCTURES

2.1 Background

The following grade separations are being considered, and are discussed in Sections 3 through 7 of this report:

- Section 3: Central Valley Greenway at rail line (pedestrian and bicycle only)
- Section 4: Malkin Avenue
- Section 5: Venables Street (possibly pedestrian and bicycle only)
- Section 6: Union Street
- Section 7: Powell Street.

The first two of these grade separations would accommodate potential extensions of the associated routes, the Central Valley Greenway and Malkin Avenue. The last three would replace existing at-grade crossings.

An initial site visit was conducted to determine if an overpass or underpass was the preferred option at each of the above sites. Issues considered were: general site topography, conflicts with property access, conflicts with cross streets, constructability, and order of magnitude construction costs. It was determined that in general overpass structures were preferred. One exception was at Venables Street where an underpass of the rail was preferable.

The overpass structures have been designed with steel superstructures to minimize the girder erection time and impact on rail operations. In the case of the underpass it will be necessary to jack the structure under the railway line to allow the rail to remain in operation during construction.

2.2 Design Criteria

Road and pedestrian/cyclist profiles were developed at each site location based on the following criteria.

Vertical Clearances

Road over Rail	7.16m
Pedestrian/Cyclist over Rail	7.16m
Road under Rail	5.0m
Pedestrian/Cyclist under Rail	3.6m
Road over Road	5.0m
Pedestrian/Cyclist over Road[1]	5.5m

Horizontal Clearances

CL of Rail to Face of Support	7.62m
Bridge over Road	Outside of Road ROW

Bridge Width

Pedestrian/Cyclist Bridge	4.88m (travel width)
Road Bridge Traffic Lanes	3.3m
Pedestrian/Cyclist (from RFP)	7.6m Malkin Avenue (clear width)
	8.6m Powell Street (clear width)

Vertical Grade

Maximum Road Bridge	8.00%
Maximum Pedestrian/Cyclist Bridge	6.00%

The maximum vertical grade for pedestrian/cyclist bridges was discussed at length by the Working Group and Steering Group. The maximum values chosen in this study are intended to balance the needs of users with the surrounding highly constrained urban environment. Shallower gradients would extend the structures, increasing costs, affecting nearby commercial and residential neighbourhoods, and disrupting cross-street connectivity. Graphics and a table showing the approximate comparative lengths of structures with maximum gradients of 4, 5, 6, and (at Powell Street and Malkin Avenue) 8 percent are included in APPENDIX C.

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[1] BC Ministry of Transportation standards requires an additional 0.5m of clearance on pedestrian bridges. The reason for this is that pedestrian bridges are lighter structures compared to road bridges and as such are more susceptible to damage or collapse due to vehicle impact. Higher clearances may be required if access for utility equipment or trolley buses is necessary.

Maximum gradients of 8.00% have been used on the Malkin Avenue and Powell Street crossing designs. This maximum gradient accommodates the increased structure depth that is required for wide track crossings, while avoiding the disruption to north/south connections that a longer structure with reduced gradients would entail. This maximum gradient will extend over lengths of between 20m and 125m, resulting in the need to consider acceleration and braking requirements (especially in winter road conditions) for all road users, particularly trucks, cyclists, and pedestrians using assistive devices. Stakeholders have expressed concern that steep grades may limit the use of the cycling and pedestrian facilities, and ultimately reduce the potential mode share for pedestrians and bicycles.

In future designs of the structures, separation of the road and pedestrian/cyclist facilities may be considered. Separation would allow the gradients on pedestrian/cycling facilities to be reduced (including through the use of switchbacks or spiral ramps), and/or allow level landings to be introduced. On pedestrian/cyclist structures, a grade of 5% or less may be preferred to meet Building Code requirements for ramps for wheelchairs with no landings. The impacts of providing 5% ramps are discussed in this report for each crossing. At the next stage of study, public consultation may be desirable to confirm the needs of potential users.

There are a number of utility and property conflicts at each proposed overpass/underpass. Storm water catch basins, sanitary and Allstream fibre optics lines would likely be affected to some degree at all proposed intersections. An initial assessment of these impacts for properties and other utilities has been made and is described below for each intersection. The development of the profiles and their impacts are discussed in APPENDIX B.

Typical bridge deck sections show a chain link cage over the pedestrian/bicycle structures that pass over rail tracks. The cage prevents debris from dropping onto the track. This requirement was discussed by the Working Group, but can be reviewed with railway operators during future design stages.

Conceptual design drawings referenced in Section 3 through 7 are provided in separate electronic files, and copied in APPENDIX B of this report.

3.0 CENTRAL VALLEY GREENWAY

TABLE 3.1 SUMMARY OF CVG OVERPASS

Users	bikes and pedestrians only
Maximum Gradient	5.3 percent (to Cottrell Street) 5.2 percent (to Glen Drive)
Approximate Length of Structure	550m (to Cottrell Street) 260m (to Glen Drive)
Obstructed Streets	None
Property Requirements	▪ The structure passes in close proximity to a car repair building on Clark Drive. ▪ The alignment conflicts with a concrete 'rotunda' shaped monument. ▪ Further liaison with CN/BNSF railways will be required to determine the final greenway geometry adjacent to the rail rights-of-way. ▪ See APPENDIX B.
Estimated Order-of-Magnitude Cost (Glen Drive structure)	$11,600,000 (typical structure costs only; property acquisition, signalization, and utility relocation not included in estimate)

3.1 Design

Design notes and drawings are in APPENDIX B, Section B.1 and Drawings C101 (excerpted in FIGURE 3.1) and S101.

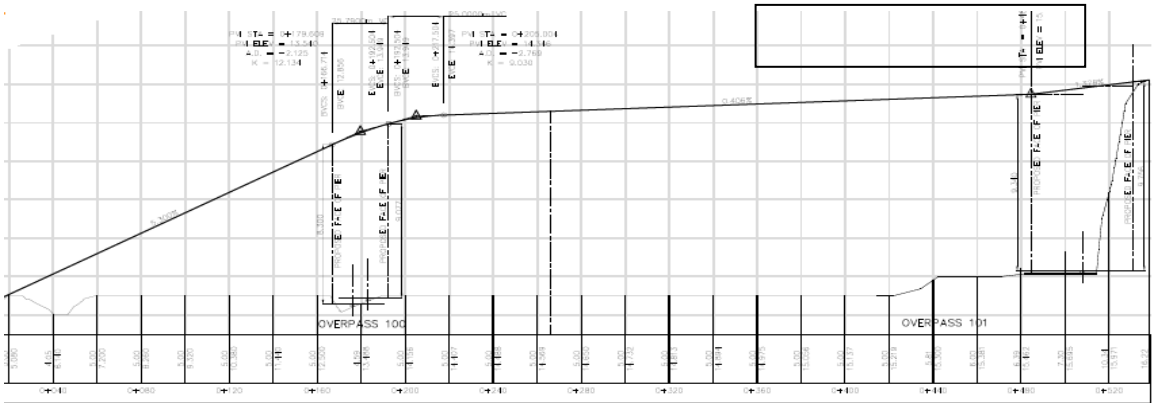


FIGURE 3.1 PROFILE OF PROPOSED BIKE/PEDESTRIAN OVERPASS: CENTRAL VALLEY GREENWAY (COTTRELL STREET ALIGNMENT)

3.2 Connections to Adjacent Bike Routes, Streets, and Transit

Two alignments are shown in APPENDIX B (Drawings C101 and S101), including CVG ramps landing on Glen Drive (Line 102) and on Cottrell Street (Line 101). Both landings are possible.

- The Glen Drive landing accommodates cyclists connecting with Windsor Street Bikeway via the north-south routes discussed in Section 5. It also connects with the VCC Skytrain station, which will facilitate intermodal transportation.
- To the west, the Cottrell Street landing accommodates cyclists connecting with existing and future CVG segments in the False Creek Flats area. Finalizing the location of the structure's ramps will depend in part on the future alignment of greenway facilities in False Creek Flats, which is the subject of a separate study.
- To the east, a connection should be provided to the CVG alignment on Grandview Highway North. Some crossing enhancement should be provided to cross Clark Drive at this landing. This will present some challenges, as the signalized intersection with 6th Avenue is only about 120 metres to the south.

4.0 MALKIN AVENUE

The discussion in this section is based on the possible downgrading of Venables Street and Prior Street from an arterial designation to a collector designation, in conjunction with possible future upgrading of Malkin Avenue to an arterial. A discussion of the impacts of the expected network changes resulting from the downgrading of Venables Street and upgrading of Malking Avenue is outside the scope of this study, which focuses on the preliminary concepts of crossing designs.

TABLE 4.1 SUMMARY OF MALKIN AVENUE OVERPASS

<table>
<tr><td colspan="3">Users</td><td colspan="3">motorized traffic, bikes, pedestrians</td></tr>
<tr><td colspan="3">Maximum Gradient</td><td colspan="3">8 percent</td></tr>
<tr><td colspan="3">Approximate Length of Structure</td><td colspan="3">400m</td></tr>
<tr><td colspan="3">Obstructed Streets</td><td colspan="3">none</td></tr>
<tr><td colspan="3">Property Requirements</td><td colspan="3">▪ See APPENDIX B.
▪ Overall width of the structure conflicts with properties on the east side of Vernon Drive by approximately 1m (greater impact on north side)
▪ Canada Post warehouse conflicts with the structure alignment between Glen Drive and the CP tracks
▪ On the west side of Glen Drive, there will be restrictions to properties on the north and south side of Malkin Avenue (including a warehouse loading bay).</td></tr>
<tr><td colspan="3">Estimated Order-of-Magnitude Cost</td><td colspan="3">$21,945,000 (typical structure costs only; property acquisition, signalization, and utility relocation not included in estimate)</td></tr>
<tr><td colspan="6">Evaluation Summary (Operations)</td></tr>
<tr><td rowspan="2">Pedestrians</td><td rowspan="2">Cyclists</td><td rowspan="2">Transit</td><td colspan="2">Goods Movements</td><td rowspan="2">General Traffic/MRN</td></tr>
<tr><td>Regional</td><td>Local</td></tr>
<tr><td>⇔</td><td>⇔</td><td>⇔</td><td>⇧</td><td>⇩</td><td>⇧</td></tr>
<tr><td colspan="6">Evaluation Summary (Safety)</td></tr>
<tr><td colspan="2">Pedestrians</td><td colspan="2">Cyclists</td><td colspan="2">Motorized Traffic</td></tr>
<tr><td colspan="2">⇔</td><td colspan="2">⇔</td><td colspan="2">⇔</td></tr>
</table>

⇧⇧=substantial benefit ⇧= moderate benefit ⇔= mixed/ no change ⇩= moderate disbenefit ⇩⇩=substantial disbenefit

4.1 Design

Design notes and drawings are in APPENDIX B, Section B.2 and Drawings C102 (excerpted in FIGURE 4.1) and S102.

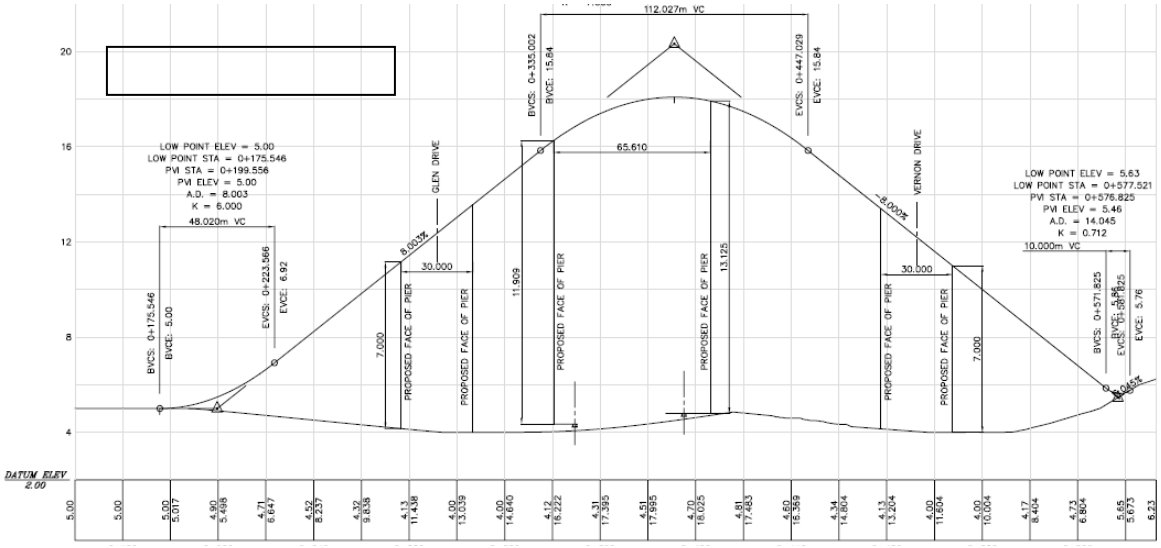


FIGURE 4.1 PROFILE OF PROPOSED FOUR-LANE BRIDGE: MALKIN AVENUE

The proposed crossing includes 3.8-metre multi-use pathways on both sides of the structure. This width could also be allocated as an on-street bicycle lane and a wide sidewalk. The City of Burnaby is developing a bicycle route along Charles Avenue. If the City wishes to extend the bike route on Malkin Avenue on Charles Street, the two-sided cycling configuration is preferred, as it provides easier transition to on-street cycling.

Alternatively, with infrequent driveways and cross streets, consideration could be given to providing a 7.6-metre multi-use path one side of Malkin Avenue only, potentially adjacent to Strathcona Park. If this option is chosen, it would be preferable to continue the pathway by providing cycling facilities on one side of the structure. Transitions back to two-sided cycling should occur at a signal or crosswalk.

4.2 Expected Impacts

Relative to existing conditions, impacts are expected to result not only from the introduction of a grade-separated crossing, but also from upgrading Malkin Avenue from its present status (as a local road providing access to a primarily industrial area) to an arterial.

- *Pedestrians and Cyclists: Operational impacts* on pedestrians and cyclists are mixed relative to the current absence of any crossing, and to the existing Venables Street crossing that this crossing will partly replace. Pedestrians currently use sidewalks with a discontinuous surface at the at-grade crossing on Venables Street, and cyclists have no dedicated facility. However, the net benefit of this structure is reduced by 8 percent grades that will increase the time and effort required to cross the railway (relative to a flat at-grade crossing), and may consequently diminish the attractiveness of this facility. *Safety impacts* on pedestrians and cyclists are similarly mixed. The proposed structure will provide a separate dedicated space for cyclists and pedestrians, but will introduce a substantial gradient that may affect control, particularly during winter or wet weather.
- *Transit:* For routes shifted from Venables Street to Malkin Avenue (if any), transit can be expected to benefit from reduced delays, and therefore greater reliability, from the elimination of the at-grade crossing. Service coverage may change, involving longer walks to and from areas close to Venables Street (including parts of the Strathcona neighbourhood), and shorter walks to and from areas close to Malkin Avenue. TransLink reports that rerouting buses to Malkin Drive would be expected to generate some service coverage gaps (where the nearest bus stop is over 400m walking distance) east and west of Clark Drive, centered around Adanac Street. A local connecting service could be considered to address these gaps.
- *Goods Movement:* The Malkin Avenue link provides a new grade-separated connection between Clark Drive (a designated truck route and a direct route to the Port) and the industrial area around the BI Line tracks. Rail-related delays will be eliminated, though volume-related delays at the new Malkin/Clark intersection may increase relative to existing delays at the Venables/Clark intersection. (Network modeling is outside of the scope of this study, and can be undertaken at a future stage.) Local truck access to some existing industrial

properties close to the tracks will be entirely or partly disrupted by the structure; see APPENDIX A.

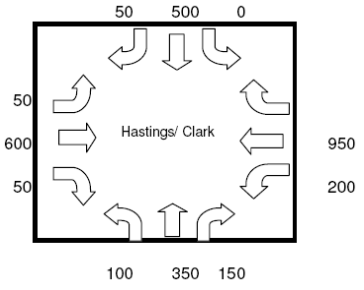
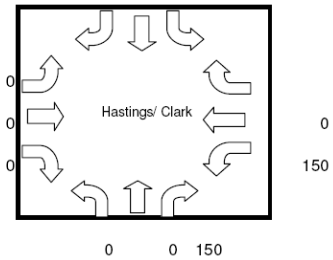
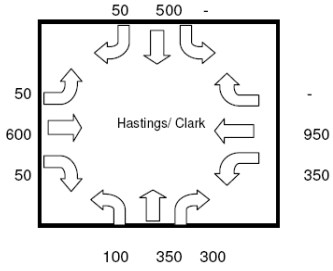
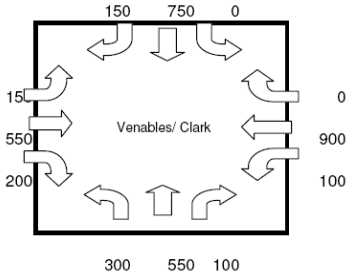
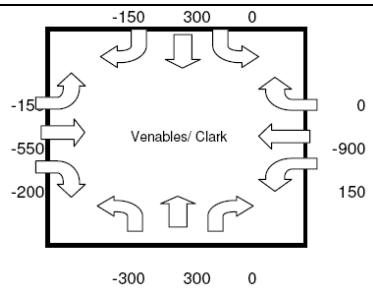
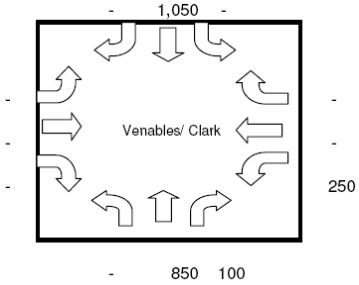
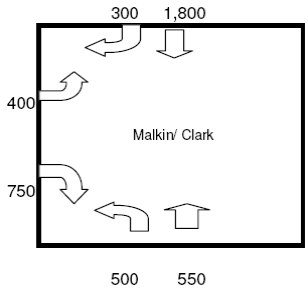
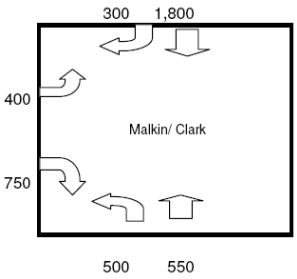
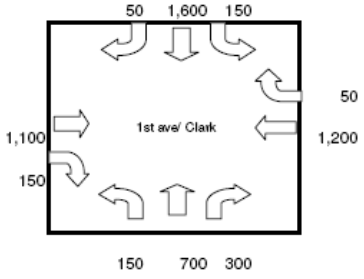
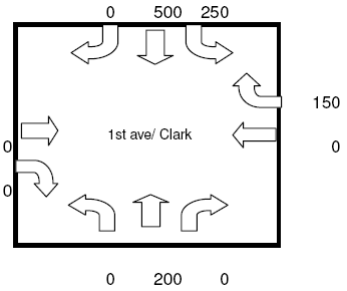
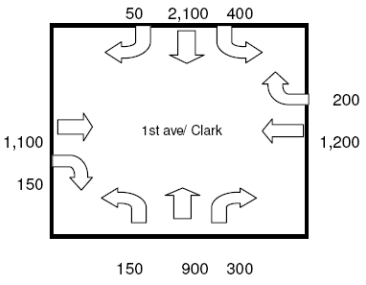
- *General Traffic / Impacts on MRN:* The Malkin Avenue link provides a new grade-separated crossing to replace the existing at-grade crossing on Venables Street, eliminating railway-generated delays and risks to traffic. The new link will reduce volumes at the intersection of Venables Street and Clark Drive (part of the MRN), and increase them at the intersection of Malkin Avenue and Clark Drive. See discussion in Section 4.3. Improved safety can be expected to result from eliminating high-volume left turn movements at the Venables/Clark intersection, where signal operations currently allow permitted left turns that result in a high potential for severe through/left conflicts. However, the introduction of gradients, especially on the approach to the signalized Clark Drive intersection, may result in a higher potential for rear-end collisions, and the proximity of the Clark Drive intersections with Malkin Avenue and First Avenue may generate interference that increases the risk of low-speed conflicts.

4.3 Traffic Diversion on Clark Avenue

The diversion of eastbound and westbound traffic from Venables Street (see Section 5) to Malkin Avenue is likely to have impacts at the intersection with Clark Drive, which is part of the region's MRN. Venables Street, a secondary arterial, currently accommodates about 3,500 entering vehicles in the morning peak hour, and about 3,800 vehicles in the afternoon peak hour. A proportion of this traffic will be shifted to the new intersection of Malkin Avenue and Clark Drive. Since east-west through traffic is not expected to use Charles Street, the new intersection will operate substantially as a "T" intersection, involving more turning movements.

A preliminary qualitative assessment of the impact of diverted volumes can be obtained from estimates of diverted traffic supplied by the City. Using peak-hour turning movement volumes from 2005, the City manually reassigned volumes that would be diverted from Venables Street to Hastings Street, Malkin Avenue, and First Avenue. Indicative results at intersections along Clark Drive are summarized in TABLE 4.2 for the afternoon peak hour. The results show that substantial increases in traffic can be expected at these intersections, which may require changes to roadways and/or traffic control, including:

TABLE 4.2 ESTIMATED PEAK HOUR TRAFFIC AT CLARK DRIVE INTERSECTIONS

	BACKGROUND TRAFFIC	REASSIGNED TRAFFIC	TOTAL TRAFFIC
Hastings Street (AM)			
Venables Street (AM)			
Malkin Avenue (PM)	(no background traffic)		
First Avenue (PM)			

- extended or double left-turn lanes at the intersections with Hastings Street (WB), Venables Street (WB), and First Avenue (SB);
- designated right-turn lane at the intersection with First Avenue (WB);
- a protected-only left turn phase for the major movement from Malkin Avenue (EB) onto Clark Drive (NB) if Charles Street remains open to eastbound traffic;
- measures to reduce use of local roads by drivers seeking to avoid increased delays on arterials;
- measures to reduce obstruction of non-signalized intersections by queued traffic on the northbound approach to Hastings Street.

Detailed operational modeling using current and forecast turning volumes will need to be undertaken at later planning stages to assess the impact of the diverted traffic from the downgraded segment of Venables Street. Modeling should consider:

- the origins and destinations of diverted traffic, which will determine likely diversion paths for traffic that currently passes through the Venables St/Clark Dr intersection eastbound and westbound;
- the proximity of the signalized Clark Drive intersections at First Avenue and Malkin Avenue, which are only about 385m (centre to centre) apart, with two intervening intersections at Grant and Gravely Streets;
- obstruction of nearby non-signalized intersections by traffic queued at signals;
- any planned upgrades to Charles Street as a result of the Malkin Avenue connection.

Intersections at which impacts can be expected include those along Clark Drive and parallel arterials (Commercial Drive and Victoria Drive), as well as major east-west arterials such as Hastings Street, Venables Street, and First Avenue.

5.0 VENABLES STREET

The discussion in this section is based on the possible downgrading of Venables Street and Prior Street from an Arterial designation to a Collector designation, in conjunction with possible future upgrading of Malkin Avenue to an Arterial. Although this study examines only a grade-separated option on Venables Street, the ultimate form of the railway crossing on a downgraded Venables Street will be determined in consultation with neighborhood businesses and residents. A discussion of the impacts of the expected network changes resulting from the downgrading of Venables Street is outside the scope of this study, which focuses on the preliminary concepts of crossing designs.

TABLE 5.1 SUMMARY OF VENABLES STREET UNDERPASS

Users	motorized traffic, bikes, pedestrians
Maximum Gradient	6 percent
Approximate Length of Structure	275m
Obstructed Streets	Raymur Avenue, George Street
Property Requirements	See APPENDIX A. Several accesses to properties on Venables Street would be affected by the underpass/tunnel. Existing laneways could be utilized as local property access.
Estimated Order-of-Magnitude Cost	$4,200,000 (pedestrian underpass) $12,000,000 (vehicle underpass) (typical structure costs only; property acquisition, signalization, and utility relocation not included in estimate)

Evaluation Summary (Operations)					
Pedestrians	Cyclists	Transit	Goods Movements		General Traffic/MRN
			Regional	Local	
⇔	⇔	⇔	⇧	⇩	⇧

Evaluation Summary (Safety)		
Pedestrians	Cyclists	Motorized Traffic
⇔	⇔	⇔

⇧⇧=substantial benefit ⇧= moderate benefit ⇔= mixed/ no change ⇩= moderate disbenefit ⇩⇩=substantial disbenefit

5.1 Design

Design notes and drawings are in APPENDIX B, Section B.3 and Drawings C104_2 (excerpted in FIGURE 5.1) and S104.

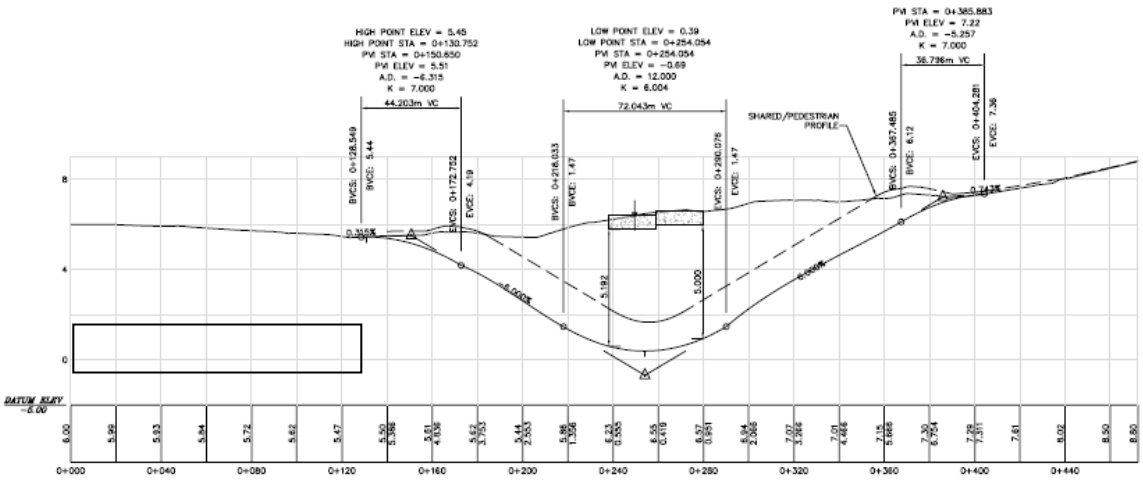


FIGURE 5.1 PROFILE OF PROPOSED SHARED USE PATH: VENABLES STREET

5.2 Expected Impacts

Impacts are expected to result not only from the introduction of a grade-separated facility for all road users, but also from downgrading Venables Street from its present status (as a secondary arterial) to a local road.

