Technical Memorandum No. 1: Technical Assessment of Operating Passenger Rail On the Interurban Corridor

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GREATER VANCOUVER TRANSPORTATION AUTHORITY

Technical Assessment of Operating Passenger Rail On the Interurban Corridor

FINAL REPORT

October 16, 2006

Prepared By:

DRL Solutions Inc.

GREATER VANCOUVER TRANSPORTATION AUTHORITY
Technical Assessment of Operating Passenger Rail
On the Interurban Corridor

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Section 1 Executive Summary:

The Greater Vancouver Transportation Authority commissioned this Technical Assessment of Operating Passenger Rail on the Interurban Corridor. It did so as a result of recent public interest that the corridor could be used as a relatively inexpensive means of providing passenger rail service to the South of Fraser area.

The objective of the study is to determine the technical elements and the construction costs that would be involved in developing passenger rail service between the Scott Road SkyTrain station in Surrey and a terminal in Langley City. The study strives to present these elements in a non-technical, easily understood format.

The scope of the study includes:

- Conducting an inventory of the existing rail corridor known as the Interurban Corridor. (See Section 3);
- Describing the rail transit mode alternatives including potential station locations, service frequencies and passenger capacities for each mode. (See Section 4);
- Identifying technical and constructability issues. (See Section 5); and
- Preparing an alternative analysis by transit mode, including rough order of magnitude (ROM) costs for the construction of each mode. (See Section 6).

The scope of the study does not include determining the cost of engineering, design, project management or the costs involved with property acquisition. Each of these cost categories can be expected to add significant expense to the project cost estimates that have been prepared as a part of this report. The scope also does not include estimating the cost to operate or maintain the passenger rail service. The scope does not include the conduct of a ridership survey. The study was prepared without the benefit of ridership projections, using the assumptions defined in this report.

The Interurban Corridor for the purposes of this study includes the right of way and track of the Southern Railway of British Columbia (SRY) from the Scott Road SkyTrain station to Pratt Junction, located in the vicinity of 180th Street and 54th Avenue. From Pratt Junction the corridor extends east on right of way and track owned by the Canadian Pacific Railway (CPR) to a point to be determined in or east of Langley City. This track is used jointly by CPR, Canadian National Railway (CN) and SRY.

To complete the rail passenger corridor, approximately one half mile of new right of way and track would need to be built from the Scott Road SkyTrain station to a junction with the SRY in the Fraser Shops area near South Westminster. Additional new right of way and trackage would also be needed in the Langley City area for an overnight layover facility. Additional property, right of way and track would also be needed for separate Light Rail Transit (LRT) right of way from Pratt Junction to Langley if either of the light rail mode alternatives were to be selected.

A physical inventory of the Interurban Corridor was conducted. The inventory includes a description of the existing railroads in the corridor, the identification and evaluation of

each of the grade crossings and the identification and evaluation of each of the industrial tracks in both the northern and southern segments of the corridor. A photographic inventory from north to south with a focus on grade crossing and potential station locations was also prepared for the corridor. Please refer to Section 3 for an in-depth description of the inventory of the Interurban Corridor. Please refer to the appendices for the details of each of the aspects of the physical inventory including:

- Grade crossing inventory;
- Industry track inventory diagrams; and
- Photographic inventory of the Interurban Corridor.

The following four passenger rail modes have been evaluated in this study:

- Heavy rail diesel push-pull commuter such as is used on the West Coast Express (WCE). A recent preliminary feasibility study developed much of the information necessary for this mode. That information has been used in this report;
- Heavy rail diesel multiple unit (DMU) commuter such as with Budd cars as used on Vancouver Island or with other compliant DMUs;
- Light rail transit with diesel multiple unit DMU vehicles such as those which are used in Ottawa; and
- Light rail transit with electric multiple unit (EMU) vehicles such as those which are used in Calgary.

For the purposes of this study and preparing ROM cost estimates, potential station sites were located for both the heavy rail and light rail alternatives. These station sites are shown in Section 4, Table 4-1.

Comparative statistics and quantified assumptions for each of the four passenger rail modes being evaluated are shown in Section 4, Table 4-2. The information shown in Tables 4-1 and 4-2 were used in preparing the ROM cost estimates shown in Section 6 of this report.

Technical and Constructability Issues are listed and discussed in detail in Section 5. Each of the 19 issues describes factors that were observed during the study that could pose significant technical obstacles to be overcome by the project should it be undertaken. Other issues presented significant cost implications. Some issues were both technically difficult and very expensive to resolve. Several of the issues that were presented may prove to be fatal flaws for one or more of the modes being evaluated. In some cases, actions could be taken to reduce the potential effects of a specific issue. Suggestions were made where appropriate indicating actions that could be considered for further investigation.

As the reader will see from the technical discussions in Section 5, there are two very important issues among the 19 discussed that have a major bearing on all four of the alternatives evaluated and the overall feasibility of the project. The first of these two issues is the fact that the SRY Fraser Valley Subdivision was originally constructed as a light density interurban line. The right of way has two parallel BC Hydro electric transmission pole lines from one end to the other that seriously restrict the ability to

expand the existing railroad infrastructure. The second of the two issues is that the CPR Page Subdivision which connects with the Fraser Valley Subdivision and passes through Langley is a busy single-track mainline that carries an increasing amount of heavy rail traffic. Coal trains and double stack container trains of CPR and CN to Roberts Bank and the Delta Port in addition to the SRY trains from the Fraser Valley Subdivision use this route.

The CPR Page Subdivision is subject to potential expansion to a two main track railroad as the CPR presses to add mainline capacity to maintain the fluidity of the growing freight operations. There have been some public discussions proposing the relocating of trains off the line through Langley to other CPR and CN rail lines. There have also been discussions proposing the relocation of the Page Subdivision out of Langley onto another yet unspecified bypass route. The existing route is already a bypass route, but as Langley has grown, it has once again surrounded the CPR mainline through the city with significant development.

There may be other significant technical and constructability issues that have not been identified in the study. These could be expected to arise during further study of the Interurban Corridor or during preliminary engineering, should the project be undertaken.

Rough Order of Magnitude (ROM) Cost Estimates are contained in Section 6. To simplify the comparison, these costs are presented in Table 6-1. The ROM costs are based on the assumptions contained in this report. They have been prepared using recent cost information from several sources and best estimates where recent information was not readily available. The estimates are prepared in current year Canadian Dollars. They have not been escalated for future year cost increases, currency fluctuations or for inflation.

In accordance with the scope of this study, several significant cost categories have not been included in the ROM estimates. These categories are identified in Section 6. In order to determine the total ROM cost of each alternative, these additional costs would need to be quantified and added to the costs shown in Table 6-1.

The ROM costs to construct each of the four modes, and the approximate capital cost per km for each, are shown below:

Table 1-1
Rough Order of Magnitude Capital Cost Comparison

Mode Cost	Heavy Rail Bi-Level Push-Pull Commuter	Heavy Rail DMU	Light Rail DMU	Light Rail EMU
ROM Cost Estimate by Mode	**$363,000,000**	**$356,000,000**	**$592,000,000**	**$697,000,000**
ROM Capital Cost per KM	**$13,000,000**	**$13,000,000**	**$23,000,000**	**$27,000,000**

Section 2 Objective and Scope:

The objective of this study is to determine the technical elements and the construction costs that would be involved in developing passenger rail service between the Scott Road SkyTrain station and a terminal in Langley City.

The scope of this study includes:

- Conducting an inventory of the existing rail corridor (the Interurban Corridor);
- Describing the rail transit mode alternatives including potential station locations, service frequencies and passenger capacities for each mode;
- Identifying technical and constructability issues; and
- Preparing an alternative analysis by transit mode including rough order of magnitude (ROM) costs for the construction of each mode.

The scope of the study does not include determining the cost of engineering, design, project management or the costs involved with property acquisition. Each of these cost categories can be expected to add significant expense to the project cost estimates that have been prepared as a part of this report. The scope also does not include the cost of operating or maintaining the passenger rail service. The scope does not include the conduct of a ridership survey. The study was prepared without the benefit of ridership projections using the assumptions defined in this report.

The Interurban Corridor

The Interurban Corridor for the purposes of this study is defined as the right of way and track of the Southern Railway of British Columbia (SRY) from the Scott Road SkyTrain station to Pratt Junction, located in the vicinity of 180th Street and 54th Avenue. From Pratt Junction the corridor extends east on right of way and track owned by the Canadian Pacific Railway (CPR) to a point to be determined in or east of Langley City. This track is used jointly by CPR, Canadian National Railway (CN) and SRY.

To complete the corridor, approximately one half mile of new right of way and track would need to be built from the Scott Road SkyTrain station to a junction with the SRY in the Fraser Shops area near South Westminster. Additional new right of way and trackage would also be needed in the Langley City area if either of the light rail mode alternatives were to be selected. The Interurban Corridor as defined above is currently used for both local industrial freight switching and for through freight train service. Passenger rail service is not currently operated in the corridor.

A physical inventory of the Interurban Corridor is contained in Section 3. This inventory includes information about:

- Right of way, track, signals and structures;
- Operating patterns, traffic levels and train speeds;
- Grade crossings; and
- Freight industrial tracks.

In addition, an inventory of photographs, each facing in the same direction of travel (north to south), and depicting level crossing locations on the proposed route over the Interurban Corridor, is contained in Appendix C to help the reader visualize the service route and the issues discussed in the report.

Passenger Rail Mode Alternatives

The following four passenger rail modes have been evaluated in this study:

- Heavy rail diesel push-pull commuter, as used on the West Coast Express (WCE). A recent preliminary feasibility study developed much of the information necessary for this mode. That information has been used in this report;
- Heavy rail diesel multiple unit (DMU) commuter, such as with Budd cars as used on Vancouver Island or with other compliant DMUs;
- Light rail transit with diesel multiple unit DMU vehicles as used in Ottawa; and
- Light rail transit with electric multiple unit (EMU) vehicles as used in Calgary.

Each of these four transit mode alternatives are discussed in greater detail in Section 4. The description includes the operating assumptions that have been included for each of the particular modes.

Technical and Constructability Issues

The operation of passenger rail service in the Interurban Corridor would involve substantially different infrastructure and additional operating capacity than are presently required for the existing freight service. The requirements differ for each of the modes that were analyzed. As a result, changes to the corridor would be required to meet the needs of both the passenger and the freight service. These changes may affect the stakeholders in the corridor including, but not limited to:

- The Southern Railway of British Columbia (SRY);
- The Canadian Pacific Railway (CPR);
- The Canadian National Railway (CN);
- Present and future freight customers of the railways;
- Present and future transit riders;
- BC Hydro (BCH);
- British Columbia Transmission Corporation (BCTC);
- Greater Vancouver Transportation Authority (GVTA);
- Greater Vancouver Sewerage and Drainage District (GVS&DD);
- Greater Vancouver Regional District (GVRD);
- Other utilities;
- Other government agencies;
- The municipalities through which the Interurban Corridor passes;
- Adjacent and nearby property owners;
- Commercial businesses;
- Residents;
- Motorists; and
- The environment.

This study identifies several technical and constructability issues that could be expected to be encountered if passenger rail service were to be provided in the Interurban Corridor. It explains the issues in a non-technical manner and describes how they might be expected to affect the ability to operate passenger rail service in the corridor. These issues are discussed in detail in Section 5 of the report. The report also suggests some actions that could be taken to address some of these issues or to more accurately evaluate how they may affect the ability to provide passenger rail service in the corridor. It is possible that some of the technical and constructability issues that have been identified may be quite difficult and/or too costly to resolve. Several of the issues that have been identified may prove to be fatal flaws in the design for one or more of the passenger rail modes that were evaluated in the study.

During the conceptual design, preliminary and final engineering and the actual construction of the project, additional technical and constructability issues could be expected to arise that have not been foreseen at this level of review. This study has addressed only those major issues that were identified during this initial assessment. This study should not be considered to be a comprehensive analysis of all the issues that could be expected to arise during the project.

Alternative Analysis by Passenger Rail Mode

Each of the four passenger rail alternatives to be considered for the Interurban Corridor has been analyzed separately. The analysis describes for each mode the service to be provided with its operating assumptions, the right of way and track configurations that would be required, and the construction costs that could be expected to be incurred. Costs have been estimated only to the ROM level. As such, they can be expected to vary significantly as preliminary engineering and resolution of the technical and constructability issues are progressed.

The following broad cost categories have been included for each of the rail modes:

- Right of Way
- Track
- Systems
- Grade Crossings
- Passenger Stations
- Utilities Relocations
- Electrification
- Revenue Equipment
- Facilities
- Vehicles
- Machinery, Equipment, Tools
- Operations during construction
- Contingency Requirement.

Within each of these categories, sub-categories were identified. For ease of comparison, a table showing the comparative costs of construction for each of the modes has been included in Section 6 of the report.

Section 3 Physical Inventory of the Existing Corridor:

The Interurban Corridor has two distinct segments; a northern and a southern segment as described below.

Northern Segment: The SRY Fraser Valley Subdivision is a single-track railway that extends from the New Westminster Bridge over the Fraser River to Pratt Junction where it joins the CPR Page Subdivision. It is primarily a north-south railway line that connects the Vancouver and New Westminster, Surrey and Langley industrial customers with the national rail network of Canada. The Surrey line connects with the BNSF Railway at Huntingdon for the interchange of international rail traffic to points in the United States and Mexico.

The SRY's Fraser Valley Subdivision carries an average of two 15 to 30-car trains each way each day. Each train normally has two locomotives of between 1,200 and 2,000 horsepower each. Train speeds on this line average 15-30 MPH over most of the route. Train operations are normally concentrated in the hours between 400PM and 900AM each day.

The Fraser Valley Subdivision track has 115-pound jointed rail with wooden ties, with four rail anchors on every second tie over most of the route. The railway is well maintained with good tie, ballast, surface and alignment conditions over the entire route. Public grade crossings appear to be well-maintained and most have been replaced within the past several years. Many crossings have modern pre-cast concrete panels for the crossing surface.

The railroad is controlled by SRY train dispatchers using Occupancy Control System Rules with a railway radio system to dispatch trains. The line does not have a signal system to control the movement of trains.

Southern Segment: The CPR Page Subdivision is a busy single-track high-speed east-west mainline freight railway which is the Roberts Bank port link to the transcontinental railroads of CPR and CN. This line handles unit trains of export coal and international double stack container traffic.

The CPR Page Subdivision carries approximately 56 million gross tons per year of rail traffic. This equates to an average of 10 trains of 80 to 130-car trains in each direction each day. Traffic on this line is increasing. The coal trains normally have one 4,400 horsepower AC-type locomotive on the front and another on the rear. Double stack container trains normally have three 4,400 horsepower AC locomotives on the front with none on the rear. Train speeds on this line average 40-50 MPH over most of the route. Trains operate at all hours of the day and night, seven days per week.

The Page Subdivision is equipped with 136-pound continuous welded rail with wooden ties with rail anchors on every tie over most of the route. The railway is very well maintained with excellent tie, ballast, surface and alignment conditions over the entire

route. Most drainage structures that were observed appeared to be functioning properly. Public grade crossings appear to be well-maintained and most have been replaced within the past several years. Most crossings have modern pre-cast concrete panels for the crossing surface.

The railroad is controlled by CPR train dispatchers using a Centralized Traffic Control (CTC) System to control trains and railway radio for communications.

Grade Crossings:

Grade crossings for both segments of the Interurban Corridor are categorized on railroad lists as public, private or pedestrian crossings. The Northern Segment has 25 public, 7 private and 5 pedestrian crossings. The Southern Segment has 7 public, 4 private and no pedestrian crossings according to the railroad listing. An inventory of each of these grade crossings is contained in Appendix C. Because of the limited access to the railway that was available during the study, there may be one or more private or pedestrian crossings that were not located and therefore were not inventoried. The inventory of all crossings on the railway line should be updated, particularly if a project is to be considered for the Interurban Corridor. Please refer to Sections 5.8, 5.9, 5.16 and 5.18 of this report for discussions about technical issues involving grade crossings and security.

The inventory of grade crossings in Appendix C also includes a series of photographs, each facing the same direction of travel (north to south), depicting level crossing locations of the proposed route from the Scott Road SkyTrain station to the proposed Langley City station site. These photographs were taken at grade crossings so that the reader can compare the photographs with the grade crossing inventory map and report. The grade crossing locations were selected for the photographic inventory because, in most cases, the potential station sites were located in the immediate vicinity of key rail-highway intersections so as to facilitate an efficient interface with existing GVTA bus routes.

Most of the public crossings are modern and appear to be well maintained. A few crossings that were shown as public crossings had been vacated and apparently had been converted to private crossings. Private crossings varied with some marked by signs and protected by gates and locks, some of which were locked. Other private crossings had no crossing surface or approach roadways and were not able to be used by vehicles. Some appeared to be completely unused.

The legal status of the private crossings and the pedestrian crossings is not clear. It would appear that an updating of the legal status of all crossings in the Interurban Corridor would be warranted should a project be undertaken on the Interurban Corridor. Such an updating would take into account the original authority for each crossing under Canadian law as well as its current use, condition and right of existence. It is believed that a review of the current federal regulations regarding crossings may be underway or about to be undertaken with a view toward taking additional action to prevent accidents involving persons and vehicles along the railroad rights of way. This study has assumed that all crossings that are to remain active would be required to be of proper legal status, would

have electronic grade crossing warning systems and would be well-maintained to the latest standards.

Industrial Tracks:

Freight industrial tracks for both segments of the Interurban Corridor were inventoried. A diagram showing the location of all industrial tracks, color-coded to show their observed current activity status, is contained in Appendix B.

For purposes of this study, an industrial track is a private track that has been constructed in accordance with a signed track agreement between the railway and the industrial customer that allows the industrial customer to ship and receive material in railway cars. Most of the industrial spur tracks on the Interurban Corridor were capable of holding between 1 and 5 freight cars each. Some could hold more than 5 cars.

This report also uses the term "lead track." For the purposes of this study, a "lead track" is one that connects the main track with one or more privately-owned industrial tracks serving the railroad's freight customers. A lead track is one which the switching locomotive uses to leave the main track and perform the switching of freight cars into and out of industrial and commercial facilities along the railway. If the lead track is long enough, the freight locomotive may be able to hold its entire train on the lead track, clear of the main track, while it is performing the switching at the industries. This allows other trains to pass on the main track without delay.

The industrial tracks and lead tracks in the Interurban Corridor were categorized as either: active, inactive but still in service, or out of service. A track that is listed as out of service is one that cannot physically be used because the switch leading to the track had been spiked in the closed position and/or one or more rails had been disconnected or removed. Industry tracks identified in the Interurban Corridor were classified as follows:

- Active: 34
- Inactive but still in service: 19
- Out of service: 14

During the inventory, several additional tracks were observed that had been removed from service, but were still in place and were not shown on the industrial track maps. One track was identified that was not shown on the track maps but was active. It had a rail car on it being loaded with lumber. An updated track inventory and track map should be completed, particularly if a project were to be considered for the Interurban Corridor.

For purposes of this study, it has been assumed that, unless otherwise provided for, an industry track or a lead track that has no current track agreement, or that has not been used by the customer in over a year would have its switch and track on the railroad right of way removed as a part of the project. This assumption is based on the need to reduce the exposure to derailments and to avoid unnecessary project construction costs. In some cases, tracks and the adjacent industrial properties appeared to have been abandoned. For several tracks, the name of the track owner did not correspond with the name of the industry shown on the buildings or signs on the property. Please refer to Section 5.18 of

this report for additional technical comments concerning right of way security. This study does not include any costs for constructing track or providing the other necessary infrastructure to serve tracks that are currently out of service.

