TRANSPORTATION

Ministry of Transportation and Infrastructure

Evaluation of the E & N Railway Corridor: Commuter Rail

REPORT

IBI GROUP

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Executive Summary

This Report presents the Commuter Rail Assessment undertaken as part of the Evaluation of the E & N Railway[1] Corridor on Vancouver Island. The assessment was carried out to determine how a commuter rail service could operate within the corridor and what investment would be required to support various rail service concepts.

In 2008, the BC Ministry of Transportation issued a ***Provincial Transit Plan*** that included goals related to sustainable development, mode shift away from the private automobile and towards public transportation, and reduction of greenhouse gas emissions. These objectives provide a link between this study and the concurrent BC Transit Victoria Regional Rapid Transit Project, which has been evaluating rapid transit options in Greater Victoria. The commuter rail service is not considered to be a rapid transit alternative because its service would not be all day or high frequency, but it could serve as a complement for longer-distance trips within certain travel markets.

Table E.1 summarizes the set of service parameters used in the commuter rail assessment. BC Transit defined target service parameters for commuter rail within the Capital Region as input to this study. Theses inputs included six station locations, a 30-minute frequency, and 30-minute target running time between Langford and Victoria. This corridor assessment determined the railway improvements required to achieve this target running time, within appropriate safety standards. The analysis factored in the corridor condition, rail operating requirements, and accommodating other traffic such as VIA intercity services.

Table E.1 - Initial Commuter Rail Service Parameters

Service Parameter	Assumed Value/Range	Comments
Hours of service (weekdays only)	6:00 am to 11:00 am	Eastbound/Inbound peak service
	3:00 pm to 8:00 pm	Westbound/Outbound peak service
Service Headway	30 minutes	Peak period headway

Due to several factors, including numerous grade crossings with limited grade crossing protection, back-to-back curves in the alignment, and a combination of the two in several places, speed limit restrictions are currently imposed on the corridor. In combination with a slow operating requirement at the Johnson Street lift bridge, this results in a 'best case' running time of 36 to 48 minutes in the peak and off-peak directions respectively if only minimal improvements are made.

Improving the corridor to achieve the targeted 30 minutes travel time would require restoration of the ballast, ties and track to return it to a sustainable condition requiring only routine maintenance. In addition, many of the existing grade crossings would require flashing lights and/or gates to allow faster train operations. This would affect up to fifteen locations, and of these, up to four could qualify for grade separation due to higher traffic volumes; this determination would be case by case.

Due to the frequency of train service in the test concepts, trains would ideally need to pass at four new locations, requiring local double track, and storage sidings would also be needed at the

[1] Esquimalt and Nanaimo Railway.

terminal stations. A signal/control system would have to be installed to safely operate the commuter rail fleet due to the passing requirements and frequency of service.

Eight to twelve self-propelled rail cars operating in 2 or 3-car trains would be needed to provide the 30-minute frequency (allowing for travel time and layover), and maintain a spare train. Examples of potentially suitable vehicles have been deployed for diesel 'light rail' and commuter rail in Ottawa, Portland and north San Diego County (among others). These trains would require a light maintenance and storage facility along the alignment.

New stations would be needed including staff facilities at Westhills and at a combined intercity/commuter station in Victoria. From a passenger perspective, having the Victoria station closer to the commercial core and employment (Douglas Street) would be preferable, but this would require significant changes to city streets to dedicate areas for tracks and an in-street station. A provisional stop southeast of Johnson and Wharf is assumed at this time. Extending the alignment farther east could cost in the order of $15 to $30 million, assuming an at-grade solution addressing proximity to historic buildings, foundation/geotechnical issues, potential changes to traffic patterns and operations on adjacent and parallel streets, accesses to buildings and parking garages. A grade-separated extension would be cost-prohibitive as it would likely need to become elevated west of the harbour (due to grade limitations for rail) to clear Wharf Street, and then running on viaduct over city streets would have construction challenges and likely meet with strong resistance. Running underground would require starting a railway tunnel west of the harbour with an even more prohibitive cost.

Table E.2 summarizes the capital cost estimates for the system. This planning-level estimate has been developed in conjunction with the baseline conditions update, and includes restoration of the railway corridor from Victoria to Langford/Westhills, and additional improvements and equipment related specifically to commuter rail service. Costs for transit exchanges and parking were estimated by BC Transit.