- *Pedestrians and Cyclists: Operational impacts* on pedestrians and cyclists are mixed. Pedestrians currently use sidewalks with a discontinuous surface at the at-grade crossing, and cyclists have no dedicated facility along Venables Street. In the future, pedestrians and cyclists will have the use of a dedicated multi-use underpass. However, the net benefit is reduced by the introduction of a grade separation (underpass) involving a 6 percent gradient, which will increase the time and effort required to cross the railway, which may diminish the attractiveness of the crossing. *Safety impacts* on pedestrians and cyclists are similarly mixed. The proposed structure will provide a separate dedicated

space for cyclists and pedestrians, but will introduce a gradient that may affect control, particularly during winter or wet weather.

- *Transit:* With the downgrading of Venables Street to a collector road, the No. 22 bus route that connects Venables Street with the downtown area would likely be relocated to an adjacent arterial. Consequently, users close to Venables Street may need to walk longer distances to access direct service to the downtown area, while other users may have shorter walking distances. A local connecting service may be considered to reduce longer walking distances. A grade-separated crossing along Venables Street may facilitate this local connecting service.
- *Goods Movement:* The designation of Venables Street as a regional Truck Route is likely to change as a result of downgrading it from its present status as a secondary arterial. The designation is likely to shift to upgraded Malkin Street. Local goods movement may be affected by the changed cross-section of Venables Street and closures at Glen Drive and George Street; see APPENDIX A.
- *General Traffic / Impacts on MRN:* See discussion regarding Malkin Avenue link (Section 4.3) above. Traffic volumes are likely to change as a result of downgrading Venables Street from its present status as a secondary arterial. This will reduce volumes at the intersection of Venables Street and Clark Drive (part of the MRN), and increase them at the intersection of Malkin Avenue and Clark Drive.

6.0 UNION STREET

TABLE 6.1 SUMMARY OF UNION STREET OVERPASS

Users	bikes and pedestrians only
Maximum Gradient	6 percent
Approximate Length of Structure	400m
Obstructed Streets	None
Property Requirements	The pedestrian/bicycle overpass would not directly conflict with properties, but access to several residential and small business properties (including a heritage building at the eastern end) would be restricted where the bridge ties-in at either end. See APPENDIX B.
Estimated Order-of-Magnitude Cost	$5,560,000 (typical structure costs only; property acquisition, signalization, and utility relocation not included in estimate)

Evaluation Summary (Operations)					
Pedestrians	Cyclists	Transit	Goods Movements		General Traffic/MRN
			Regional	Local	
⇔	⇔	⇔	⇔	⇩	⇔

Evaluation Summary (Safety)		
Pedestrians	Cyclists	Motorized Traffic
⇔	⇔	⇔

⇧⇧=substantial benefit ⇧= moderate benefit ⇔= mixed/ no change ⇩= moderate disbenefit ⇩⇩=substantial disbenefit

6.1 Design

Design notes and drawings are in APPENDIX B, Section B.4 and Drawings C105 (excerpted in FIGURE 6.1) and S103.

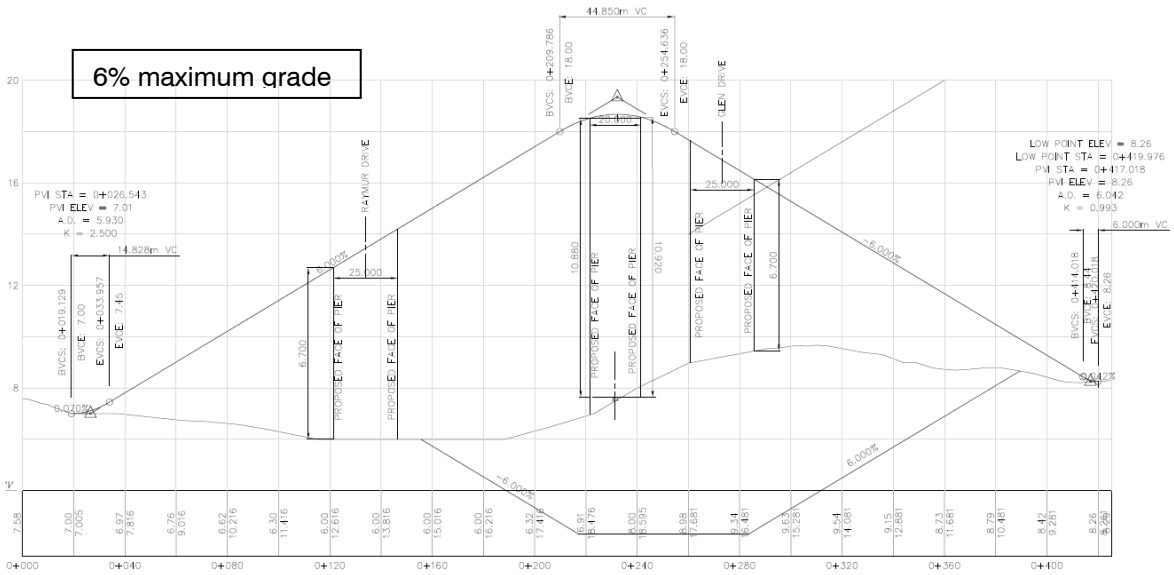


FIGURE 6.1 PROFILE OF PROPOSED BIKE/PEDESTRIAN OVERPASS AND UNDERPASS: UNION STREET

6.2 Expected Impacts

- *Pedestrians and Cyclists: Operational impacts* on pedestrians and cyclists are expected to be mixed. At-grade crossing delays for cyclists would be eliminated. Pedestrians currently use sidewalks with a discontinuous surface at the at-grade crossing, and cyclists have no dedicated facility along Union Street, a designated cycle route. In the future, pedestrians and cyclists will have the use of a dedicated multi-use facility on structure. However, the net benefit is reduced by the introduction of a grade separation involving a 6 percent gradient, which will increase the time and effort required to cross the railway, and may consequently diminish the attractiveness of this facility. *Safety impacts* on pedestrians and cyclists are similarly mixed. The proposed structure will provide a separate dedicated space for cyclists and pedestrians, but will introduce a gradient that may affect control, particularly during winter or wet weather.
- *Transit:* No substantial operational changes are anticipated, since Union Street is not a bus route.

- *Goods Movement:* Regional goods movements would be unaffected by changes to Union Street, since the road is not a regional truck route. Locally, access to some small business properties would be disrupted where the bridge ties in at either end. Alternative access to these properties via a laneway or another street would still be possible, but may involve reconfiguration of accesses. See APPENDIX A.
- *General Traffic / Impacts on MRN:* The closure of the at-grade crossing will obstruct local traffic along this local road. Local traffic would need to access Union Street from Vernon Drive, Glen Drive, or Clark Drive (approaching from the east), or Campbell Avenue (approaching from the west).

7.0 POWELL STREET

TABLE 7.1 SUMMARY OF POWELL STREET OVERPASS

Users	motorized traffic, bikes and pedestrians
Maximum Gradient	8 percent
Approximate Length of Structure	310m
Obstructed Streets	Raymur Avenue
Property Requirements	▪ See APPENDIX B. ▪ There is an encroachment into existing track clearance within CP Rail property on the north side of Powell Street, although it is understood that the tracks would be relocated or de-activated. ▪ Buildings (not currently occupied) on the south-east side of the tracks would be directly impacted, ▪ A Chevron gas station on the south side of Powell St would be impacted by fill slopes to the structure overpass. ▪ The same fill slopes may only slightly impact the Smith Construction building on the south east side of Glen Drive.
Estimated Order-of-Magnitude Cost	$15,300,000 (typical structure costs only; property acquisition, signalization, and utility relocation not included in estimate)

Evaluation Summary (Operations)					
Pedestrians	Cyclists	Transit	Goods Movements		General Traffic/MRN
			Regional	Local	
⇔	⇔	⇧⇧	⇧	⇩	⇧

Evaluation Summary (Safety)		
Pedestrians	Cyclists	Motorized Traffic
⇔	⇔	⇧⇧

⇧⇧ =substantial benefit ⇧ = moderate benefit ⇔ = mixed/ no change ⇩ = moderate disbenefit ⇩⇩ =substantial disbenefit

7.1 Design

Design notes and drawings are in APPENDIX B, Section B.5 and Drawings C107_1 (partly excerpted in FIGURE 7.1), C107_2, and S105.

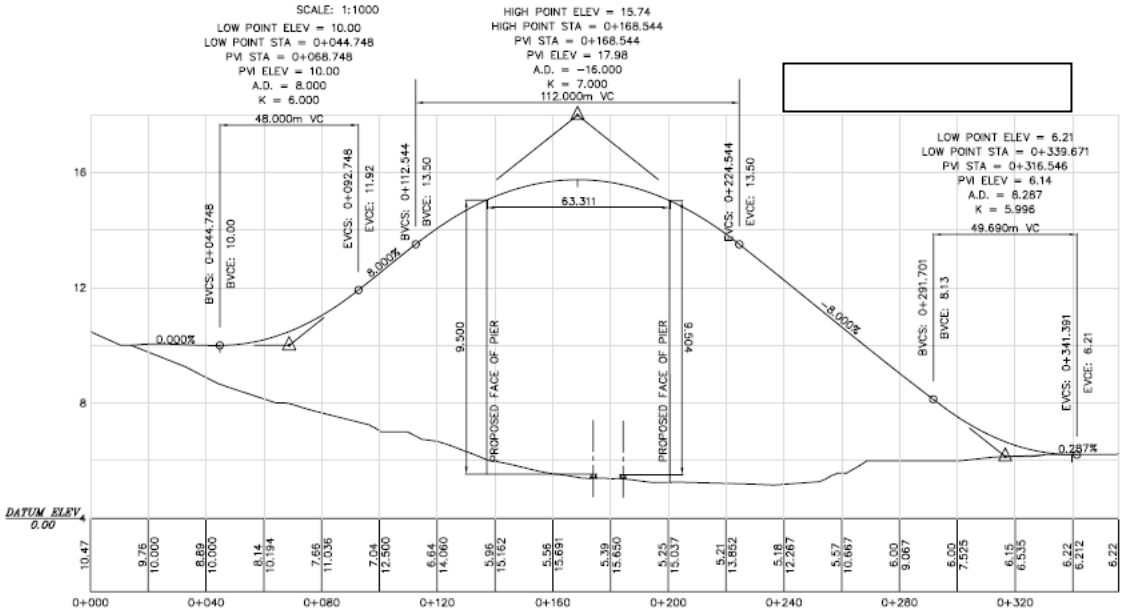


FIGURE 7.1 PROFILE OF PROPOSED FOUR-LANE OVERPASS: POWELL STREET (EASTBOUND)

City staff note that Powell Street is potentially part of a future greenway. The proposed crossing is a four lane bridge with two 4.3 metre multi-use pathways on both sides. Similar to Malkin Avenue, the 4.3 metres for multi-use pathways could also be allocated as an on-street cycle lane and wide sidewalks. These two configurations provide the easiest and safest connections to the existing on-street bicycle route and sidewalks on both sides of the road. A single 8.6 metre multi-use pathway could be provided on one side, if a two-way multi-use pathway is expected to extend beyond the length of the Powell Street overpass.

7.2 Expected Impacts

- *Pedestrians and Cyclists: Operational impacts* on pedestrians and cyclists are expected to be mixed. Pedestrians currently use sidewalks with a discontinuous surface at the at-grade crossing. Cyclists have no dedicated facility, and consequently travel in the right traffic lane close to high vehicle volumes, including trucks. In the future, pedestrians and cyclists will have the use of a wider, dedicated multi-use facility on structure. However, the net benefit is reduced by the introduction of a grade separation involving an 8

percent gradient, which will increase the time and effort required to cross the railway, and may consequently diminish the attractiveness of this facility. *Safety impacts* on pedestrians and cyclists are similarly mixed. Cyclists currently cross angled tracks that may be hazardous for inattentive or inexperienced cyclists whose wheels become trapped in the flangeway. The proposed structure will provide a separate dedicated space for cyclists and pedestrians, but will introduce a substantial gradient that may affect control, particularly during winter or wet weather.

- *Transit:* Transit can be expected to benefit from reduced delays, and therefore greater reliability, from the elimination of the at-grade crossing, particularly as this crossing can cause significant delays affecting several transit routes. Unlike general or commercial traffic, transit (including trolleys) cannot easily divert to alternate routes such as Hastings Street when there is an extended delay, which can occur at this crossing when trains slow for the track curvature and the diamond crossing with the CPR track.
- *Goods Movement:* Regional goods movement at this site, immediately adjacent to the port, can be expected to benefit from reduced delays and greater reliability following the elimination of the at-grade crossing. However, circulation in the adjacent industrial area, and access to some existing industrial properties, will be entirely or partly disrupted for local goods movements. See APPENDIX A.
- *General Traffic / Impacts on MRN:* Existing at-grade crossing delays will be eliminated, resulting in a potential for reduced delays to all road users on Powell Street, a major arterial. The grade-separated crossing will reduce the risks of a severe train-vehicle crash, but introduce risks associated with lower-severity crashes on downhill gradients.

8.0 CLOSURE OF AT-GRADE CROSSINGS

8.1 Background

Preliminary strategies have been developed for each of the three locations at which existing at-grade crossings may be removed. These preliminary strategies identify the changes to roadway geometry and/or redirection of road network that will be necessary to maintain access to the adjacent industrial areas, and minimize disruption to adjacent areas as a result of traffic diversion. The impacts of proposed grade-separated crossings and crossing closures have been reviewed with respect to the road network and property access, using a WB-19 design vehicle. Following comments received on the Technical Memorandum, potential connections (rather than turnarounds) have been considered for large trucks.

Road closures associated with future grade-separated crossings have been incorporated in the strategies. These closures are associated with the preliminary designs shown in APPENDIX B, which have maximum gradients of 6 or 8 percent. Designs based on shallower gradients would generally result in more road closures.

In the figures in this section, approximate barrier locations are based on a lateral clearance distance requirement of approximately 5 metres, measured from the nearest rail of continuous double mainline tracks (but not from sidings).

It is noted that consultation with adjacent industrial areas and neighbourhoods would be required if there was a desire to proceed with closures of at-grade railway crossings.

8.2 Cordova Street

Key issues associated with the closure of the Cordova Street crossing are shown in TABLES 8.1 and 8.2, and FIGURES 8.1 and 8.2.

TABLE 8.1 IMPACTS OF CLOSURE OF CORDOVA STREET AT-GRADE CROSSING

EFFECT ON:	ASSESSMENT
roadway geometry and property acquisition	The impacts of this closure will be affected by two other closures: ▪ closure of the Raymur Ave at-grade crossing ▪ closure of the Powell St/Raymur Ave intersection due to obstruction by the Powell St grade-separation structure (overpass). To accommodate trucks with these closures, connecting links to adjacent through streets need to be considered. A new link between Cordova Street and Raymur Avenue may be considered to allow truck movements without turn-arounds; the link would result in the need to acquire property along the west side of the rail. Existing and possible future links are shown schematically in FIGURE 8.1, and an indication of resulting truck turning paths is shown in FIGURE 8.2. These links will require likely property acquisitions as shown in FIGURE 8.2 and TABLE 8.2.
pedestrian traffic	The closure will obstruct the sidewalks at the crossing on the north and south sides of Cordova Street in an industrial area having low pedestrian volumes. Diverted pedestrians may travel on East Hastings Street or the proposed overpass at Powell Street. Depending on the origins and destinations of the pedestrians, these two alternative routes would add up to about 600 meters (Powell St) or 700 meters (East Hastings St) to the total trip length. Familiar users would likely pre-select a route to avoid such a diversion. See Section 8.5.
cyclist traffic	▪ Will close a local road (Cordova Street) that is not a designated greenway or bicycle route, but which currently accommodates cyclists. ▪ Diverted cyclists may travel on Powell Street, potentially part of a future greenway, which would have dedicated cycling facilities on a grade-separated structure.
general traffic	▪ Will close a local road (Cordova Street), diverting local traffic to Powell Street (an arterial and designated truck route) and East Hastings Street (an arterial, a designated truck route, and part of the MRN). ▪ See FIGURES 8.1 and 8.2.
transit	▪ Little direct impact, since the subject segment of Cordova Street is not a designated transit route. ▪ Possible indirect impact by diverting pedestrians travelling to and from transit stops on Powell Street and East Hastings Street.
MRN	▪ Minor impact from a small volume of local traffic diverted from a local road (Cordova Street) to East Hastings Street.
goods movements and impacts on adjacent properties	▪ Access routes to properties will change (see “general traffic” impacts above). ▪ One commercial access would be obstructed by closure barriers. ▪ Provision of a link road between Cordova St and Raymur Av can be considered to facilitate access by trucks without the need to turn around. See FIGURE 8.1; an indication of the alignment and truck turning paths is shown in FIGURE 8.2.
adjacent neighbourhoods	▪ Diverted traffic will need to use roadways in adjacent industrial areas. ▪ Diverted traffic is not expected to impact residential areas or commercial areas.

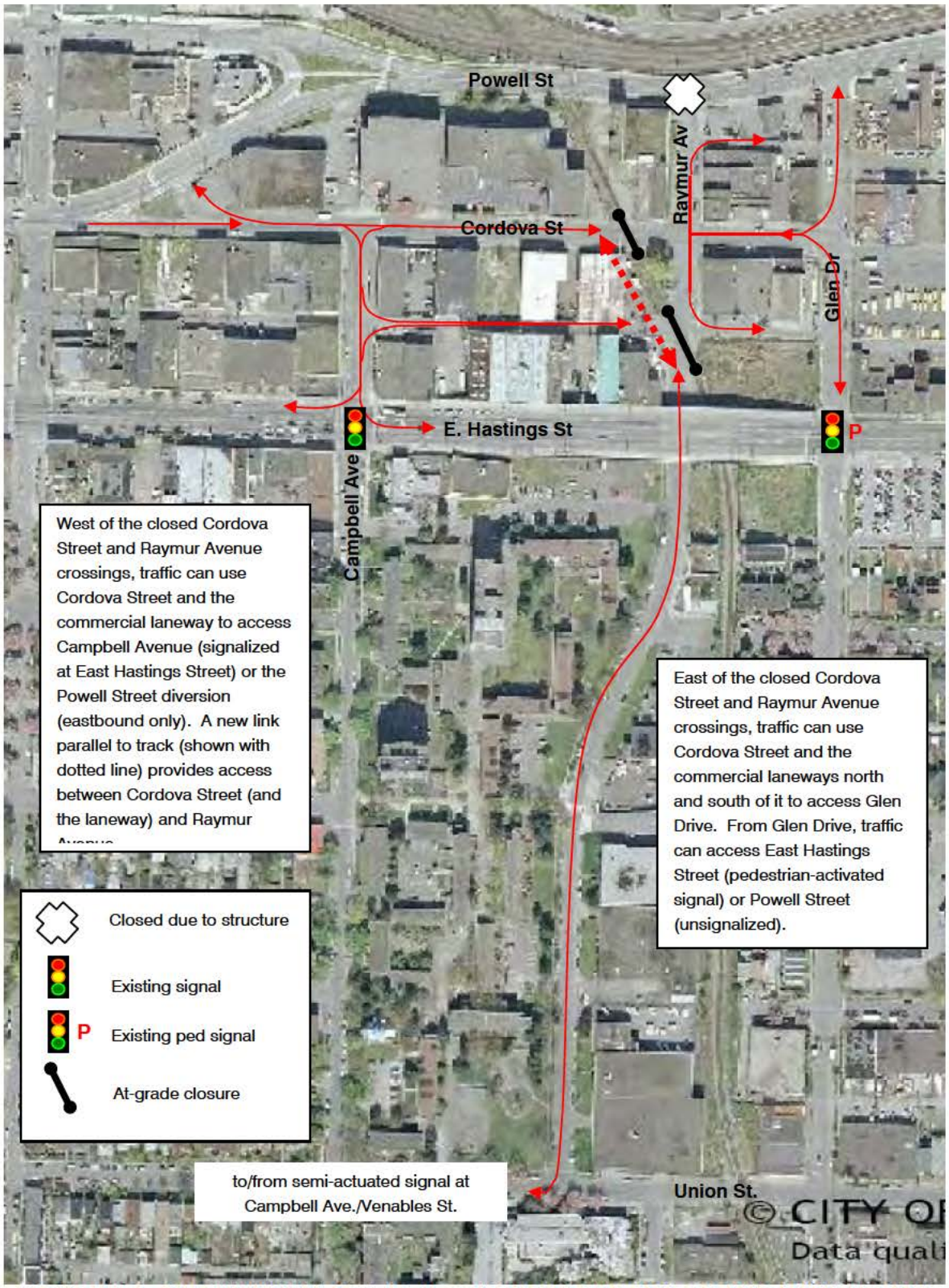


FIGURE 8.1 CIRCULATION AFTER CLOSURES (CORDOVA ST AND RAYMUR AV)

Truck path west of BI Line assumes presence of a new connecting link between Cordova Street and Raymur Avenue.

FIGURE 8.2 TRUCK TURNING REQUIREMENTS: CORDOVA STREET AND RAYMUR STREET AT-GRADE CROSSING CLOSURES

TABLE 8.2 EXPECTED PROPERTY IMPACTS AND REQUIREMENTS: CORDOVA STREET AND RAYMUR STREET AT-GRADE CROSSING CLOSURES

ADDRESS*	ZONING and USE	CITY OWNED?	COMMENT
987 E. Cordova St	M-2 Industrial (warehouse)	no	Cordova Street access to adjacent parking area will be obstructed by closure of at-grade crossing.
968 E. Cordova St	M-2 Industrial (various commercial)	no	Most of the property may be required for a new road connection between E. Cordova St and Raymur Av. (along the west side of the rail right of way).
1020 E. Cordova St	M-2 Industrial (various commercial)	no	Closure of at-grade crossing will partly obstruct Raymur Av, resulting in the need for part of the laneway (rear) parking area for turns into/out of laneway.

ADDRESS*	ZONING and USE	CITY OWNED?	COMMENT
383 Raymur Av	M-2 Industrial (commercial laundry)	no	Most of the property may be required for a new road connection between E. Cordova St and Raymur Avenue (along the west side of the rail right of way).
1015 E. Hastings St	M-1 Industrial (vacant)	yes	Closure of at-grade crossing at Raymur Av will block Raymur Av access to property. Access will remain from Glen Dr and laneway.

** Addresses shown in FIGURE 8.2.*

8.3 Raymur Avenue

Key issues associated with the closure of the Raymur Avenue crossing are shown in TABLE 3.3 and FIGURE 3.3.

TABLE 8.3 IMPACTS OF CLOSURE OF RAYMUR AVENUE AT-GRADE CROSSING

EFFECT ON:	ASSESSMENT
roadway geometry and property acquisition	The impacts of this closure will be affected by two other closures: ▪ closure of the Cordova Street at-grade crossing ▪ closure of the Powell St/Raymur Ave intersection due to obstruction by the Powell St grade-separation structure (overpass). ▪ To accommodate trucks with these closures, connecting links to adjacent through streets need to be considered. Links are shown schematically in FIGURE 8.1, and an indication of resulting truck turning paths is shown in FIGURE 8.2. These links will require likely property acquisitions as shown in FIGURE 8.2 and TABLE 8.2.
pedestrian traffic	The closure will obstruct the sidewalks north and south of the crossing, in an industrial area having low pedestrian volumes. Diverted pedestrians may use parallel routes on Campbell Avenue or Glen Drive. Depending on the origins and destinations of the pedestrians, these alternative routes would add up to approximately 900 meters (Campbell Avenue) or 700 meters (Glen Drive) to their total trip length. Diversions to the south would need to cross the tracks at the Keefer Street pedestrian overpass. Familiar users would likely pre-select a route to avoid such a diversion. See Section 8.5.
cyclist traffic	The closure will close a local road (Raymur Avenue) that is not a designated greenway or bicycle route, but which currently accommodates cyclists. Routes for diverted cyclists are discussed in Section 8.5.