Other Items of Interest or Issues:
Between the New Westminster Bridge and Royal Heights (96th Avenue), there is a 2.9% ascending grade with curves as well as cuts and fills and an adjacent stream bed. This is the ruling grade or most severe terrain feature on the line. After cresting the grade in Kennedy Heights, the line gradually descends to the southeast. The steepest downgrade occurs southeast of King George Highway before reaching flatter terrain and wetlands in the vicinity of Sullivan.

Please refer to Section 5 of the report for detailed discussions of technical and constructability issues related to the potential development of the Interurban Corridor that were identified during the study.

Section 4 Description of Passenger Rail Mode Alternatives:

The following four passenger rail modes have been evaluated for the Interurban Corridor:

- Heavy rail diesel push-pull commuter, as used on the West Coast Express (WCE). A recent preliminary feasibility study developed much of the information necessary for this mode. That information has been used in this report;
- Heavy rail diesel multiple unit (DMU) commuter, such as with Budd cars as used on Vancouver Island or with other compliant DMUs;
- Light rail transit with diesel multiple unit DMU vehicles as used in Ottawa; and
- Light rail transit with electric multiple unit (EMU) vehicles as used in Calgary.

For the purposes of the study, potential station sites were located along the Interurban Corridor. The following three criteria were used to select these potential sites:

- Near one or more principal roadways that are served by existing bus routes;
- Near existing or future population centers, either residential or commercial/industrial; and
- Not near important freight railroad junctions.

These station sites were determined without the benefit of the usual input process for locating passenger rail stations. These sites were selected solely for the purpose of preparing the ROM cost estimates and identifying technical issues that might be encountered by the project.

Table 4-1 on the following page shows the potential sites that were selected for purposes of the study. Scenario A indicates stations at which heavy rail trains would stop. Scenario B indicates stations at which light rail trains would stop. These are the station assumptions used by the study and do not constitute recommendations.

East of Pratt Junction, the study has assumed that:

- Heavy rail trains would use the existing CPR Page Subdivision mainline through Langley to a new terminal and overnight layover yard east of Langley. Those facilities would be constructed east of the existing Mufford Crescent grade crossing on the north side of the CPR Page Subdivision. This site is in agricultural use. It is not known whether or not a rail yard could be constructed at this location.
- Light rail trains would follow a new separate right of way that could potentially use the original interurban route into Langley from the southwest. Using this route, some track would be constructed in existing street rights of way to Langley Mall and beyond. It appeared several route options were possible within Langley's downtown district should there be interest in extending the service further than Langley Mall. This study assumes that the line would terminate at Kwantlen University.

The shaded areas in Table 4-1 indicate that the mode shown in each column would not serve the stations included in the shaded area. It must be emphasized that these route assumptions were made solely for the purposes of determining the ROM costs to extend

service through the Interurban Corridor. These assumptions must not be considered as recommendations.

Fewer station stops have been assumed for the heavy rail trains because of the slower rates of acceleration and braking of the heavy rail trains. Light rail trains are generally able to accelerate and decelerate much more quickly than heavy rail trains. For this reason, more stops were assumed for the light rail trains.

A map of the potential station sites is included in Appendix A.

Table 4-1
Potential Station Locations

		Scenario A	Scenario A	Scenario B	Scenario B
Potential Station Site	Miles (4)	Heavy Rail Push-Pull Commuter	Heavy Rail-DMU	Light Rail-DMU	Light Rail-EMU
Scott Road SkyTrain	0.00	X	X	X	X
96 Ave-Royal Heights	2.44			X	X
92 Ave & Scott Road	2.92	X	X	X	X
Nordel Road-Kennedy	3.39			X	X
82 Ave & 128th St-Burke	4.71	X	X	X	X
76 Ave & 132 St-Burke	5.54			X	X
72 Ave & King George Highway-Newton (1)	6.30	X	X	X	X
Hyland Road & 144th St	7.58			X	X
64 Ave & 152 St-Sullivan	8.70	X	X	X	X
56 Ave & 168 St	11.02	X	X	X	X
176 St-Clover Square (2)	11.95	X	X	X	X
Fraser Highway-Langley	15.45	X	X		
Mufford Crescent-Langley	16.83	X	X		
200 St & Michaud	15.40			X	X
201A St & Michaud	15.60			X	X
Langley Mall	16.10			X	X
56 Ave & Glover (3)	16.20			X	X
Kwantlen University (3)	16.30			X	X

Notes:

(1) The station facility could include a major mid-route transit interchange point for connections between the passenger rail service and primary bus routes.

(2) The station site would be located on a new SRY rail bypass route at the south end of 176 Street at Clover Square. The right of way for the new bypass track is presently under construction. A ballast deck, concrete rail bridge is in place and right of way preloading was in progress during the time of the inventory of the route.

(3) These two stations (or others) could be optional station sites if the light rail line were to be extended via city streets through Langley's central business district.

The service pattern used for this study assumes that the line would be constructed through to Kwantlen University. Running times and costs have been calculated accordingly.

(4) The Miles column shows the approximate miles in tenths from the Scott Road SkyTrain station for each of the two passenger rail alternative routes (Scenario A and Scenario B). These are preliminary estimated distances which were based on the railroads' grade crossing report. These distances were shown in order to estimate running time and determine one way trip times for the passenger rail alternatives. Final route and station selection can be expected to cause these distances to vary from those shown in Table 4-1.

For each of the four passenger rail mode alternatives being studied, the following information and assumptions were developed:

- Service frequencies (peak and off-peak);
- Type and quantity of rolling stock required based on the service frequencies;
- Maintenance shop location;
- Overnight train storage location(s);
- Potential station locations (Scenario A or Scenario B as described below);
- System to be used to achieve level boarding and accessibility;
- Estimated one-way running times with station stops;
- Passenger seating capacity per vehicle used;
- Total passenger capacity of the line using these assumptions; and
- The plan to continue freight service over the corridor.

In Table 4-2 below, the following comments and explanations apply:

- Dwell time at intermediate stations was assumed to be 40 seconds, except at King George Highway Station where the dwell time was assumed to be 60 seconds.
- Heavy rail diesel push-pull commuter trains were assumed to be equipped with bi-level cars. Heavy rail DMU trains were assumed to be equipped with single-level DMUs. Light rail trains were assumed to be equipped with single-level DMU or EMU cars. Computer simulations were not used to estimate one-way trip times.
- Peak Hours were assumed to be 500AM-830AM and 300PM-630PM. Off-Peak Hours were assumed to be 830AM-300PM and 630PM-930PM. With these assumptions, trains would not originate trips from either terminal before 500AM or after 930PM. Off-peak hours could be extended beyond 930PM but would result in increased conflict with SRY switching activity and may result in unacceptable delays to both parties without additional track above what is being considered in this study. If temporal and physical separation is required between freight trains and light rail commuter trains then compressing SRY trains into a smaller time window may make it very hard or not feasible at all to provide freight service.
- Train consists were assumed to be changed only at the Scott Road SkyTrain Station or at Fraser Shops. An Operating Plan would determine the actual requirements for reducing and increasing train sizes as necessary.

- Mini-high ramps on station platforms and portable ramp plates carried on the commuter cars as used on the West Coast Express will be used for bi-level push-pull trains. New heavy rail DMUs would be equipped with wheelchair lifts.
- Station platform gangways have been assumed for both light rail alternatives. They are remotely-controlled movable station platform ramps which extend to meet the car side at each door opening to permit level boarding. They are retracted vertically when the railway line is in the freight mode. This type of installation and its operation are described in more detail in Section 5.6.
- Local freight service on the SRY Fraser Valley Subdivision would be handled by a night local freight train that only carried cars to and from the Fraser Valley Subdivision. Through freight cars would move in SRY trains via the New Westminster Bridge, then via the BNSF to the CPR Page Subdivision at Mud Bay and on to Huntingdon. Re-routing traffic would incur additional costs and may also result in increased trip times for cars traveling to and from industrial customers. The SRY operating assumptions used in this study were adopted to minimize conflict between freight and commuter rail modes and thus to minimize the additional trackage required. SRY has stated that they will not accept any reduction in service to their customers. Without a more detailed knowledge of the SRY traffic flows and customer commitments it is not known whether this option would be feasible or practical to SRY.

Table 4-2
Assumptions by Passenger Rail Mode

Mode / Assumptions	Heavy Rail Diesel Push-Pull	Heavy Rail DMU	Light Rail DMU	Light Rail EMU
Rolling Stock Requirements	Locos-5 Cab Cars-8 Coaches-8	Single-end Colorado DMU Cabs-14	Single-end articulated DMUs-32	Double-end articulated EMUs-40
Maintenance Shop	Fraser Shops	Fraser Shops	Fraser Shops	Fraser Shops
Overnight Layover Location(s)	Fraser Shops East Langley	Fraser Shops East Langley	Fraser Shops West Langley	Fraser Shops West Langley
Potential Station Locations	Scenario A 9 Stations	Scenario A 9 Stations	Scenario B 16 Stations	Scenario B 16 Stations
Frequencies: • **Peak** • **Off-Peak**	 30 minutes 60 minutes	 30 minutes 60 minutes	 15 minutes 15 minutes	 15 minutes 15 minutes
Accessibility System	Ramps w/Ramp Plates	Wheelchair Lift Equipped Coaches	Station Platform Gangways	Station Platform Gangways
Estimated Distance	16.83 miles 27.08 km	16.83 miles 27.08 km	16.30 miles 26.23 km	16.30 miles 26.23 km
Estimated One-Way Running Time	40 minutes	40 minutes	42 minutes	42 minutes
Aver. Speed	25.2 mph 40.5 kph	25.2 mph 40.5 kph	23.3 mph 37.5 kph	23.3 mph 37.5 kph
Passenger Cars per Train	Peak-3 Off-Peak-3	Peak-4 Off-Peak-2	Peak-3 Off-Peak 2	Peak-4 Off-Peak-3
Aver. Seats per Car	134	94	135	64
Passenger Capacity per Train (seated)	Peak-402 Off-Peak-402	Peak-376 Off-Peak-188	Peak-405 Off-Peak-270	Peak-256 Off-Peak-192
Passenger Capacity Hourly (seated)	Peak-1608 Off-Peak-804	Peak-1504 Off-Peak-376	Peak-3240 Off-Peak-2160	Peak-2048 Off-Peak-1536
Freight Service on SRY Surrey Sub-Division	Local-nights. Through-rerouted via BNSF	Local-nights. Through-rerouted via BNSF	Local-nights. Through-rerouted via BNSF	Local-nights. Through-rerouted via BNSF

Section 5 Technical and Constructability Issues:

This section identifies several technical and constructability issues that could be expected to be encountered if passenger rail service were to be provided in the Interurban Corridor. It explains the issues in a non-technical manner and describes how they might be expected to affect the ability to operate passenger rail service in the corridor.

This section also suggests some actions that could be taken to address several of these issues or to more accurately evaluate how they may affect the ability to provide passenger rail service in the corridor. It is possible that some of the technical and constructability issues that have been identified in the study may be quite difficult or too costly to resolve. As a result, one or more of the issues identified could prove to be a fatal flaw in the design for one or more of the passenger rail mode alternatives that are being evaluated in the study.

During the conceptual design, preliminary and final engineering and construction of the project, additional technical and constructability issues could be expected to arise that have not been foreseen at this level of review. This study has addressed only those major issues that were identified during this initial assessment. This study should not be considered to be a comprehensive analysis of all the issues that could be expected to arise during the project.

The following Technical and Constructability Issues have been identified:

5.1 Service Reliability and Freight Train Operations on SRY Fraser Valley Subdivision;
5.2 Service Reliability and Freight Train Operations on CPR Page Subdivision;
5.3 Constructability of Additional Trackage on Steep Rail Gradients;
5.4 Electrical Pole Line Restrictions on New Track Construction;
5.5 Passenger Car Safety Standards Applicable to Heavy Rail Trackage;
5.6 Conflict between Vehicle Clearance and Passenger Accessibility Requirements;
5.7 LRT Access to Langley Town Center;
5.8 Grade Crossing Warning System/Highway Traffic Signal Interface;
5.9 Safety Aspects of Pedestrian and Private Crossings;
5.10 Availability of Competing Sources for Compliant Rail Vehicles;
5.11 Utilities Relocations-Cost and Effects on Construction Schedule;
5.12 Property Acquisition-Cost and Effects on Construction Schedule;
5.13 Environmental Issues-Floodplain and Wetlands Construction;
5.14 Environmental Issues-Train Operations and Passenger Station Facilities;
5.15 Environmental Issues-Noise and Rail Line Maintenance Restrictions;
5.16 Environmental Issues-Visibility, Safety and Vegetation Control Restrictions;
5.17 Compatibility of Rail Signals/Communications Systems with Transmission Lines;
5.18 Security Issues; and
5.19 Track Maintenance Standards for the Operation of LRT DMU/EMU Vehicles.

Each of the 19 technical and constructability issues listed above are discussed below in a non-technical format to explain how the issue might affect the project should it be

undertaken. Detailed references to applicable technical specifications or regulatory requirements have not been included so as to make the text easier to read and understand. No attempt has been made to quote specific regulatory requirements. It is also understood that in several of the issues, changes in federal regulatory requirements may be under negotiation, while changes to others may be under consideration. These changes could have significant effects on the project. The study has endeavored to anticipate additional future federal regulatory requirements in evaluating the alternatives and preparing ROM cost estimate.

Where conflicts or problems arise in these discussions, one or more alternatives are suggested for consideration where available or where appropriate. The treatment of each issue is not meant to be a complete discussion of all aspects of the issue. Rather, it is meant to attract the reader's attention to the issue and provide the reader with an initial understanding of the implications of the issue to the potential project. For some of the issues, an action has been suggested that, if taken, might lead to a better understanding of the issue and its potential effects on the project.

Several of the issues that are presented may have the effect of being a fatal flaw that could eliminate one or more of the rail mode alternatives being considered. In other situations, there may be actions that could be taken, or changes in the concept of the project that could be made, that could neutralize or reduce the potential for a negative impact on the project.

5.1 Service Reliability and Freight Train Operations on SRY Fraser Valley Subdivision:

Freight train service on the northern section of Interurban Corridor is provided by the Southern Railway of British Columbia (SRY). The line from the Westminster Bridge to Pratt Junction is known as the Fraser Valley Subdivision of the SRY. SRY normally operates two round trip freight trains each day on the line. One train departs New Westminster Yard for the Interurban Corridor at about 400PM each day and the other at about 1100PM each day. At least one of those trains operates to the U.S. border to deliver and pick up rail cars from railroads in the United States. Both trains may provide switching service to the industrial plants and commercial businesses that have spur tracks along the line. SRY has stated that it is important for it to be able to maintain the freight train schedules that it presently operates and to serve customers along the line at the times they are now served and by the trains that now serve them.

This requirement from SRY is a function of when and where the freight cars are available, what direction they are coming from or going to, and which train must handle the cars to make the proper connections or service the industries in the proper direction of travel over the railroad.

The operation of passenger rail service over the corridor would require that additional mainline and industrial lead trackage be constructed to allow both types of trains to use the railroad. Even with two main tracks and additional industrial lead tracks, including changes to the industrial spurs that would be required, service conflicts would occur that

will delay both SRY and GVTA trains. This is due to the nature of the switching operations and the timing and frequency of passenger trains.

Delays to SRY trains could mean that the trains miss their connections with other trains, delaying the cars in the train by 24 hours or more. This would hamper operating efficiency causing additional operating expense, customer complaints and possible loss of revenue. GVTA trains would be even more time-sensitive. Even minor delays to GVTA trains could disrupt the operating cycles of trains and increase operating expense while causing passenger delays, missed connections, complaints and, eventually, lost ridership.

One alternative might be to have GVTA acquire the rail line from SRY and reconfigure it exclusively for passenger rail service to ensure that GVTA system performance standards were met. This would result in the loss of freight rail service to SRY's local freight customers on the line. Such a loss could mean a significant loss of revenue to SRY and could also mean the loss of further industrial employment in the Surrey area. Both would likely be considered to be serious adverse effects to SRY from the project. SRY freight trains could be diverted from the New Westminster Bridge south along the BNSF Railway to Mud Bay Junction and then east on CPR's Page Subdivision through Pratt Junction and Langley City. Due to the regulatory, commercial and legal issues involved, it is not clear whether such an acquisition of the Fraser Valley Subdivision by GVTA would meet with governmental approval.

Another alternative might be to handle all the local freight cars moving to and from industries on the Fraser Valley Subdivision with a local freight train that leaves SRY's New Westminster Yard and performs the industry switching at night. This train would then return to the New Westminster Yard before the beginning of the morning rush period. Through freight trains would be rerouted across the New Westminster Bridge onto BNSF tracks for movement to Mud Bay where they would join the CPR Page Subdivision for the continuation of the trip to Pratt Junction, Langley and Huntingdon.

This last scenario does not meet SRY's stated service requirements. Further, it would result in added expense for train operations and train crews, additional locomotives and increased car hire expense for the company. It would increase transit times on certain freight car movements. One suggestion that could make the scenario worthy of consideration might be to negotiate some form of compensation for SRY for the operation of the local train (which would be a train SRY does not now operate) and also for the access fees that would likely be required to be paid to BNSF and CPR should BNSF and CPR agree to the concept. The study uses this last scenario as its assumption for continuing freight service on the line and for preparing the ROM cost estimates.

Because of the rapidly expanding demand for passenger rail service in North America, the railway associations and governmental bodies in both the United States and Canada are focusing more attention on issues such as those raised in the paragraphs above. This study has assumed that additional requirements, not currently in effect in Canada, would likely govern the infrastructure and service design of a future Interurban Corridor project, should it be pursued. This study has attempted to identify and estimate as many of those

costs and requirements as it could to avoid underestimating the project's complexity and understating the ROM cost estimates.

5.2 Service Reliability and Freight Train Operations on CPR Page Subdivision:

Freight train service on the southernmost portion of the Interurban Corridor is provided by three railroads: CPR, CN and SRY. The segment of the Interurban Corridor between Pratt Junction and points east of Langley City is on the CPR's Page Subdivision. All three railroads use the line under a Joint Trackage Agreement. The Page Subdivision is a busy high-speed single-track freight line dispatched by CPR using a Centralized Traffic Control (CTC) system over which long, heavy coal and double stack container trains operate long distances on time-sensitive schedules.

The coal and double stack container trains move to and from the ocean terminals at Roberts Bank and Delta Port. The line presently averages approximately 20 trains per day and the volume is increasing each year. SRY operates between its Fraser Valley Subdivision and the railway interchange point with the United States at Huntingdon. It also provides local freight switching service to the industries along the line at Pratt and Langley City. SRY would require the same operating conditions for its freight service on CPR's Page Subdivision as it does on its own Fraser Valley Subdivision to the north.

Resolutions and the improvements that they might require could be expected to occur at the expense of GVTA. This could be expected to occur because the GVTA project would be considered to be the one that brought the problems to the line by its presence. It should also be anticipated that due to the increasing heavy unit-train traffic on the Page Subdivision, the CPR may wish to add a second main track of its own to maintain the fluidity of freight traffic on its mainline to Roberts Bank. A second CPR track would eliminate the possibility of separate GVTA trackage on the same right of way.

Delays to freight trains could cause domino-effect delays for other freight trains and could result in the trains having to be re-crewed en route. This could occur because train crew hours of service are regulated by Transport Canada. The delays could cause operating expenses to rise and operating revenues to fall. It should be anticipated that CPR, CN and SRY would not accept the possibility of such delays to their trains. Delays to GVTA trains could occur while waiting to move over the Page Subdivision or meeting or following freight trains over the line. This could disrupt the operating cycles of GVTA trains and increase GVTA operating expense. At the same time, it could be expected to cause passenger delays and complaints and, eventually, lost ridership.