Table E.2 - Commuter Rail System, Victoria-Langford – ROM Costs

Improvement Element	**Minimum System** (13km, shorter trains, 4 stations)		**Expanded System** (17km, longer trains, 6 stations)	
	Low	**High**	**Low**	**High**
Track and Ballast	$ 4,000,000	$ 4,140,000	$ 5,330,000	$ 5,330,000
Grade Crossings, Signals	$ 3,580,000	$ 4,000,000	$ 4,760,000	$ 4,760,000
Other Corridor Works	$ 920,000	$ 960,000	$ 1,200,000	$ 1,200,000
Stations and Fare Collection	$ 2,300,000	$ 2,650,000	$ 3,700,000	$ 3,700,000
Parking and Transit Exchanges	$ 11,000,000	$ 15,500,000	$ 11,000,000	$ 15,500,000
Maintenance and Storage	$ 5,970,000	$ 6,370,000	$ 7,960,000	$ 7,960,000
Spare Equipment	$ 2,250,000	$ 2,400,000	$ 3,000,000	$ 3,000,000
Operations Preparation	$ 380,000	$ 400,000	$ 500,000	$ 500,000
Design, Management, Insurance	$ 7,300,000	$ 8,740,000	$ 8,990,000	$ 8,990,000
Contingencies	$ 9,430,000	$ 11,290,000	$ 11,610,000	$ 12,740,000
Allowance for Grade Separation	$ -	$ 50,000,000	$ -	$ 70,000,000
Vehicles (self-propelled)	$ 22,400,000	$ 22,400,000	$ 32,000,000	$ 32,000,000
Total	**$ 69,530,000**	**$ 128,850,000**	**$ 90,050,000**	**$ 165,680,000**

The minimum system corresponds to the 4-station scenario ending in Langford (Peatt Avenue), and as such, shorter trains and improvements scaled back to 13 km are included. The 'expanded' system includes 6 stations, longer trains, and addresses the full set of track improvements from earlier in this section.

The estimated costs range from $70 million to $90 million for a basic commuter rail system with 4 to 6 stations. (These costs are shown in the 'low' columns.) The range of average costs for the fixed facilities, $3.4 to $3.6 Million per kilometre, is similar to the implementation costs for the O-Train in Ottawa and the Westside Express Service near Portland. Other commuter rail systems have seen costs as high as $20 million per kilometre where significant corridor and station construction was required, and right of way drove up the average costs. Capital cost estimates for facilities and track are fairly typical for cities restoring passenger service. Cost of passenger cars varies depending on how many cars per train you select, and what is built into purchase price; smaller operations tend to include provision for parts exchange.

In addition to the basic costs shown in the 'low' cost estimates, there may be potential grade separation costs. These typically cost $15 to 20 million per location depending on the layout and associated right of way needs.

Operations for 10 hours per day, 250 days per year at a 30-minute frequency would amount to 7,500 train-hours of service per year and would cost approximately $3.5 million annually (2009 $).

Extensions to Duncan (adding two stops) might be achievable at lower average costs provided the rest of the corridor could undergo less rigorous repair and upgrading, meaning the trains would be no faster than the current VIA service. A rock fall warning system for the Malahat segment would likely be required to support such a service extension.

Ridership estimates drawn from the passenger analysis, in conjunction with the estimated costs, suggest the service concepts would have a fairly high per-passenger initial cost to implement. The annualized value of capital costs and operations would be $9.5-$11.5 million (2009 $ + inflation for future costs) over a 25-year life for the improvements and rail cars (assuming no new grade separations). The resulting average cost would be $50-60 per passenger trip, where the operating cost portion would be $20-23 per passenger trip.

Lowering this average cost would require intensifying employment and population near the corridor. One could start by building ridership, evolving the service from a lower cost start point such as the VIA service with a commuter-friendly schedule.

Proposed E&N Rail Trail

ICF has signed an occupancy agreement with the Capital Regional District to install a rail trail in phases alongside the existing tracks. This has been designed to meet Transport Canada clearance requirements. An initial assessment of the preliminary design suggests there is one potential conflict between part of the trail and one of the sidings (MP 3.65 - 4.00) the commuter rail concept proposed to retain. Operationally, increasing train frequencies in the corridor means that trail users may have to wait at the grade crossings of the trail and tracks that are included in the design, and with higher train volumes these grade crossings might require an upgrade to the passive warnings that are planned for these locations. Provided that this type of delay was acceptable to trail users, the train and the trail could co-exist in the corridor.