EFFECT ON:	ASSESSMENT
general traffic	▪ The closure will obstruct a local road (Raymur Avenue). Parallel streets (Campbell Avenue and Glen Drive) will remain open. Local traffic may be diverted to Cordova Street, Powell Street (an arterial and designated truck route), or East Hastings Street (an arterial, a designated truck route, and part of the MRN), from which Campbell Avenue and Glen Drive can be accessed. ▪ See FIGURE 8.1.
transit	▪ Little direct impact, since Raymur Ave. is not a designated transit route. ▪ Possible indirect impact by diverting pedestrians travelling to and from transit stops on Powell Street and East Hastings Street.
MRN	▪ Minor impact from a small volume of local traffic diverted from a local road (Raymur Avenue) to East Hastings Street.
goods movements and impacts on adjacent properties	▪ Access routes to properties will change (see "general traffic" impacts above). ▪ A commercial laneway providing access to ten properties on Cordova Street and Hastings Street will be blocked at one end by the closure of the rail crossing, resulting in disruption to access. Laneway access constitutes the *only* street access for three of these properties along East Hastings Street. To address this impact, a new link between Cordova Street and Raymur Avenue may be considered; the link would result in the need to acquire property along the west side of the rail. ▪ Access to the City-owned property at 1015 East Hastings Street will be limited to Glen Drive and a laneway to the north. ▪ See FIGURES 8.1 and 8.2.

adjacent neighbourhoods	▪ Closure of Raymur Avenue at the crossing may generate impacts in areas south of the closure site by vehicles that formerly accessed the area from the north:
	  ▪ the CD-1 (comprehensive development) area on the west side of Raymur Avenue between East Hastings Street and Union Street, representing about eight addresses that include provincial housing
	  ▪ two RM-3A (multi-family) dwellings south of Union Street, at 970 Union Street and 830 Campbell Avenue.

8.4 Parker Street/ Glen Drive

Key issues associated with the closure of the Parker Street/Glen Drive crossing are shown in TABLES 8.4 and 8.5 and FIGURES 8.3 and 8.4.

TABLE 8.4 IMPACTS OF CLOSURE OF PARKER STREET/GLEN DRIVE AT-GRADE CROSSING

EFFECT ON:	ASSESSMENT
roadway geometry and property acquisition	▪ The impacts of this closure will be affected by the closure of the Venables Street intersection due to obstruction by a grade-separation structure (uderpass). ▪ To accommodate traffic with these closures, connecting links to adjacent through streets need to be considered. A new link between Glen Drive and Parker Street may be considered to allow truck movements without turn-arounds; the link would result in the need to acquire property along the east side of the rail. Existing and possible future links are shown schematically in FIGURE 8.4, and an indication of resulting truck turning paths is shown in FIGURE 8.5. These links will require likely property acquisitions as shown in FIGURE 8.5 and TABLE 8.4.
pedestrian traffic	Because there are currently no sidewalks at the grade crossing, pedestrians use roadways. The closure will obstruct roadways in a light-industrial area having some pedestrian volumes. Diverted pedestrians may travel to the proposed grade-separated crossing at Prior Street via Raymur Avenue or George Street. Depending on the origins and destinations of the pedestrians, these alternative routes would add up to 300 meters (Raymur Avenue) or 550 metres (George St) to their total trip length. Familiar users would likely pre-select a route to avoid such a diversion. See Section 8.5.
cyclist traffic	▪ Crossing closure will block two local roads, Parker Street and Glen Drive, at the crossing. Currently, neither is a designated greenway or bicycle route. ▪ Parker Street and Glen Drive do not currently accommodate many cyclists, likely because of poor pavement conditions and interference from commercial truck operations. ▪ Diverted cyclists may travel to the proposed grade-separated crossing at Prior Street via Raymur Avenue or George Street.
general traffic	▪ Crossing closure will obstruct two local roads (Parker Street and Glen Drive). ▪ Parker Street functions as a significant east-west connection in the light industrial area between Prior Street and Malkin Avenue, because it is the only east-west street in the area that is not obstructed by the BI rail line. Consequently, local and through traffic diverted from Parker Street will likely use Prior Street (currently an arterial and designated truck route, but a candidate for downgrading in the future), Clark Drive (an arterial and part of the MRN), or Malkin Avenue (an arterial). ▪ See FIGURE 8.3.

EFFECT ON:	ASSESSMENT
transit	▪ Little direct impact is expected, since Parker Street and Glen Drive are not designated transit routes. ▪ Indirect impact possible by diverting pedestrians travelling to and from transit stops on Prior Street and Clark Drive.
MRN	▪ Minor impact expected from a small volume of local traffic diverted from local roads (Parker Street and Glen Drive) to Clark Drive.
goods movements and impacts on adjacent properties	▪ Access routes to properties will change (see "general traffic" impacts above). To facilitate truck movements without the need to turn around, a new connection east of the railway is proposed between Glen Drive and Parker Street. ▪ One commercial access (950 Raymur Av) and one signed loading zone (1100 Venables St) would be directly obstructed by closure barriers. ▪ See FIGURES 8.3 and 8.4.
adjacent neighbourhoods	Diversion of traffic to Malkin Avenue may generate impacts on residential lots adjacent to or near the intersection of Malkin Avenue and Prior Street (zoned two-family dwelling).

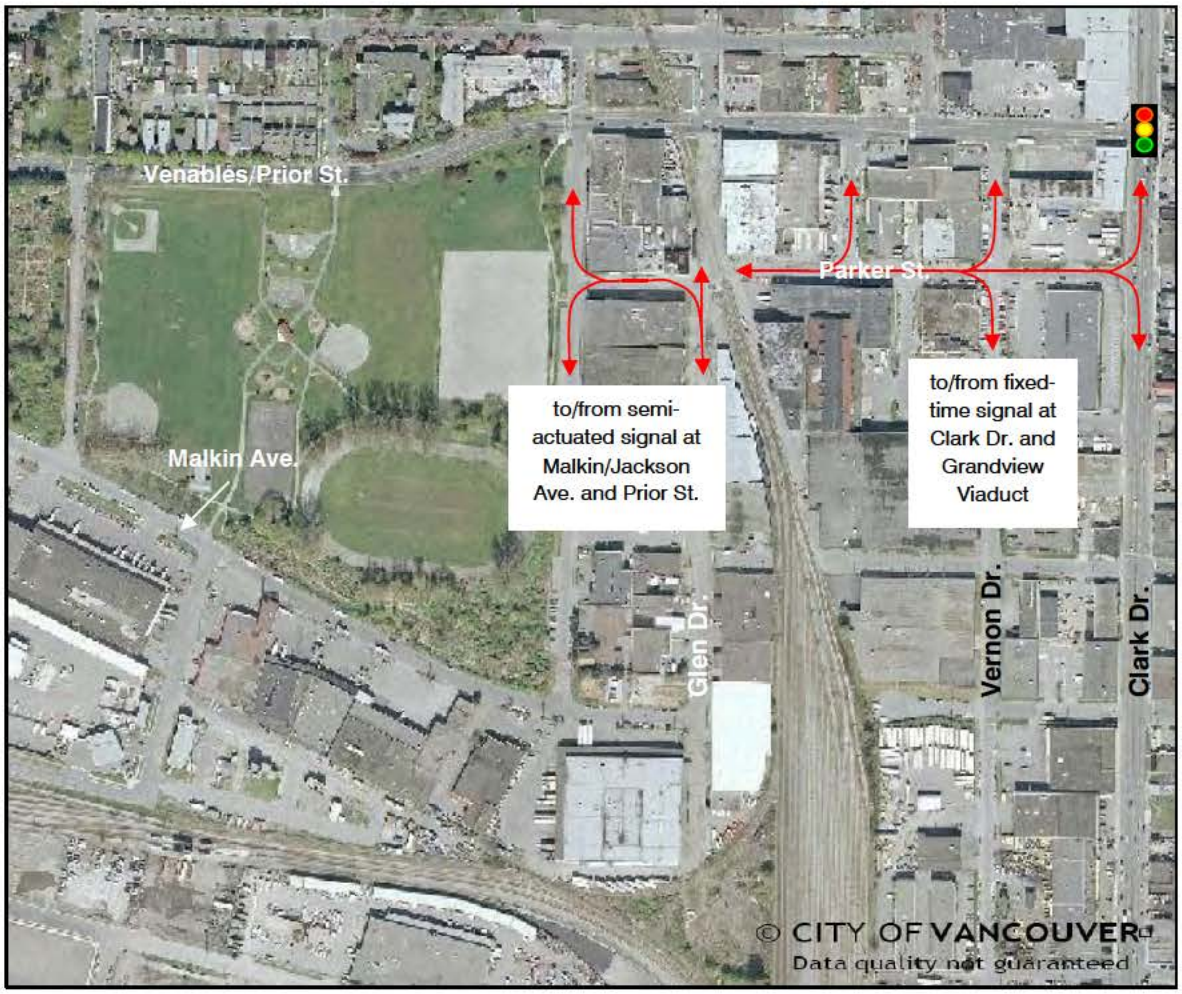


FIGURE 8.3 CIRCULATION FOLLOWING CLOSURE OF AT-GRADE CROSSING AT PARKER STREET / GLEN DRIVE

Anticipated property requirements are shown in FIGURE 8.4 and summarized in TABLE 8.5. These requirements are preliminary only, and will need to be confirmed following more detailed design of the at-grade crossing closure.

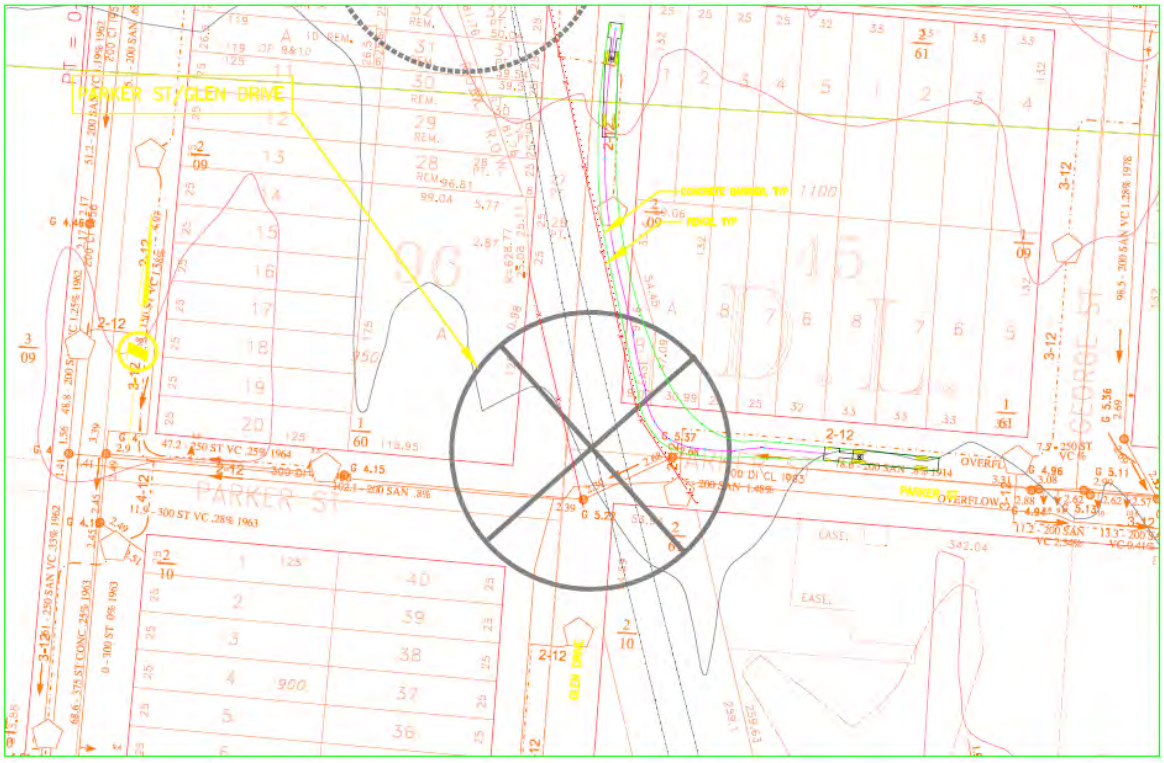


FIGURE 8.4 TRUCK TURNING REQUIREMENTS:
PARKER STREET/GLEN DRIVE AT-GRADE CROSSING CLOSURE

TABLE 8.5 EXPECTED PROPERTY IMPACTS AND REQUIREMENTS: PARKER STREET/GLEN DRIVE AT-GRADE CROSSING CLOSURE

ADDRESS*	ZONING and USE	CITY OWNED?	COMMENT
950 Raymur Av	I-2 Industrial (General Paints)	no	At-grade closure will obstruct existing driveway off Glen Dr for outdoor storage area.
1100 Venables St	I-2 Industrial (warehouse)	no	At-grade closure will obstruct existing loading zone off Glen Dr. Part of this property may be required for a link between Parker Street and Glen Drive, which will facilitate movements for all road users in the area.
1000 Parker St	I-2 Industrial (commercial)	no	At-grade closure could partly or fully obstruct Parker St driveway adjacent and parallel to the tracks, limiting or eliminating access to some of the buildings on this site.
900 Parker St	I-2 Industrial (various commercial)	no	NE corner of the property (Strata Plan 015552276) may be affected by trucks turning right from EB Parker St onto SB Glen Dr if these trucks are to remain entirely on their side of road centerline when turning. (If some encroachment into the opposing lane of traffic is permissible, then no impacts to this property are anticipated.)

** Addresses shown in FIGURE 8.4.*

8.5 Evaluation of Crossing Closures on Pedestrians and Cyclists

While some local trips may be significantly inconvenienced by some of the proposed closures, it is expected that demand for these trips will be quite low. For example, the number of pedestrians originating on Cordova Street east of Raymur Avenue and heading to a destination in the block immediately west of Raymur Avenue is expected to be minimal. Therefore, in reviewing the diversion of pedestrian trips, an assessment was conducted of the spacing of through corridors for pedestrians and cyclists in the study area. The results of the assessment are summarized in FIGURE 8.5.

Intersection / Crossing	Detour Distance To The North	Detour Distance To The South
Cordova St @ Raymur Ave	84 m	100 m
Glen Dr @ Parker St	100 m	300 m

Intersection / Crossing	Detour Distance To The East	Detour Distance To The West
Raymur Ave @ Cordova St	80 m	170 m
Glen Dr @ Parker St	200 m	100 m
Glen Dr @ Venables St	150 m	270 m

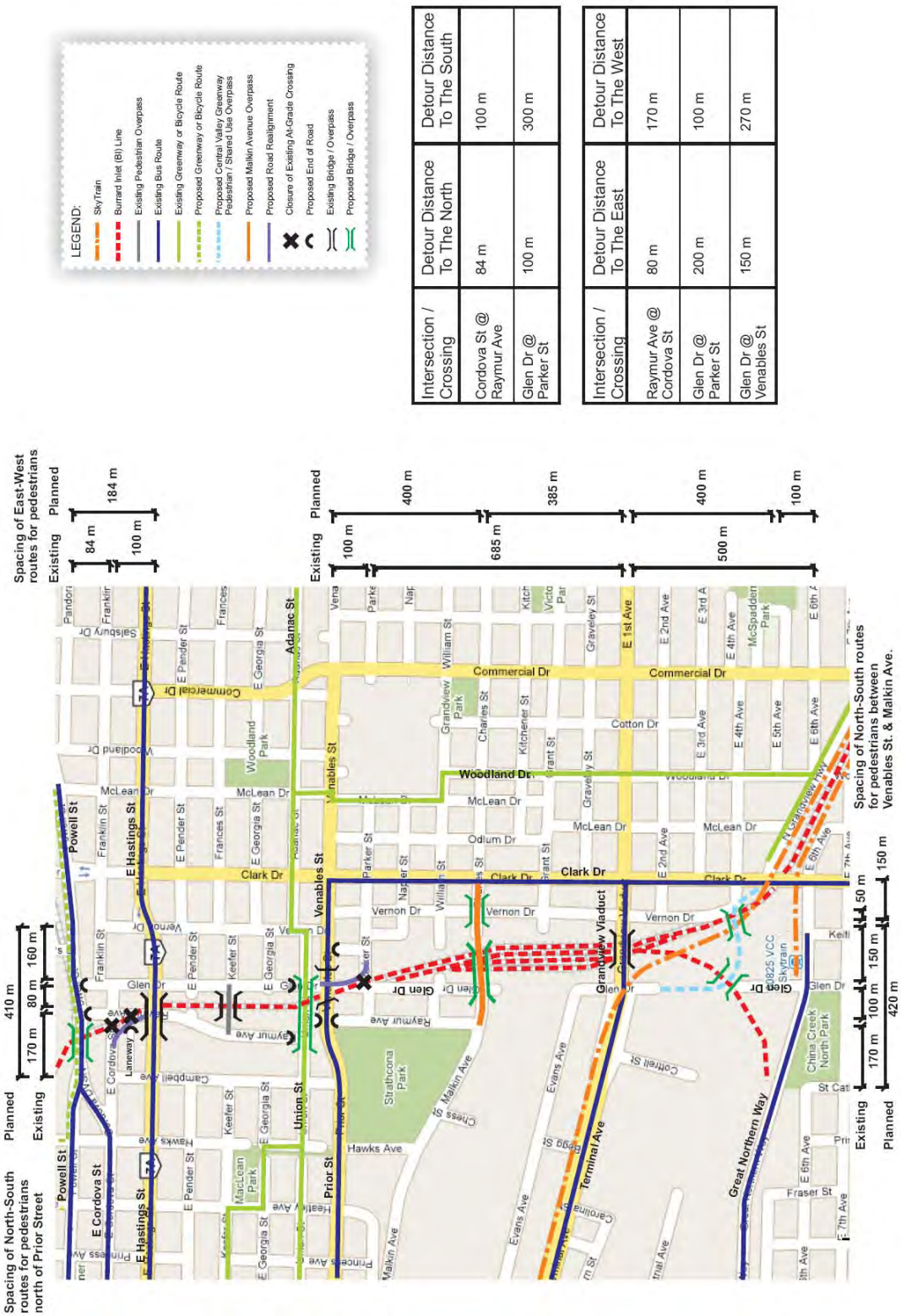


FIGURE 8.5 SPACING OF PEDESTRIAN AND CYCLE THROUGH CORRIDORS

For example, north of Hasting Street, east-west routes for pedestrian and cyclists are provided on Powell Street and Cordova Street. East-west routes are therefore provided at intervals of 84 to 100 metres. With the closure of Cordova Street at Raymur, through pedestrians will have to divert to either Powell Street or Hastings Street, and so east-west routes are provided at intervals of 184 metres. This is still considered to be acceptable spacing, particularly in an area of relatively low pedestrian demand.

South of Venables Street, the spacing for pedestrian corridors improves with the proposed extension of Malkin Avenue and provision of the Central Valley Greenway. Currently, spacing of through pedestrian routes on this route ranges from 100 metres to 685 metres. With the provision of the rail overpasses, spacing will range from 100 to 400 metres.

Impacts are most significant on north-south pedestrian routes. Whereas currently north-south routes are spaced every 100 metres on the existing street grid, the closure of streets to accommodate overpasses will result in spacing of through north-south streets of up to 410 metres. Between Cordova Street and Hastings Street, the only viable through routes will be Campbell Avenue and Clark Drive. Between Hastings Street and Venables Street, the only viable routes will be Campbell Avenue, Glen Drive, Vernon Drive, and Clark Drive.

8.6 Evaluation of Crossing Closures

On the basis of the discussion in Sections 8.1 through 8.4, the evaluation of all crossing closures is summarized below and in TABLE 8.6. *Pedestrians and cyclists* are expected to have reduced operational efficiency as they are diverted from direct walking or cycling routes to grade-separated crossings. While the grade-separated crossings reduce the safety risks associated with occupied rail crossings, and for cyclists the risks associated with traversing skewed rail crossings, the introduction of gradients may increase risks associated with a loss of control for cyclists and pedestrians with assistive devices. For both operations and safety, diversions may increase pedestrians' and cyclists' willingness to engage in risky behaviour (such as jaywalking or trespassing) to reduce increased travel distances. *Transit* does not operate on any of the obstructed streets, but walking distances can be expected to increase for diverted pedestrians walking to and from transit stops. *Regional goods movements* would likely be unaffected by

the closures, since none of the obstructed roads are regional trucks routes. However, *local goods movements* and *general traffic* movements would be disrupted by road closures and obstructed accesses. New road links have been suggested to facilitate local movements. Impacts on the MRN are expected to be minimal, reflecting a minor volume of local traffic diverted onto MRN roads. Safety for all motorized road users is expected to be mixed. Closure of at-grade crossings reduces the risk of high-severity collisions involving trains (especially at the Parker/Glen crossing, which extends diagonally through a large offset intersection), but increases the risks associated with diverted traffic at intersections and on structure grades.

TABLE 8.6 EVALUATION SUMMARY (ALL CROSSING CLOSURES)

Evaluation Summary (Operations)					
Pedestrians	Cyclists	Transit	Goods Movements		General Traffic/MRN
			Regional	Local	
⇩	⇩	⇔ or ⇩	⇔	⇩⇩	⇩

Evaluation Summary (Safety)		
Pedestrians	Cyclists	Motorized Traffic
⇔	⇔	⇔

⇧⇧=substantial benefit ⇧= moderate benefit ⇔= mixed/ no change ⇩= moderate disbenefit ⇩⇩=substantial disbenefit

9.0 NORTH-SOUTH CYCLING ROUTE OPTIONS

In conjunction with planning for the Burrard-Inlet Rail Corridor, the City wished to identify opportunities to develop a north-south cycling route parallel to the Burrard Inlet line. The City suggested that the route should use existing streets where possible, and provide connectivity between the Windsor Bikeway (south of 6th Avenue) and the Adanac/Union Bikeway, and on to the Powell Street Greenway.

In developing the routes, attention was given to directing cyclists to lower volume streets, and to minimize the requirements for crossing infrastructure at railways and at major arterials.

Based on these criteria, three options shown in FIGURE 9.1 were developed. Photos of the bicycle route environments are provided in FIGURE 9.2.

9.1 Option 1 – Glen Drive/ Vernon Avenue

This route, shown in FIGURE 9.1, is just east of the BI rail corridor, and takes advantage of the lack of east-west through streets and thereby crossing traffic. The route travels along the right-of-way for Glen Drive from East 6th Avenue to just north of the VCC Skytrain station. It would travel east parallel to the Skytrain, and then turn north to connect with Vernon drive. The route would then follow Vernon Drive from East 4th Avenue to Parker Street. It would travel west on Parker Street to Glen Drive, and pass under Venable Street at the proposed rail underpass. It would then travel north along Glen Drive from Venables Street to Powell Street, to connect with the Powell Street greenway.

As Powell Street is a two-way street at this location, a signal is likely to be required at this location.

This route crosses passes under the Grandview Viaduct at an existing underpass. It will cross under Malkin Avenue and Venables Street at the proposed rail overpasses. It would cross Hastings Street at an existing signal.

Some property acquisition at the Parker Street rail closure is required for this route. This acquisition is also recommended to help complete the network for motorized vehicles.

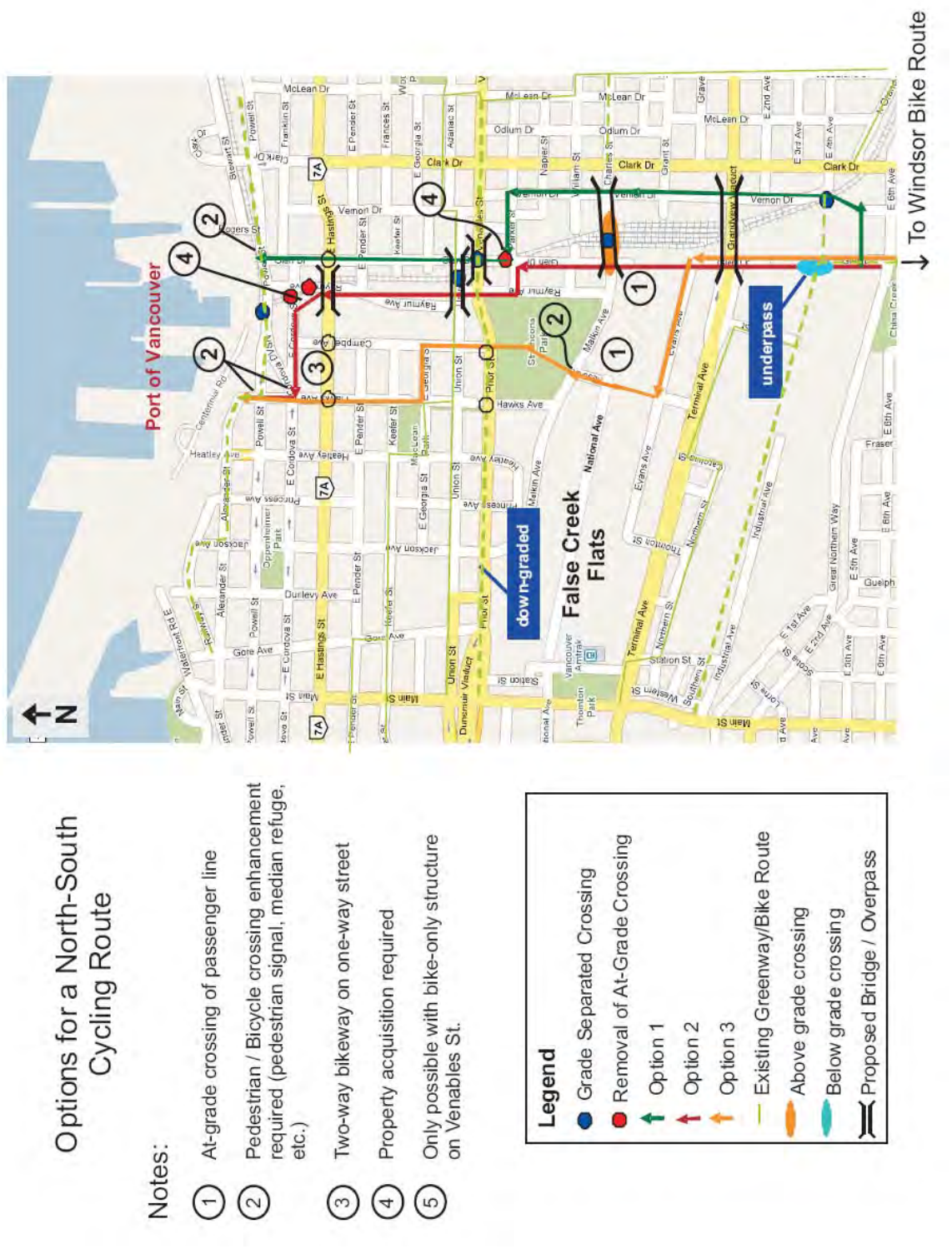


FIGURE 9.1 NORTH-SOUTH BICYCLE ROUTE OPTIONS

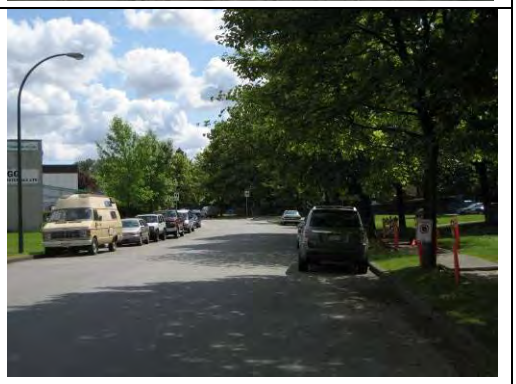
Option 1 Vernon Drive, south of Venables St.		
Option 2 *Left:* Glen Drive south of Venables St. *Right:* Raymur Avenue north of Venables Street		
Option 3 Strathcona Park		

FIGURE 9.2 BICYCLE ROUTE OPTION ENVIRONMENTS

As this route passes under the Central Valley Greenway, Malkin Avenue, Venables Street and Union Street, connections to existing and proposed east-west bicycle routes may be challenging. Connections to the Central Valley Greenway could be incorporated into the proposed Central Valley Greenway overpass.