Pressure on GVTA to improve operating performance could be expected to lead to conflicts and disputes with the freight railroads. Resolutions and the improvements that they might require could be expected to occur at the expense of GVTA since GVTA would be the operator that brought the problems to the line by its presence.

The situations described in the preceding paragraph would likely be anticipated by the railway association and the federal government in their review of current transport regulations and related negotiations. This study has assumed that additional regulations

could be in effect that could affect the infrastructure and service design of the Interurban Corridor. The comments on this subject at the end of Section 5.1 above have been assumed to apply to this section also.

5.3 Constructability of Additional Trackage on Steep Rail Gradients:

The Fraser Valley Subdivision of the SRY has a very steep railroad gradient as it climbs out of the Fraser River plain near the Scott Road SkyTrain station several miles up through South Westminster and Royal Heights to Kennedy Heights. The alignment of this grade climbs diagonally up a bluff line for much of the distance. The track is on either a cut or raised embankment through much of the area. In some areas, the railway is cut on the upper side and filled on the lower side of the main track.

Much of the available right of way currently serves as a transition grade between the right of way and the property both above and below the track. Large amounts of cut and fill work, as well as the construction of long, large retaining walls to hold the wider track bed and changes in drainage courses would be required to construct a second track through this segment. The cost of construction on the grades in the Interurban Corridor will substantially increase the cost of the project.

Based on field observations, a significant amount of property acquisition would likely be required along the steep grade segments in order to construct a second main track. Some of the property acquisition could require the aquisition of personal residences on one or both sides of the track. The length of the track segment and the slow (10-25 MPH) train operating speeds on this grade (both uphill and down) would present a significant operating restriction for GVTA trains.

Without two main tracks on this grade, GVTA would not be able to maintain the service frequency required for passenger rail service frequencies of less than one hour. The second main track would also be necessary to accommodate SRY freight trains moving to and from the New Westminster Bridge over the Fraser River.

As mentioned above, a new right of way and track would have to be built from the Scott Road SkyTrain station to connect with the SRY. The junction point would be on the steep grade near the base of the hill. Additional design and construction will be required to relocate this junction from its natural point of convergence to a point outside of the curve to reduce track maintenance costs and derailment risks.

Even with the added engineering, the location near the bottom of the steep grade could pose serious train-handling challenges for both passenger and freight trains. It is not an ideal location and may be sufficiently serious to constitute a fatal flaw in track and operational design. Consideration could possibly be given to establishing the connection at a lower point on the grade closer to the Fraser River. This would probably involve additional property acquisition and industrial relocation for the added right of way and track. It would also be likely to result in the relocation of the proposed Fraser Shops maintenance facility for the passenger rail service.

One option that could be taken in the conceptual design stage would be to have several proposed alignments prepared to address the safety issues. Including the design data as input, computer simulations conducted with the appropriate train handling software programs could be used to predict how freight trains and GVTA trains (in each of the four modes being considered) might perform on the various proposed alignments.

There is a second steep rail gradient as the track descends from King George Highway to 64th Avenue in the southeastward direction. The gradient is not as steep, and the right of way appears better suited to accommodate a second main track, than the grade on the north end of the corridor. However, some of the same issues as those described for the north end of the project could be encountered.

5.4 Electrical Transmission Pole Lines Restrictions on New Track Construction:

Historic photographs of the British Columbia Electric Railway's Fraser Valley Line through Sullivan taken in 1923 show a single track railroad with a short interurban train on it. The train and track are straddled by two large pole lines that parallel the track, one on each side. These pole lines supported the catenary structure that supported the energized trolley wire that carried the electrical current that was used to propel the trains. The poles also supported cross arms at the tops of the poles which carried high voltage electrical transmission wires parallel to the track.

These transmission wires carried electrical power along the rail route. The power served both the interurban catenary and local customers. At certain points along the line, normally parallel to roads and streets, other pole lines branched away from the track to distribute electrical power to the new communities and electrical customers that were under construction along the line. The first interurban railroads were often owned by the power companies and operated as subsidiary corporations. These lines acted as a catalyst to encourage and enable development along the railway lines.

The Interurban Corridor track configuration today looks much like it did 80 years ago. A single main track is straddled by parallel electrical transmission pole lines. Today however, many of the power poles are larger and taller, and they are not always spaced equally, or across from each other. There is no catenary structure or trolley wire, though guy wires stretch across the tracks between the tops of many of the poles that are located across from each other. Where the transmission lines cross streets and meet other pole lines, there are connections that allow electrical energy to flow to the pole lines that reach into the adjacent and nearby industrial plants and residential neighborhoods.

The pole lines are often as close as only 10 feet from the centerline of the main track on each side. In comparison, the minimum statutory clearance between an obstruction and the side of a rail car is 8 ½ feet. This is a safety regulation to permit railway employees to ride on the sides of locomotives and cars to perform switching and other railway duties. There is no room to construct a second main track between the existing pole lines. This condition changes along the line at various points. In some segments where second tracks already exist, the poles are out closer to the edge of the right of way to allow room for the track network. In other places, individual poles have been spaced differently and

relocated further from the track. However, over most of the line, the pole lines would both have to be relocated in order to accommodate the construction of a second main track.

One option might be to explore with BC Hydro the possibility of combining both power transmission lines onto a single pole line that would be located on one side of the right of way. Such an option could substantially simplify the rail construction efforts. Doing so, however, might well result in technical issues in the distribution of electrical power that BC Hydro would have to address. One action that could be taken would be to open exploratory talks with BC Hydro to discuss the potential for such a project and to learn what implications such a project might have on BC Hydro's infrastructure and operations.

The cost of relocating the power transmission pole lines for the Interurban Corridor would be a significant expense, and might well approach the cost of constructing the second main track along the corridor. Such relocations could also involve other complications. The Interurban Corridor passes directly beside, and serves, BC Hydro's Operations Center which is located south of 88th Avenue and west of 120th Street. Changes to electrical transmission lines may cause other effects to BC Hydro's electrical distribution grid that have not been identified.

In addition to the actual cost of the relocating the power transmission pole lines, there could be significant effects on the Interurban Corridor project construction schedule because of the major impact on BC Hydro and its ability to physically relocate the quantity of poles and lines that would be required. This becomes much more complex when alternate plans to maintain electrical service and train service during the construction project are considered.

A project of this magnitude could be expected to tax the physical capacity of both BC Hydro and its construction contractors to perform the changes. The demands for such services might cause delays to other unrelated transmission line projects in the area. BC Hydro could not be expected to bear the cost of the relocations as they would have to pass this cost to their customers. GVTA would be expected to shoulder the burden of these costs, and pass them on to their customers, and to the taxpayers (many of whom would be the same as BC Hydro's customers). Any significant storm that occurred during the project construction could result in the diversion of the crews and equipment from the project to the repair of downed power lines. That could further delay the project construction schedule.

The scheduling complexities of utility relocation (for all utilities) and the relocation sequence in which those relocations would need to be carried out would significantly extend the construction schedule for the Interurban Corridor project. Many of the utilities are located under streets and involve electrical, gas, water, sewer, communications and other facilities. The affected streets would need to be closed to permit the pavement to be removed for utility removal and reconstruction, and then the streets would need to be repaired or reconstructed completely. Such works have serious adverse effects on street

and traffic patterns, emergency response alternatives, transit service routes, shopping, the ability to get to and from churches and schools, etc. The adverse effects on the adjacent business and residences can be expected to add significantly to the duration and cost of the project. In addition to carefully-coordinated utility relocation planning, an extremely effective public outreach effort would be required throughout the project.

The construction of an electrical catenary system to serve the railroad could seriously restrict or prohibit BC Hydro's ability to use cranes and other equipment in the right of way to maintain or repair its electric transmission power pole lines. This position, and BC Hydro's ability to enforce it, could well prove to be a fatal flaw that eliminates the LRT EMU alternative from consideration. It would also be reasonable to expect that future federal regulations could be forthcoming that could dictate procedures, rights and responsibilities that would apply to the project.

5.5 Passenger Car Safety Standards Applicable to Heavy Rail Trackage:

Transport Canada enforces construction and crashworthiness standards that are applicable to passenger cars that are used on the general railway system of Canada, including the Interurban Corridor. These standards generally require that passenger-carrying vehicles be built to withstand derailments or collisions with freight trains, other passenger trains and highway vehicles to protect the passengers.

Heavy rail diesel push-pull commuter trains like the West Coast Express equipment and heavy rail DMU cars like the Budd cars used on Vancouver Island meet these standards. Therefore, these two modes of passenger rail service can be operated on the general railway system on the same tracks and along with freight trains. Because of recent accidents involving passenger rail trains and freight trains and/or trucks at grade crossings, regulators in both Canada and the United States are considering more stringent passenger rail car standards. These would be applicable to both heavy rail and light rail equipment.

As an example, LRT trains, whether they are DMUs as used in Ottawa, or EMUs as used in Calgary, may not share the same railroad track with heavy freight and passenger trains without special restrictions. Because of the pressure to utilize existing rail corridors for public transit, more attention is being focused on the regulatory requirements for mixed use railway operations.

To anticipate the possibility of new and stricter federal requirements in Canada, comparable to those currently in effect in the United States, this study has assumed that significant restrictions would govern the Interurban Corridor project. These assumptions have been made in order to reduce the chance of significantly underestimating the complexity or the ROM costs of the project for each mode.

The study has assumed that if LRT trains are to use the heavy rail track network, they must be both physically and temporally separated from the heavy rail operations at all times. For purposes of this study, that means that LRT trains may not use the railroad when heavy rail trains are on the line, and vice versa. It also means that at the points

where either type of equipment can enter the line, physical barriers such as derails, diversion tracks and on-board rail signal systems that enforce the signal indications must be a part of the system design in order for the system to be approved for service by the appropriate regulatory authorities. Compliance with such requirements could be expected to be an absolute requirement of the insurance companies for obtaining the necessary liability insurance that is normally required for a transit project of this nature.

Restricting freight train operations to the few hours of the night when passenger rail is not operating can sometimes be a solution. Doing so could achieve temporal separation. Construction of the physical barriers could also be accomplished. Such a solution would not be viable for the CPR's Page Subdivision. SRY management has said that it would not accept such an arrangement for its Fraser Valley Subdivision. The resistance of the freight railroads to the two LRT alternatives could prove to be a fatal flaw for both alternatives. It could also present a serious obstacle to regulatory approval for the project.

In addition, the LRT EMU option would not be possible on the Page Subdivision because double stack container trains are much higher than the level of the catenary wire. The same situation could occur on the SRY Fraser Valley Subdivision. However, at the present time, double stack container traffic does not operate over the Fraser Valley Subdivision.

One solution that could be considered would be the construction of separate tracks on a separate right of way or a separate segment of the right of way to allow the LRT alternatives to be used. This would be extremely difficult for several reasons. The first is the limited right of way width, the number of tracks that would be required, and the existence of the BC Hydro pole lines. Just as restricting would be the number of freight industrial spur tracks that serve the industrial and commercial facilities along the Interurban Corridor. Freight locomotives would have to cross the LRT tracks to reach certain industries. Doing so would result in extensive changes in trackwork and signals and would substantially increase the cost of construction, the complexity of operations and the cost of maintenance for both passenger and freight services.

Even with the added expense and complication of the additional construction, delays to both passenger and freight trains would result and could be expected to adversely affect the performance of both services. Regulators also might well determine that there is not sufficient separation between light and heavy rail operations to permit the safe operation of both modes on the same constrained right of way. If the transit line were to be constructed, doing so might require the relocation of freight trains off the line and the loss of freight service to the corridor. That could be expected to pose another obstacle to regulatory approval.

5.6 Conflict between Vehicle Clearance and Passenger Accessibility Requirements:
Heavy rail diesel push-pull commuter trains and heavy rail DMU vehicles such as Budd cars are both constructed to the same dimensions (especially width) as freight locomotives and cars. Accessibility to the passenger trains at station platforms is obtained by the use of wheelchair lifts installed on the passenger cars or by the use of special

portable bridge plates or ramps and raised platform segments that are located on the platform no closer than 8½ feet from the centerline of the track. The portable ramp or bridge plate carried on the passenger cars is manually positioned by a crew member to span the distance between the raised wheelchair platform and the car floor at the doorway. These two types of arrangements satisfy both the statutory clearance and the level boarding accessibility requirements for passenger trains. The use of such methods often results in delays to trains at stations while passengers with accessibility needs are accommodated.

However, LRT DMUs (as in Ottawa) and LRT EMUs (as in Calgary) are both narrower than heavy rail vehicles and normally operate on exclusive rapid transit rights of way. Level boarding is achieved by constructing the passenger platform to the height of the car floor, with the platform edge built to within 3 inches of the side of the passenger rail car. This is an excellent solution for the normal LRT application. It is more convenient for the passengers and results in little or no train delay.

If the LRT vehicles are to be used on tracks that also are used for the wider locomotives and cars of heavy rail operations, there will be a large (over three feet) gap between the platform and the car. The platform cannot be constructed out into the track area to meet the side of the narrower LRT vehicles because doing so would encroach upon the space used by the passage of heavy rail locomotives and cars. There are two potential solutions to resolving this conflict. Both are feasible, and both are operationally burdensome and expensive.

One option might be to construct overlapping dual trackage on each track at each station platform to safely accommodate the two types of trains. The narrower LRT trains would switch to the closer track alignment just prior to entering the station platform area. Doing so positions the side of the car within 3 inches of the platform and facilitates level boarding in accordance with accessibility standards. The train would then return to the regular route after leaving the platform. Heavy rail trains such as freight trains would be routed to the track that passes several feet further away from the station platform area so that the locomotives and cars would safely clear the platform.

This arrangement requires a CTC control point (a system of track, switches and signals remotely controlled by the train dispatcher) with a track switch at each end of the platform on each track that allows the wider heavy rail trains to switch to the outer track to “move over a little” to get past the platform area. Each such installation can be expected to cost over $1,000,000 to construct and greatly increases the track and signal maintenance requirements for the line. Two such installations have recently been constructed in Northwest Indiana on the South Shore Line between Chicago, Illinois and South Bend, Indiana by the Northern Indiana Commuter Transit District (NICTD).

Another option that could be considered to resolve this issue would be to construct station platform gangways (also known as platform extensions) as a part of each passenger platform. The normal passenger platforms are constructed up at the passenger car floor

level but do not encroach on the statutory distance of 8½ feet from centerline of main track clearance limit. They also do not reach out far enough to allow boarding the train.

The station platform gangway is an electrically controlled lift ramp with hand rails that is mounted on the station platform. Several gangways are mounted on each platform and are located to match the location of the doors on the passenger cars. There must be a gangway for each passenger car door in the train. These gangways are lowered by the operation of an electric motor that drives a threaded shaft which raises and lowers the gangway. Limit switches are used to stop the travel in each direction with position indications being transmitted to the control center. Each station to be equipped with platform gangways could be expected to cost at least $300,000 more to construct than a station without the gangways.

When freight trains are running, the gangways at all passenger stations on the line are all raised. When freight trains are clear of the line, and the LRT trains are running, all the gangways are in their lowered positions to allow for boarding and alighting of passengers at stations. These gangways are operated by the train dispatcher or a control operator in the dispatching office. The status of each gangway is shown on a communications display panel used by the train dispatcher. At stations that are equipped with Closed Circuit Television Cameras (CCTV), the cameras may be designed to be rotated by the train dispatcher or control operator to observe the platform conditions at the time the gangways are moved. Gangways are also equipped with warning buzzers and warning lights that operate before and during gangway movement to warn persons who may be nearby.

If freight trains are operated each night, then after the last LRT train has cleared the line for the evening, all the gangways are raised. They stay raised until the last fright train has cleared the line in the morning before the LRT service resumes. If freight trains do not operate each night, then on the nights that no freight trains or maintenance equipment will be operated, the gangways remain in the lowered position all night to reduce the chance of a failure.

Because the failure of a station platform gangway to operate properly prevents the safe operation of trains, an immediate response to a failing gangway is required. Delays at this critical time period would prevent the startup of train service (either freight or passenger). If a gangway did not operate properly when lowered after the freight trains were cleared, the resulting delays could cripple the LRT service schedule for the morning rush hour. Delays to the freight train at night after the end of LRT operations could result in delayed freight train movement and the resultant failure of the freight train to clear the line by the start of the morning rush hour, again crippling the LRT service schedule for the morning rush hour.

For these reasons, one suggested maintenance precaution is to equip a 5-ton hi-rail boom truck (a heavy truck that can run on the rails or on the road) with an open cargo body, a lifting boom, an electric welding machine and equipment and spare parts including a spare station platform gangway ready to install. The welder and the electrician assigned

to this vehicle would normally work from about 1000PM to about 600AM so as to be on duty during both times of the night when the station platform gangways are being raised and then lowered again.

If an emergency arose, the welder and electrician could drive promptly to the site of the problem, set the truck on the track and make the necessary repairs at the station. This provides a response time that is several hours faster than waiting for employees to be called to respond from home in the middle of the night, get their truck and equipment and move to the scene. The resultant delay of several hours to train operations that would be involved would be unacceptable.

Using the system described above, the welder and electrician would also work during the night performing routine gangway maintenance, making track welds, performing switch maintenance and inspections and assisting track and signal crews as needed during the time that the LRT trains were not operating. In this way, both the personnel and the equipment would used in a productive manner while serving as an on-duty emergency response team should they be needed.

5.7 LRT Access to Langley Town Center:

Heavy rail freight trains operate 24 hours a day, 7 days a week on CPR's Page Subdivision (the south end of the Interurban Corridor between Pratt Junction and east of Langley City). The study has assumed that the use of LRT trains (DMU or EMU) on the heavy rail mainline freight tracks is not an option and would not receive regulatory approval.

The construction of adjacent LRT mainline tracks parallel to the CPR Page Subdivision would likely not be feasible for one or more of the following reasons:

- The tracks would limit access to freight industrial tracks;
- The right LRT tracks would be very close to fast, heavy freight trains on the adjacent CPR tracks;
- There would be insufficient clearance for double stack trains under the catenary structure (EMU only);
- Highway intersections, grade crossings and the grade crossing warning systems would be complex;
- The parties would likely share liability exposure in the event of any accident on either railroad;
- Due to track curvature, commercial development and vegetation along the route, visibility limitations exist through much of the segment; and
- With the increasing freight train traffic on the Page Subdivision, it is probable that CPR may desire to construct a second main track of its own in the future.

For these reasons, the possibility of a potential separate alignment for the light rail alternatives may not be feasible along the Page Subdivision.

Construction is underway to provide a new alignment to reroute the SRY main track on the Fraser Valley Subdivision from where it parallels Highway 10 just east of 172nd Street in an "s" curve configuration moving to the south to pass under the north span of the new

Highway 15 overpass over the CPR Page Subdivision. The re-routed SRY would then parallel the CPR to Pratt Junction. A concrete ballast deck bridge has been constructed and much of the pre-load fill west of the Highway 15 overpass has been placed for this new alignment. This new alignment would eliminate two busy grade crossings and two private crossings on the SRY. It would also cause the relocation of the potential passenger station site for Clover Square several blocks to the south.

One alternative to the busy CPR Page Subdivision situation might be to consider the acquisition of an exclusive LRT right of way from the area of Pratt Junction to the area of the Langley Mall and the Kwantlen University via the general alignment of the (now removed) original interurban line. The existing CPR Page Subdivision parallel to the Langley Bypass (Highway 10) was actually constructed as a rail bypass route of the Langley's town center. The city has now expanded and has once again surrounded the CPR mainline with development. If an exclusive LRT right of way were to be pursued as an alternative, LRT trains might effectively use the former interurban alignment and the existing street rights of way through residential areas to reach the Langley Mall, Langley town center and Kwantlen University from the southwest.