1. INTRODUCTION

This report presents the Commuter Rail Assessment undertaken within the Evaluation of the E & N Railway[2] Corridor on Vancouver Island. This is one of a series of reports covering the freight, passenger, and tourism markets, the feasibility of commuter rail, and an update of railway corridor conditions and potential improvement costs.

This commuter rail assessment is also related to the Victoria Regional Rapid Transit Study. The focus will be determining the required improvements along the E&N corridor to support a potential commuter rail service between the West Shore and Victoria. The study will determine how a commuter rail operation would fit in and what investment would be required to support various levels of rail service. The evaluation also considers the potential for extending commuter rail service into the Cowichan Valley.

The purpose of this report is to present the following:

- Review of previous rail service studies for this corridor;
- Service Assumptions for commuter rail;
- Performance and infrastructure characteristics of the existing corridor;
- Required improvements and new facilities to support commuter rail service; and
- A summary of ridership estimates from the Passenger Analysis Report.

1.1 Background

Current passenger rail service on the railway is limited to one daily VIA train departing northbound from Victoria in the morning and returning from Courtenay in the afternoon. The train leaves Victoria at 8 a.m., arrives in Nanaimo two and a half hours later, and in Courtenay two hours after that (12:45 p.m.). Returning southbound trains leave Courtenay at 1:15 p.m., eventually arriving in Victoria at 6 p.m. Sunday service starts and ends two hours later. This functions as a form of intercity service most suited to excursions by Island residents and tourists heading away from Victoria, and has limited practical application for any form of commuting.

Over the past two decades, studies commissioned by BC Transit, the Capital Regional District and the Ministry of Transportation have all investigated forms of rail-based public transportation on the E & N railway corridor, including light rail and commuter rail to the West Shore and in some cases as far as Duncan. None of the studies and plans to date has led to the creation of a rail service on this corridor. The next section provides a review of three of the more relevant studies and identifies assumptions and outcomes of relevance to the current undertaking.

[2] Esquimalt and Nanaimo Railway.

1.2 Previous Studies

This section is focused on reviewing previous studies of commuter train alternatives in Vancouver Island. The documents were reviewed to gather overall understanding of the types of alternatives that were considered, their strengths and weaknesses and how practical they are. These previous works provided guidance to the concept development carried out in the current study.

The following documents were reviewed:

- *Victoria Light Rail Transit Implementation Strategy*, BC Transit (1996)
- *West Shore Tram Line Assessment*, Communities for Commuter Rail (2008)
- *West Shore Tram Line Assessment Technical Review*, BC Ministry of Transportation (2008)

Each document is summarized in the sections that follow, in terms of

- Report Title
- Report Author/s
- Agency
- Date of publication
- General Content
- Outcome of Study

Illustration:

The Sprinter service in northern San Diego County is marketed as 'light rail' but uses modern rail diesel cars. Service operates every 30-60 minutes between Oceanside and Escondido.

If regular service were started in Victoria, vehicles could look like this.

Report Title	**Victoria light Rail Transit Implementation Strategy** **Phase I – Alignment Evaluation Study**
Report Authors	N.D. Lea Consultants Ltd./City Spaces/Edwin Hull Associates Ltd.
Agency	BCTransit
Date of publication	September 1996
General Content	The study focused on identifying a preferred light rail corridor between downtown Victoria and the "Western Communities". In order to do so, the study investigated a large number of possible alignments, most of which were based on one of the two available rail corridors – Galloping Goose or the E & N railway corridor. For the purposes of the evaluation, the analysis of the alternatives was divided into a western section and an eastern section, for which the dividing point was the Colwood interchange. For the east section, the analysis determined that the Galloping Goose alternative is preferred over the E & N corridor, mostly because of its superior route with regard to connecting current and planned residential and employment centres; in addition, it was also predicted to provide easier implementation due to right-of-way issues. On the other hand, the E & N option was found to be preferable because of its shorter travel times, relatively low social and environmental impact, lower disruption of other transportation modes and the lower costs required for it. In addition to the alignments, the study also looked at a large number of possible station locations and evaluated each of them based on several factors such as accessibility, potential for future development and nearby facilities. In the end the study recommended 14 stations at the start of service and 3 more as potential for the future. The study also included a pretty elaborated service plan and ridership forecast. The service was supposed to work throughout the day at fairly high headways (15 min. headways at mid-day off-peak periods). Based on this service plan the study predicted that the car fleet needs to include about 30 light rail cars, based on forecast 2010 ridership.
Outcome of Study	Eventually the plan was not implemented, but some of the ideas in it are present in later studies.