9.2 Option 2 – Glen Drive/ Raymur Avenue

This route, shown in FIGURE 9.1, travels parallel to and west of the B-I Rail line to take advantage of the reduced cross-street traffic afforded by the road closures for rail. It travels along the right-of-way for Glen Drive from East 6th Avenue to Parker Street. Due to the proposed closure of the Parker Street at-grade rail crossing, the route would require diversion to Raymur Avenue. It would follow Raymur Avenue from Parker Street to East Cordova Street., and then travel west along Cordova Street to Hawk Avenue. This route would require a brief section of two-way bicycle path along the one-way portion of Cordova Street from Cordova Diversion to Hawk Avenue. Cyclists would cross Cordova and Powell Streets at grade. While both Cordova and Powell Streets are one-way streets in this area, some crossing enhancement would likely still be required at these two intersections. Enhancements could include a signal, curb extensions, a median refuge, or a combination of the above.

Option 2 would pass under Terminal Avenue at the existing Grandview Viaduct and under Hastings Avenue at the existing rail underpass. It would pass under Malkin Avenue and Union Street under the proposed rail overpasses. It is proposed that the route cross Venables Street at grade; this is only possible if a pedestrian/bicycle-only structure is selected for Venables Street.

Raymur Avenue could be left as is, or it could be straightened between Union Avenue and East Hastings Street. There is potential for a BC Housing development west of Raymur Avenue to be redeveloped. If this occurs, Raymur Avenue could be straightened and realigned.

A new underpass would be required for the route to cross the CN rail tracks at Glen Drive. The route would also cross the CN rail tracks south of Malkin Avenue. City staff has indicated that an at-grade crossing may be considered for this location, as the traffic on this line is primarily passenger rail.

If this route is selected, the City may wish to consider preserving right-of-way adjacent to the BI Rail line at the proposed Powell Street underpass to provide a more direct connection from this route to the proposed Powell Street greenway.

Some property acquisition at the Raymur Avenue road closure is required for this route. This acquisition is also recommended to help complete the network for motorized vehicles.

As this route passes under Malkin Avenue and Union Street, connections to proposed east-west bicycle routes on Charles Street and Union Street may be difficult. Connections to the Central Valley Greenway could be incorporated into the proposed Central Valley Greenway overpass.

9.3 Option 3 – Glen Drive / Strathcona Park/ Hawks Avenue

This route takes advantage of the existing pathways through Strathcona Park and existing traffic calming on Hawks Avenue to provide a route with fewer encounters with motorized vehicles. This route would follow the same alignment as Option 1 from East 6th Avenue in the south to Evans Avenue in the north. It would then travel west along Evans Avenue to the extension of Chess Avenue. It would travel along Chess Avenue to Malkin Avenue. The route would then cross Strathcona Park and proceed northwards along Campbell Avenue. At Cordova Street, the route would head west until Hawks Street. The route would travel north along Hawks Street to connect to the Alexander Street greenway. As with Option 2, bicycle route enhancements may need to be installed at Powell Street and Hawks Avenue.

As with Option 1, this route would pass under Terminal Avenue at the existing Grandview Viaduct. Also as with Option 1, a new underpass would be required for the route to cross the CN rail tracks at Glen Drive, and an at-grade crossing may be required just south of National Avenue at Chess Street. The route would also cross the CN rail tracks south of Malkin Avenue.

Some right-of-way may be required between Evan Avenue and National Avenue to accommodate this route. This could be addressed through the False Creek Industrial Lands use strategy.

As this route crosses Malkin Avenue, Prior Street and Union Street at grade, good connections are provided to existing and proposed east-west bicycle routes. Similar to Option 1, connections to the Central Valley Greenway should be incorporated into the proposed rail overpass for that route. A new traffic signal would be required at Malkin Avenue.

9.4 Evaluation Criteria for North-South Bicycle Routes

The criteria used to evaluate the four north-south cycling route options are listed in TABLE 9.1. For each criterion, the options are rated on a scale of 1 to 3, with 3 being the most preferred and 1 being the least preferred.

TABLE 9.1 EVALUATION CRITERIA TO ASSESS THE NORTH-SOUTH BICYCLE ROUTE OPTIONS

CRITERIA	DEFINITIONS
route efficiency	takes into account any deviations from a straight route
gradient	slope of route
aesthetics (public realm)	how welcoming an environment the route is for cyclists
safety	safety of the route in terms of exposure to motor vehicular traffic
ease of implementation	presence of existing roads and crossings
connectivity with east-west routes	ease with which users of this north-south route can connect with existing designated east-west cycle routes

9.5 Evaluation Results for North-South Bicycle Routes

Table 9.2 shows the results of the evaluation process, with the high-scoring options for each criterion highlighted in red.

Based on the evaluation, the corridors are very close in ranking. There are generally trade-offs between the various criteria for the options. For example, while Option 3 does not rank as well for safety because it has many more at-grade crossings. However, all of these at-grade crossings mean that the Hawks route can more easily be connected to east-west routes. For the gradient criteria, the Hawks route crosses through slightly more hilly terrain, but the remaining options have more underpasses and overpasses.

Other than the implementation of the rail overpasses and underpasses previously discussed in this report, the most significant challenge in implementing the north-south corridor for all three options is crossing the rail line between Great Northern Way (East 6th Avenue).

TABLE 9.2 EVALUATION RESULTS OF NORTH-SOUTH BICYCLE ROUTES ASSESSMENT

CRITERIA	OPTION 1 (Vernon/Glen	OPTION 2 (Glen/Raymur)	OPTION 3 (Hawks)
route efficiency	3	2	2
gradient	2	2	2
aesthetics (public realm)	2	2	3
safety	3	2	1
ease of implementation	3	2	2
connectivity with east-west routes	1	2	3
TOTAL	14	13	13

10.0 CONCLUSIONS AND SUMMARY

10.1 Purpose and Objectives of the Study

To facilitate rail growth and mitigate the conflicts of rail and other transportation modes at existing at-grade crossings, grade separation or rail priority may be considered at a number of key rail crossings. A review of preliminary concepts, potential cost implications and benefits, and the potential to enhance existing pedestrian and bicycle networks, will assist the City in prioritizing grade separation projects as funding becomes available. Accordingly, the purpose of this study is to assist the City of Vancouver in developing a grade separation strategy for the BI Line rail corridor between the waterfront and False Creek Flats.

10.2 Grade Separated Crossings

Conceptual designs of the grade-separation structures have been developed. Important points to note include the following:

- The overpass structures have been designed with steel superstructures to minimize the girder erection time and impact on rail operations.
- There are a number of utility and property conflicts at each proposed overpass/underpass, which have been discussed in the report.
- Storm water catch basins, sanitary and Allstream fibre optics lines would likely be affected to some degree at all proposed intersections. An initial assessment of these impacts for properties and other utilities has been made and is described for each intersection.

Order of magnitude cost estimates have been provided for each grade separation, ranging from $4.2M to $31.7M (excluding property acquisition, signalization, and utility relocation).

10.3 Closure of At-Grade Crossings

Preliminary strategies have been developed for each of the three locations at which existing at-grade crossings may be removed:

- E. Cordova Street
- Raymur Avenue
- Parker Road / Glen Drive.

These preliminary strategies identified the changes to roadway geometry and/or redirection of road network that will be necessary to maintain access to the adjacent industrial areas, and minimize disruption to adjacent areas as a result of traffic diversion. The impacts of proposed grade-separated crossings and crossing closures were reviewed with respect to the road network and property access.

10.4 Evaluation

Evaluation summaries for each grade-separated and closed crossing are shown together in TABLE 10.1, based on the following qualitative evaluation scheme:

- substantial benefit (⇧⇧)
- moderate benefit (⇧)
- little or no change (⇔)
- moderate disbenefit (⇩)
- substantial disbenefit (⇩⇩).

The results of the evaluation suggest that grade-separated crossings generally have mixed or net benefits in all areas except local goods movements, where road obstructions caused by the grade-separation structures block access and circulation in the surrounding industrial areas. While crossing closures greatly reduce the risk of potentially severe conflicts between trains and all road users, they have negative impacts on local goods movements (similar to the grade-separated crossings), as well as potentially negative impacts on pedestrian and cyclist operations due to diversion of these modes.

Other considerations that are outside the scope of this project, but that may be considered when evaluating crossing closures, include:

TABLE 10.1 EVALUATION SUMMARY

ASSESSMENT CATEGORY	CROSSING					
	GRADE SEPARATED				CLOSED	
	Powell	Union	Venables	Malkin	Parker/ Glen	Cordova/ Raymur
OPERATIONS FOR:						
pedestrians	⇔	⇔	⇔	⇔	⇩	⇩
cyclists	⇔	⇔	⇔	⇔	⇩	⇩
transit	⇧⇧	⇔	⇔	⇔	⇔ or ⇩	⇔ or ⇩
goods movement (regional)	⇧	⇔	⇧	⇧	⇔	⇔
goods movement (local)	⇩	⇩	⇩	⇩	⇩⇩	⇩⇩
general traffic / MRN impacts	⇧	⇔	⇧	⇧	⇩	⇩
SAFETY FOR:						
pedestrians	⇔	⇔	⇔	⇔	⇔	⇔
cyclists	⇔	⇔	⇔	⇔	⇔	⇔
motorized traffic	⇧⇧	⇔	⇔	⇔	⇔	⇔

Neighbourhood Impacts

- Residences or parks adjacent or near to new structures may be affected by the visual impacts of an elevated structure, and by obstruction to access caused by an elevated or below-grade structure. Areas most likely to be affected by the proposed structures include the existing residential and parks around Union Street and Venables Street, and any future sensitive development in the False Creek Flats area.
- Residences or parks can be affected by traffic diverted from closed crossings, or obstructed by structures. Areas most likely to be affected are Strathcona Park and residential areas at the west end of Malkin Avenue.

Impacts on Rail Operations

- Segregation of road and rail traffic by closing at-grade crossings or converting them to grade-separated crossings can generally be expected to have benefits for rail operations by reducing the risks and delays resulting from conflicts between trains and road users.

It is noted that this preliminary qualitative evaluation will need to be followed by a more detailed business case evaluation for future decision-making. More detailed evaluations can be based on a comparison of conditions before and after the improvements have been implemented, including complete details of specific road reconfigurations and traffic improvements. A detailed evaluation of the impacts of the improvements on the area's Major Road Network (including Clark Drive, Hastings Street, Main Street, and Terminal Avenue), as well as provincial highways and the arterial road network, may be required.

10.5 North-South Cycling Route Options

Three corridor options were developed, discussed, and evaluated in Section 9. The evaluation suggests that the corridors are very close in ranking, due to trade-offs between the evaluation criteria for the different options. Other than the implementation of the rail overpasses and underpasses, the most significant challenge in implementing the north-south corridor for all three options is crossing the rail line between Great Northern Way (East 6th Avenue).

APPENDIX A

ANTICIPATED PROPERTY REQUIREMENTS

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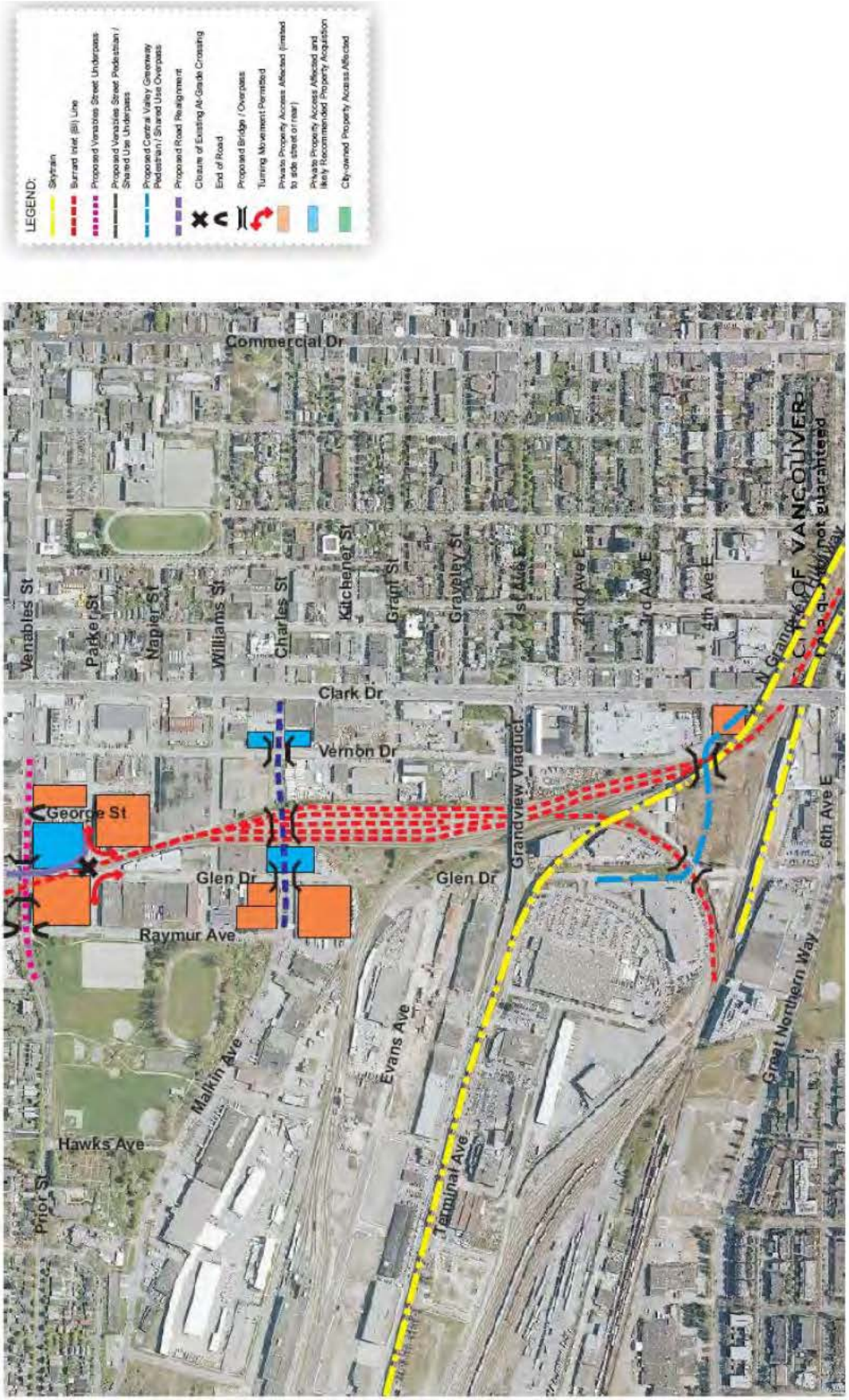
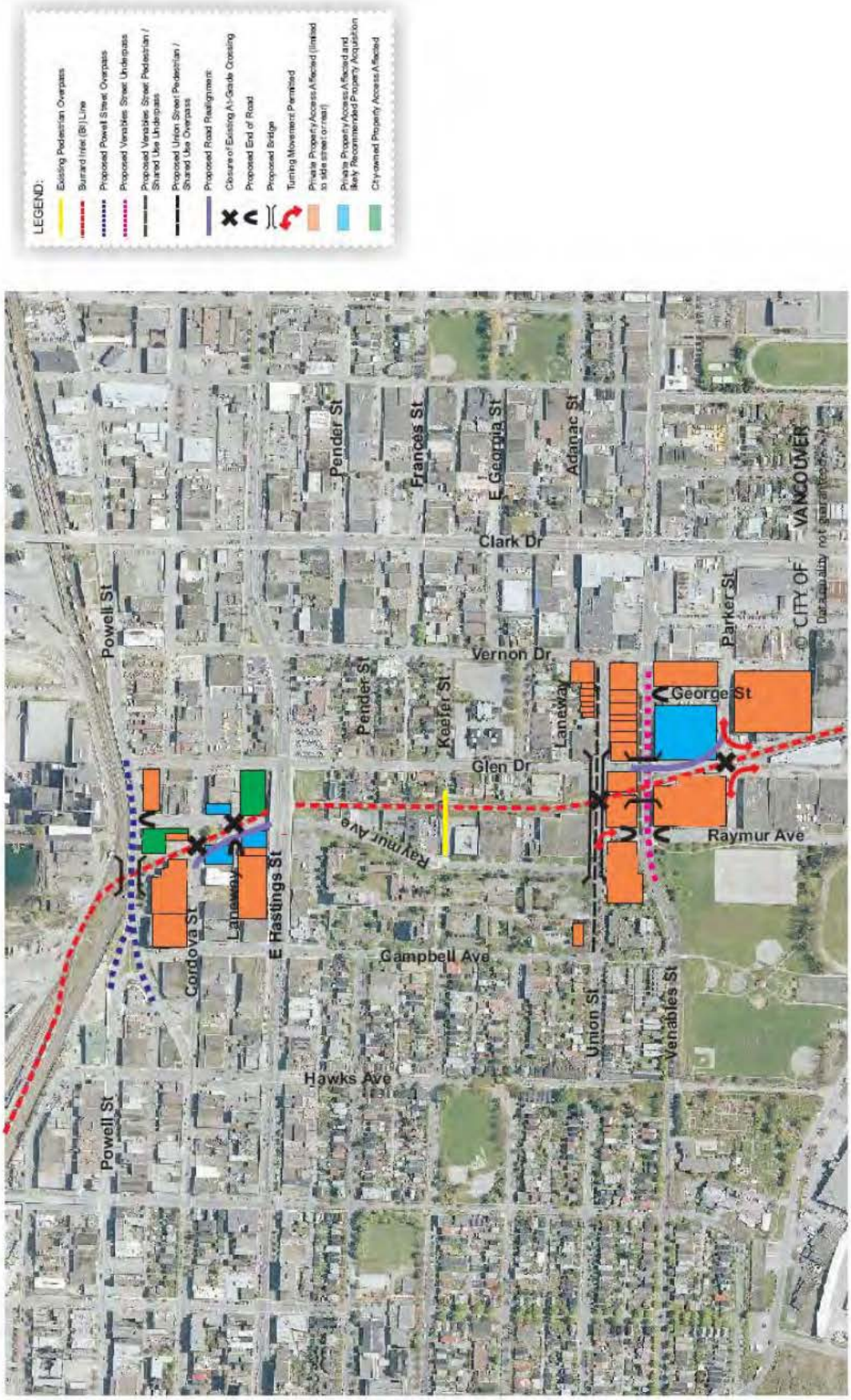

LEGEND:
Skytrain
Burrard Inlet (BI) Line
Proposed Venables Street Underpass
Proposed Venables Street Pedestrian / Shared Use Underpass
Proposed Central Valley Greenway Pedestrian / Shared Use Overpass
Proposed Road Realignment
Closure of Existing At-Grade Crossing
End of Road
Proposed Bridge / Overpass
Turning Movement Permitted
Private Property Access Affected (limited to side street or rear)
Private Property Access Affected and likely Recommended Property Acquisition
City-owned Property Access Affected
Commercial Dr
Venables St
Parker St
Napier St
Williams St
Charles St
Kitchener St
Grant St
Graveley St
1st Ave E
2nd Ave E
3rd Ave E
4th Ave E
Clark Dr
Vernon Dr
George St
Glen Dr
Raymur Ave
Grandview Viaduct
6th Ave E
Evans Ave
Malkin Ave
Hawks Ave
Prior St
Terminal Ave
Great Northern Way


LEGEND:
Existing Pedestrian Overpass
Burrard Inlet (BI) Line
Proposed Powell Street Overpass
Proposed Venables Street Underpass
Proposed Venables Street Pedestrian / Shared Use Underpass
Proposed Union Street Pedestrian / Shared Use Overpass
Proposed Road Realignment
Closure of Existing At-Grade Crossing
Proposed End of Road
Proposed Bridge
Turning Movement Permitted
Private Property Access Affected (limited to side street or rear)
Private Property Access Affected and likely Recommended Property Acquisition
City-owned Property Access Affected
Pender St
Frances St
E Georgia St
Adanac St
Clark Dr
Powell St
Vernon Dr
Parker St
George St
Keefer St
Lanaway
Glen Dr
Raymur Ave
E Hastings St
Campbell Ave
Cordova St
Union St
Venables St
Hawks Ave
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APPENDIX B

GRADE-SEPARATED STRUCTURES:

DESIGN NOTES AND PRELIMINARY DRAWINGS

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B.1 CENTRAL VALLEY GREENWAY

The initial horizontal alignment for the pedestrian/cyclist bridge started on the west side of Clark Drive at East 4th Avenue, proceeded in a westerly direction crossing Vernon Drive. This alignment was discussed at the working group meeting and it was concluded that the impact on vehicle traffic on East 4th Avenue and Vernon Drive would be an issue. It was concluded that a preferable alignment would be to start the pedestrian/cyclist bridge at the northwest corner of Clark Drive bridge in the small park at that location.

The alignment would then follow the Skytrain tracks crossing the rail line at the south end of Vernon Drive. The alignment was subsequently revised (see Drawing C101).

The Central Valley Greenway must cross two railway tracks, one adjacent to Vernon Drive and one at Glen Drive. Initially two overpasses were developed, one for each track. Given the length of the ramps, however, it was concluded that a single bridge crossing both tracks would be preferable. The advantages of this solution are:

- shorter travel distance
- less climbing
- less construction cost.

Two ramp options are shown in the drawings, one connecting to Cottrell Street and one to Glen Drive. The ramp down to Glen Drive has been set at under 6.00%. If preferred a 5.00% grade is achievable. This will lengthen the bridge and increase construction cost. See drawings C101 and S101.

During later design stages, careful design of the at-grade transitions to and from the elevated structure will be important. Some of the users of the CVG may be children, given the proximity of the crossing to the Grandview Elementary School, and the facility is likely to be used by families and other recreational cyclists.

Utility Conflict: Structure piers and foundations will need to avoid a GVS manhole chamber in the vicinity of 4th Avenue; a street lighting column may conflict at the

end of the structure at Clark Drive; Hydro poles may have to be raised at Glen Drive where the alignment heads eastwards and potential fibre optic line impacts.

B.2 MALKIN AVENUE

The Malkin Avenue overpass is being considered in conjunction with a possible diversion of through traffic from Prior Street/Venables to Malkin Avenue. The proposed cross-section to accompany this diversion has not yet been confirmed.

This diversion would also result in Prior Street being downgraded to a local street. While Prior Street currently extends east of Clark Drive, the City has indicated that through traffic would not be permitted on Malkin Avenue east of Clark Drive. This is expected to result in significant turning movements at the intersection of Malkin Avenue and Clark Drive. Detailed traffic analysis is beyond the scope of this railroad crossing study; an indicative preliminary analysis by City staff is summarized in Section 4.3 (main text).

The proposed grade separated railway crossing at Malkin Avenue is a four lane bridge with 3.8 metre multi-use pathway on both sides. Alternatively a 7.6 metre multi-use pathway could be provided on one side.

The bridge will cross approximately 10 rail tracks resulting in a bridge span of about 68 metres unless some of the tracks can be abandoned or realigned to allow intermediate supports. This will require a structure depth of approximately 3.2 metres which will impact the vertical profile. The bridge also has to cross Glen Drive and Vernon Drive with the required vehicle clearance.

Based on the clearance and grade criteria above a vertical profile has been developed. The profile has been developed to have the east ramp return to grade before Clark Drive to eliminate any modifications to Clark Drive. The resulting profile is less than ideal and may have to be addressed in detailed design should the proposed overpass proceed. See Drawings C102 and S102.

Utility Conflict: Street lighting and Hydro/TELUS poles would conflict with the structure on both east and west sides of the tracks; storm water catch basins would be affected at tie-in points.