To reach Langley City, from Pratt Junction, one alternative might be to construct a separate LRT alignment along the north side of the CPR Page Subdivision on an existing right of way that appears to be owned by Greater Vancouver Regional District (GVRD) and/or the Greater Vancouver Sewerage and Drainage District (GVS&DD). It appears that a large underground sewer has recently been constructed along this alignment. An important consideration would be the actual location of this sewer and whether or not a railway could be constructed over the top of it.

Following parallel to CPR's Page Subdivision, at a point east of 188th Street, there is undulating terrain that appears to be suitable to facilitate the construction of a flyover structure that would carry the LRT line from the north side to the south side of the CPR Page Subdivision. The BC Hydro power transmission lines would need to be raised to accommodate this new structure. At 192nd Street, the route of the exclusive right of way would depart from its alignment along the CPR and would follow the route of the former interurban alignment under a large formation of converging electric transmission tower lines owned by British Columbia Transmission Corporation (BCTC) near the site of its McClellan Substation and transmission line upgrade project. The exclusive right of way would then follow the former interurban route and enter Langley City from the southwest, using city streets to reach the Langley Mall and/or the Langley Town Center.

If the exclusive right of way option were to be pursued, it is quite possible that the use of DMU LRT vehicles would be precluded from operating on the Langley City streets because of noise from the diesel engines and exhaust emissions in the densely populated residential area. This could prove to be a fatal flaw for the use of DMU LRT vehicles. EMU LRT vehicles would be quieter, with only their bell, an occasional use of the warning horn and the lighter sound of their traction motors and could well be acceptable to residents because the environmentally friendlier vehicles would bring clean, modern and accessible public transportation within walking distances of their residences.

The exclusive right of way option would be significantly more expensive due to the need for greater property acquisition costs and the cost of the 192nd Street flyover structure over the CPR. Additional utility line relocations would also be anticipated with this alternative.

5.8 Grade Crossing Warning System/Highway Traffic Signal Interface:

Many of the grade crossings in the Interurban Corridor are very close to or a part of major street intersections and require careful engineering design and also an interface with the traffic control computer as well as very careful programming.

Grade crossing interconnection and pre-emption is necessary to be sure that highway traffic does not get trapped on tracks within the grade crossings (in or near street intersections) during the approach and passing of a train. The rail-highway signal interface provides advance warning to the traffic computer of the approach of a train, giving the computer time to stop flows of traffic approaching the crossing and give signals to other traffic on the crossing to clear the rail grade crossing.

In many of the most modern intersection projects, traffic signals are being installed ahead of the grade crossing warning systems to prevent vehicle entry into an intersection when a train is approaching. With such arrangements and appropriate programming, upon the approach of a train, all entrances to the intersection and crossing are closed with traffic signals, and vehicles within the intersection and crossing are allowed to clear promptly. The activation of the crossing warning system then follows with sufficient time to provide the required warning in advance of the approaching train. This study has assumed that such designs will be required at all closely located grade crossings and street intersections.

Multiple tracks at the same crossing give rise to the possibility of one train clearing the crossing while another is closely approaching from the opposite direction. Circuitry and programming are available to prevent the raising of the gates and the start of traffic movement when another train is closely approaching on the adjacent track. This is called "pump prevention." The term means that the special circuitry prevents the gates from pumping up and then down again quickly. Pump prevention is an important feature that can have the effect of reducing the number of broken crossing gates.

Because many of the stations that would be located on the Interurban Corridor could be sited very near major streets, they may be termed "near-side stations." Traffic is heavy near such stations and it is desirable to minimize interruptions to traffic flow caused by train movements. In these situations, where a train stops at a station just before entering a grade crossing, it may be advisable to install communications and signal equipment with special interface devices (called Train-to-Wayside Communication) that detect the identify of an approaching train by the use of transponders.

If the train had a transponder, it would be recognized as a GVTA train which would stop at the station before entering the crossing. The system would be programmed to delay the

activation of the crossing warning system until the train had stopped in the circuit at the station platform and had partially consumed its pre-programmed dwell time. If the approaching train had no transponder, as would be the case with a freight train, the grade crossing warning system would detect the lack of a transponder, recognize the train as one that would not stop at the station and activate the crossing warning devices in the normal sequence.

Once a timer in the signal circuitry had operated to allow for the pre-programmed amount of dwell time, the signal system would activate the grade crossing warning system sufficiently in advance of the train's departure. Once the gates were in the lowered position, the system would clear a railroad signal just past the end of the platform and before the entrance to the crossing, allowing the train to proceed. Installing such equipment can reduce by approximately 50% the time that a crossing warning system is operating and the time that the crossing is blocked for the approach and passage of a train. Such systems are costly to install and maintain, but can provide important traffic congestion relief for busy roadways and intersections near grade crossings.

Observations in the Interurban Corridor disclosed several opportunities for improved rail-highway grade crossing installations. The complexity of these installations increases the cost of the design, construction, operation and maintenance of the crossings and intersections themselves. It also increases the costs of the crossing warning systems, the railroad signal system and the highway traffic control computer system. However, these systems can significantly reduce the exposure to grade crossing accidents, reduce the number of crossing signal violations by motorists and pedestrians and improve highway traffic flow without delaying train traffic.

5.9 Safety Aspects of Pedestrian and Private Crossings:

There are many pedestrian crossings and private crossings of the railroad in the Interurban Corridor. Many of these crossings were only unmarked well-worn paths that did not appear to have the official status of an authorized crossing. Others did have indications of official approval at some time in the past, though they did not have any crossing markings or warning signs. Some private crossings were not usable. Others which were usable appeared to have public activity over them with or without proper warning signs, indicating a change in official status that needed to be addressed. Other private crossings were properly marked and secured.

The operation of a passenger rail line with frequent train movements over pedestrian and private crossings without proper crossing structures and without grade crossing warning systems can significantly increase the risk and severity of accidents with passenger rail service. It is anticipated that GVTA and/or the railroads would need to address these issues with the parties involved.

Recently in North America, there has been increased regulatory attention to grade crossing safety, raising the possibility that standards for all types of grade crossings may be more restrictive in the future. This is particularly true for private and pedestrian crossings which have not had much attention up to this point. As a result, this study has

assumed that only officially authorized crossings would be permitted to exist. It also assumed that every officially authorized crossing would be required to be equipped with an electronic crossing warning system and maintained to modern safety standards. The probability of more restrictive federal regulation may provide the benefit of reducing the litigation that can be encountered by the railroads when they initiate action to close private and pedestrian crossings.

5.10 Availability of Competing Sources for Compliant Rail Vehicles:

Heavy rail diesel locomotives and bi-level push-pull passenger rail cars that meet all current federal standards for compatibility and accessibility are available from several suppliers. Fleets of this equipment are in service throughout North America including on the WCE.

However, there are few sources for modern, compliant heavy rail DMU vehicles such as Budd cars. The Budd rail diesel car has not been manufactured for over 50 years and the company has long since gone out of business. Most Budd cars still in existence have been overhauled and are being operated and maintained by railroads and commuter agencies. The remaining cars are in demand because of their versatility and suitability for light density rail lines. However, since these cars were constructed, federal passenger car construction standards have become more restrictive and accessibility standards have been promulgated. Colorado Railcar has developed a car which it advertises as being compliant with Federal Railroad Administration passenger car standards in the United States. It is not known whether or not the company's offerings meet current Canadian passenger car standards.

Colorado Railcar manufactures two configurations of a heavy rail DMU, one of which is available in a double-ended control, single level configuration. The other configuration is a high capacity bi-level DMU. It is available as a trailer coach or equipped with a control cab on one end. Because the heavy rail DMU may be the vehicle most suitable for use on the Interurban Corridor, the lack of a suitable vehicle supplier or suppliers from whom to solicit competing bids for the needed equipment may present both availability and purchasing issues for GVTA.

Light rail DMUs and EMUs are available in a variety of designs and configurations from several suppliers. Should their operation be found to be suitable for the Interurban Corridor, it would appear that several suppliers could be found to provide competing bids to supply rolling stock for the project.

5.11 Utilities Relocations-Cost and Effects on Construction Schedule:

Utilities relocations including water, sewer, storm drain, telephone, cable TV, fiber optic cable, power lines overhead and underground, buried gas and petroleum pipelines and other utilities will require relocation and/or replacement should the Interurban Corridor be redeveloped for passenger rail service. These are all in addition to the relocation of BC Hydro lines that were discussed in Section 5.4 above.

Experience on similar projects has shown that the sheer volume of utility installations that must be relocated will tax the resources available to relocate them in each mode. Many of these utilities are located underground and beneath streets requiring grade crossing and street closures and the disruption of both residential and commercial access and traffic flow as well as public transportation routes during their relocation.

Utility relocation must be carefully coordinated and the schedule carefully developed and sufficient time and resources must be included in the project schedule and budget to accommodate these relocations. In addition, there are other projects under development and under construction that must be carefully considered when planning the relocation of utilities. A very effective public outreach aspect must also be considered as a part of the utility relocation as it would be with other aspects of the project. Please refer to the more-detailed discussion of utility relocations contained in Section 5.4 above.

5.12 Property Acquisition-Cost and Effects on Construction Schedule:

The development of the Interurban Corridor would require a wider right of way in several segments to accommodate the additional tracks that would need to be constructed to accommodate the increased train service. Additional property would be needed for activities such as:

- Constructing a suitable rail right of way link between the Scott Road SkyTrain station and the existing SRY right of way near Fraser Shops;
- Adding a second main track on the steep grades in South Westminster and south of the Burke Road area;
- Adding a second main track while accommodating industrial switching leads and relocating industry tracks in several areas including the Surrey Industrial Lead, the Burke Passing Track, the Comber Way Lead, the East Surrey Industrial Lead, the SRY Industrial Lead, the Fraser Way Industrial Lead and the Langley Passing Track;
- Relocating BC Hydro power lines to accommodate additional track construction or reconfiguration;
- Widening and expanding grade crossings and street intersections at several locations;
- Providing passenger stations, Kiss and Ride, Park and Ride and bus access lanes at the stations;
- Constructing a maintenance and train yard facility in the Fraser Shops area near the Scott Road SkyTrain station;
- Constructing an overnight layover facility in the Langley City area; and
- Providing a new right of way to access Langley City from the southwest should an LRT option be exercised; and
- Constructing a flyover for the LRT to cross over the CPR Page Subdivision between Pratt and Langley City.

In addition to the costs involved with property acquisition, legal proceedings may be necessary to acquire critical parcels of property from landowners who are unwilling to sell their property. These proceedings may increase the project cost and delay the project schedule. The possibility of pending federal legislation may pose new regulatory

requirements and may add both schedule delay and construction cost to the project schedule.

5.13 Environmental Issues-Floodplain and Wetlands Construction:

Approximately one third of the Interurban Corridor passes through floodplains or wetlands areas including the large Serpentine River floodplain in the south of Surrey. Major creeks and water courses parallel and cross other segments of the railroad. Expansion and reconstruction or the Interurban Corridor, even within the existing right of way, could be subjected to an intense environmental impact study. The study must be carefully considered in the project schedule and budget. Added costs in flood plains and unstable terrain as well as wetlands mitigation must be included in the project budget. There are a large number of drainage structures, primarily culverts and pipes under the railroad and parallel to it that would be affected by constructing a second main track and relocating the BC Hydro power lines.

5.14 Environmental Issues-Train Operations and Passenger Station Facilities:

The following environmental impacts can be expected to be identified by the environmental impact study:

- Noise from locomotives and traction motors;
- Noise from braking and wheels squealing on the rails in curves;
- Noise from the operation of bells and horns and the additional operation of grade crossing warning systems;
- Noise from public address system announcements at stations;
- Exhaust emissions;
- Light pollution from station and parking lot lighting installations; and
- Noise and pollution from the added vehicular and pedestrian traffic near passenger stations.

There would be project costs to mitigate these adverse impacts.

5.15 Environmental Issues-Noise and Rail Line Maintenance Restrictions:

Because several segments of the Interurban Corridor pass through residential areas, it can be expected that normal life-cycle replacement maintenance activities like replacing ties and rail, dumping ballast, surfacing track, operating trucks, cranes and dozers, vegetation control such as brush cutting and other activities that make noise, create dust and require additional lighting will not be permitted at night, at least in residential areas. This is an important restriction because with frequent passenger rail service on demanding service schedules during the day, maintenance activity performed at night can be more efficient and will result in fewer train delays. The night maintenance option may not be available over most of the Interurban Corridor.

Methods of performing maintenance in a carefully-coordinated, more concentrated and intense activity pattern will be required. For trackwork that cannot be performed on nights and weekends, special planning and coordination of both maintenance and operations must occur. This is essential to minimize train delays and maximize maintenance productivity. Such actions can include train schedule modifications for certain periods or single-track operations through work zones.

If necessary, train operations can be suspended in the work zone and the gap can be bridged with shuttle buses. This will permit maintenance activities to be carried out in a shorter work window. Other actions can include additional work crews to concentrate more work in the available time slots. Additional crews require additional vehicles, track equipment, tools, supervision, etc.

Even with the best preparations, significant delays and disruptions to passenger rail service can be expected during periods when track and signal maintenance work must be done under traffic.

5.16 Environmental Issues-Visibility, Safety and Vegetation Control Restrictions:
Much of the Interurban Corridor has large concentrations of overgrown vegetation on and near the track and ditches. Due to the proximity of residential and commercial structures and the sensitivity of the environment, there are restrictions concerning the use of herbicides that may affect how vegetation control is performed. This may require a greater use of chain saws, brush cutters and other on and off-track machinery to physically maintain control of vegetation. Such operations can be more costly and time-consuming than the use of herbicides. In its present state, the right of way is in need of a vegetation control program over much of its route.

5.17 Compatibility of Rail Signals/Communications Systems with Transmission Lines:
Certain radio, signal and train control and communications equipment can be affected by the presence of strong electromagnetic fields such as those found in overhead electrical transmission lines. The situation can become more pronounced when the power grid is under load from high electrical demand. In certain circumstances, particularly if the railroad signal system is not fully grounded, the electrical fields from the transmission tower lines may interfere with the electrical currents in the railroad signal system. This results in what railroad personnel call a "false clear" signal indication. In such cases, because of electrical interference, the railroad signal erroneously indicates that the track ahead is clear when it really is not. This can result in a train entering a block on a clear signal when the track ahead is actually occupied by another train or when another condition exists that makes it unsafe for the train to proceed.

Given the presence of BC Hydro and BCTC electrical transmission lines along and across the Interurban Corridor, the performance of all signal and communications systems should be carefully tested to be certain that they will perform correctly in this environment before the systems are purchased and installed.

5.18 Security Issues:
Many of the industrial track switch stands in the Interurban Corridor have graffiti and gang symbols painted on them. Most track switches which are not in active service have been spiked to prevent vandalism and danger to the train operations. Some track switches have been equipped with switch point clamps and locks in addition to the locks on the switch stand. The number of new switch locks along the route may indicate the occurrence of damage to the locks by vandals requiring frequent replacement. There are

indications of unauthorized activity on the right of way. Trespassers are frequently seen walking down the track between grade crossings.

Industry fencing forms most of the right of way barrier along the corridor. Train speeds are reduced over much of the route through Surrey due to concerns with vandalism and trespassing issues. The introduction of passenger rail service to this corridor would require a higher standard of security with increased expenses to maintain a greater level of security for the passengers and employees using the corridor as well as for the right of way, track, switches, stations, passenger station platforms and parking lots.

5.19 Track Maintenance Standards for the Operation of LRT DMU/EMU Vehicles:
Heavy rail push-pull commuter and heavy rail DMUs (Budd cars) can successfully operate on track maintained to Transport Canada heavy rail track standards. However, experience has shown that several of the DMU and EMU LRT vehicle models in service today require that the track surface be maintained to much higher standards than those needed for heavy rail operation.

These higher standards are required because many types of LRT vehicles have more rigid suspension and running gear than heavy rail equipment. They cannot negotiate the normal rail surface deviations that are commonplace in heavy rail track used by freight trains and commuter trains. Track surface deviations can cause the LRT vehicles to climb the rail and derail, particularly in switches and curves. If the LRT option is to be considered for the Interurban Corridor, much more stringent maintenance standards will be required, resulting in more maintenance activity, more maintenance cost and more train delays when conflicts between maintenance and operations occur.

Section 6 Alternative Analysis by Transit Mode:

ROM cost estimates were prepared for each of the four modes included in this study. They are listed in Table 6-1 below. For each cost category, sub-categories are shown to describe the types of costs that were included in the ROM cost estimates. The detail of each sub-category has not been included in this report. Costs shown are estimated in Canadian Dollars, without taking into effect future currency fluctuations, price increases or inflation factors. The cost estimates also do not include the significant categories that are described following the table. To obtain the complete ROM project cost by mode, those costs would have to be estimated and added to the following ROM cost estimates.

Table 6-1
ROM Cost Estimates by Mode
(000 Omitted)

Cost Category and Sub-Categories	Heavy Rail Diesel Push-Pull	Heavy Rail DMU	Light Rail DMU	Light Rail EMU
Right of Way Demolition Retaining Walls Clearing, Grading Vegetation Control Drainage Structures Fencing, Gates, Signage Access roadways Parts/Materials Inventory	29,700	29,700	69,700	69,700
Track Removal Main Track Construction Other Track Construction Interlocking Construction Yard and Shop Tracks Parts/Materials Inventory	54,950	54,950	86,400	86,400
Systems Signals & Train Control Communications Dispatching Fiber Optics Parts/Materials Inventory	30,790	30,790	42,540	42,710
Grade Crossings Demolition & Detours Pavement, Lanes, Curbs Rail Crossing Surface Crossing Warning Signals Highway Traffic Signals Rail/Highway Interface	16,250	16,250	18,420	18,420

Signs and Striping Street Lighting				
Passenger Stations Station Buildings Platforms and Ramps Platform Gangways Bus Lanes and Parking Ticket Vending System Lighting	35,000	35,000	48,800	48,800
Utility Relocations BC Hydro On-Corridor BC Hydro Off-Corridor BCTC Transmission Lines Connecting Power Lines Telephone Lines Fiber Optic Cables Cable Television Lines Natural Gas Pipelines Petroleum Pipelines Water Sanitary & Storm Sewer	25,200	25,200	23,730	23,730
Electrification Power Substations Commercial Power Feeds Catenary Construction Control System	N/A	N/A	N/A	48,600
Revenue Equipment Rolling Stock Transportation to Site Spare Parts Inventory Vehicle Testing/Acceptance	53,000	47,440	108,320	135,360
Facilities Train Maintenance Shop Overnight Storage Yard Engineering Shop Offices	15,020	15,020	36,400	39,050
Vehicles (Track & Highway) Transportation Engineering Mechanical Administration	8,100	8,100	8,680	9,110
Equipment/Tools Transportation Engineering Mechanical Administration	2,450	2,450	3,660	5,210

Operations during construction SRY Detours/Access Fees SRY Local Switch Train Force Account Work Work Trains-Construction Flagging-Construction Crew Costs/Transportation Coordination/Supervision Transportation & Travel Vehicles and Facilities Offices & Equipment Communications/Shipping Self-Insured Casualty Insurance Premiums	9,050	9,050	9,050	9,200
Sub-Totals	279,510	273,950	455,700	536,290
Contingency (30%) (1)	83,850	82,190	136,710	160,890
Total ROM Cost by Mode (2)	**363,360**	**356,140**	**592,410**	**697,180**
ROM Capital Cost per KM (2)	**13,420**	**13,150**	**22,590**	**26,580**

Notes:

(1) For purposes of these ROM cost estimates and this study, the term "Contingency" is defined as an allowance for unforeseen events or conditions, emergencies, project interruptions or Force Majeur conditions. It is specifically not intended to provide a "cushion" to compensate for general cost overruns in any of the cost categories listed above. Because this estimate is being prepared in the early phase of the conceptual stage, where no decision has been made to pursue the project, and where no preliminary engineering has been done, and where there are many significant unknowns, the project contingency has been arbitrarily estimated at 30%. This percentage should be expected to decrease as the various planning milestones are reached.