Report Title	**West Shore Tram Line Assessment**
Report Authors	Colledge Transportation Consulting Inc./ DRE Transportation Solutions Inc./ Victoria Transport Policy Institute
Agency	Communities for Commuter Rail
Date of publication	January 2008
General Content	The purpose of this study was to investigate the feasibility of establishing a rail service between Langford and Victoria using the E&N rail alignment. The study was to be a mostly conceptual exercise in order to recommend if this idea should be taken to the next stage of a more detailed planning and design phase. The conceptual service plan the study develops suggests an initial service that would minimize start-up costs and provide financial viability so that it would allow implementation within a relatively short timeframe. The study considered only the E&N Railway line from Victoria to Langford. It suggested that in the first phase the service will include a route of about 18 km with five stations located at Westhills, Langford, Atkins Road, Esquimalt and Victoria. The study suggests that future expansions of service could include a station in the vicinity of the Victoria City Hall as well as service to places like Duncan and Nanaimo. The suggested service was assumed to be carried out by one train-set that shuttles back and forth between Westhills and Victoria. The train-set would depart from one endpoint station on the hour and from the other on the half-hour (resulting in one hour headways). To accomplish this, the travel time in each direction should be about 23 minutes, leaving 7 minutes for turnover, with the service operated mainly at peak hours (10 hours per week day). Since the study was a conceptual exercise it included a large number of assumptions regarding the service; some examples include: • Ridership numbers are estimated as percentages of bus and car users in the corridor; • It is assumed that the tracks and service could be extended to city streets without causing major traffic disturbances or safety issues; • It is assumed that lack of park-and-ride facilities in most stations will not have adverse affect on ridership; • It is assumed that some of the current grade level crossings could be eliminated; • The capacity of one train-set will suffice for the demand in the corridor and will be able to meet the conceptual schedule.
Outcome of Study	The coalition submitted the paper to the Island Corridor Foundation and the findings were shared with the Ministry of Transportation. Independent studies of certain technical aspects were carried out in the immediate aftermath of this paper, including travel time feasibility analyses by the railway operator (SRVI).

Report Title	**West Shore Tram Line Assessment** **Technical Review**
Report Authors	IBI Group/Giffels Associates Limited
Agency	British Columbia Ministry of Transportation
Date of publication	July 2008
General Content	The report is a conceptual review of the previous study. The report follows the "West Shore Tram Line Assessment" and comments on assumptions made by that report, providing alternative suggestions in some cases. The review compares the assumptions of the previous study with actual O-Train rail service. Some of the main issues the report raises are: • The study did not take into consideration the possible resistance from residents adjacent to the railway that may find the tram line implications to their property values unacceptable • The West Shore Tram Line Assessment report assumes approximately a 0.5% to 0.8% population usage benchmark, which is extremely optimistic; especially considering that the line lacks a core institutional ridership base (like a university, for example), it does not reach Douglas Street which is the business centre. Parking supply is not explicitly provided at stations. • The conceptual peak service was only hourly with limited flexibility for riders. • There is also risk to reliability from operating only one train-set, this means that any equipment malfunction or maintenance needed may result in disruptions to service or even service stoppage • There is an inherent service delay risk at the Johnson Street drawbridge. The E&N operating rules require trains to stop, and then proceed with approval at 5 miles/hour. • It would be very difficult to achieve the suggested 23 minutes travel time of the service without major infrastructure investments; • The existence of a parallel service by VIA rail on the same tracks as the tram service potentially introduces scheduling conflicts (or safety risks); • The suggested road closures involve community consultation with low probability of success; • Each level crossing must be reviewed by Transport Canada as to its safety level and be upgraded as required. This could be an expensive or time-consuming procedure.
Outcome of Study	The report was produced as an information item, and as such, some of the technical commentary is being carried into this current study.