B.3 VENABLES STREET

Currently, the majority of east-west bicycle traffic in the area travels along Union Street, as it is part of the Adanac-Union bicycle route. However, grades along Venables Street may accommodate cyclists better than those along Union Street near the railway crossings. With the possible downgrading of Prior/Venables Street, it may be preferable to relocate the bicycle/pedestrian crossing from Union Street to Venables Street, which could then be a designated bikeway in the future.

The proposed grade separated crossing at Venables Street is an underpass and includes a multi-use pathway on the north side only, open to daylight (except at the railway crossing and Glen Drive) to provide natural lighting and reduce the tightness of the space. The railway crossing and Glen Drive would be included in a short tunnel section 41.5m long (see drawing S-104). The proposed width of the underpass is approximately 15.5 metres. Concrete traffic barriers and a fence will be provided along both sides of the underpass – this will have an impact on access to properties. There would be sufficient ROW to maintain two traffic lanes and a multi-use pathway on the north side of Venables Street.

The proposed grade is 6.00%. A 5.00% grade could be provided but would result in a grade difference at Raymur Drive and would cause further property impacts, project cost and disruption to the public.

Traffic lanes accommodated in the underpass have a lane width of 3.3m with a 1.2m shoulder. The grade separated traffic lanes under Glen Drive and the railway line, creates grade differences at Raymur Avenue and George Street. The existing north and south side pedestrian walkways would remain in place to accommodate pedestrian and business access. Vehicle accesses however, would be affected. See Drawings C104 and S104.

Utility Conflict: Street lighting columns on both sides of Venables Street would be impacted; Hydro/TELUS poles on the north side of Union St would be impacted;

there is an underground gas service on the north side of Venables St; an underground fiber optic cable marker post is situated alongside the railtracks and runs in a north-south direction.

B.4 UNION STREET

Grade separation may use either an overpass or an underpass. The choice of overpass or underpass should be made in consultation with the local, pedestrian, and cycling communities. No recommendation is made in this report.

A pedestrian/cyclist grade separated structure could be located on the north side of Union Street, as there are fewer conflicts than on the south side. Care must be taken in the transition from two-side to one-side operation of bicycles.

An overpass is shown in Drawings C105 and S103. The vertical profile is dictated by the need to have 5.5m vertical clearance over Raymur Avenue and Glen Drive. Because of these two constraints the clearance over the railway is more than required. The proposed profile will also provide access to the warehouse building between the railway track and Raymur Avenue. A 6.00% grade is required on the ramps to bring them to grade before Vernon Drive at the east end and Campbell Avenue at the west end. If a 5.00% grade is preferred, the bridge ramp at the ends would have to turn north up Vernon Drive and Campbell Avenue to avoid conflicts with the side streets.

As an alternate to the overpass, an underpass is also feasible. Like the overpass, the grades are such that grade separation, with reduced clearance, would also be required at Glen Drive and at Raymur Avenue (which could be obstructed at Venables Street by a vehicle underpass). The total length of the underpass would be slightly shorter than the overpass. There are several disadvantages to an underpass structure:

- A significant portion would have to be enclosed with a roof at Glen Drive, the railway, the industrial property between the railway and Raymur Avenue, and under Raymur Avenue. This may raise public safety concerns.

- The construction of an underpass will have significantly more impact on railway operations than construction of an overpass.
- The construction cost of either option will be similar. However, if the rail line must remain in service during construction, the underpass under the rail line will have to be jacked into place under an active rail line, which will be significantly more expensive than an overpass.

Utility Conflict: Street lighting columns on both sides of Union St would be affected; Hydro/TELUS poles are situated on the north side of Union St and would be impacted; the buried fibre optic cable runs across Union St and would have to be avoided by piers and pier foundations.

B.5 POWELL STREET

The proposed grade separated railway crossing at Powell Street is a four lane bridge with two 4.3 metre multi-use pathways on both sides. Alternatively, one 8.6 metre multi-use pathway could be provided on one side. It is recommended that the former configuration be implemented, as it would allow the bridge to be easily and safely accessed by cyclists travelling along the new north-south bicycle route (see Section 5), which would otherwise end at Powell Street close to the proposed bridge. The multi-use pathways would also provide pedestrians access across the railway tracks. Additionally, bicycles on Powell Street currently travel in mixed traffic, and therefore on both sides of the road, and sidewalks are provided on both sides of the road. Providing the multi-use facility on one-side only would lead to conflicts in the transition areas.

To help address the capacity constraint of the BI Line crossing of the CP mainline, one option would be to add an additional track at the north end of the BI line with a smaller radius that connects adjacent to the CP Mainline. This would not replace the existing track, but would be in addition to the current one and would allow freight or passenger trains to connect from the west onto the BI line. A similar track connection to the east may also be of benefit but would require more property acquisition and could not be accommodated under the same structure.

The new bridge structure needs to be constructed to accommodate this future track. As there are no plans of this future track, an alignment was developed by

EarthTech based on an understanding of what will be required. A clear span of 60 metres has been provided to allow construction of the new line and eliminate support columns in the railway ROW. Further discussion with CN railway is required to substantiate their future trackage requirements and locations of expansion areas. See Drawings C107_1, C107_2, and S105.

It is also understood that this overpass could potentially accommodate capacity increases east west along the waterfront, and should be explored with future work that is being completed by the Port.

The following conflicts are noted:

- Access to the gas station at the corner of Powell Street and Raymur Avenue will be eliminated; the access from Raymur Avenue and Cordova will remain.
- Access to the properties immediately west of Raymur Avenue will be affected. It is understood that these properties are owned by the City.
- Access to the two industrial properties south of the new bridge at the west end will be significantly impacted. There will be significant grade difference between the Powell Street Bridge and Raymur Avenue. Using straddle bents to support the bridge structure may allow access from Raymur Avenue. This would be similar to areas of Waterfront Road near the Convention Centre. Alternatively, if ROW can be obtained, an access road at the present grade could be built parallel to Powell Street.

<u>Utility Conflict:</u> Street lighting columns on both sides of Powell Street and Hydro/TELUS poles (mainly on the north side) would be impacted; there are also trolley bus overhead wires that run along the north side of Powell Street that would be impacted; traffic signals at the rail track crossing would be affected; a gas and water service runs along the north side.

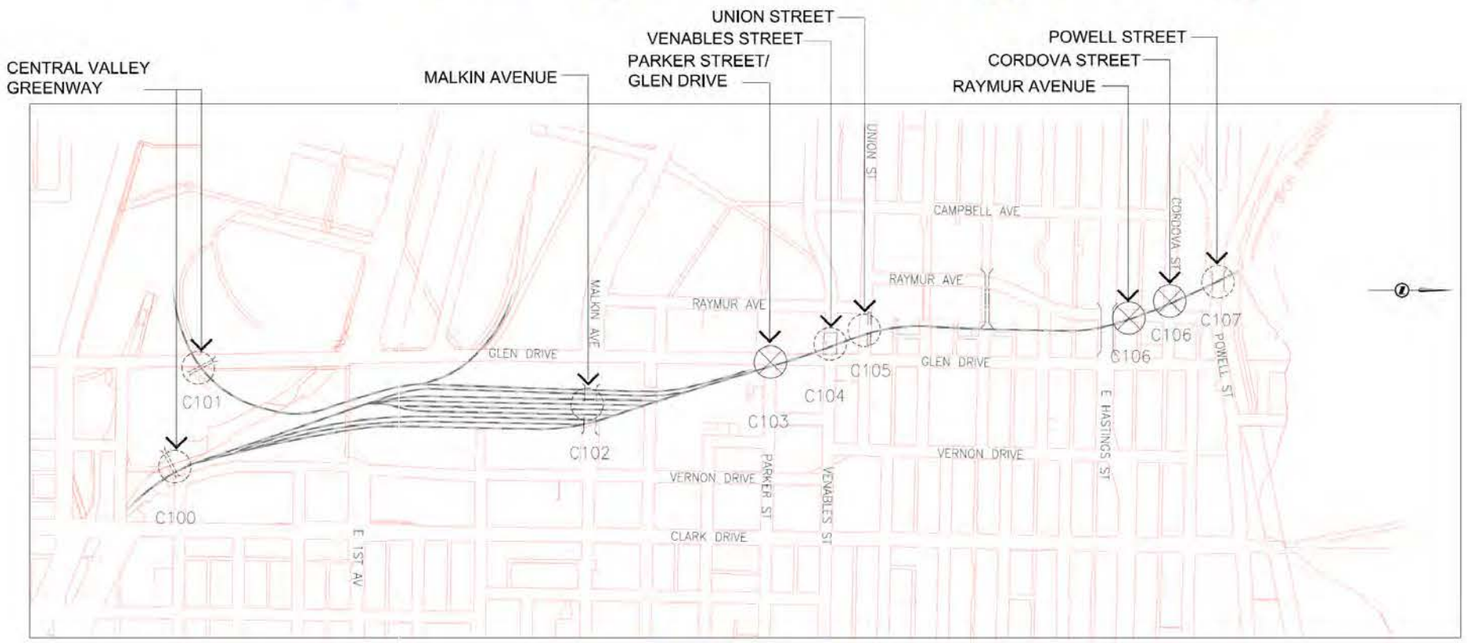
CITY OF VANCOUVER
ENGINEERING SERVICES

EARTH TECH

Earth Tech Inc. Vancouver, BC

1901 Rosser Ave, 6th Floor
Burnaby, B.C. V5C 6S3
PH: (604) 298-6181
FAX: (604) 294-8597

Railway Crossing Study



LOCATION PLAN

N.T.S.

DRAWING INDEX	
NO.	NAME
C000	KEY PLAN AND LEGEND
C101–C107	SITE PLANS
S–101	GENERAL ARRANGEMENT CENTRAL VALLEY GREENWAY PEDESTRIAN/BICYCLE OVERPASS
S–102	GENERAL ARRANGEMENT MALKIN AVENUE OVERPASS
S–103	GENERAL ARRANGEMENT UNION STREET PEDESTRIAN/BICYCLE OVERPASS
S–104	GENERAL ARRANGEMENT VENABLES STREET UNDERPASS
S–105	GENERAL ARRANGEMENT POWELL STREET OVERPASS
S–106	TYPICAL BRIDGE DECK SECTIONS

LEGEND

- GRADE SEPARATED CROSSING
- REMOVAL OF AT–GRADE CROSSING
- EXISTING OVERPASS
- PROPOSED OVERPASS
- PROPOSED UNDERPASS
- EXISTING PEDESTRIAN OVERPASS
- PROPOSED CYCLIST & PEDESTRIAN OVERPASS
- PROPOSED CYCLIST & PEDESTRIAN UNDERPASS

no.	rev.	y/m/d	issued for	by	app.
0		06/09/25	ISSUED FOR REPORT	BJP	DHM

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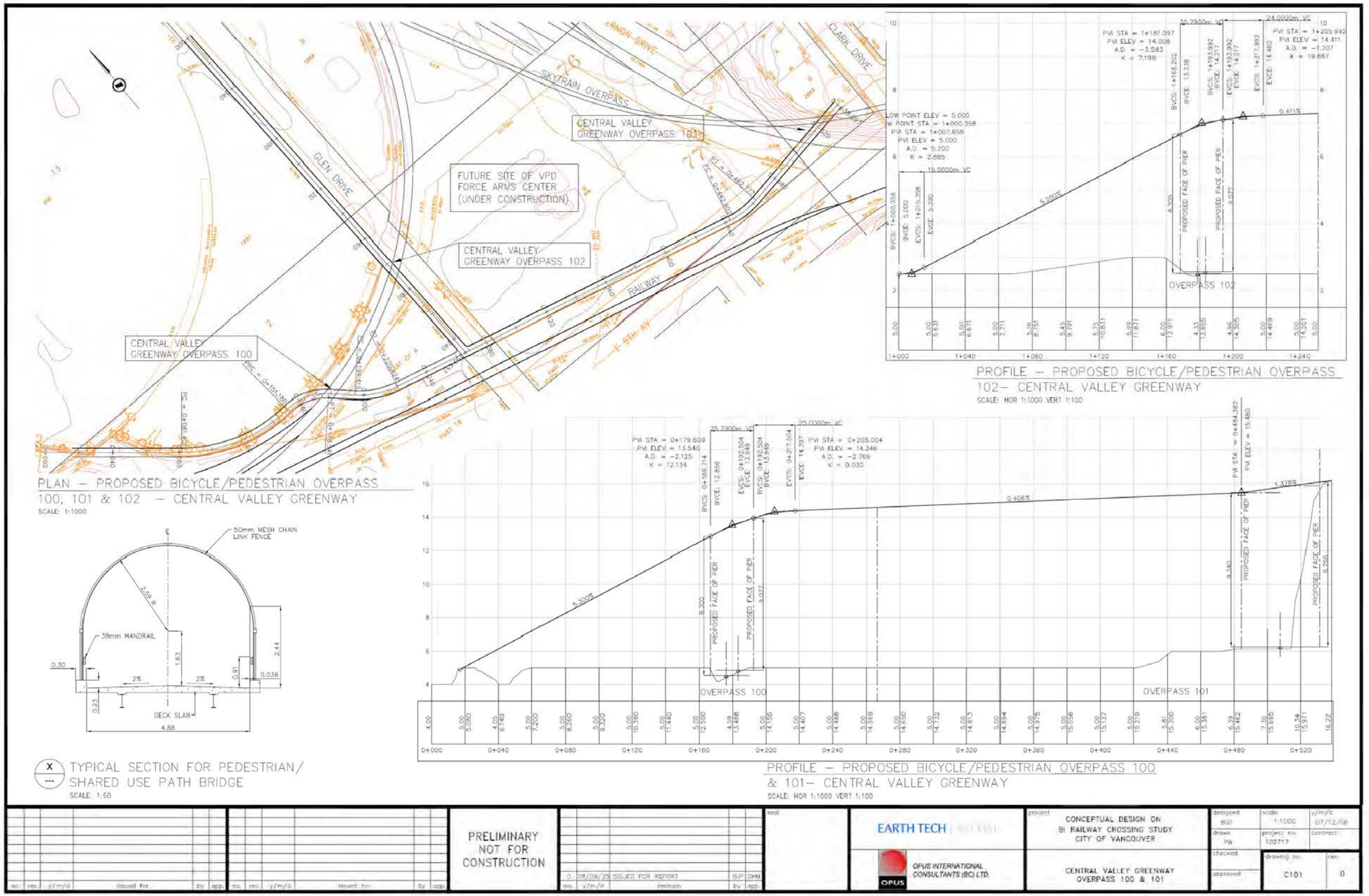
EARTH TECH AECOM

OPUS INTERNATIONAL CONSULTANTS (BC) LTD.

project: CONCEPTUAL DESIGN ON
BI RAILWAY CROSSING STUDY
CITY OF VANCOUVER

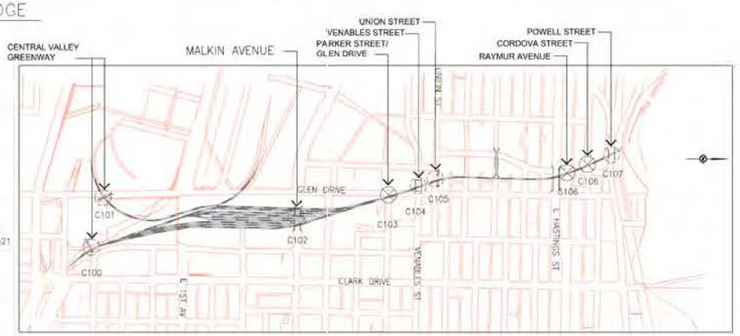
KEY PLAN & LEGEND

designed	scale	y/m/d
BJP	1:500	07/12/06
drawn: PW	project no. 102717	contract
checked	drawing no. C000	rev. 0
approved		

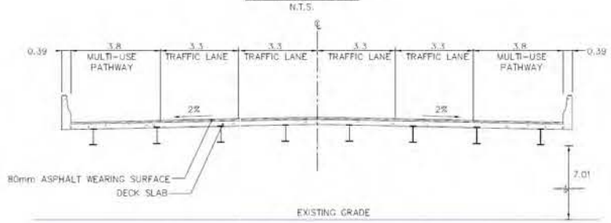

SKYTRAIN OVERPASS
CENTRAL VALLEY GREENWAY OVERPASS 101
FUTURE SITE OF VPD FORCE ARMS CENTER (UNDER CONSTRUCTION)
CENTRAL VALLEY GREENWAY OVERPASS 102
CENTRAL VALLEY GREENWAY OVERPASS 100
GLEN DRIVE
CLARK DRIVE
RAILWAY
E. 5TH AV
PROFILE – PROPOSED BICYCLE/PEDESTRIAN OVERPASS 102– CENTRAL VALLEY GREENWAY
SCALE: HOR 1:1000 VERT 1:100
PLAN – PROPOSED BICYCLE/PEDESTRIAN OVERPASS 100, 101 & 102 – CENTRAL VALLEY GREENWAY
SCALE: 1:1000
50mm MESH CHAIN LINK FENCE
38mm HANDRAIL
DECK SLAB
TYPICAL SECTION FOR PEDESTRIAN/ SHARED USE PATH BRIDGE
SCALE: 1:50
PROFILE – PROPOSED BICYCLE/PEDESTRIAN OVERPASS 100 & 101– CENTRAL VALLEY GREENWAY
SCALE: HOR 1:1000 VERT 1:100
PRELIMINARY NOT FOR CONSTRUCTION
EARTH TECH
OPUS INTERNATIONAL CONSULTANTS (BC) LTD.
CONCEPTUAL DESIGN ON BI RAILWAY CROSSING STUDY CITY OF VANCOUVER
CENTRAL VALLEY GREENWAY OVERPASS 100 & 101
C101

PLAN – PROPOSED ALL MODES 4 LANES BRIDGE
MALKIN AVENUE
SCALE: 1:1000

PROFILE – PROPOSED ALL MODES 4 LANES BRIDGE – MALKIN AVENUE
SCALE: HOR 1:1000 VERT 1:100



LOCATION PLAN
N.T.S.



X — TYPICAL SECTION FOR 4–LANE BRIDGE DECK (ROADWAY)
SCALE: 1:100

no.	rev.	y/m/d	issued for	by	app.
0		08/09/25	ISSUED FOR REPORT	BJP	DHM

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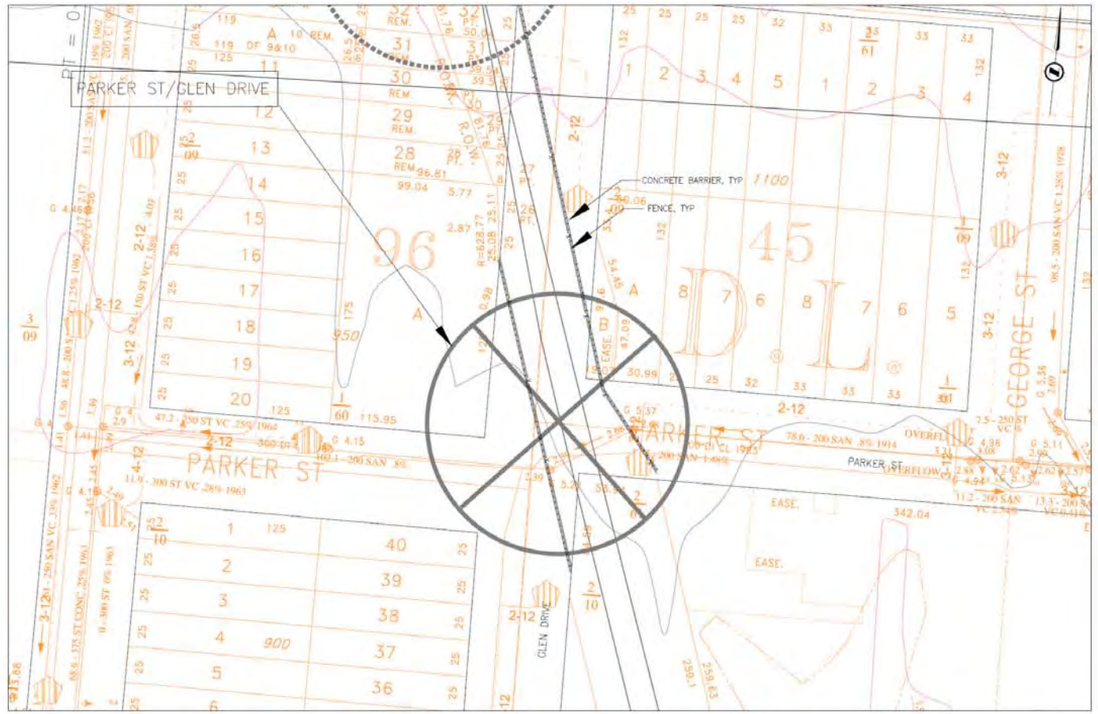
OPUS INTERNATIONAL CONSULTANTS (BC) LTD.

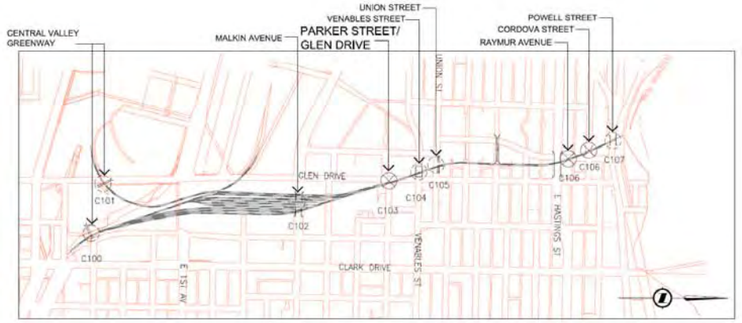
project: CONCEPTUAL DESIGN ON BI RAILWAY CROSSING STUDY CITY OF VANCOUVER

MALKIN AVENUE

designed: BJP	scale: 1:500	y/m/d: 07/12/06
drawn: PW	project no.: 102717	contract:
checked:	drawing no.: C102	rev.: 0
approved:		



PLAN – PROPOSED REMOVAL OF AT–GRADE CROSSING
– PARKER STREET / GLEN DRIVE
SCALE: 1:500



LOCATION PLAN
N.T.S.

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CONSTRUCTION

no.	rev.	y/m/d	issued for	by	app.
0		08/09/25	ISSUED FOR REPORT	BJP	DHM

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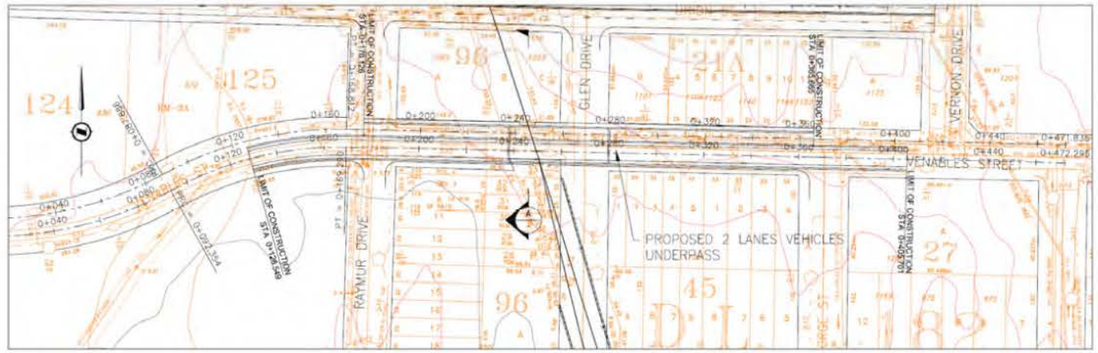
OPUS INTERNATIONAL CONSULTANTS (BC) LTD.

project: CONCEPTUAL DESIGN ON BI RAILWAY CROSSING STUDY CITY OF VANCOUVER

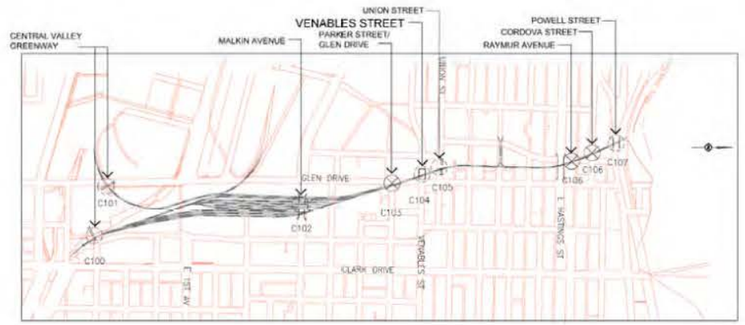
PARKER STREET / GLEN DRIVE

designed: BJP	scale: 1:500	y/m/d: 07/12/08
drawn: PW	project no.: 102717	contract:
checked:	drawing no.: C103	rev.: 0
approved:		



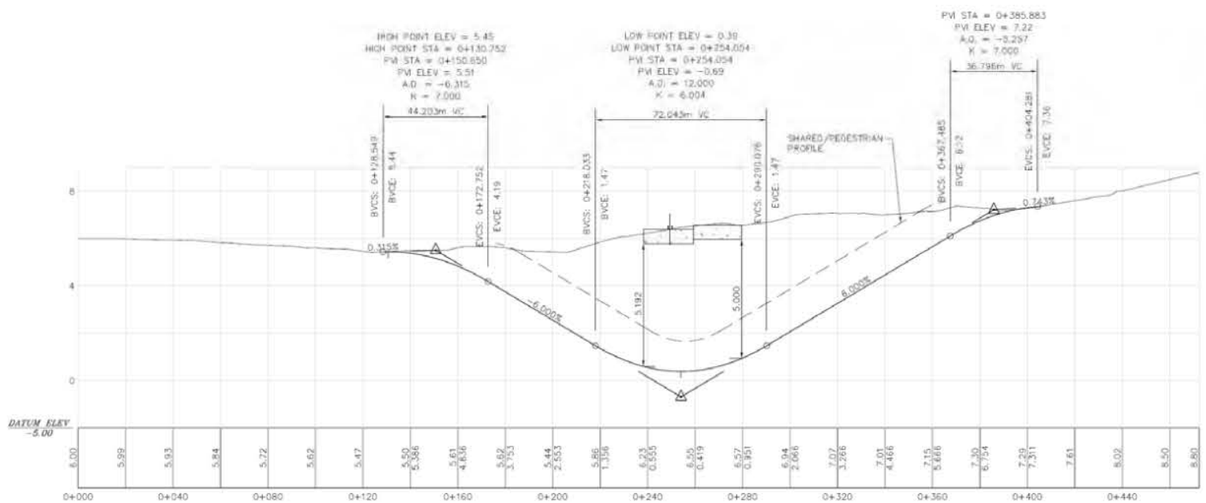
PLAN – PROPOSED PEDESTRIAN/SHARED USE PATH UNDERPASS & 2 LANES VEHICLE UNDERPASS– VENABLES STREET

SCALE: 1:1000



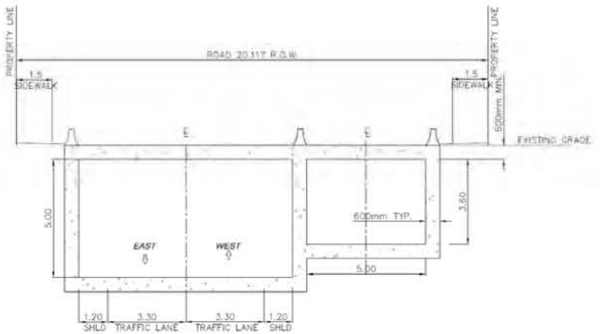
LOCATION PLAN

N.T.S.