(2) Specifically not included in these ROM estimates are the following cost categories:

a. Property acquisition;
b. Relocation of businesses and residences;
c. Engineering and design-all levels;
d. Project management during planning;
e. Project management during construction;
f. Owners representative staffing requirements;
g. Environmental impact studies;
h. Permits-all categories;
i. Public outreach activities;
j. Allowance for future year cost escalation;
k. Interest on debt obligations; and
l. Consulting and legal fees

These costs can be expected to significantly increase both the Total ROM Cost by Mode and the ROM Capital Cost per Mile of the project were it to be undertaken.

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APPENDIX A

Maps of Conceptual Station Locations

Light Rail Station= Single Circle
Light Rail / Heavy Rail Station= Double Circle

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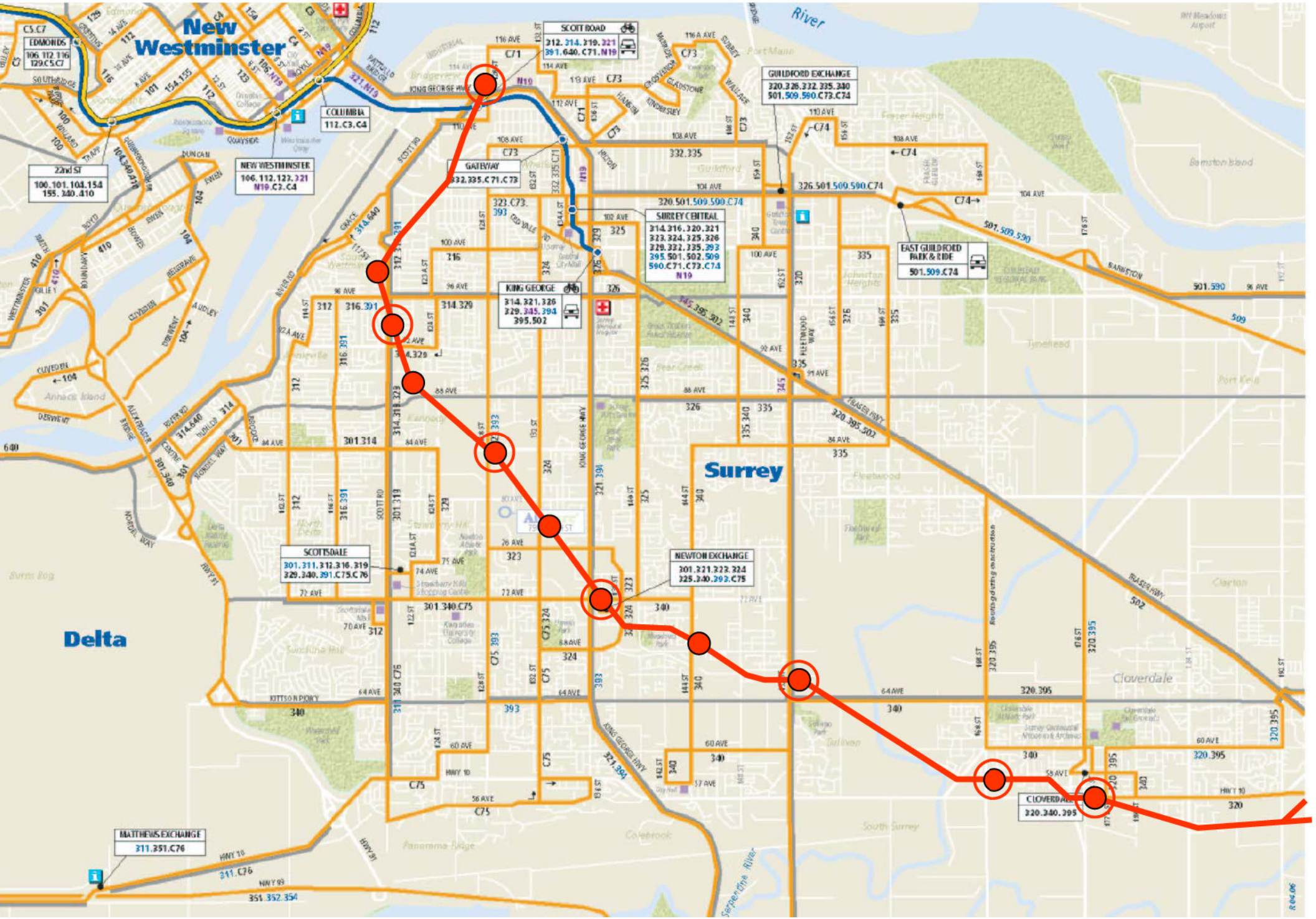
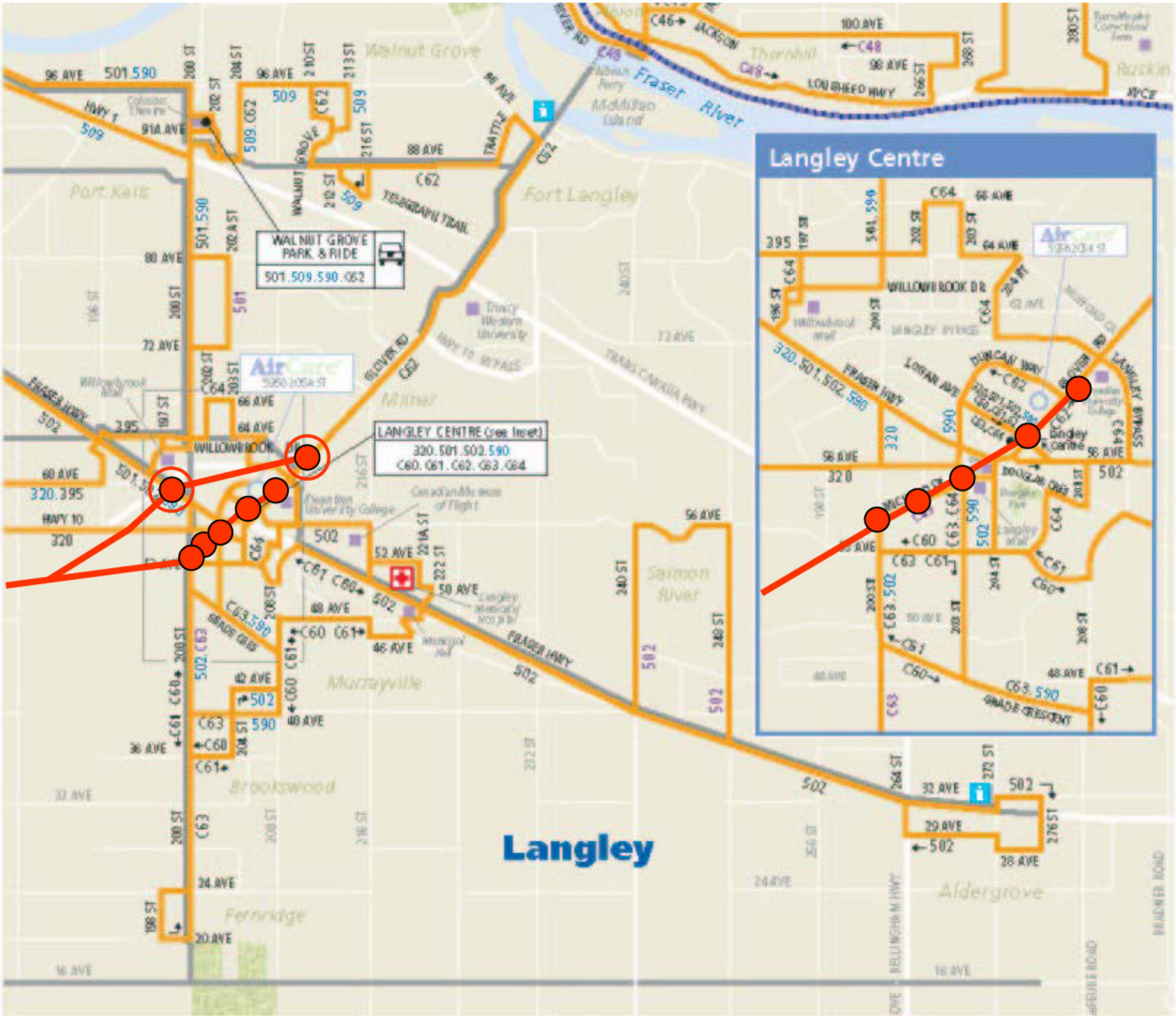

New Westminster
Surrey
Delta
River
SCOTT ROAD
212. 314. 319. 321
391. 640. C71. N19
GUILDFORD EXCHANGE
320. 326. 332. 335. 340
501. 509. 590. C73. C74
COLUMBIA
112. C3. C4
22nd ST
100. 101. 103. 154
155. 340. 410
NEW WESTMINSTER
106. 112. 122. 321
N19. C2. C4
GATEWAY
332. 335. C71. C73
SURREY CENTRAL
314. 316. 320. 321
323. 324. 325. 326
329. 332. 335. 393
395. 501. 502. 509
590. C71. C72. C74
N19
EAST GUILDFORD PARK & RIDE
501. 509. C74
KING GEORGE
314. 321. 326
329. 345. 394
395. 502
SCOTTSDALE
301. 311. 312. 316. 319
329. 340. 391. C75. C76
NEWTON EXCHANGE
201. 321. 323. 324
325. 340. 392. C75
CLOVERDALE
320. 340. 395
MATTHEWS EXCHANGE
311. 351. C76
FRASER HWY
KING GEORGE HWY
SCOTT RD
HWY 10
HWY 99


Langley Centre
Langley
WALNUT GROVE PARK & RIDE
501.509.590.C62
LANGLEY CENTRE (see inset)
320.501.502.590
C60.C61.C62.C63.C64
Fraser River
Walnut Grove
Fort Langley
Port Kells
Milner
Murrayville
Brookswood
Fernridge
Aldergrove
Salmon River
Thornhill
FRASER HWY
TRANS CANADA HWY
TELEGRAPH TRAIL
GLOVER RD
Trinity Western University
Kwantlen University College
Canadian Museum of Flight
Langley Memorial Hospital
AirCare

APPENDIX B

Industrial Track Inventory Diagrams

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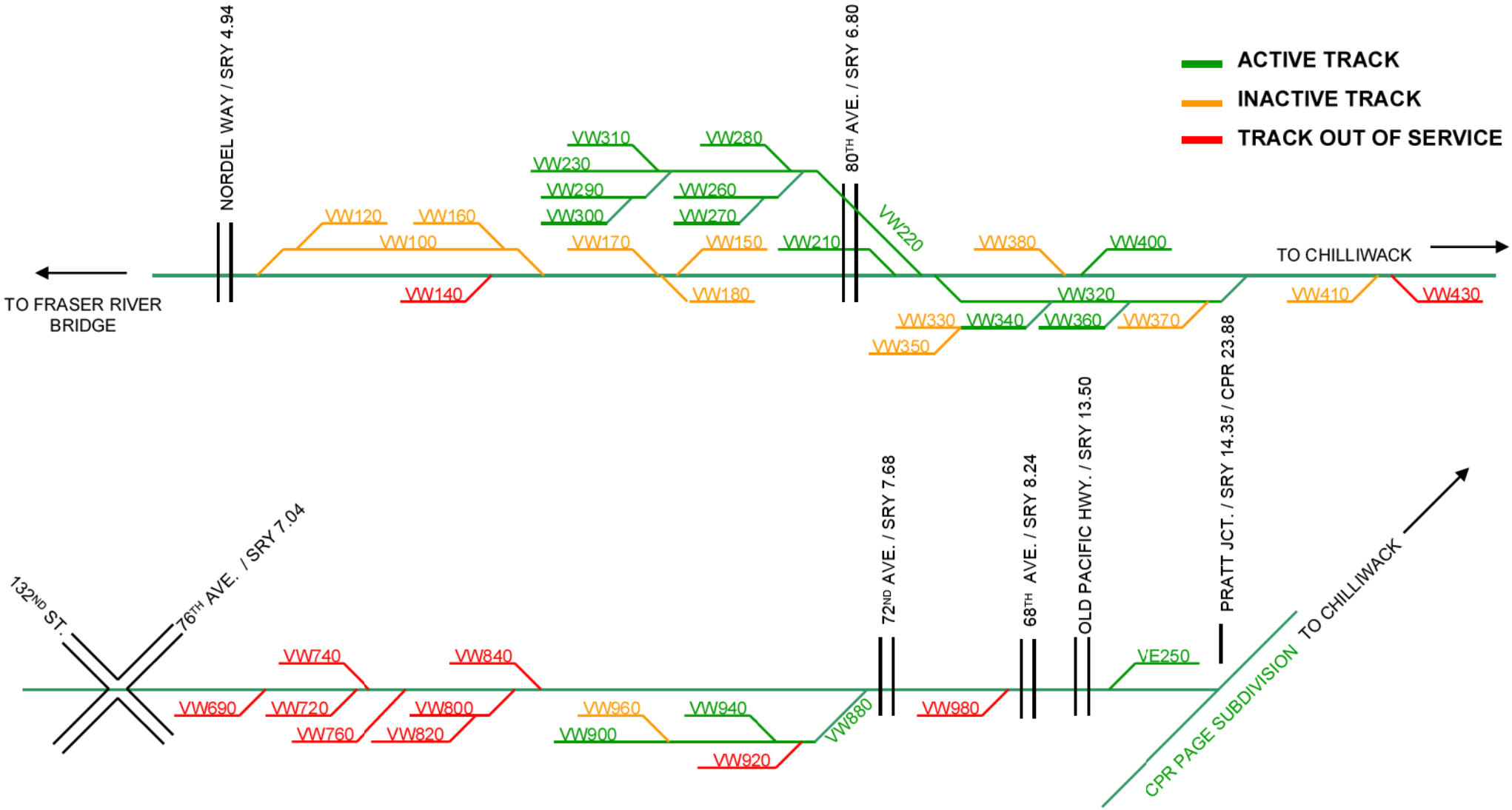
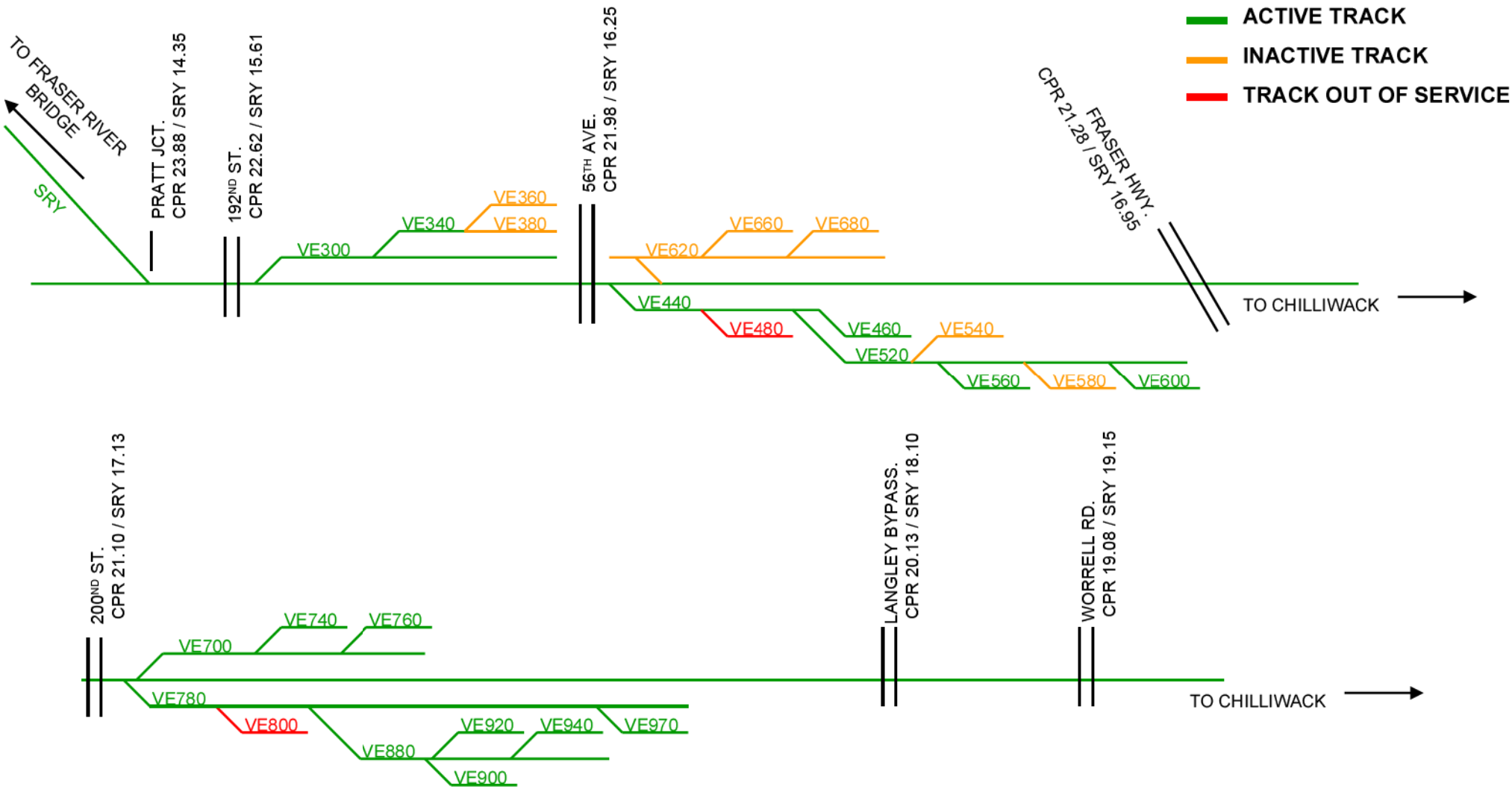
INDUSTRY TRACKS ON SRY FROM MP 4.94 TO MP 14.35 (PRATT JCT.)