2. SERVICE ASSUMPTIONS

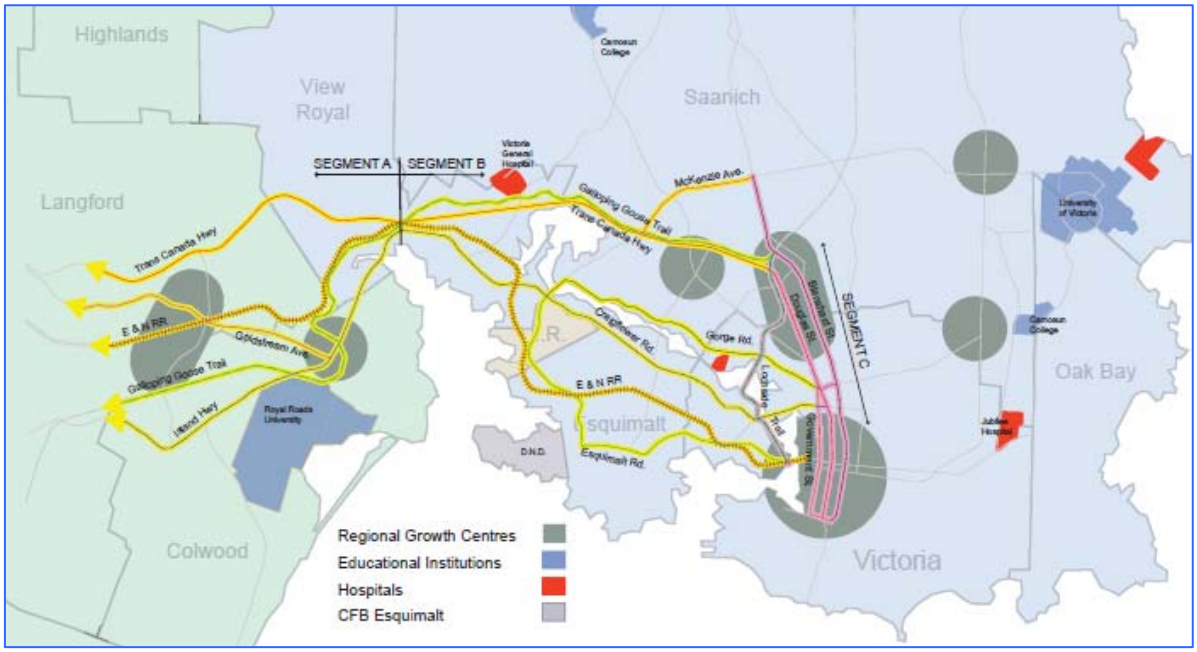
This chapter outlines the rationale for the commuter rail assessment and the service requirements built into the evaluation, including the set of rail stations defined for both this study and for BC Transit. In addition, this section outlines the relationship of commuter rail with other transportation services in the corridor.

2.1 Relationship to BC Transit Study

BC Transit is conducting its Victoria Regional Rapid Transit Study (VRRTS) to develop a Master Plan for higher-order transit systems in the Capital Regional District (CRD). A focused review of rapid transit alternatives between the West Shore communities and Victoria is being carried out within the first phase of VRRTS. BC Transit is evaluating several different corridors in terms of how each could serve the travel market and provide rapid transit services such as rapid bus, light rail or commuter rail. **Exhibit 2-1** shows the range of alternatives under study by BC Transit. The E & N railway corridor, from Langford through View Royal and Esquimalt to downtown Victoria, forms part of several alignment combinations in the BC Transit study.

E&N Commuter Rail would not be Rapid Transit as it does not have better than 15 minute service frequency, now would it operate 18 hours per day, 7 days a week. A Commuter Rail service could supplement the existing transit system and investments in the transit system will still be required regardless of E&N commuter rail materializing.

Exhibit 2-1: BC Transit Study – West Shore Alignment Options



Source: BC Transit

This current report has been developed to complement the BC Transit work by focusing on the requirements and the implications of a commuter rail service on the E & N railway within the CRD. BC Transit has defined a set of service objectives and targets for commuter rail service, and is providing assumptions on the potential layout and size of park and ride lots and transit exchanges at some of the station sites being studied.

This evaluation for BC MoT defines several options to operate commuter rail within the railway corridor and then providing the associated costs for infrastructure and operations. The evaluation also considers two other aspects of the commuter rail operation:

- It considers the context of other existing and potential uses of the rail corridor, including long-haul passenger service, freight, and use as a recreational trail; and
- It considers a service extension beyond the CRD boundary into the Cowichan Valley. Other longer-haul passenger services (serving the entire corridor) are the subject of the Passenger Analysis Report.

2.2 System Requirements

For the purpose of comparing different rapid transit alternatives, BC Transit identified several broad operating parameters for a commuter rail service based in Victoria. These initial assumptions are summarized in Table 2-1.