PROFILE – PROPOSED 2 LANES VEHICLES UNDERPASS – VENABLES STREET

SCALE: HOR 1:1000 VERT 1:100



A — SECTION FOR PEDESTRIAN/SHARED USE PATH & VEHICLES OPEN–CUT UNDERPASS

SCALE: 1:100

no.	rev.	y/m/d	issued for	by	app.

no.	rev.	y/m/d	issued for	by	app.

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no.	y/m/d	revision	by	app.
0	08/09/29	ISSUED FOR REPORT	BJP	DHM

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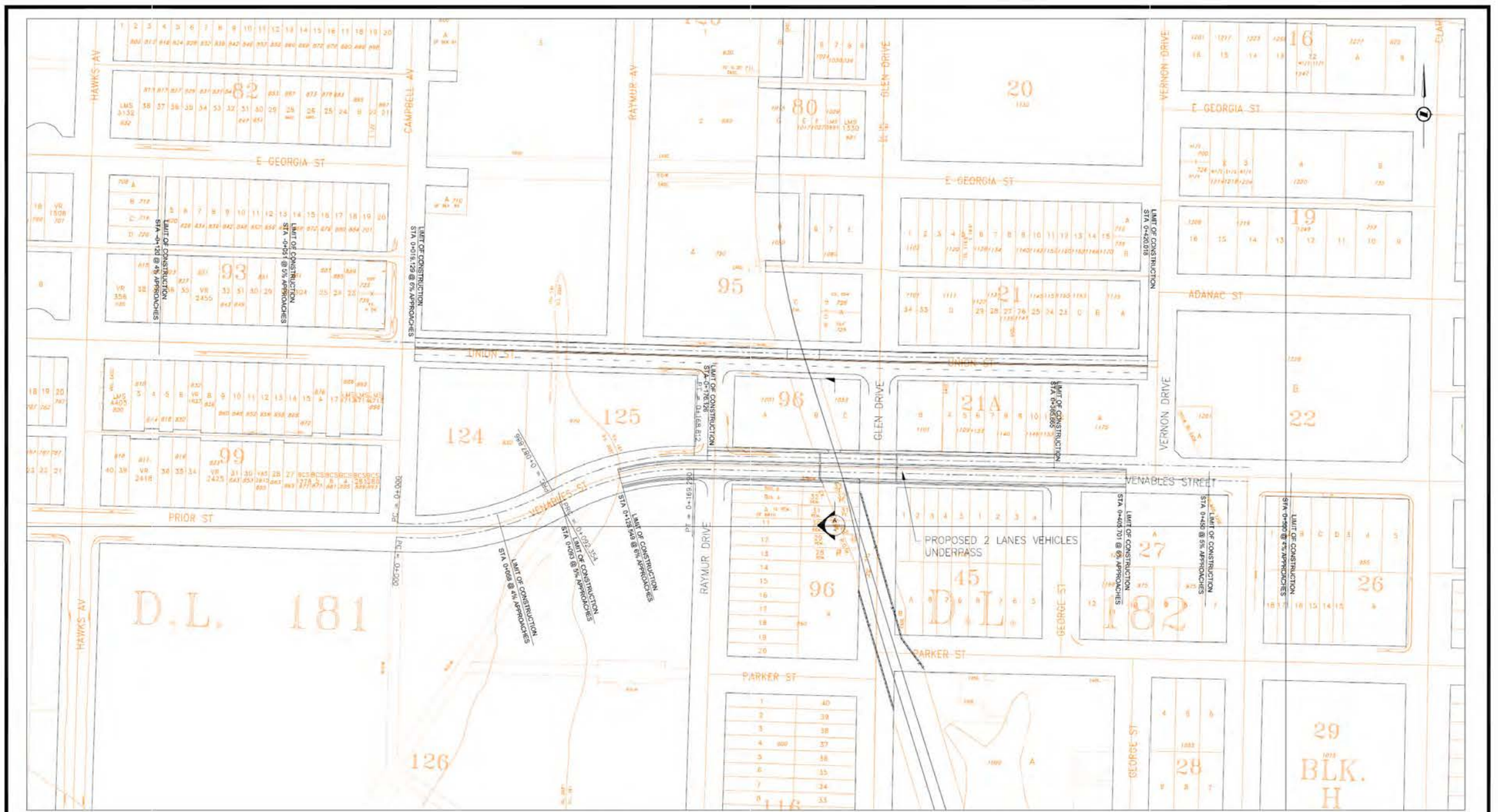
OPUS INTERNATIONAL CONSULTANTS (BC) LTD.

project: CONCEPTUAL DESIGN ON BI RAILWAY CROSSING STUDY CITY OF VANCOUVER

VENABLES STREET (SHEET 2 OF 2)

designed: BJP	scale: 1:500	y/m/d: 07/12/06
drawn: HW	project no.: 102717	contract:
checked:	drawing no.: C104_2	rev.: 0
approved:		



PLAN – PROPOSED PEDESTRIAN/SHARED USE PATH & 2 LANE VEHICLE UNDERPASS – VENABLES STREET

SCALE: 1:1000

no.	rev.	y/m/d	issued for	by	app.
0		08/09/25	ISSUED FOR REPORT	BJP	DHM

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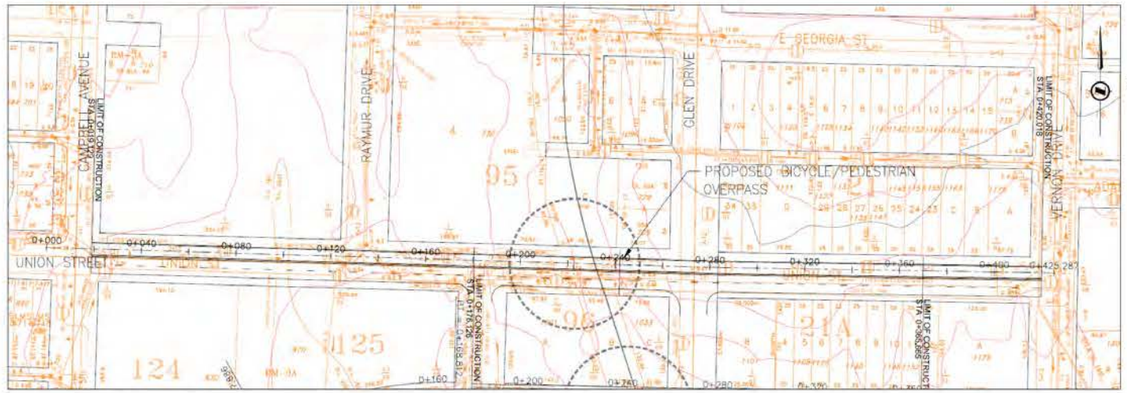
OPUS INTERNATIONAL CONSULTANTS (BC) LTD.

project: CONCEPTUAL DESIGN ON BI RAILWAY CROSSING STUDY CITY OF VANCOUVER

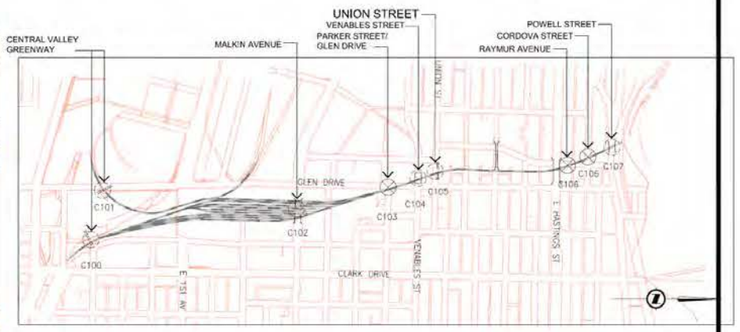
VENABLES AND UNION STREET

designed: BJP	scale: 1:500	y/m/d: 07/12/06
drawn: PW	project no.: 102717	contract:
checked:	drawing no.: C203	rev.: 0
approved:		

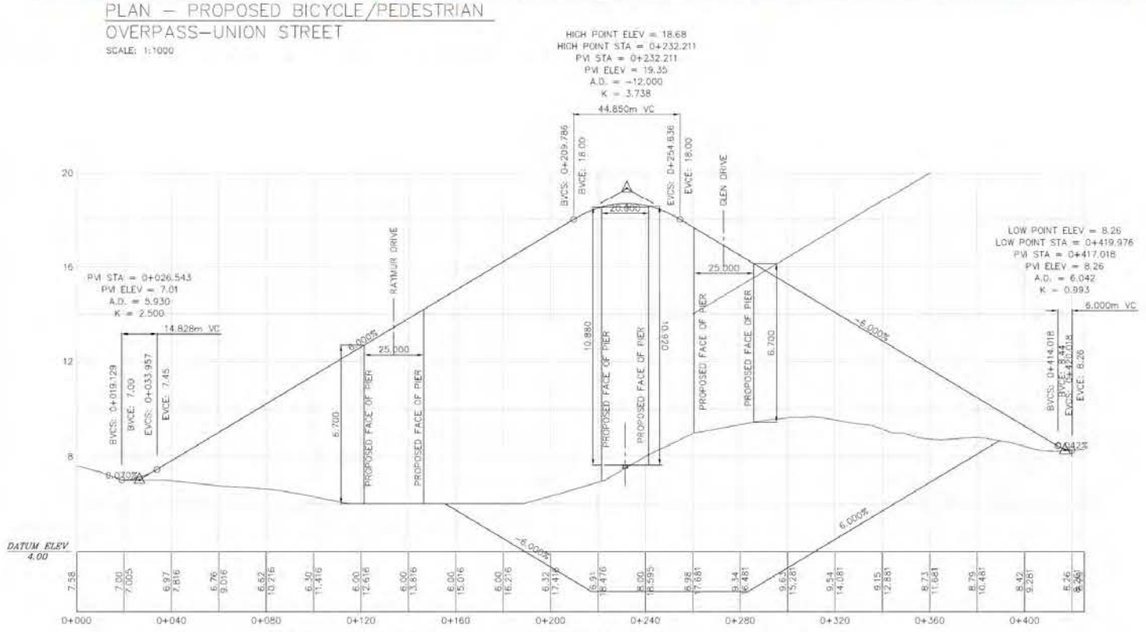
OPUS Hamilton



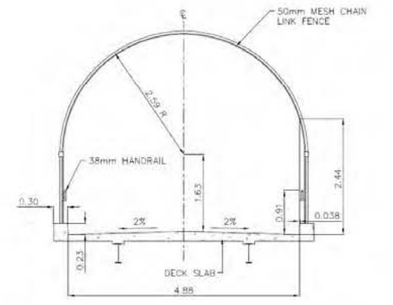
PLAN – PROPOSED BICYCLE/PEDESTRIAN OVERPASS–UNION STREET
SCALE: 1:1000



LOCATION PLAN
N.T.S.



PROFILE – PROPOSED BICYCLE/PEDESTRIAN OVERPASS–UNION STREET
SCALE: HOR 1:1000 VERT 1:100



X TYPICAL SECTION FOR PEDESTRIAN/ SHARED USE PATH BRIDGE
SCALE: 1:50

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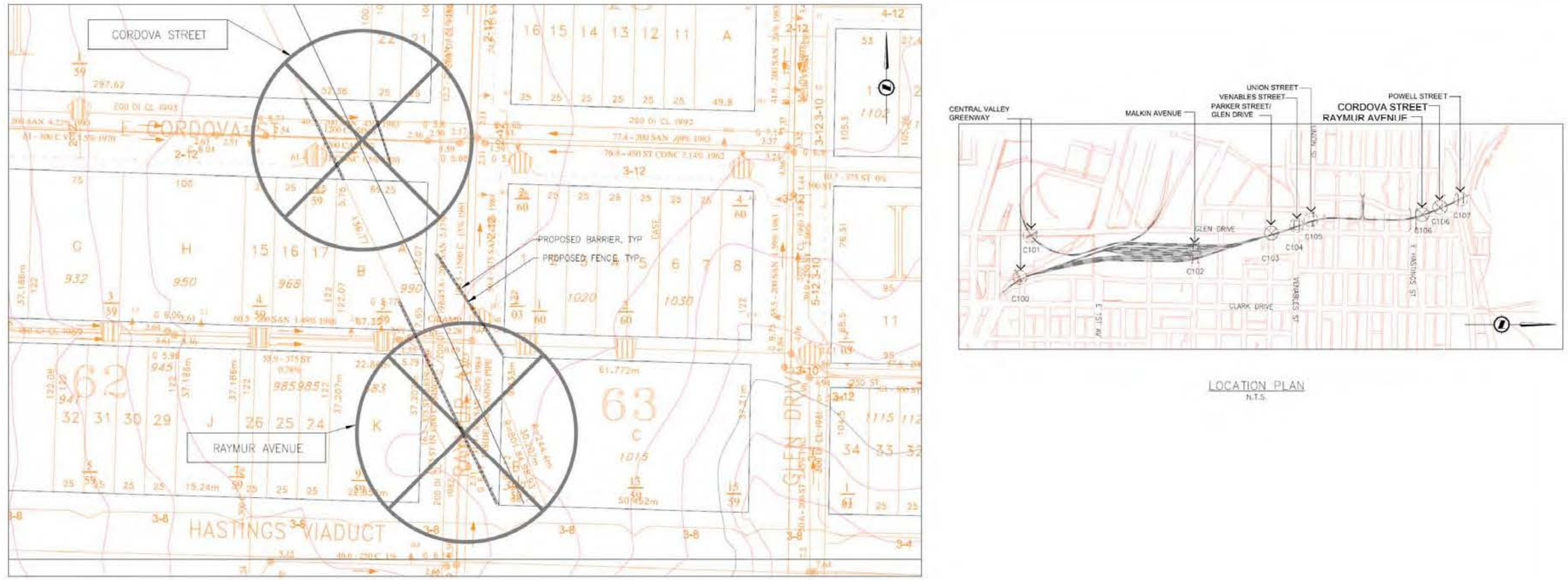
OPUS INTERNATIONAL CONSULTANTS (BC) LTD.

project: CONCEPTUAL DESIGN ON BI RAILWAY CROSSING STUDY CITY OF VANCOUVER

UNION STREET

designed: BJP	scale: 1:250	y/m/d: 07/12/06
drawn: PW	project no.: 102717	contract:
checked:	drawing no.: C105	rev.: 0
approved:		



PLAN – PROPOSED REMOVAL OF AT-GRADE CROSSING
– RAYMUR AVENUE & CORDOVA STREET
SCALE: 1:500

LOCATION PLAN
N.T.S.

PRELIMINARY NOT FOR CONSTRUCTION

no.	y/m/d	revision	by	app.
0	08/09/25	ISSUED FOR REPORT	BJP	DHM

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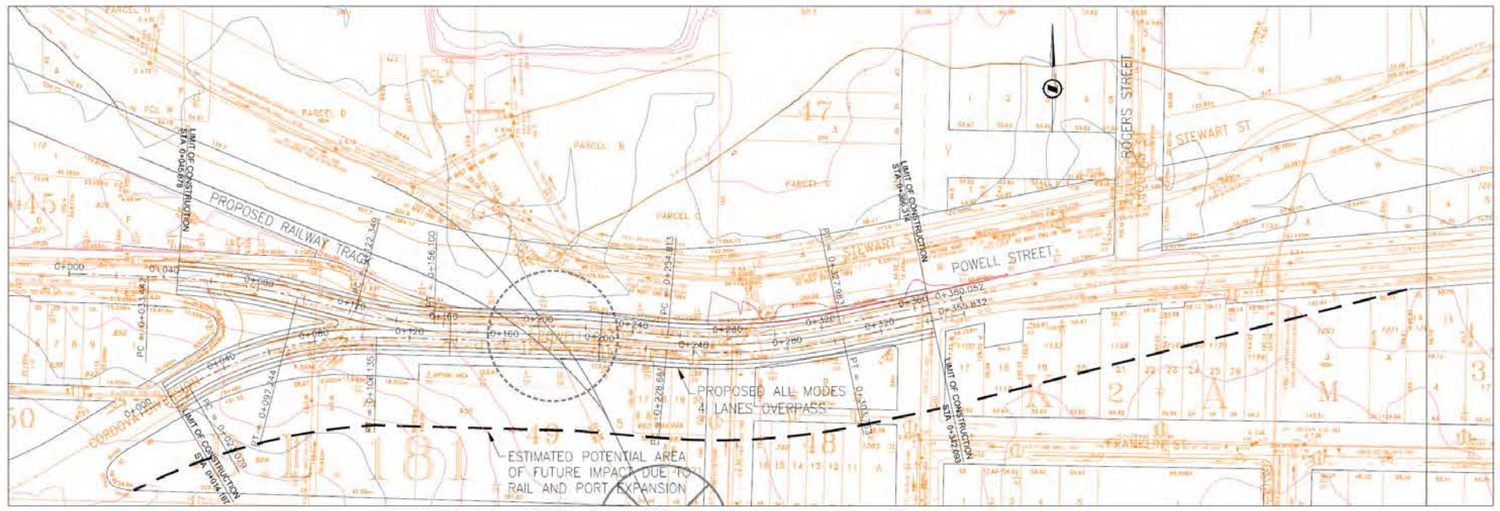
OPUS INTERNATIONAL CONSULTANTS (BC) LTD.

project: CONCEPTUAL DESIGN ON BI RAILWAY CROSSING STUDY CITY OF VANCOUVER

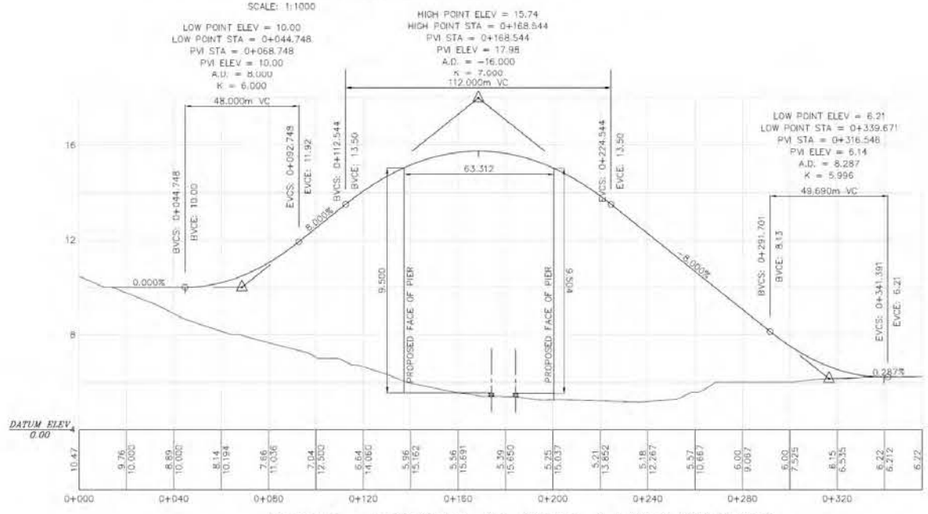
RAYMUR AVENUE & CORDOVA STREET

designed	scale	y/m/d
BJP	1:500	07/12/06
drawn	project no.	contract
PW	102717	
checked	drawing no.	rev.
approved	C106	0



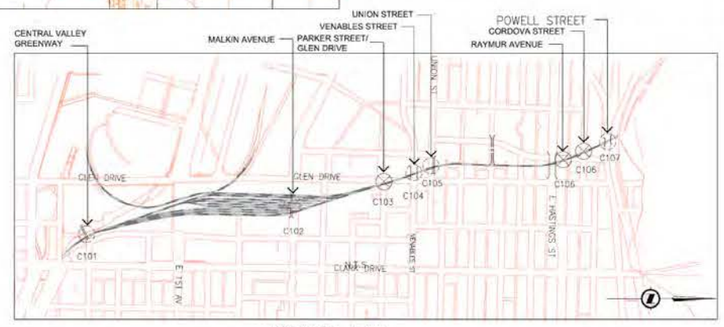
PLAN – PROPOSED ALL MODES 4 LANES OVERPASS–POWELL STREET

SCALE: 1:1000

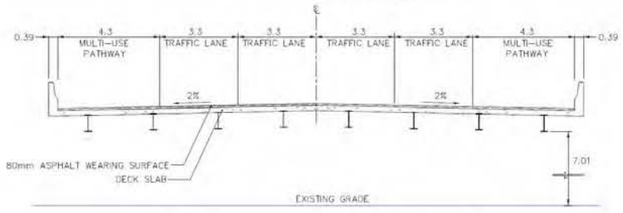


PROFILE – PROPOSED ALL MODES 4 LANES OVERPASS –POWELL STREET EASTBOUND

SCALE: HOR 1:1000 VERT 1:100



LOCATION PLAN



X TYPICAL SECTION FOR 4–LANE BRIDGE DECK (ROADWAY)

SCALE: 1:100

no.	rev.	y/m/d	issued for	by	app.
0		08/09/25	ISSUED FOR REPORT	BJP	DHM

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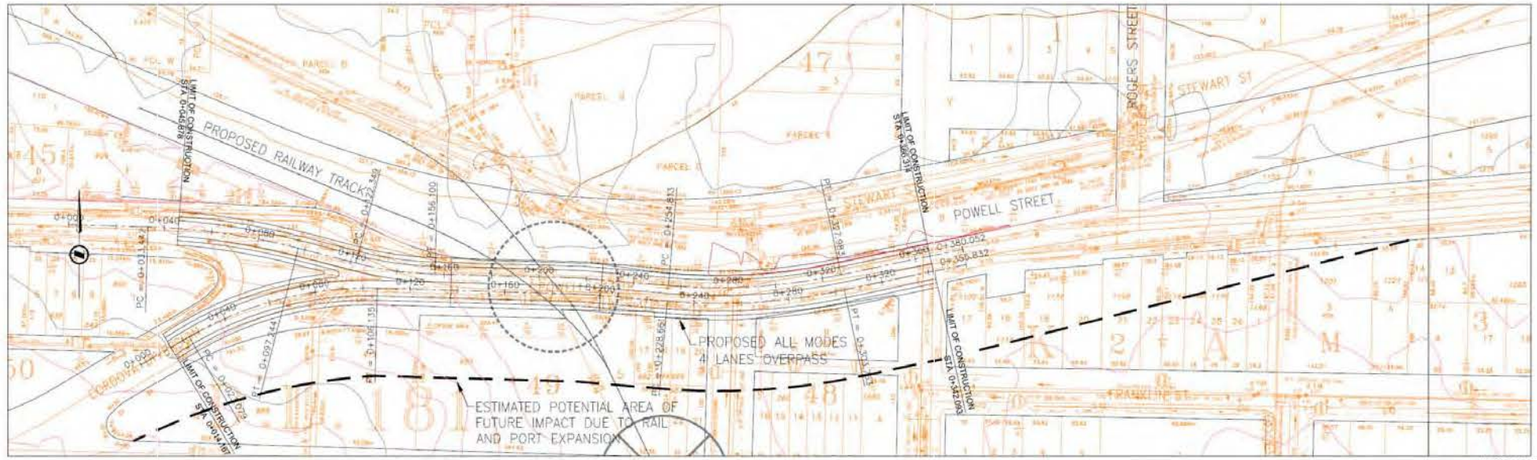
OPUS INTERNATIONAL CONSULTANTS (BC) LTD.