INDUSTRY TRACKS ON CPR FROM MP 23.88 (PRATT JCT.) TO MP 19.08
PAGE SUBDIVISION



APPENDIX C

Grade Crossing Inventory with Photograph

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STREET/ROAD NAME:		110TH AVENUE
RAILROAD AND MILEPOST LOCATION:		NONE
CROSSING TYPE:		WILL BE PUBLIC OR GRADE SEPARATION
NUMBER & DESCRIPTION OF TRACKS:		NONE YET
NUMBER OF ROADWAY LANES:		3 – BLACKTOP
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	
	BELL	
	FLASHERS	
	CANTILEVERS	
	CROSSBUCKS	
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	
	OTHER:	SCOTT ROAD TERMINAL
CROSSING GEOMETRY:		~90DEG / CROSS STREET 126A ST. / CREEK PARALLEL TO 126A ST.
OBSERVED UTILITIES:		OVERHEAD POWER LINES / UNDERGROUND FIRE HYDRANT / OVERHEAD COMM. LINES
PHOTO NUMBER:		844-847

STREET/ROAD NAME:		OLD YALE ROAD
RAILROAD AND MILEPOST LOCATION:		SRY MP 2.19
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		2 – BLACKTOP
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	YES
	FLASHERS	YES
	CANTILEVERS	NO
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	STEEP HIGHWAY APPROACH GRADES
CROSSING GEOMETRY:		~90DEG ON STEEP GRADE AND SHARP CURVE ON RAILWAY
OBSERVED UTILITIES:		OVERHEAD POWER LINE PARALLEL TO TRACK WEST SIDE / OVERHEAD COMM LINES PARALLEL TO TRACK WEST SIDE / UNDERGROUND SEWER LINES
PHOTO NUMBER:		848-852

STREET/ROAD NAME:		SCHOOL ROAD 125A STREET
RAILROAD AND MILEPOST LOCATION:		SRY MP 2.35
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		1.5 BLACKTOP/GRAVEL
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	NO
	FLASHERS	NO
	CANTILEVERS	NO
	CROSSBUCKS	YES WITH STOP SIGNS
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	ON STEEP RAIL GRADE
CROSSING GEOMETRY:		SHARP APPROACH ANGLE NORTH SIDE OF TRACK / 125A ST. CROSSES TRACK DIAGONALLY AND BECOMES 125 ST. CROSS ROAD 106 AVE.
OBSERVED UTILITIES:		OVERHEAD POWER LINES PARALLEL TO TRACK WEST SIDE AND STREET LIGHTING CABLE OVER TRACK, SEWER
PHOTO NUMBER:		853-856

STREET/ROAD NAME:		104TH AVENUE
RAILROAD AND MILEPOST LOCATION:		SRY MP 2.63
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		2 – W/BLACKTOP & SIDEWALK
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	YES
	FLASHERS	YES
	CANTILEVERS	NO
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	STEEP GRADE ON RAILROAD
CROSSING GEOMETRY:		~80DEG STEEP APPROACH GRADES ON 104TH AVENUE
OBSERVED UTILITIES:		OVERHEAD POWER LINES PARALLEL TO TRACK WEST SIDE & CROSSING TRACK WOUTH SIDE OF 104TH AVENUE / SURREY STORM SEWER LINES
PHOTO NUMBER:		857-863

STREET/ROAD NAME:		SCOTT ROAD & 99TH AVENUE
RAILROAD AND MILEPOST LOCATION:		SRY MP 3.51
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		6 ON SCOTT RD / 3 ON 99TH & SIDEWALKS / BLACKTOP ROADS / CONCRETE CROSSING
DIVIDED ROADWAY (YES/NO)		YES – ON SCOTT RD
CROSSING WARNING SYSTEM:		
	GATES	YES – 6
	BELL	YES – 2
	FLASHERS	YES – MULTIPLE SETS
	CANTILEVERS	YES – 5 RAIL & 4 HIGHWAY
	CROSSBUCKS	YES – 6
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	YES – ADVANCE WARNING LIGHTS & SIGNS ON SCOTT
	OTHER:	PEDESTRIAN WALK SIGNALS 4 WAYS / STOP LIGHTS AT CROSSING
CROSSING GEOMETRY:		TRACK DIAGONALLY CROSSES INTERSECTION OF SCOTT RD. & 99TH AVE. / PARALLEL RIVER CHANNEL / TRACK ON STEEP GRADE
OBSERVED UTILITIES:		OVERHEAD POWER LINES BOTH SIDES OF RAILROAD AND NORTH SIDE OF 99TH AVE. / SEVERAL IDIVIDUAL OVERHEAD WIRES / ELECTRICAL SUBSTATION NE QUADRANT
PHOTO NUMBER:		864-872

STREET/ROAD NAME:		96TH AVENUE
RAILROAD AND MILEPOST LOCATION:		SRY MP 3.94
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		2 – BLACKTOP
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	YES
	FLASHERS	YES
	CANTILEVERS	NO
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	STEEP APPROACH GRADES ON RAILROAD
CROSSING GEOMETRY:		~90DEG WITH MODERATE APPROACH GRADES / PARALLEL RIVER UNDER 96TH AVE.
OBSERVED UTILITIES:		OVERHEAD POWER LINES BOTH SIDE OF RAILROAD AND BOTH SIDES OF 96TH AVENUE / UNDERGROUND TELEPHONE AND SEWER LINES
PHOTO NUMBER:		873-876

STREET/ROAD NAME:		92ND AVENUE
RAILROAD AND MILEPOST LOCATION:		SRY MP 4.42
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		2 – BLACKTOP WITH SIDEWALKS
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	YES
	FLASHERS	YES
	CANTILEVERS	NO
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	
CROSSING GEOMETRY:		~90DEG
OBSERVED UTILITIES:		POWER LINES BOTH SIDES
PHOTO NUMBER:		877-882

STREET/ROAD NAME:		SCOTT ROAD (NEAR 91ST AVENUE)
RAILROAD AND MILEPOST LOCATION:		SRY MP 4.57
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		4 BLACKTOP WITH 2 SIDEWALKS
DIVIDED ROADWAY (YES/NO)		YES
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	YES – 2
	FLASHERS	YES – MULTIPLE
	CANTILEVERS	YES
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	UNKNOWN
	OTHER:	
CROSSING GEOMETRY:		LONG DIAGONAL CROSSING OF SCOTT ROAD (ATLEAST 300FT LONG CONCRETE CROSSING) ~30DEG ANGLE
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK AND WEST SIDE OF SCOTT RD. / UNDERGROUND LINES
PHOTO NUMBER:		883-888

STREET/ROAD NAME:		90TH AVENUE (PEDESTRIAN)
RAILROAD AND MILEPOST LOCATION:		SRY MP 4.65
CROSSING TYPE:		PEDESTRIAN / WELL-WORN PATH
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		0 (1 PATH)
DIVIDED ROADWAY (YES/NO)		N/A
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	NO
	FLASHERS	NO
	CANTILEVERS	NO
	CROSSBUCKS	NO
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	N/A
	OTHER:	RIGHT-OF-WAY FENCE CUT OPEN – WEST SIDE
CROSSING GEOMETRY:		~90DEG / TOP OF 1 ST GRADE (HIGHEST POINT ON RAILRAOD BETWEEN SCOTT RD TERMIANL AND PRATT JCT.)
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK AND ACROSS TRACK AT SEVERAL LOCATIONS
PHOTO NUMBER:		889-892

STREET/ROAD NAME:		88TH AVENUE AT 120A STREET
RAILROAD AND MILEPOST LOCATION:		SRY MP 4.94
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		2 – BLACKTOP WITH 2 SIDEWALKS
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	YES
	BELL	YES
	FLASHERS	YES
	CANTILEVERS	NO
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	CURVE IN RAILROAD
CROSSING GEOMETRY:		~80DEG WITH MODERATE APPROACH GRADES
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK AND SOUTH SIDE OF 88TH / STREET LIGHTING OVER TRACK / UNDERGROUND PHONE, SEWER, HYDRANT LINES, ETC
PHOTO NUMBER:		893-896

STREET/ROAD NAME:		NORDEL WAY
RAILROAD AND MILEPOST LOCATION:		SRY MP 5.05
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		4 BLACKTOP WITH 2 SIDEWALKS
DIVIDED ROADWAY (YES/NO)		YES
CROSSING WARNING SYSTEM:		
	GATES	YES
	BELL	YES – 2
	FLASHERS	YES
	CANTILEVERS	NO
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	STEEP GRADE ON RAILROAD
CROSSING GEOMETRY:		~80DEG / CONCRETE CROSSING
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF RAILROAD/ LARGE TRANSMISSION TOWER LINE OVER TRACK / SEVERAL POLE LINES SOUTH OF CROSSING AND SEVERAL UNDERGROUND CROSSINGS
PHOTO NUMBER:		897-902

STREET/ROAD NAME:		124TH STREET (PEDESTRIAN)
RAILROAD AND MILEPOST LOCATION:		SRY MP 5.40
CROSSING TYPE:		PEDESTRIAN / WORN PATH ONLY
NUMBER & DESCRIPTION OF TRACKS:		
NUMBER OF ROADWAY LANES:		
DIVIDED ROADWAY (YES/NO)		
CROSSING WARNING SYSTEM:		
	GATES	
	BELL	
	FLASHERS	
	CANTILEVERS	
	CROSSBUCKS	
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	
	OTHER:	
CROSSING GEOMETRY:		
OBSERVED UTILITIES:		
PHOTO NUMBER:		n/a

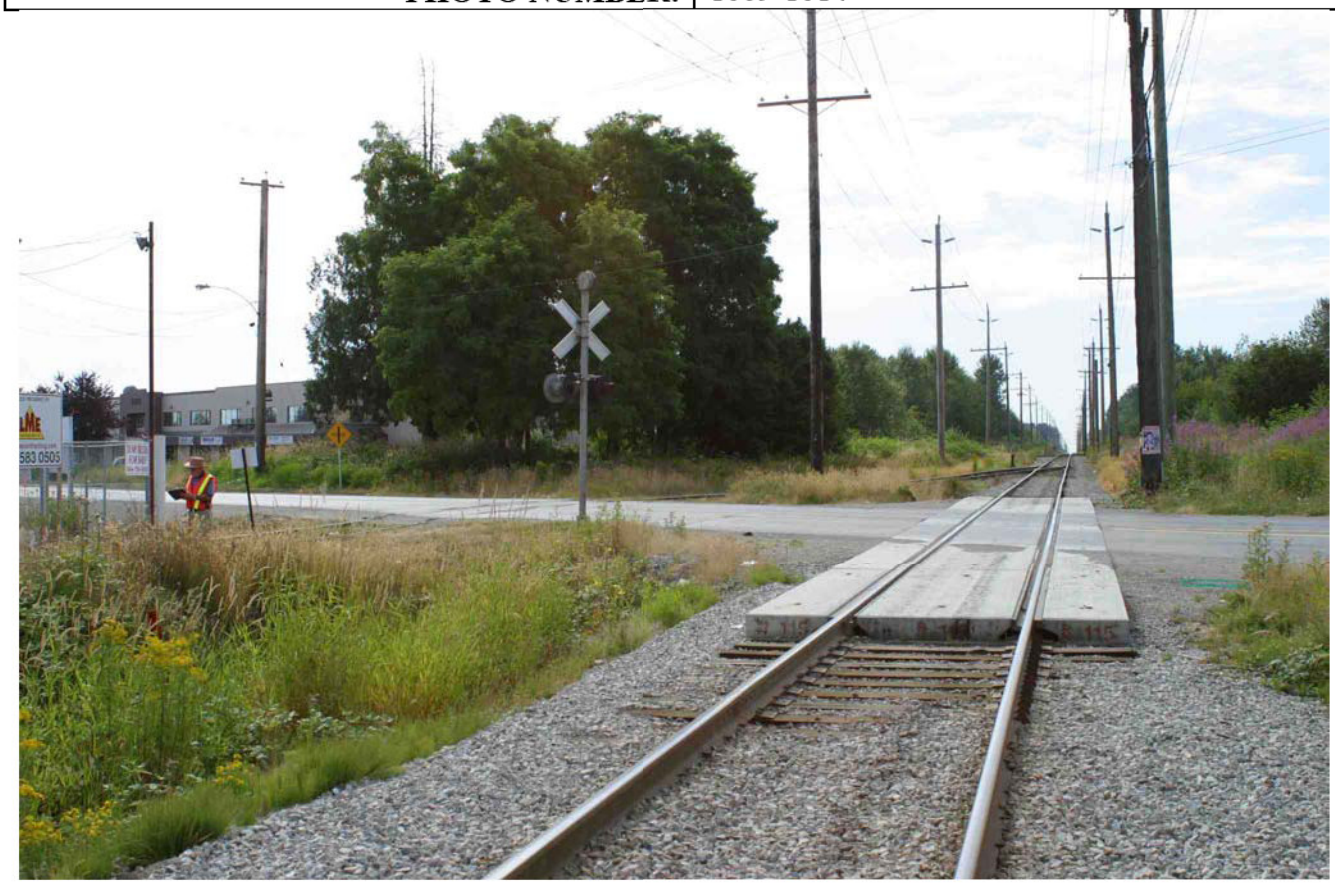
STREET/ROAD NAME:		HICKLETON (PEDESTRIAN)
RAILROAD AND MILEPOST LOCATION:		SRY MP 5.48
CROSSING TYPE:		PEDESTRIAN / WORN PATH ONLY
NUMBER & DESCRIPTION OF TRACKS:		
NUMBER OF ROADWAY LANES:		
DIVIDED ROADWAY (YES/NO)		
CROSSING WARNING SYSTEM:		
	GATES	
	BELL	
	FLASHERS	
	CANTILEVERS	
	CROSSBUCKS	
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	
	OTHER:	
CROSSING GEOMETRY:		
OBSERVED UTILITIES:		
PHOTO NUMBER:		n/a

STREET/ROAD NAME:		84TH AVENUE
RAILROAD AND MILEPOST LOCATION:		SRY MP 5.73
CROSSING TYPE:		NO CROSSING AT THIS LOCATION
NUMBER & DESCRIPTION OF TRACKS:		
NUMBER OF ROADWAY LANES:		
DIVIDED ROADWAY (YES/NO)		
CROSSING WARNING SYSTEM:		
	GATES	
	BELL	
	FLASHERS	
	CANTILEVERS	
	CROSSBUCKS	
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	
	OTHER:	
CROSSING GEOMETRY:		
OBSERVED UTILITIES:		
PHOTO NUMBER:		n/a

STREET/ROAD NAME:		UNLISTED PEDESTRIAN CROSSING
RAILROAD AND MILEPOST LOCATION:		SRY MP 5.80
CROSSING TYPE:		PEDESTRIAN / WORN PATH ONLY
NUMBER & DESCRIPTION OF TRACKS:		
NUMBER OF ROADWAY LANES:		
DIVIDED ROADWAY (YES/NO)		
CROSSING WARNING SYSTEM:		
	GATES	
	BELL	
	FLASHERS	
	CANTILEVERS	
	CROSSBUCKS	
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	
	OTHER:	
CROSSING GEOMETRY:		
OBSERVED UTILITIES:		
PHOTO NUMBER:		n/a

STREET/ROAD NAME:		128TH STREET AT 82ND AVENUE
RAILROAD AND MILEPOST LOCATION:		SRY MP 6.21
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		4 – BLACKTOP WITH 1 SIDEWALK
DIVIDED ROADWAY (YES/NO)		YES
CROSSING WARNING SYSTEM:		
	GATES	YES – 6
	BELL	YES – 2
	FLASHERS	YES – MULTIPLE
	CANTILEVERS	YES (RAIL – 1, HIGHWAY – 3)
	CROSSBUCKS	YES – 7
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	
	OTHER:	
CROSSING GEOMETRY:		TRACK CROSSES 128TH STREET DIAGONALLY. 82ND AVENUE JOINS 128TH STREET FROM THE WEST
OBSERVED UTILITIES:		POLE LINES BOTH SIDES OF TRACK AND EAST SIDE OF 128TH STREET / BURIED PHONE CABLES
PHOTO NUMBER:		1002-1008

STREET/ROAD NAME:		80TH AVENUE
RAILROAD AND MILEPOST LOCATION:		SRY MP 6.80
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN, 2 – INDUSTRIAL
NUMBER OF ROADWAY LANES:		2
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	YES
	FLASHERS	YES – FOR MAIN TRACK ONLY
	CANTILEVERS	NO
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	ONLY MAIN TRACK SIGNALIZED
CROSSING GEOMETRY:		~60DEG / 100-FT CONCRETE CROSSING
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK AND SOUTH SIDE OF 80TH AVENUE
PHOTO NUMBER:		1009-1014



STREET/ROAD NAME:		132ND STREET AND 76TH AVENUE
RAILROAD AND MILEPOST LOCATION:		SRY MP 7.64
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		3 ON 132ND ST., 3 ON 76TH AVE. / SIDEWALKS
DIVIDED ROADWAY (YES/NO)		
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	YES – 2
	FLASHERS	YES – MULTIPLE
	CANTILEVERS	YES - 4 RAILROAD, 4 HIGHWAY
	CROSSBUCKS	YES– 4
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	YES
	OTHER:	
CROSSING GEOMETRY:		TRACK DIAGONALLY CROSSES ROADWAY INTERSECTION
OBSERVED UTILITIES:		
PHOTO NUMBER:		1015-1022

STREET/ROAD NAME:		72ND AVENUE
RAILROAD AND MILEPOST LOCATION:		SRY MP 7.68
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		4 – BLACKTOP
DIVIDED ROADWAY (YES/NO)		YES
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	YES
	FLASHERS	YES – MULTIPLE
	CANTILEVERS	YES – 2
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	
CROSSING GEOMETRY:		~75DEG
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK AND SOUTH SIDE OF 72ND AVENUE
PHOTO NUMBER:		1023-1027

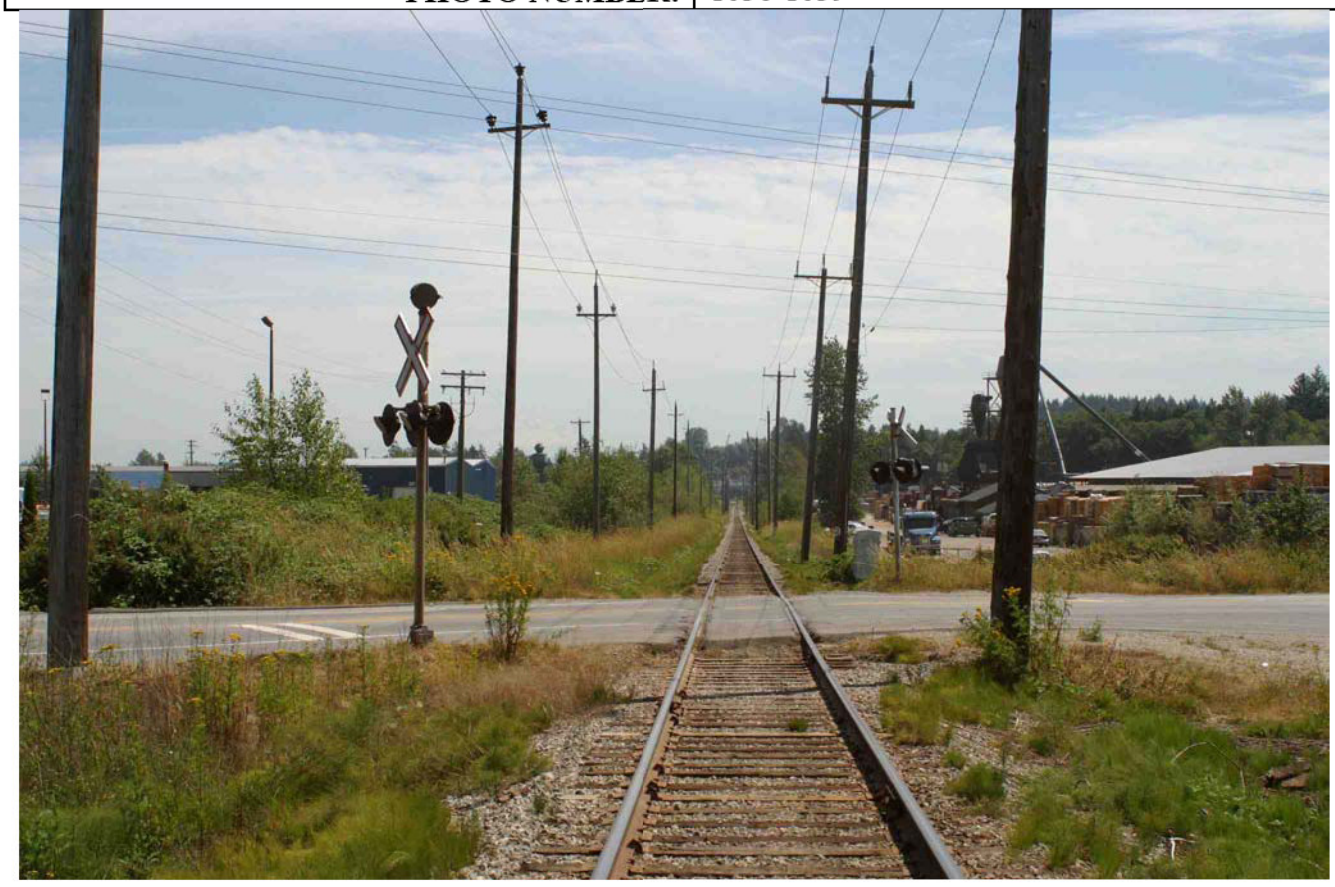
STREET/ROAD NAME:		KING GEORGE HIGHWAY AT HALL ROAD
RAILROAD AND MILEPOST LOCATION:		SRY MP 7.83
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		4 – BLACKTOP WITH SIDEWALK
DIVIDED ROADWAY (YES/NO)		YES
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	YES
	FLASHERS	YES – MULTIPLE
	CANTILEVERS	YES – 2
	CROSSBUCKS	YES – 2
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	
	OTHER:	
CROSSING GEOMETRY:		~45DEG
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK AND EAST SIDE OF KING GEORGE HIGHWAY / STREET LIGHTING OVER TRACK
PHOTO NUMBER:		1028-1031