Table 2-1: Initial Commuter Rail Service Parameters

Service Parameter	Assumed Value/Range	Comments
Hours of service	6:00 am to 11:00 am	Off-peak and weekend travel would be served by other transit modes.
	3:00 pm to 8:00 pm	
Days of Service	Monday to Friday	
Travel Time (Desired)	25 to 30 minutes	Represents Westhills to Victoria
Stopping Time at Stations	30-60 seconds each	Dwell time for passengers to board and alight
Service Headway	30 minutes	Peak period headway
Peak Hour Capacity	575 passengers in peak direction	Estimated 1-2 years after start-up of service

The hours of service assume at a minimum that peak direction service would be provided into Victoria during the morning peak and mid-morning and outbound service from Victoria during the afternoon peak and early evening. To keep the size of the fleet of trains reasonable, reverse commute service is assumed within this study so that some or all of the trains can serve more than one peak direction trip per period.

The travel time objective was defined to provide a competitive travel time between the West Shore and Victoria, with the understanding that this assessment needs to review the feasibility of meeting this objective based on the existing and potential railway operating conditions. The 30-minute concept was intended to include travel time plus a turn around at the ends of the route.

The stopping time at stations is based on typical practice by other commuter rail operations such as West Coast Express (in Vancouver) and Sounder (based in Seattle). The minimum required dwell time at a station is a function of the number of passengers boarding and leaving the train, the number and arrangement of the doors, and the accessibility of the train. Higher-floor trains such as the Budd cars used on the VIA service take longer because they involve stepping up into the train from the platform. The 30 to 60 second range of times is typical of commuter rail services using bi-

level passenger cars where the train door is a small step up from the platform. The dwell time at the end stations in Victoria and Westhills would be longer to account for schedule recovery and required layover to switch the direction of train operations.

The service headway of 30 minutes during the peak is representative of most commuter rail systems during the peak period. It is also fairly standard to operate every 30 to 60 minutes during the off-peak period. Only the busiest commuter rail corridors in North America (including the operations centred in New York, Chicago, Toronto and Montreal) offer more frequent commuter rail service to meet the highest peak period demands in their busiest corridors.

The peak hour capacities indicated by BC Transit are based on the estimated market potential for the corridor, derived from analysis of travel patterns as part of the VRRTS. This capacity figure is an input to the number of peak hour train cars that need to be operated in the peak direction.

2.3 Rail Stations

The E&N corridor has several stations associated with the current VIA 'Malahat' train that operates daily out of Victoria. These include the Victoria terminal station (at Pandora and Wharf, east of the Johnson Street Bridge), a trackside 'flag stop' in Esquimalt, and small stations at Fort Victoria Trailer Park and in Langford. Not all of these station locations are suitable for commuter rail service and none except the Victoria station offers any passenger amenities.

The previous studies of light rail and commuter rail in this corridor identified potential stations between Langford and Victoria, including options in Langford, View Royal, Esquimalt and Victoria. For the purpose of the current study, the following stations were selected by BC Transit:

- Victoria: The downtown location may remain near the current VIA terminal, but there is a preference from a service planning perspective for a location more central to employment and frequent transit connections;
- Esquimalt: The conceptual location is at Admirals and Coleville, adjacent to part of the Canadian Forces Base;
- Six Mile: This conceptual station in View Royal (replacing the Fort Victoria VIA stop), with its proximity to the Island Highway, is a strong candidate for a park-and-ride hub;
- Atkins is a provisional future station, depending on intensification of development in the adjoining neighbourhood;
- Langford – Downtown is proposed by the City to be located on Station Avenue west of Peatt (replacing the VIA stop), where a transit exchange was recently constructed; and
- Westhills is a conceptual future station to serve western Langford once it develops and there is a large enough travel market to serve.

Exhibit 2-2 is a map of the E & N Railway focusing on the Capital Region, showing the portion of the corridor that overlaps the BC Transit study and this core group of four initial stations and two future stops. The highlighted segment from Victoria to Westhills is 16.4 kilometres following the railway alignment.

Beyond the corridor segment that is also being studied by BC Transit, this Commuter Rail Assessment is also looking at extensions of service in the form of more frequent VIA-style service, and an extension of commuter rail into the Cowichan Valley. A service from Victoria to Duncan, for example, would run for 64 km, which compares closely to the 69 km between Vancouver and Mission on the West Coast Express.

Stations for an extended service option between Duncan and Victoria would include:

- Within the CRD: Victoria, Esquimalt, Six Mile, (Atkins in future), Langford, (Westhills in future);
- Shawnigan Lake; and
- Duncan.