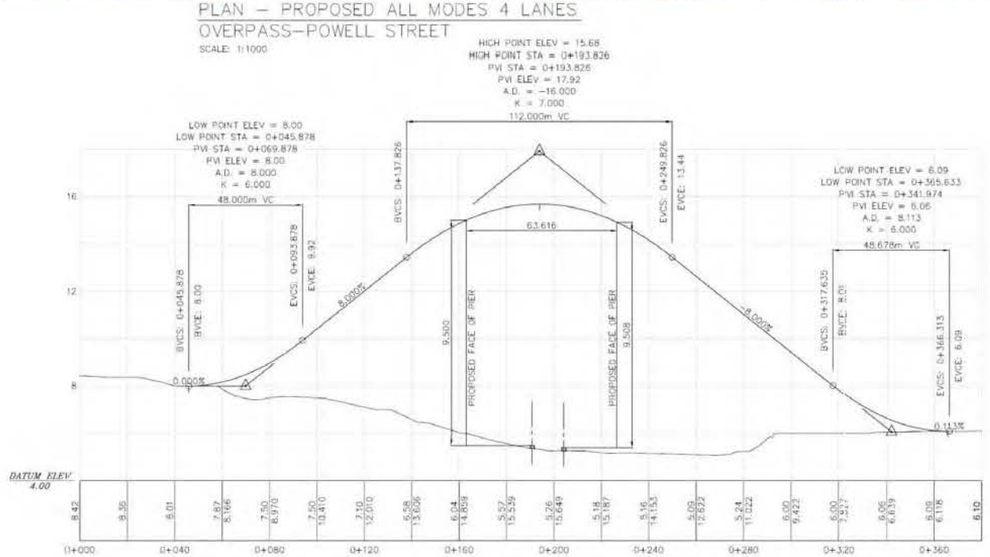
project: CONCEPTUAL DESIGN ON BI RAILWAY CROSSING STUDY CITY OF VANCOUVER

POWELL STREET EASTBOUND

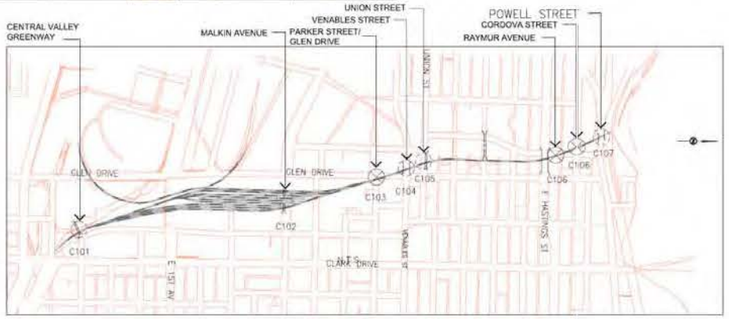
designed: BJP	scale: 1:1000	y/m/d: 07/12/06
drawn: PW	project no.: 102717	contract:
checked:	drawing no.: C107_1	rev.: 0
approved:		



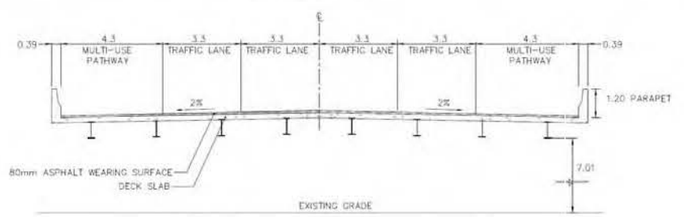
PLAN – PROPOSED ALL MODES 4 LANES
OVERPASS–POWELL STREET
SCALE: 1:1000



PROFILE – PROPOSED ALL MODES 4 LANES
OVERPASS–POWELL STREET WESTBOUND
SCALE: HOR 1:1000 VERT 1:100



LOCATION PLAN



X TYPICAL SECTION FOR 4–LANE
--- BRIDGE DECK (ROADWAY)
SCALE: 1:100

no.	rev.	y/m/d	issued for	by	app.

no.	rev.	y/m/d	issued for	by	app.

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NOT FOR
CONSTRUCTION

no.	y/m/d	revision	by	app.
0	08/09/29	ISSUED FOR REPORT	BJP	DHM

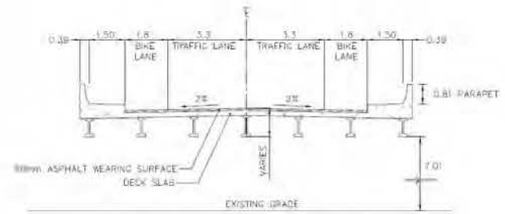
seal

EARTH TECH AECOM
OPUS INTERNATIONAL CONSULTANTS (BC) LTD.

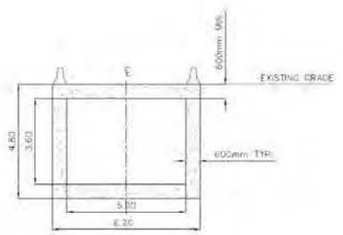
project: CONCEPTUAL DESIGN ON BI RAILWAY CROSSING STUDY CITY OF VANCOUVER
POWELL STREET WESTBOUND

designed: BJP	scale: 1:250	y/m/d: 07/12/06
drawn: PW	project no.: 102717	contract:
checked:	drawing no.: C107_2	rev.: 0
approved:		

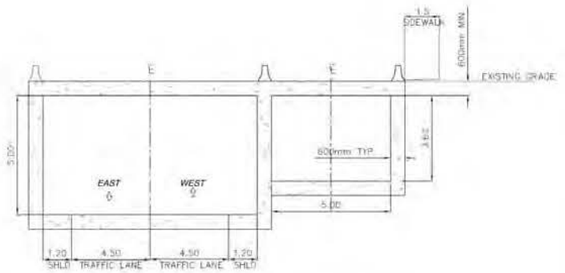
OPUS Hamilton



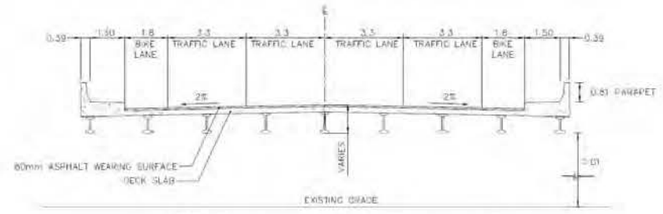
X — TYPICAL SECTION FOR 2-LANE BRIDGE DECK (ROADWAY)
SCALE: 1:100



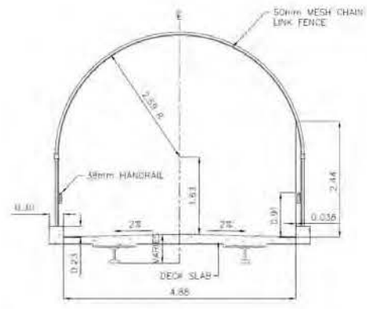
X — TYPICAL SECTION FOR PEDESTRIAN/ SHARED USE PATH OPEN-CUT UNDERPASS
SCALE: 1:100



A — SECTION FOR PEDESTRIAN/SHARED USE PATH & VEHICLES OPEN-CUT UNDERPASS
SCALE: 1:100



X — TYPICAL SECTION FOR 4-LANE BRIDGE DECK (ROADWAY)
SCALE: 1:100



X — TYPICAL SECTION FOR PEDESTRIAN/ SHARED USE PATH BRIDGE
SCALE: 1:50

* ALL DIMENSIONS ARE APPROXIMATE, FOR CONCEPTUAL DISCUSSIONS ONLY.

no.	rev.	y/m/d	issued for	by	app.

no.	rev.	y/m/d	issued for	by	app.

PRELIMINARY NOT FOR CONSTRUCTION

no.	y/m/d	revision	by	app.
0	06/09/25	ISSUED FOR REPORT	BJP	DHM

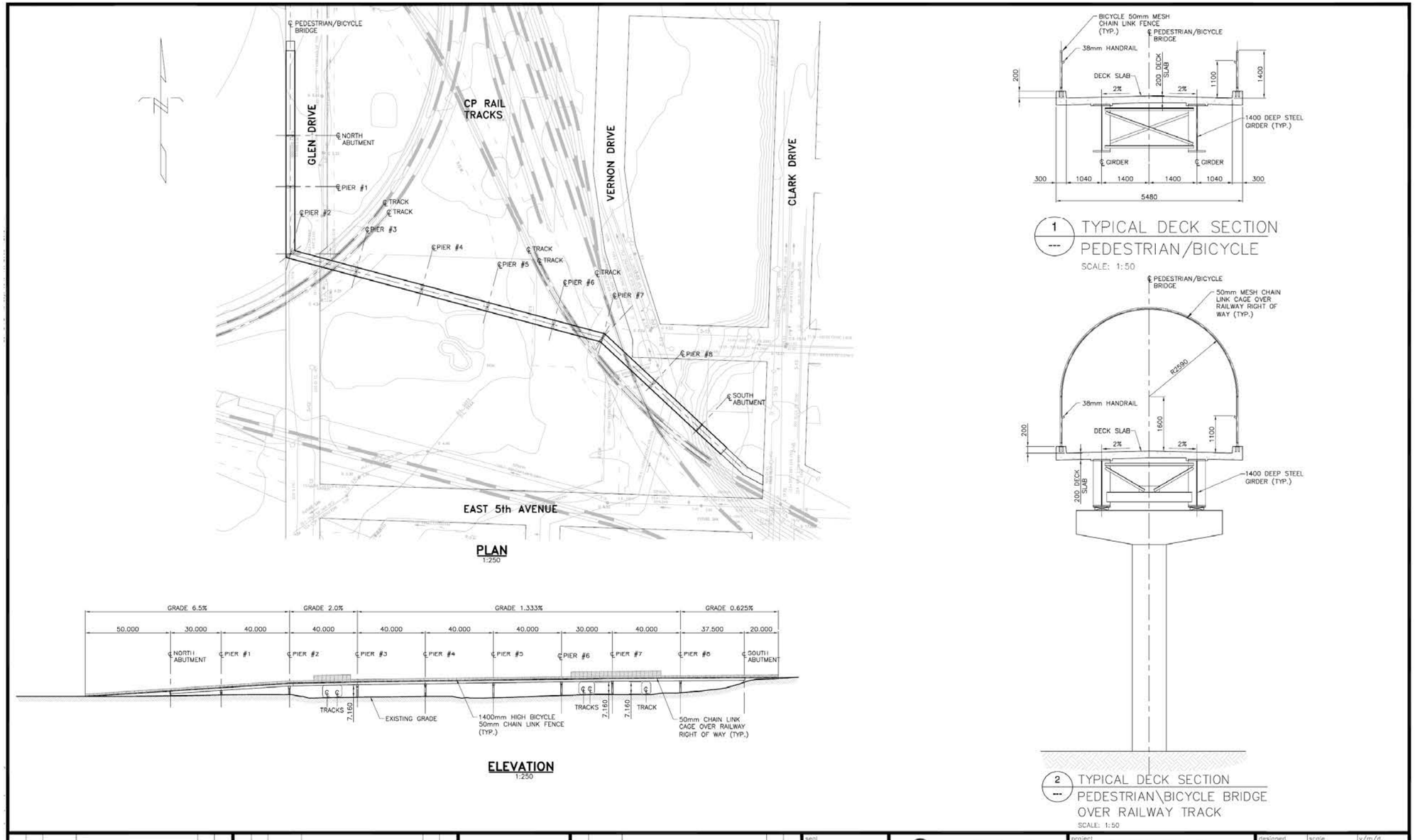
seal

EARTH TECH
OPUS INTERNATIONAL CONSULTANTS (BC) LTD.

project: CONCEPTUAL DESIGN ON BI RAILWAY CROSSING STUDY CITY OF VANCOUVER

TYPICAL SECTIONS

designed: BJP	scale: SEE NOTE	y/m/d: 07/12/06
drawn: PM	project no.: 102???	contract:
checked:	drawing no.: C200	rev.: 0
approved:		



1 --- TYPICAL DECK SECTION PEDESTRIAN/BICYCLE

SCALE: 1:50

2 --- TYPICAL DECK SECTION PEDESTRIAN\BICYCLE BRIDGE OVER RAILWAY TRACK

SCALE: 1:50

no.	rev.	y/m/d	issued for	by	app.

no.	rev.	y/m/d	issued for	by	app.

PRELIMINARY NOT FOR CONSTRUCTION

no.	y/m/d	revision	by	app.

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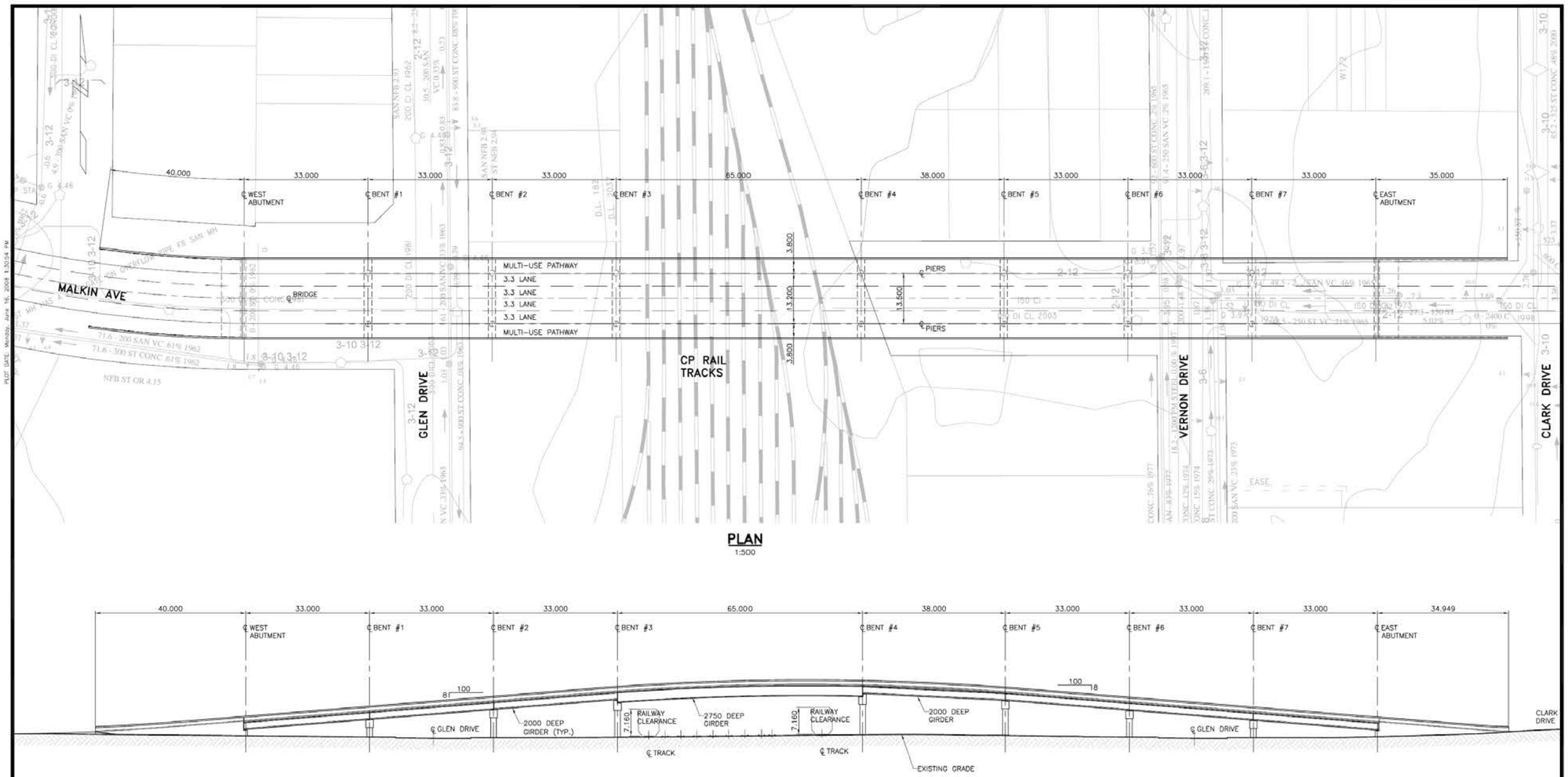
EarthTech
A Tyco International Ltd. Company

project: CONCEPTUAL DESIGN ON BI RAILWAY CROSSING STUDY CITY OF VANCOUVER

GENERAL ARRANGEMENT CENTRAL VALLEY GREENWAY PEDESTRIAN/BICYCLE OVERPASS

designed	scale	y/m/d
DHM	1:200	2008/06/02
drawn	project no.	contract
PSG	102717	
checked	drawing no.	rev.
approved	S-101	

OPUS Hamilton



no.	rev.	y/m/d	issued for	by	app.

no.	rev.	y/m/d	issued for	by	app.

PRELIMINARY
NOT FOR
CONSTRUCTION

no.	y/m/d	revision	by	app.

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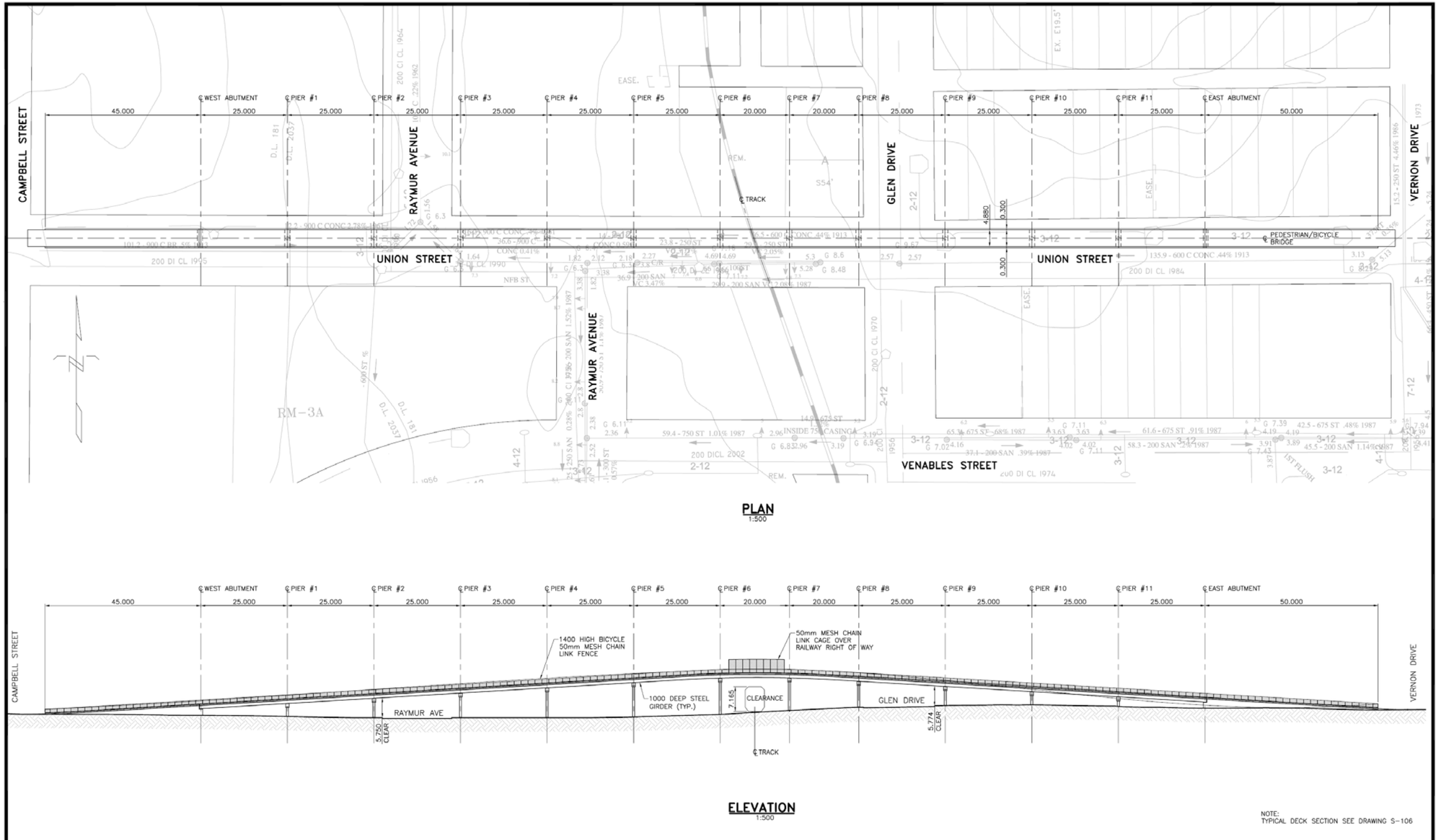
EarthTech
A Tyco International Ltd. Company

project
CONCEPTUAL DESIGN ON
BI RAILWAY CROSSING STUDY
CITY OF VANCOUVER

GENERAL ARRANGEMENT
MALKIN AVENUE
OVERPASS

designed DHM	scale 1:500	y/m/d 2008/06/02
drawn PSG	project no. 102717	contract
checked	drawing no. S-102	rev.
approved		



no.	rev.	y/m/d	issued for	by	app.

no.	rev.	y/m/d	issued for	by	app.

PRELIMINARY
NOT FOR
CONSTRUCTION

no.	y/m/d	revision	by	app.

seal

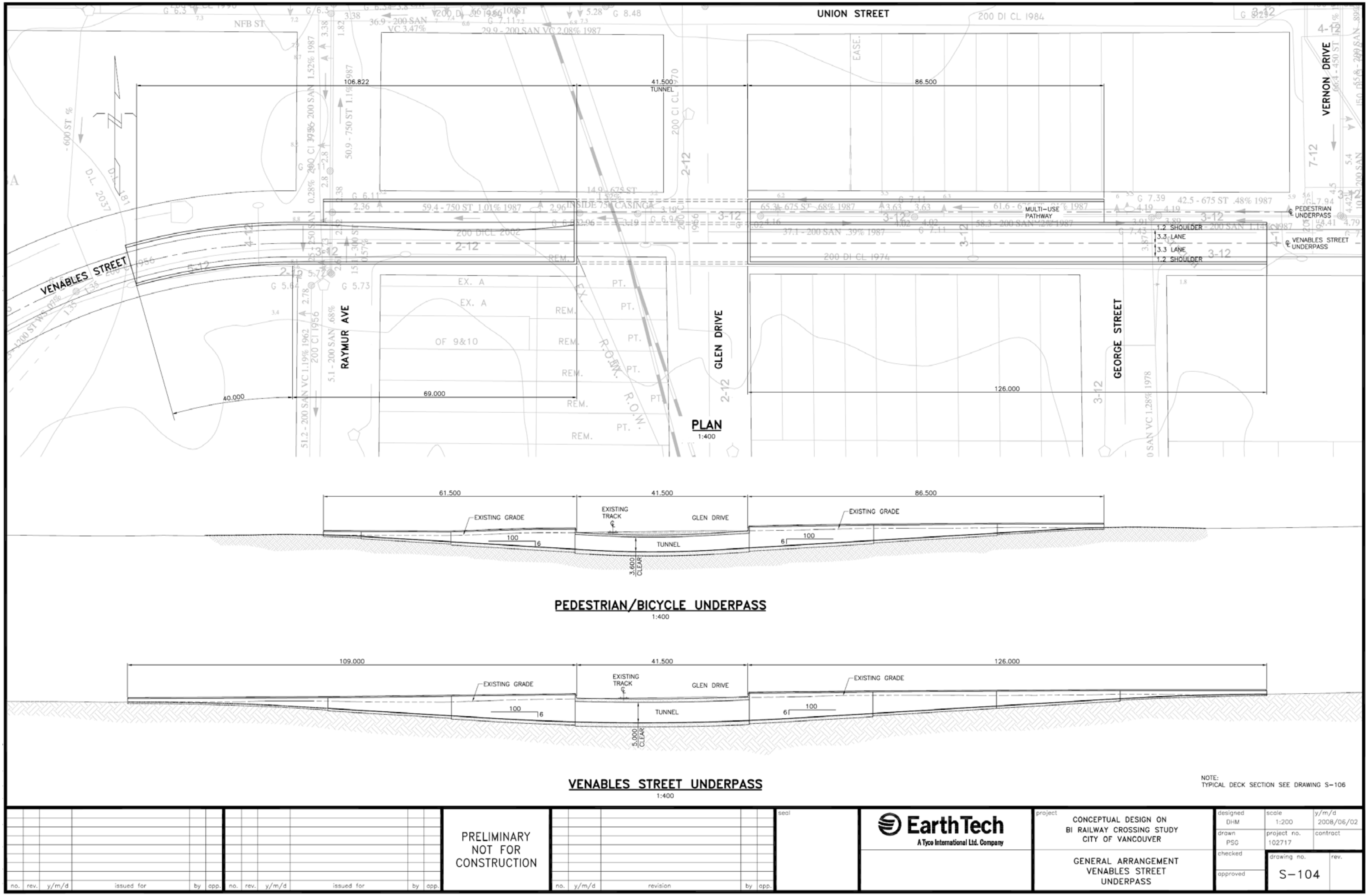
EarthTech
A Tyco International Ltd. Company

project: CONCEPTUAL DESIGN ON
BI RAILWAY CROSSING STUDY
CITY OF VANCOUVER

GENERAL ARRANGEMENT
UNION STREET
PEDESTRIAN/BICYCLE OVERPASS

designed DHM	scale 1:500	y/m/d 2008/06/02
drawn PSG	project no. 102717	contract
checked	drawing no. S-103	rev.
approved		