STREET/ROAD NAME:		68TH AVENUE
RAILROAD AND MILEPOST LOCATION:		SRY MP 8.24
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		4 – BLACKTOP WITH 2 SIDEWALKS
DIVIDED ROADWAY (YES/NO)		YES
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	YES
	FLASHERS	YES – MULTIPLE
	CANTILEVERS	YES – 2
	CROSSBUCKS	YES – 2
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	
CROSSING GEOMETRY:		ON CURVE AND GRADE ON RAILROAD
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK
PHOTO NUMBER:		1032-1035

STREET/ROAD NAME:		140TH STREET (PEDESTRIAN)
RAILROAD AND MILEPOST LOCATION:		SRY MP 8.55
CROSSING TYPE:		NONE LOCATED
NUMBER & DESCRIPTION OF TRACKS:		
NUMBER OF ROADWAY LANES:		
DIVIDED ROADWAY (YES/NO)		
CROSSING WARNING SYSTEM:		
	GATES	
	BELL	
	FLASHERS	
	CANTILEVERS	
	CROSSBUCKS	
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	
	OTHER:	
CROSSING GEOMETRY:		NOT LOCATED AT 140TH STREET / WELL-WORN PATH LOCATED AT 138TH ST. AREA
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK
PHOTO NUMBER:		n/a

STREET/ROAD NAME:		142ND STREET (PEDESTRIAN)
RAILROAD AND MILEPOST LOCATION:		SRY MP 8.51
CROSSING TYPE:		PEDESTRIAN / WELL-WORN PATH ONLY
NUMBER & DESCRIPTION OF TRACKS:		1 - MAIN
NUMBER OF ROADWAY LANES:		
DIVIDED ROADWAY (YES/NO)		
CROSSING WARNING SYSTEM:		
	GATES	
	BELL	
	FLASHERS	
	CANTILEVERS	
	CROSSBUCKS	
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	
	OTHER:	
CROSSING GEOMETRY:		STEEP GRADE AND CURVE ON RAILROAD / NO CROSSING
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK
PHOTO NUMBER:		n/a

STREET/ROAD NAME:		144TH STREET
RAILROAD AND MILEPOST LOCATION:		SRY MP 9.08
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		2 – BLACKTOP
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	YES
	FLASHERS	YES
	CANTILEVERS	NO
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	
CROSSING GEOMETRY:		~60DEG / STEEP GRADE ON RAILRAOD – TANGENT TRACK
OBSERVED UTILITIES:		POLE LINES BOTH SIDES OF TRACK AND SOUTH SIDE OF 144TH STREET
PHOTO NUMBER:		1036-1039



STREET/ROAD NAME:		148TH STREET
RAILROAD AND MILEPOST LOCATION:		SRY MP 9.69
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		3 – BLACKTOP WITH 2 SIDEWALKS
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	YES
	BELL	YES
	FLASHERS	YES – MULTIPLE
	CANTILEVERS	YES
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	UNKNOWN
	OTHER:	
CROSSING GEOMETRY:		~45DEG / TRACK IN A CURVE / ADJACENT TO INTERSECTION WITH 148TH STREET AND 148TH STREET GRADE CROSSING
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK AND BOTH SIDES OF 148TH STREET / ONE POWER POLE IS ALSO A COMMUNICATION ANTENNA TOWER
PHOTO NUMBER:		1040-1053

STREET/ROAD NAME:		64TH AVENUE
RAILROAD AND MILEPOST LOCATION:		SRY MP 9.76
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		4 – BLACKTOP WITH SIDEWALKS AND BIKE LANE
DIVIDED ROADWAY (YES/NO)		YES
CROSSING WARNING SYSTEM:		
	GATES	YES – 3
	BELL	YES
	FLASHERS	YES – MULTIPLE
	CANTILEVERS	YES – 1
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	UNKNOWN
	OTHER:	BIKE PATH CROSSING IN CURVE
CROSSING GEOMETRY:		LONG CURVE IN TRACK THROUGH CROSSING (~300FEET) FORMAS A TRIANGLE OF INTERSECTIONS WITH 148TH STREET
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK AND SOUTH SIDE OF 64TH AVENUE
PHOTO NUMBER:		1040-1053

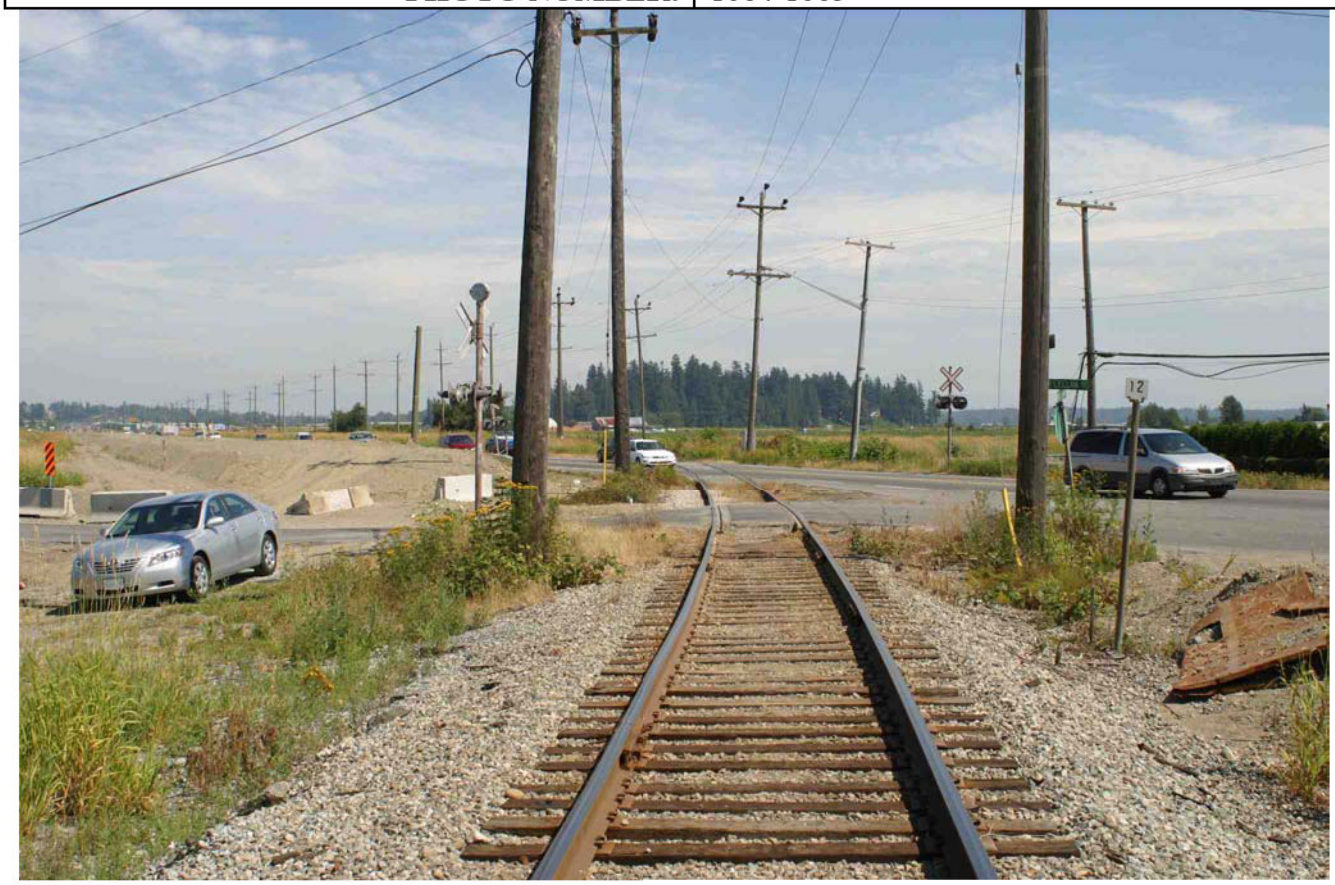
STREET/ROAD NAME:		152ND STREET AT 64TH AVENUE
RAILROAD AND MILEPOST LOCATION:		SRY MP 10.20
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		5 – BLACKTOP WITH 2 SIDEWALKS
DIVIDED ROADWAY (YES/NO)		YES
CROSSING WARNING SYSTEM:		
	GATES	YES – 4
	BELL	YES – 2
	FLASHERS	YES – MULTIPLE
	CANTILEVERS	YES – 1 (HIGHWAY)
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	UNKNOWN
	OTHER:	
CROSSING GEOMETRY:		ON SHARP CURVE ON RAILROAD IMMEDIATELY SOUTH OF 64TH AVENUE / 50FEET BETWEEN TRACK AND 54TH AVENUE LANES
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK AND WEST SIDE OF 152ND STREET
PHOTO NUMBER:		1054-1058

STREET/ROAD NAME:		156TH STREET
RAILROAD AND MILEPOST LOCATION:		SRY MP 10.80
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		2 – BLACKTOP
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	NO
	FLASHERS	NO
	CANTILEVERS	NO
	CROSSBUCKS	YES – 2
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	STOP SIGNS – 2
CROSSING GEOMETRY:		~80DEG
OBSERVED UTILITIES:		POWER LINES ON BOTH SIDES OF TRACK / POWER LINE (LOW WIRE) OVER TRACK TO STREET LIGHT ON SOUTH SIDE / UNDERGROUND TELEPHONE CABLE
PHOTO NUMBER:		1059-1062

STREET/ROAD NAME:		60^{TH} AVENUE PUMP STATION
RAILROAD AND MILEPOST LOCATION:		SRY MP 11.13
CROSSING TYPE:		PRIVATE
NUMBER & DESCRIPTION OF TRACKS:		MAIN – 1
NUMBER OF ROADWAY LANES:		1 – WOOD PLANK/GRAVEL
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	NO
	FLASHERS	NO
	CANTILEVERS	NO
	CROSSBUCKS	YES – 2
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	STOP SIGNS – 2
CROSSING GEOMETRY:		~45DEG / ACCESSIBLE BY PRIVATE ROAD WITH LOCKED GATE
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK AND POWER LINES ACROSS TRACK TO PUMP STATION
PHOTO NUMBER:		n/a

STREET/ROAD NAME:		PRIVATE CROSSING – NO NAME
RAILROAD AND MILEPOST LOCATION:		SRY MP ~ 11.89
CROSSING TYPE:		PRIVATE – CLOSED
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		1 – WOOD
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	NO
	FLASHERS	NO
	CANTILEVERS	NO
	CROSSBUCKS	YES – 2
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	STOP SIGNS – 2
CROSSING GEOMETRY:		~90DEG – ROAD ON BOTH SIDES OF CROSSING CLOSED / NO ACCESS BY VEHICLE
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK
PHOTO NUMBER:		n/a

STREET/ROAD NAME:		OLD MCLELLAN ROAD AT HIGHWAY 10
RAILROAD AND MILEPOST LOCATION:		SRY MP 12.01
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		2 – BLACKTOP
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	YES
	FLASHERS	YES – ONLY NORTH SIDE
	CANTILEVERS	NO
	CROSSBUCKS	YES – ONLY NORTH SIDE
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	STOP SIGN APPROACHING FROM NORTH SIDE ONLY
CROSSING GEOMETRY:		IN CURVE ON RAILROAD / HIGHWAY PRELOAD BOTH SIDES OF CROSSING, PARALLEL TO ROUTE 10
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK AND ACROSS TRACK
PHOTO NUMBER:		1064-1065



STREET/ROAD NAME:		HIGHWAY # 10 (56TH AVENUE)
RAILROAD AND MILEPOST LOCATION:		SRY MP 12.04
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		2 – BLACKTOP
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	YES
	FLASHERS	YES
	CANTILEVERS	NO
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	
CROSSING GEOMETRY:		~45DEG / CROSSING IN CURVE ON RAILROAD
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK / UNDERGROUND COMMUNICATION CABLES
PHOTO NUMBER:		1064-1065

STREET/ROAD NAME:		L. KEMPIN (PRIVATE)
RAILROAD AND MILEPOST LOCATION:		SRY MP 12.12
CROSSING TYPE:		PRIVATE
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		1 – TIMBER/SAND
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	NO
	FLASHERS	NO
	CANTILEVERS	NO
	CROSSBUCKS	NO
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	FENCE GATE – OPEN
CROSSING GEOMETRY:		~90DEG
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK / POWER POLES 10FEET FROM CENTERLINE OF TRACK
PHOTO NUMBER:		1067

STREET/ROAD NAME:		168TH STREET AT HWY 10
RAILROAD AND MILEPOST LOCATION:		SRY MP 12.52
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		2 – BLACKTOP
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	YES
	BELL	YES
	FLASHERS	YES – MULTIPLE
	CANTILEVERS	YES – 4 HIGHWAY, 0 RAIL
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	UNKNOWN
	OTHER:	
CROSSING GEOMETRY:		~90DEG
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK AND ACROSS THE TRACK ON THE WEST SIDE OF 168TH STREET
PHOTO NUMBER:		1068-1069

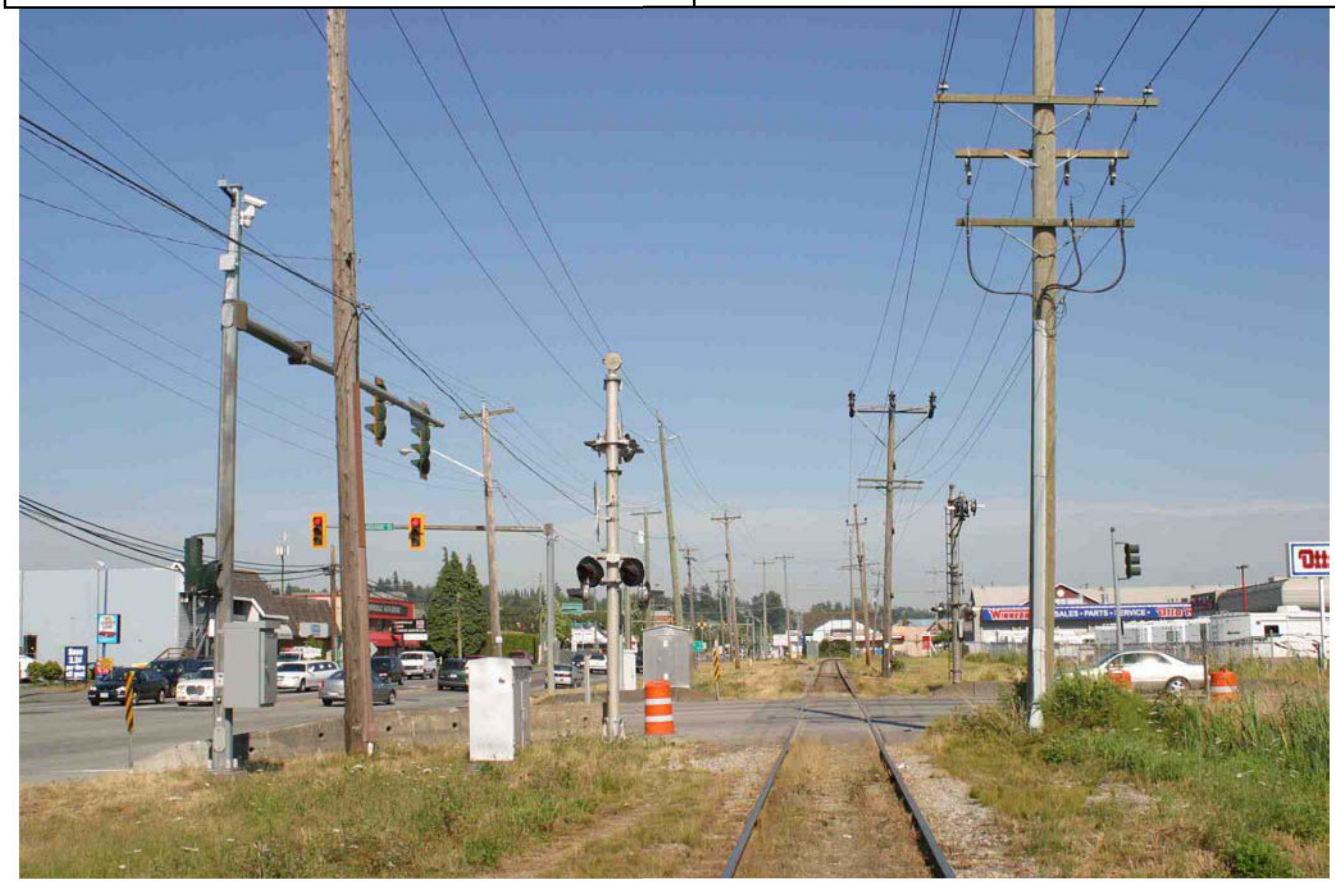
STREET/ROAD NAME:		MADDOCK (PRIVATE)
RAILROAD AND MILEPOST LOCATION:		SRY MP 12.68
CROSSING TYPE:		PRIVATE – NOT ACTIVE
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		NONE
DIVIDED ROADWAY (YES/NO)		
CROSSING WARNING SYSTEM:		
	GATES	
	BELL	
	FLASHERS	
	CANTILEVERS	
	CROSSBUCKS	
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	
	OTHER:	
CROSSING GEOMETRY:		~90DEG / LOCKED GATE ON IGHWAY 10 SIDE / NO APPROACH FROM FIELD SIDE / DEEP DITCH
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK
PHOTO NUMBER:		n/a

STREET/ROAD NAME:		MADDOCK (PRIVATE)
RAILROAD AND MILEPOST LOCATION:		SRY MP 12.90
CROSSING TYPE:		PRIVATE
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		NONE
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	NO
	FLASHERS	NO
	CANTILEVERS	NO
	CROSSBUCKS	NO
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	
CROSSING GEOMETRY:		~90DEG / LOCKED GATE HIGHWAY 10 SIDE /
OBSERVED UTILITIES:		
SPECIAL NOTE:		A NEW CONCRETE BALLAST DECK RAIL BRIDGE HAS BEEN BUILT OVER A STREAM AND IS ALIGNED WITH A NEW PRELOAD FILL CURVING TO THE SOUTH. THIS APPEARS TO BE A NEW RAIL ROUTE DIVERSION SOUTH AND JOINS THE CPR RIGHT-OF-WAY UNDER THE HIGHWAY 15 OVERPASS THEN RUNS PARALLEL (EASTWARD) TO THE CPR AND REJOINS THE EXISTING SRY RIGHT-OF-WAY JUST WEST OF PRATT JUNCTION
PHOTO NUMBER:		1070-1072