Service beyond this point, for instance to Nanaimo, Parksville, Qualicum and Courtenay, is being considered in the ***Passenger Analysis Report.*** Extended corridor service could potentially take the form of additional/enhanced VIA-style services.

2.4 Relationship with Other Transportation Services

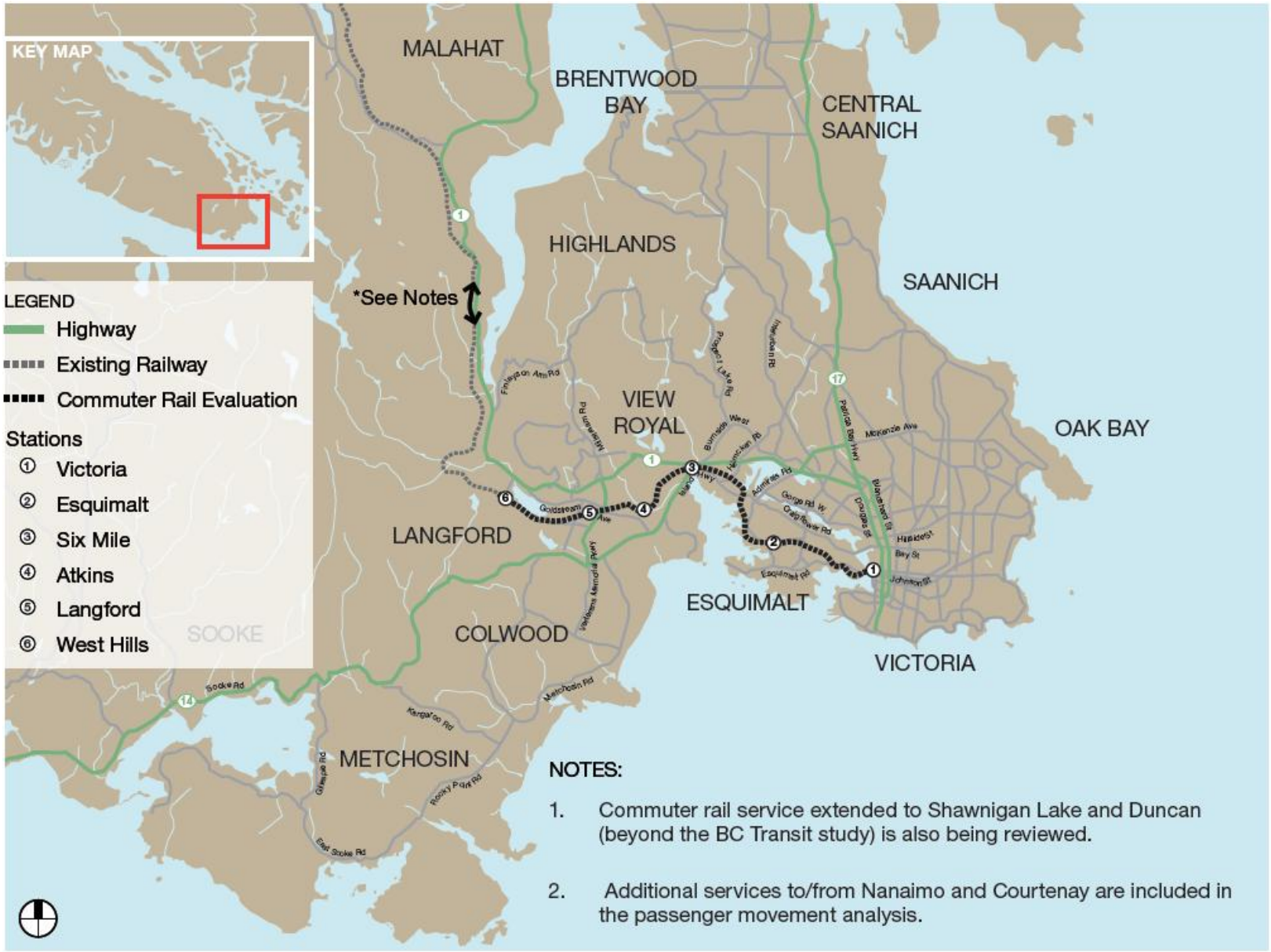
On the railway corridor itself, a commuter rail service would have to co-exist with intercity passenger rail, and might potentially see a resurgence of freight service to this portion of the E & N Railway in the future. The conceptual commuter rail service would also form a component of the regional transit network; this is being studied by BC Transit and has implications for the current assessment. The following descriptions outline the basic assumptions related to existing and potential future conditions within and related to the corridor.