OPUS Hamilton


UNION STREET
VENABLES STREET
RAYMUR AVE
GLEN DRIVE
GEORGE STREET
VERNON DRIVE
PLAN
1:400
PEDESTRIAN/BICYCLE UNDERPASS
1:400
VENABLES STREET UNDERPASS
1:400
NOTE:
TYPICAL DECK SECTION SEE DRAWING S-106
PRELIMINARY NOT FOR CONSTRUCTION
EarthTech
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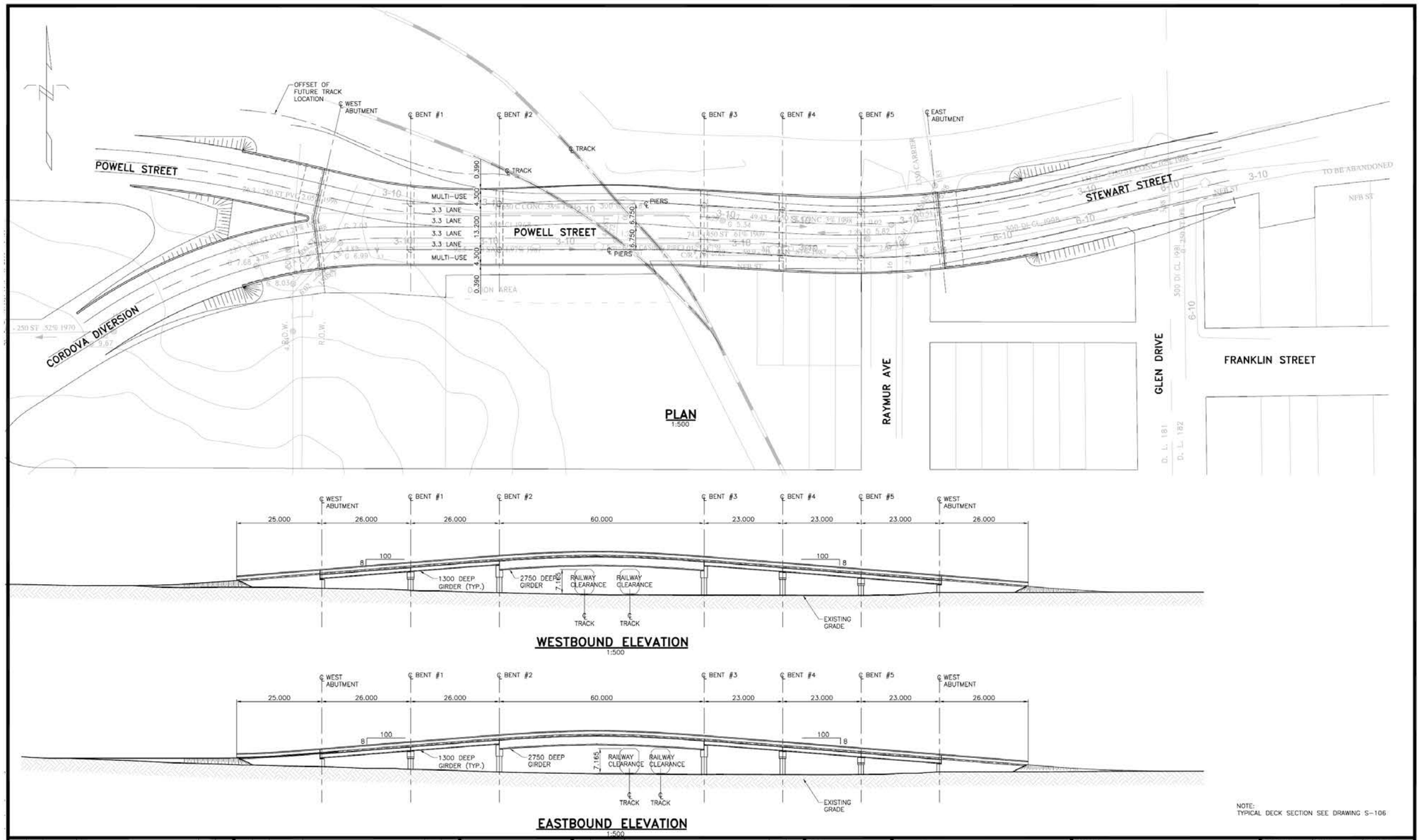
CONCEPTUAL DESIGN ON BI RAILWAY CROSSING STUDY CITY OF VANCOUVER
GENERAL ARRANGEMENT VENABLES STREET UNDERPASS
designed DHM
drawn PSG
scale 1:200
y/m/d 2008/06/02
project no. 102717
drawing no. S-104



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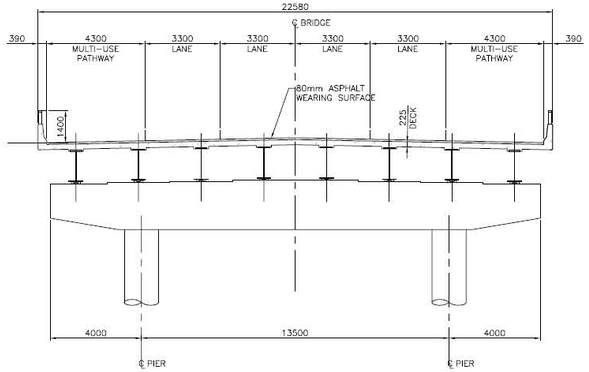
project: CONCEPTUAL DESIGN ON
BI RAILWAY CROSSING STUDY
CITY OF VANCOUVER

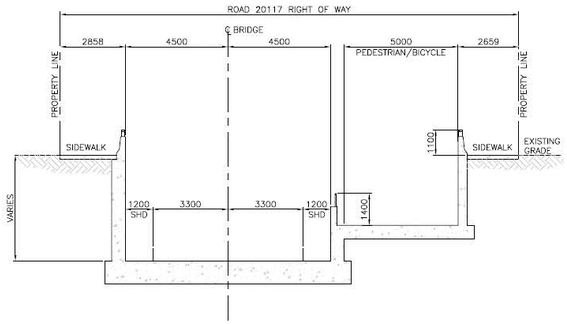
GENRAL ARRANGEMENT
POWELL STREET
OVERPASS

designed	scale	y/m/d
DHM	1:200	2008/06/02
drawn	project no.	contract
PSG	102717	
checked	drawing no.	rev.
approved	S-105	

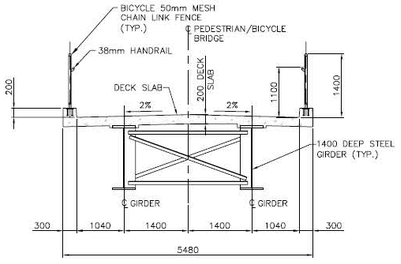
OPUS Hamilton



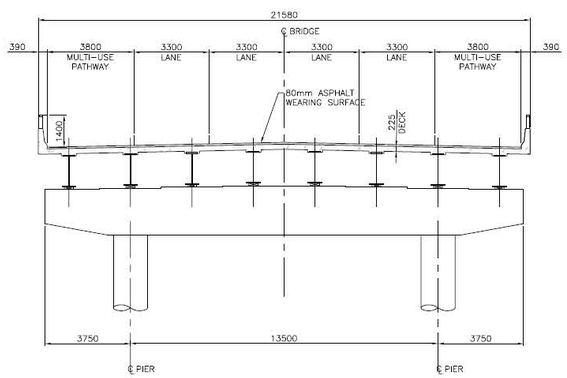
POWELL STREET
TYPICAL DECK SECTION
1:100



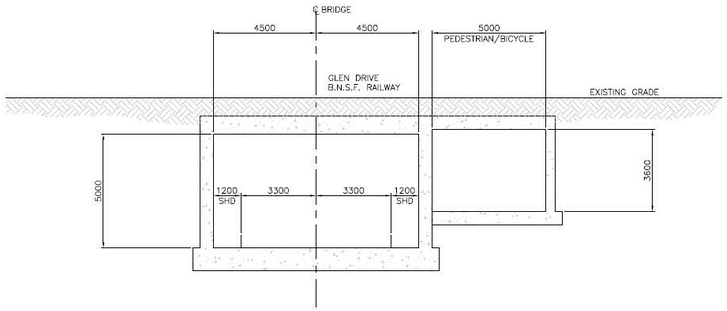
VENABLES STREET
TYPICAL UNDERPASS SECTION
1:100



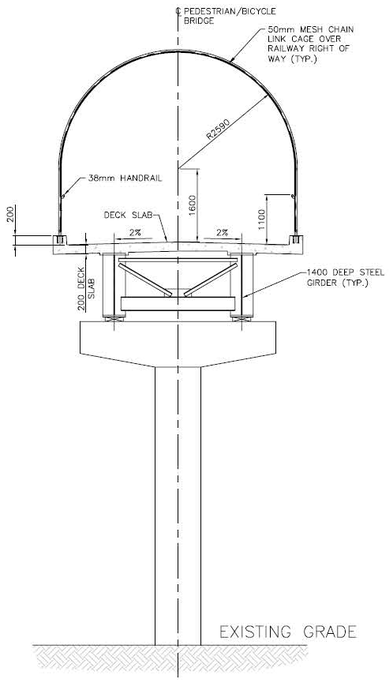
TYPICAL DECK SECTION
PEDESTRIAN/BICYCLE
SCALE: 1:50



MALKIN AVENUE
TYPICAL DECK SECTION
1:100



VENABLES STREET
TYPICAL UNDERPASS SECTION
1:100



TYPICAL DECK SECTION
PEDESTRIAN/BICYCLE
OVER RAIL TRACK
SCALE: 1:50

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CONCEPTUAL DESIGN ON
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CITY OF VANCOUVER

TYPICAL BRIDGE DECK SECTIONS

designed DHM	scale 1:200	y/m/d 2008/06/02
drawn PSG	project no. 102717	contract
checked	drawing no. S-106	rev.
approved		

PLOT DATE: Friday, July 04, 2008 8:47:36 AM

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APPENDIX C

IMPACT EXTENTS

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APPENDIX C

IMPACT EXTENTS

In response to stakeholder requests, the impacts of structures having a range of maximum gradients were identified. The maximum gradients considered in this preliminary assessment were 4, 5, 6, and (in some cases) 8 percent. The varying maximum gradients had a direct impact on the lengths of the structures, and consequently on the costs of the structures. This Appendix provides an indication of the structure lengths (Dwgs C301 through C304, and Table C.1) and costs (Table C.2).

TABLE C.1 Vancouver Railway Crossing Study Bridge Lengths

	@4%	@5%	@6%	@8%
CVG1	593	549	-	-
CVG2	298	257	-	-
Malkin Avenue	770	678	585	404
Venables	442	357	277	-
Union	670	536	401	-
Powell	655	570	484	312

TABLE C.2 Vancouver Railway Crossing Study Bridge Costs

	@4%	@5%	@6%	@8%
CVG	$12,840,000	$11,600,000	-	-
Malkin Avenue	$41,725,000	$36,740,000	$31,700,000	$21,945,000
Venables	$6,700,000	$5,415,000	$4,200,000	-
Union	$9,290,000	$7,432,000	$5,560,000	-
Powell WB	$32,120,000	$27,950,000	$23,735,000	$15,300,000

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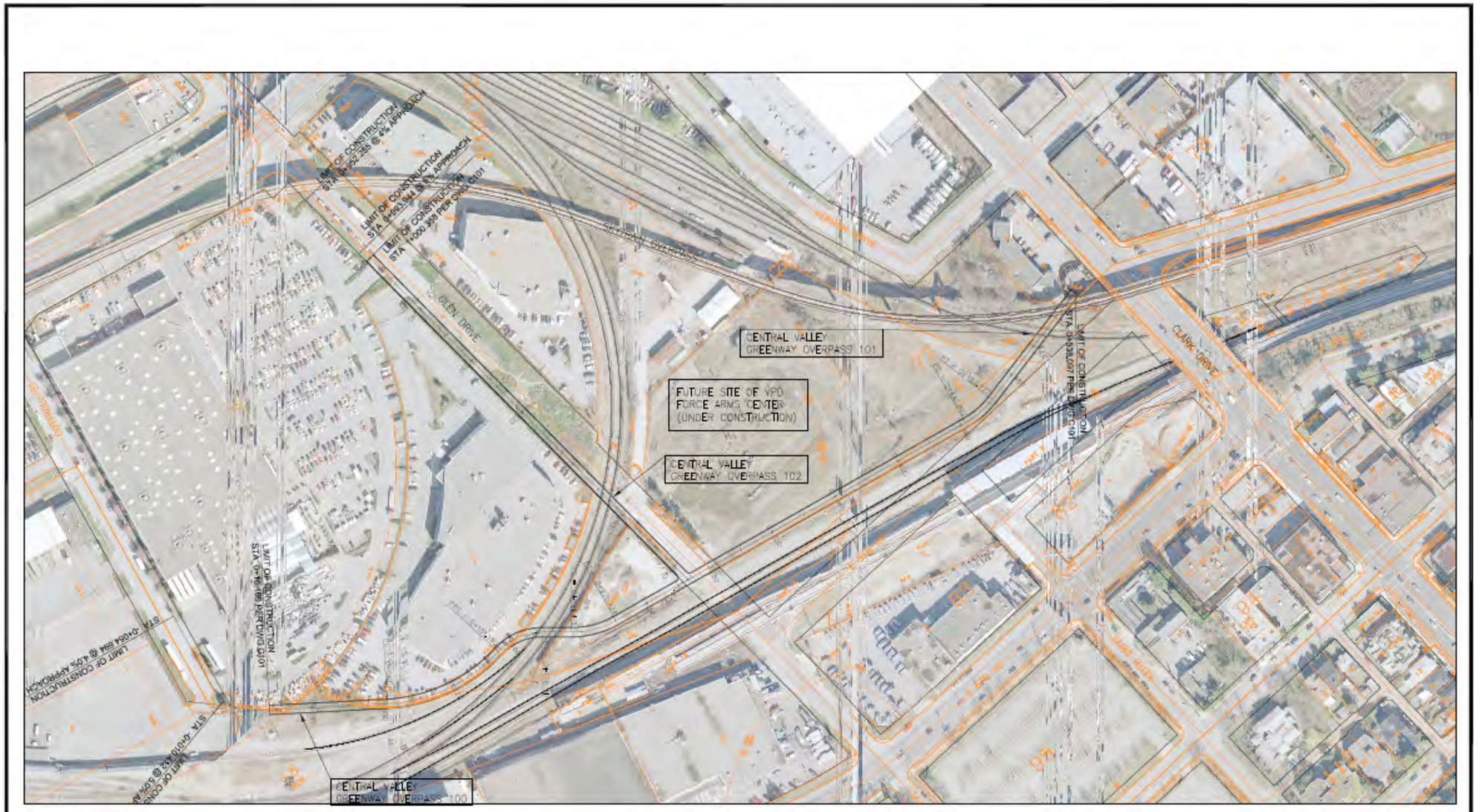

PLAN – PROPOSED BICYCLE/PEDESTRIAN OVERPASSES
CENTRAL VALLEY GREENWAY
SCALE 1:1000

PRELIMINARY
NOT FOR
CONSTRUCTION

EARTH TECH | AECOM
OPUS INTERNATIONAL CONSULTANTS (BC) LTD.

CONCEPTUAL DESIGN OF
RAILWAY CROSSING STUDY
CITY OF VANCOUVER

CENTRAL VALLEY GREENWAY OVERPASSES
IMPACT EXTENTS

1:1000
07/12/06
C301
0

PLAN – PROPOSED ALL MODES 4 LANE OVERPASS
MALKIN AVENUE
SCALE: 1:1000

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MALKIN AVENUE – IMPACT EXTENTS

designed: BJP	scale: 1:500	y/m/d: 07/12/06
drawn: PW	project no.: 102717	contract:
checked:	drawing no.: C302	rev.:
approved:		

OPUS Hamilton

PLAN – PROPOSED PEDESTRIAN/SHARED USE PATH & 2 LANE VEHICLE UNDERPASS – VENABLES STREET

SCALE: 1:1000

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CONCEPTUAL DESIGN ON
BI RAILWAY CROSSING STUDY
CITY OF VANCOUVER

VENABLES AND UNION STREET
IMPACT EXTENTS

designed BJP	scale 1:500	y/m/d 07/12/06
drawn PW	project no. 102717	contract
checked	drawing no. C303	rev.
approved		

PLAN – PROPOSED ALL MODES 4 LANES OVERPASS
POWELL STREET
SCALE: 1:1000

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CONCEPTUAL DESIGN ON
BI RAILWAY CROSSING STUDY
CITY OF VANCOUVER

POWELL STREET AND CORDOVA DIVERSION
IMPACT EXTENTS

designed	scale	y/m/d
BJP	1:1000	07/12/06
drawn	project no.	contract
PW	102717	
checked	drawing no.	rev.
approved	C304	

OPUS HAMILTON

OPUS Hamilton

- Traffic Operations
- Transportation Planning
- Road Safety Engineering
- Transit and Sustainability
- Asset Management
- Project Management

The following is a consolidated summary of the comments on the Rail Crossing Report. This summary incorporates comments from VACC, City of Vancouver (Neighbourhoods and Greenways Branch, Structures, Strategic Transportation), TransLink (Roads and Infrastructure Planning Group), Vancouver Port Authority.

Introduction

A new introduction is likely needed that updates the chronology and background for this project. A suggested revision is provided below.

"Railways are an essential component of the region's good movement network. They are vital to the success of port operations in the Greater Vancouver area, as well as the provincial and national economies. The market for Vancouver ports has recently experienced significant volume growth. It is forecast that rapid growth in rail goods movement will continue over the next 15 years. Railways are also a critical element of passenger movement for local, regional, and intraprovincial travel. The VIA, Amtrak, Rocky Mountaineer, and West Coast Express passenger train services are all candidates for future expansion.

Available rail capacity at the south shore terminals is very important to encourage future intermodal growth at these terminals. To accommodate the short term critical needs for rail, CN and CPR have agreed (co-production agreement) that the two railways will share key sections of track to improve the fluidity of rail operations over existing infrastructure in the Vancouver area.

Rail modelling analyses currently being undertaken by the Port of Vancouver indicates that this co-production agreement along with a few minor infrastructure and rail operational improvements could help to meet the demand for the south shore terminals up to approximately 2012. However, in order to allow for future growth in all commodity sectors or if this co-production agreement were to end there would need to be new ways to satisfy the demands for rail in the future.

One of the potential areas for additional rail capacity is the rail yards within the False Creek Flats. However, prior to the CN/CP co-production agreement, rail analysis was conducted by the Greater Vancouver Gateway Council that identified constraints in the Burrard Inlet Rail line (BI Line) that links the Port to the False Creek Flats. These constraints affect the ability for the False Creek Flats to efficiently provide additional rail capacity to support the Port facilities. The two primary constraints along the BI Line included

- At grade road/ rail intersections
- The rail/ rail intersection with the CP mainline at the Port

The City of Vancouver is supportive of increases in goods by rail as it is a more sustainable mode of transport than by truck. Recent statistics from the Rail Association of Canada indicate that goods movement by rail is nine times more efficient than by truck in terms of overall energy consumption and creates over 60% less greenhouse gas emissions.

In order to examine ways how to remove the constraints along the BI Line, the City of Vancouver applied for funding through Transport Canada under the Transportation Planning and Modal Integration Initiative for the False Creek Flats Rail Corridor Strategy. In June 2006, the City's proposal was accepted by Transport Canada and this report is the summary of the work completed by Opus Hamilton and EarthTech to develop and evaluate a grade separation concept of the BI Line corridor."

Safety Audit

There are some concerns about items within this section being incorporated directly within the report. Some items that are outlined in this safety audit could not be completed because of surrounding conditions (ie overhead power lines) others may not be a priority due to current low train volumes along this corridor. This should be brought out as a separate report with a commentary included in the safety section of the body of the report. It could read

"A safety audit was conducted of the current arterial street at grade crossings along the corridor. A report was provided to the City of Vancouver that outlined some changes at these locations for consideration that would update the crossings to the current signage and rail crossing standards. However due to the low volumes of trains currently using this rail corridor it is not anticipated that any items from the safety review would change the construction priority for removing any of these at grade crossings. If the volumes of trains along the corridor increases this may need to be revisited."

Also, could this report also mention TAC guidelines for pavement markings and signage for peds & cyclists?

At grade closures

In this section it would be better to have a description of the amount of property that would be required to maintain access and a description of the properties that would be affected. This section should also include a discussion of how cyclist/ pedestrians could be rerouted and whether there appears to be any destinations that might be cut off.

Powell

This section is missing the plan for how the pedestrian and bike routing in this area would connect to the overpass. This should be examined to determine if a bike path on one side or bike lanes on both sides are more desirable and how the connections would work as well as how the pedestrians fit in each scenario.

Powell is described as a greenway, this should be described as potentially part of a future greenway. Bridge width allowance for peds/cyclists should be 8.6m at Powell.

Should reword the section that states the long term plan is to construct a new track south and west of the existing track crossing Powell Street at a larger skew angle than the present track"

It could read

"To help address the capacity constraint of the BI Line crossing of the CP mainline, one option would be to add an additional track at the north end of the BI line with a smaller radius that connects adjacent to the CP Mainline. This would not replace the existing track but would be in addition to the current one and would allow freight or passenger trains to connect from the west onto the BI line. A similar track connection to the east may also be of benefit but would require more property acquisition and could not be accommodated under the same structure"

A figure would help to describe the above situation.

Should add a statement that this overpass could also potentially accommodate capacity increases east west along the waterfront and should be explored with future work that is being completed by the Port.

The new line that is shown on the drawing ties into the existing CP mainline at the waterfront. This should be slightly south of the mainline and might mean shifting the west abutment further west.

Union

How is this location in terms of cyclist safety, is there adequate sight distances? Is an underpass completely unfeasible in this location. Grades could be slightly steeper for an underpass, could overhead clearances be reduced to make it feasible.

Venables

The Venables street crossing is not well described should be consistent in the way that cross sections are described either with a width or number of lanes..

Venables is not a designated bikeway but may be in the future.

Malkin

As discussed in the steering committee meeting there should be some discussion and review of the impacts on the new Malkin Connection to Clark in relation to its proximity to 1st Avenue and the turning volumes that could be directed there.

The report seems to be missing the section on how the cycling and pedestrian facilities would connect to the road network and how the space would be allocated on the structures (ie bike lanes, shared sidewalks etc)

Bridge width allowance for peds/ cyclists should be 7.6m at Malkin

North South Connection at Glen Drive

The north/ south connectivity in the vicinity of Glen Drive seems to be missing. Concepts were developed for the Central Valley Greenway connection from Clark instead. This connection should be able to lead to an east/ west connection behind the Showmart site by Home Depot and connect to Cottrel.

Does this have to be covered with a chainlink fence? Was this a previous requirement?

North/ South Cycling Facility

There should be an inclusion of the north/ south cycling facility for comment before finalising the report.

Overall Comments

Should make sure that the study is referred to as the same name all the way through. On the first page there is a different name used than in other areas.

The map that was used on page three seems to indicate other roadway/ rail at grade crossings. (E Pender). Should make sure that only the road rail crossings that actually exist are shown.

The rail clearance of 7.01 should be at least 7.16 or 23'6" from top of rail which is standard rail clearance

Pedestrian/ cyclist clearance under rail may be able to be smaller than 3.6m…as low as 2.4 if this helps to reduce grades

3.2 Design Criteria:

- Why does ped/bike OP require more clearance than road OP?

The bridge width allowance for pedestrians and cyclists at Malkin and Powell are reversed. Should be 7.6m at Malkin and 8.6 at Powell

For Powell overpass, should confirm that this allows for connection of rail to adjacent of mainline. Could the abutments be parallel to rail to preserve more space for rail?

Goods movement- This whole area is a truck area and every road is a truck route. Should comment on impacts of rerouting or access.

Section 3 is difficult to read. a profile sketch for each location included in the text would help .
The drawings in the appendix don't show up well on my screen or the printer.

At grade closures

Unsure of some of the comments in the tables

Cyclists and peds- mention of closing sidewalks and local road connections. The sidewalks won't be closed, just the crossing. The cyclists could reroute with the traffic. Should examine how cyclists and pedestrians are rerouted.

Should comment on the number of properties with impacts. This would be to reconnect streets. Should not look at cul de sacs for large trucks but potential connections

4.3 Glen/Parker closure – Glen is a potential future bike route connecting CVG and Windsor to Union and Portside. Closure would necessitate rerouting , likely to Raymur. Although it appears not to be included in the study, we would like to see bike access along the Glen Drive alignment between Gt Northern Way and Union.

Overall Structure Comments

Did all structural design have ease of construction and rapid erection time in mind.

Evaluation

The discussion in the evaluation section seems like it needs some work. We should discuss the evaluation criteria. They should link if possible to the criteria outlined in the Asia Pacific Gateway application including impacts on traffic circulation for the MRN. Some potential evaluation criteria could be as follows:

Goods Movement –How does the concept effect the connections for goods movement and what are the potential impacts. Are there accesses to industrial buildings that are cut off. Are there shorter or easier connections to arterial roadways

Pedestrians- How are pedestrian linkages affected. Is there extra distance required to cross now. Are there new linkages created. Is there more pedestrian space. Are there new crossings that were not available previously.

Cyclists- How are cyclists affected. Are the connections longer. Is there potential for access that was not there previously. How does this fit with current and future cycling networks.

Neighbourhood impacts- How does the changes to the crossing fit with the neighbourhood. Does it have a potential to divert traffic away from residential areas. Will the structures impact on any houses. Will there be visual impacts.

Passenger rail- - Do the changes to the crossing bring any specific benefits for passenger rail connections.

Freight Rail- Do the changes to the crossing bring any specific benefits to freight rail traffic. Does the crossing bring opportunities to change the rail network.

MRN impacts- Does the changes to the crossing affect traffic patters on MRN roads. Does the crossing have the potential to affect traffic on arterial roads. What are the potential diversions and how does this affect traffic volumes.

Port Security- How does the crossing help with Port Security

General Considerations- Are there considerations that should be examined. Are there potential dead zones under structures. Are there considerations to regrade building lines?

All grade crossing changes should be evaluated both structural and non structural. This evaluation would not create a priority but would provide the information in which a priority could be developed.