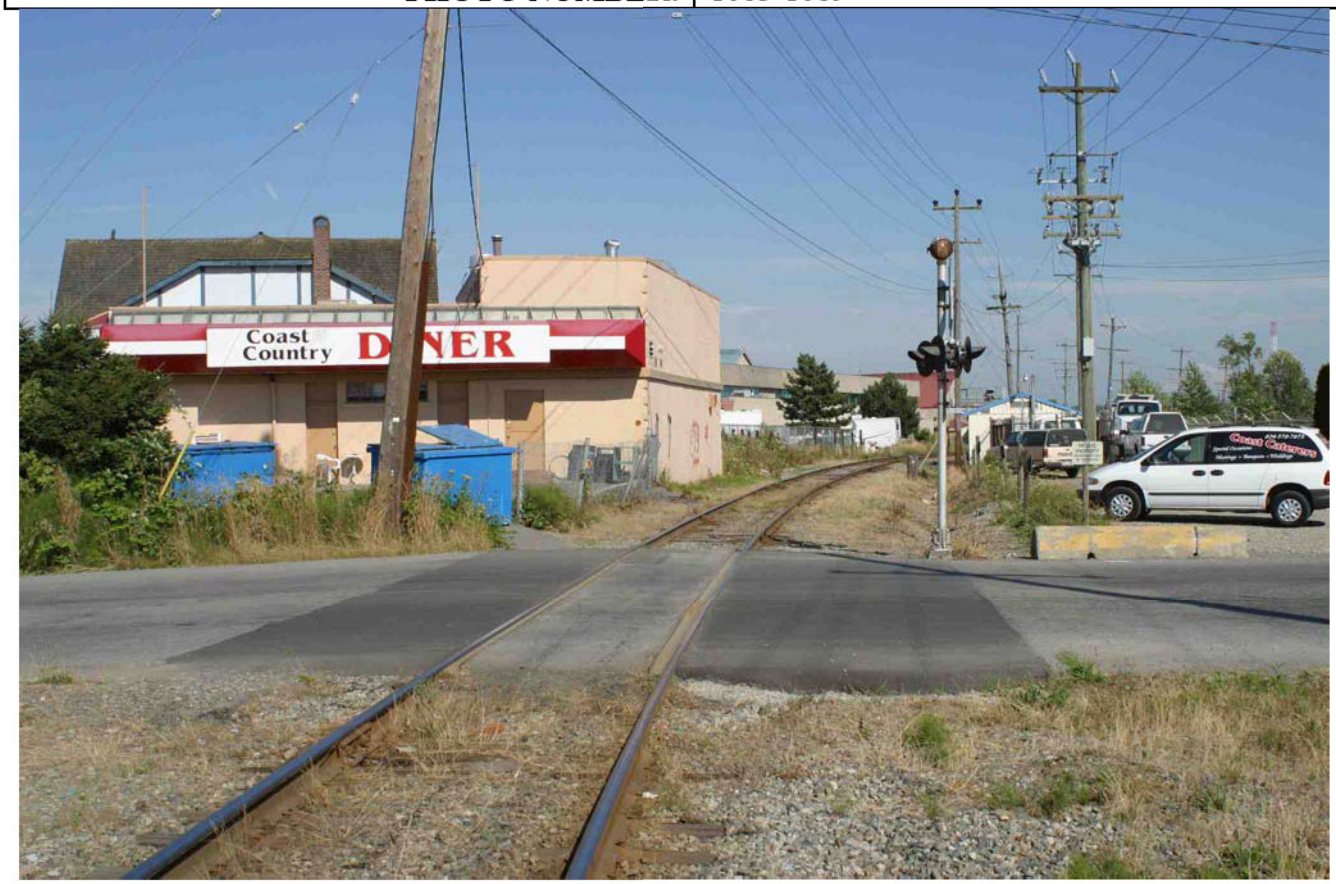
STREET/ROAD NAME:		174TH STREET (PRIVATE)
RAILROAD AND MILEPOST LOCATION:		SRY MP 13.21
CROSSING TYPE:		PRIVATE
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		2 – BLACKTOP
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	NO
	FLASHERS	NO
	CANTILEVERS	NO
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	STOP SIGNS
CROSSING GEOMETRY:		~90DEG / PRIVATE CROSSING BUT SERVES SEVERAL BUSINESSES AND FARM RESIDENCE AND IS ACCESS POINT FOR NEW SRY ALIGNMENT PRELOAD
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK / 174TH STREET VACATED AT SOME TIME IN THE PAST
PHOTO NUMBER:		n/a

STREET/ROAD NAME:		SURREY BUILDING SUPPLIES (PRIVATE)
RAILROAD AND MILEPOST LOCATION:		SRY MP 13.31
CROSSING TYPE:		PRIVATE
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		2 – BLACKTOP / PLANK CROSSING
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	NO
	FLASHERS	NO
	CANTILEVERS	NO
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	STOP SIGNS
CROSSING GEOMETRY:		~90DEG / SERVES SEVERAL BUSINESSES
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK
PHOTO NUMBER:		1078-1079

STREET/ROAD NAME:		PACIFIC HIGHWAY (NEW)
RAILROAD AND MILEPOST LOCATION:		SRY MP 13.35
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		4 – DIVIDED
DIVIDED ROADWAY (YES/NO)		YES
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	YES
	FLASHERS	YES – MULTIPLE
	CANTILEVERS	YES – 2
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	UNKNOWN
	OTHER:	CAMERA
CROSSING GEOMETRY:		~90DEG
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK
PHOTO NUMBER:		1080-1082



STREET/ROAD NAME:		PACIFIC HIGHWAY (OLD) A.K.A. 176TH ST.
RAILROAD AND MILEPOST LOCATION:		SRY MP 13.50
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		2 – BLACKTOP
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	YES
	FLASHERS	YES
	CANTILEVERS	NO
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	
CROSSING GEOMETRY:		~80DEG ON SHARP CURVE ON RAILROAD
OBSERVED UTILITIES:		POWERLINES BOTH SIDES OF TRACK AND ON SOUTH SIDE OF ROADWAY
PHOTO NUMBER:		1083-1089



STREET/ROAD NAME:		184TH STREET
RAILROAD AND MILEPOST LOCATION:		SRY MP 14.84 / CPR MP 23.59
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		2 – BLACKTOPS
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	YES
	BELL	YES
	FLASHERS	YES
	CANTILEVERS	NO
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	
CROSSING GEOMETRY:		~90DEG / CONCRETE CROSSING WITH 136LB RAIL AND GREATER VANCOUVER REGIONAL DISTRICT GRAVEL RIGHT-OF-WAY NORTH OF RAILROAD
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK AND ON WEST SIDE OF 184TH ST.
PHOTO NUMBER:		1090-1093

STREET/ROAD NAME:		192ND STREET AT 52ND AVENUE
RAILROAD AND MILEPOST LOCATION:		SRY MP 15.61 / CPR MP 22.62
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		2 – BLACKTOP
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	YES
	BELL	YES
	FLASHERS	YES
	CANTILEVERS	NO
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	
	OTHER:	
CROSSING GEOMETRY:		~88DEG / SHARP CURVE IN THE RAILROAD
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK AND ACROSS TRACK / BURIED COMMUNICATION CABLES / GVS&DD SEWER LINE ON NORTH SIDE AND PARALLEL TO TRACK / LATIMER SANITARY PUMP STATION IN NW QUADRANT
SPECIAL NOTES:		STORM SEWERS UNDERGROUND / BC HYDRO TRANSMISSION CORP. TOWER LINES CROSS TRACKS AND RUN PARALLEL TO TRACKS EAST OF CROSSING / MCLELLAN SUBSTATION AND TRANSMISSION LINE UPGRADE PROJECT SIGN AND ROAD ARE SOUTH EAST OF CROSSING. B.C. Transmission Corp (604)-699-7551
PHOTO NUMBER:		1094-1103

STREET/ROAD NAME:		D. HUNTER (PRIVATE)
RAILROAD AND MILEPOST LOCATION:		SRY MP 14.77 / CPR MP 23.46
CROSSING TYPE:		PRIVATE
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		NONE – PATH ONLY
DIVIDED ROADWAY (YES/NO)		
CROSSING WARNING SYSTEM:		
	GATES	
	BELL	
	FLASHERS	
	CANTILEVERS	
	CROSSBUCKS	
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	
	OTHER:	
CROSSING GEOMETRY:		
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK
PHOTO NUMBER:		n/a

STREET/ROAD NAME:		VAVDERZALM & ABBY (PRIVATE)
RAILROAD AND MILEPOST LOCATION:		SRY MP 15.22 / CPR MP 23.09
CROSSING TYPE:		PRIVATE
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		1 – GRAVEL WITH TIMBER CROSSING
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	NO
	FLASHERS	NO
	CANTILEVERS	NO
	CROSSBUCKS	NO
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	CHAIN & GATE / PRIVATE CROSSING SIGNS
CROSSING GEOMETRY:		~90DEG / TRACK IN CURVE
OBSERVED UTILITIES:		POWER LINES BOTH SIDES OF TRACK AND ACROSS TRACK
PHOTO NUMBER:		n/a

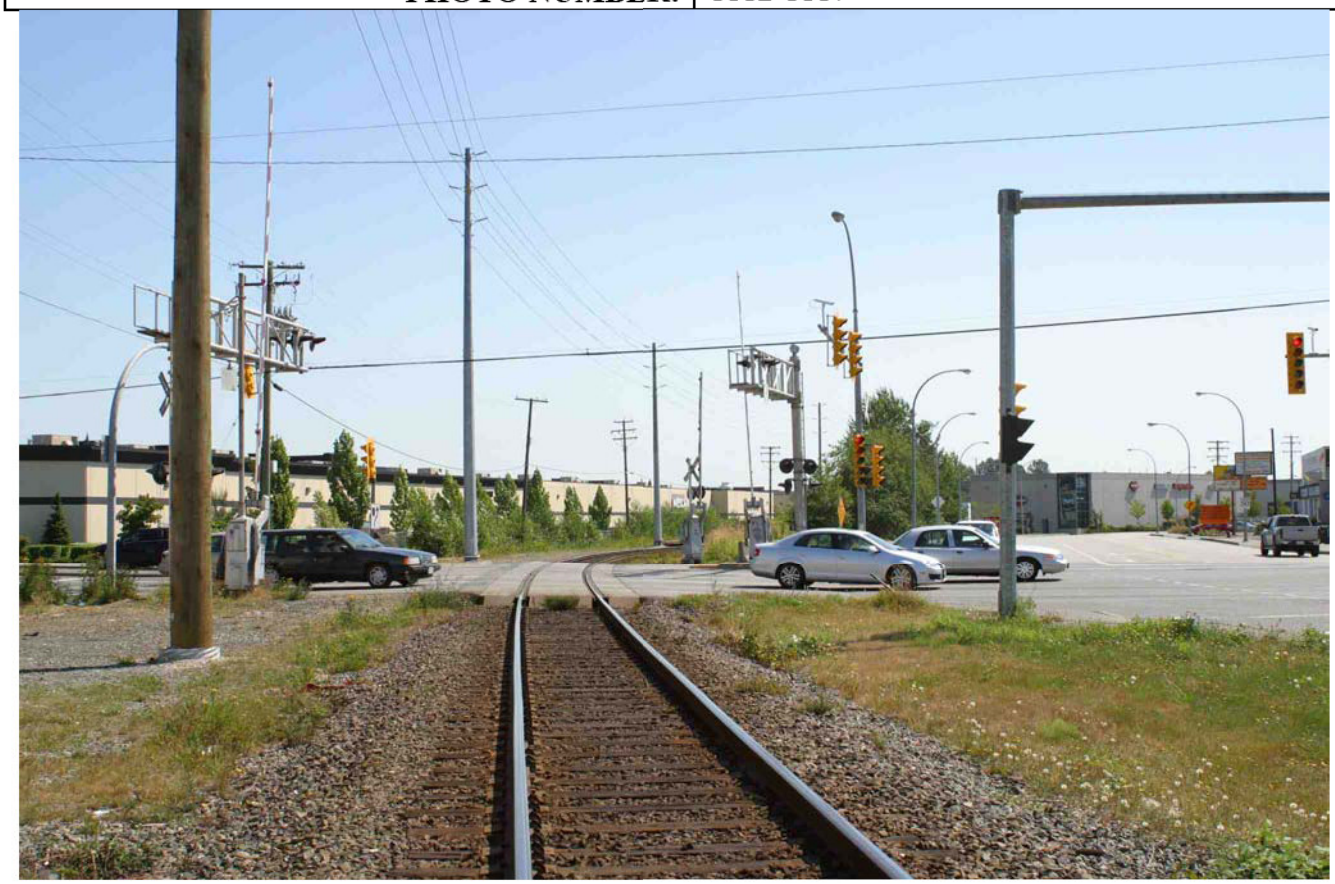
STREET/ROAD NAME:		54TH AVENUE (PRIVATE)
RAILROAD AND MILEPOST LOCATION:		SRY MP 15.98 / CPR MP 22.27
CROSSING TYPE:		PRIVATE
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN, 1 – INDUSTRIAL
NUMBER OF ROADWAY LANES:		NONE
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	NO
	FLASHERS	NO
	CANTILEVERS	NO
	CROSSBUCKS	
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	
	OTHER:	PIPE GATE / CONCRETE BARRIER / PRIVATE CROSSING SIGNS
CROSSING GEOMETRY:		STREET VACATED / PRIVATE CROSSING FOR PEDESTRIANS ONLY AT PRESENT / ACCESS TO CONSTRUCTION SITE
OBSERVED UTILITIES:		2 POWER LINES PARALLEL TO TRACKS ON NORTH SIDE
PHOTO NUMBER:		n/a

STREET/ROAD NAME:		56TH AVENUE
RAILROAD AND MILEPOST LOCATION:		SRY MP 16.25 / CPR MP 21.98
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		2 – BLACKTOP / CONCRETE CROSSING
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	YES
	BELL	YES
	FLASHERS	YES
	CANTILEVERS	NO
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	
CROSSING GEOMETRY:		~90DEG / CTC SIGNALS WEST OF CROSSING
OBSERVED UTILITIES:		2 POWERLINES PARALLEL TO RAILRAOD ON NORTH SIDE / OVERHEAD POWER AND COMMUNICATION LINES CROSS BOTH SIDES OF THE ROAD / DRAINAGE CANAL ON THE SOUTH SIDE
PHOTO NUMBER:		1104-1107

STREET/ROAD NAME:		196TH STREET
RAILROAD AND MILEPOST LOCATION:		SRY MP 16.56 / CPR MP 21.67
CROSSING TYPE:		CROSSING VACATED
NUMBER & DESCRIPTION OF TRACKS:		
NUMBER OF ROADWAY LANES:		
DIVIDED ROADWAY (YES/NO)		
CROSSING WARNING SYSTEM:		
	GATES	
	BELL	
	FLASHERS	
	CANTILEVERS	
	CROSSBUCKS	
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	
	OTHER:	
CROSSING GEOMETRY:		
OBSERVED UTILITIES:		
PHOTO NUMBER:		n/a

STREET/ROAD NAME:		FRASER HIGHWAY
RAILROAD AND MILEPOST LOCATION:		SRY MP 16.95 / CPR MP 21.28
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		4 – BLACKTOP / CONCRETE CROSSING WITH SIDEWALKS
DIVIDED ROADWAY (YES/NO)		YES
CROSSING WARNING SYSTEM:		
	GATES	YES – 2
	BELL	YES – 2
	FLASHERS	YES – MULTIPLE
	CANTILEVERS	YES – 2
	CROSSBUCKS	YES – 2
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	UNKNOWN
	OTHER:	
CROSSING GEOMETRY:		~60DEG
OBSERVED UTILITIES:		2 OVERHEAD POWER LINES NORTH OF RAILROAD / POWER AND COMMUNICATION LINES ALONG FRASER HIGHWAY BOTH SIDES
PHOTO NUMBER:		1108-1111

STREET/ROAD NAME:		200TH STREET AT LOGAN AVENUE
RAILROAD AND MILEPOST LOCATION:		SRY MP 17.13 / CPR MP 21.10
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		4 – BLACKTOP
DIVIDED ROADWAY (YES/NO)		YES
CROSSING WARNING SYSTEM:		
	GATES	YES – 2
	BELL	YES – 2
	FLASHERS	YES – MULTIPLE
	CANTILEVERS	YES – 2 (RAIL), 4 (HIGHWAY)
	CROSSBUCKS	YES – 2
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	UNKNOWN (EXPECTATIONS ARE YES)
	OTHER:	
CROSSING GEOMETRY:		~90DEG / TRACK IS IN CURVE
OBSERVED UTILITIES:		2 POWERLINES NORTH OF TRACK / POWER AND COMMUNICATION LINES ON BOTH SIDES OF 200TH ST.
PHOTO NUMBER:		1112-1117



STREET/ROAD NAME:		LANGLEY BYPASS
RAILROAD AND MILEPOST LOCATION:		SRY MP 18.10 / CPR MP 20.13
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		4 – BLACKTOP / CONCRETE CROSSING
DIVIDED ROADWAY (YES/NO)		YES
CROSSING WARNING SYSTEM:		
	GATES	YES – 2
	BELL	YES – 2
	FLASHERS	YES – MULTIPLE
	CANTILEVERS	YES – 2
	CROSSBUCKS	YES – 2
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	CONCRETE BARRIERS IN MEDIAN
CROSSING GEOMETRY:		~90DEG / TANGENT TRACK / LANGELY BYPASS IN CURVE AT CROSSING
OBSERVED UTILITIES:		
PHOTO NUMBER:		1118-1121

STREET/ROAD NAME:		MUFFORD CRESCENT
RAILROAD AND MILEPOST LOCATION:		SRY MP 18.23 / CPR MP 20.00
CROSSING TYPE:		PUBLIC
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		2 – BLACKTOP / CONCRETE CROSSING
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	YES
	BELL	YES
	FLASHERS	YES
	CANTILEVERS	NO
	CROSSBUCKS	YES
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	
CROSSING GEOMETRY:		~80DEG
OBSERVED UTILITIES:		GAS LINE UNDERGROUND / POWER LINE PARALLEL TO TRACK NORTH SIDE AND EAST SIDE OF MUFFORD CRES. / COMMUNICATION CABLE OVER TRACKS
PHOTO NUMBER:		1122-1125

STREET/ROAD NAME:		L.W. MUFFORD (PRIVATE)
RAILROAD AND MILEPOST LOCATION:		SRY MP 18.28 / CPR MP 19.95
CROSSING TYPE:		PRIVATE
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		1 – GRAVEL / PLANK CROSSING
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NNO
	BELL	NO
	FLASHERS	NO
	CANTILEVERS	NO
	CROSSBUCKS	NO
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	1 PRIVATE CROSSING SIGN
CROSSING GEOMETRY:		~80 DEG / RAILROAD IS IN A CURVE
OBSERVED UTILITIES:		POWER LINES PARALLEL TO TRACK NORTH SIDE
PHOTO NUMBER:		n/a

STREET/ROAD NAME:		COLUMBIA ESTATE LTD. (PRIVATE)
RAILROAD AND MILEPOST LOCATION:		SRY MP 18.54 / CPR MP 19.69
CROSSING TYPE:		PRIVATE
NUMBER & DESCRIPTION OF TRACKS:		1 – MAIN
NUMBER OF ROADWAY LANES:		1 – GRAVEL / RUBBER CROSSING
DIVIDED ROADWAY (YES/NO)		NO
CROSSING WARNING SYSTEM:		
	GATES	NO
	BELL	NO
	FLASHERS	NO
	CANTILEVERS	NO
	CROSSBUCKS	NO
	HIGHWAY TRAFFIC SIGNAL INTERCONNECT	NO
	OTHER:	2 PRIVATE CROSSING SIGNS
CROSSING GEOMETRY:		~90DEG
OBSERVED UTILITIES:		
PHOTO NUMBER:		n/a