Intercity Train Service

The current VIA service operates over the same corridor, and in the event of commuter rail service this would result in sharing of the corridor by the two passenger services. The following broad assumptions are made within this analysis:

- Any new commuter rail stations in this section of the corridor would also be served by the VIA trains, in lieu of the existing VIA flag stops;
- At a minimum, the current outbound departure from Victoria at 8 am on weekdays, and the inbound arrival around 6 pm, would be accommodated within the operating schedule of the commuter rail service;
- Weekend VIA operations would not affect commuter rail but the VIA trains may benefit from improvements made to accommodate both types of service on weekdays;
- Options for expanded intercity service would include inbound and outbound trains at least once during the morning peak period, and once or twice during the afternoon peak. These train movements would also be accommodated within the appropriate commuter rail service options;

Exhibit 2-2: E & N Commuter Rail Study Corridor



- The intercity trains would terminate at Victoria station. Typical layover times for intercity trains at the terminus can exceed 30 minutes. Since this is longer than the intended headway for the commuter service, commuter trains are likely to be arriving, briefly laying over, then departing while the intercity train is present; and
- The overnight storage for the VIA trains (Budd cars) is currently the E & N Roundhouse south of Esquimalt Road. This location would apparently remain open in the future since the developer of the site proposes to keep the rail maintenance function onsite. Alternatively, the VIA trains might be based out of Nanaimo, where the current operator (Southern Railway of Vancouver Island) already bases its other operations.

Freight Service

Historically, the Victoria area had enough freight and passenger demand for the E & N railway and the CN Railway (Tidewater subdivision) to exist for nearly eight decades. Following a decline in forest industry and other shipments through Victoria, the CN railway lines were abandoned in the early 1990's and these have since been converted to regional trails (e.g. Galloping Goose, Lochside Trail). Currently, there is little to no railway freight activity south of Duncan. However, the potential for railway shipments has been identified by corridor stakeholders, subject to potential upgrades to the railway corridor to sustain the loads that freight would entail, and also subject to the economic/price feasibility to shippers.

The following broad assumptions are made within the commuter rail analysis:

- No freight movements are scheduled during the times of day that commuter rail is conceived to operate;
- Unused freight cars currently sitting on sidings between Langford and Victoria would be moved if necessary to free up the tracks for commuter rail operations;
- Improvements proposed within the corridor would not preclude future freight service.
- The scope and cost of improvements within the Langford – Victoria segment will be restricted to what would be required to support commuter and passenger rail operations. Incremental changes to sustain heavier freight loads, such as higher capacity rails, would not be included except where already necessitated by the safe and efficient operation of passenger service.

Public Transit Service

The BC Transit study is defining specific assumptions related to other public transit services, and the key assumptions are identified here:

- Local and regional buses would be reconfigured to connect to the commuter rail stations where logical (without causing undue disruption to current routes that serve established travel patterns);
- The stations at Langford and Six Mile Road would include transit exchanges and park-and-ride lots;
- Parking would also be provided at other stations except in downtown Victoria.

Accessibility of Victoria Terminus to Regional Transit and Downtown Employment

It is recognized by both the commuter rail assessment and the BC Transit study that the current location of the Victoria station (on Pandora Street east of the Johnson Street Bridge) is not optimal from a customer perspective.

In the course of the evaluation, several generic options for a terminus station have been identified:

- Near the current terminal east of the bridge;
- On Johnson Street at a location closer to the downtown core, providing a shorter walk to Douglas and Blanshard Streets; and,
- West of the bridge.

Since resolution of these options is beyond the scope and timing of the current study, a brief commentary on the pros and cons of these options is documented in Appendix C. This does not represent a formal recommendation.

For the purpose of the initial commuter rail assessment, an expanded commuter rail/intercity railway terminus is assumed to be located just east of the Johnson Street Bridge.

Illustration:

The current Victoria E & N station was constructed in 1985 in a heritage style. This is at the edge of the downtown area. The building sits between the track and Pandora Street, with the Johnson Street

3. EVALUATION OF CURRENT CORRIDOR

This section summarizes an evaluation of the current railway corridor's capacity to provide commuter rail service, taking into consideration the track condition, alignment, grade crossings and other features. This forms the basis for defining corridor improvements that would allow a conceptual rail service to meet the service objectives defined in Section 2.

3.1 Train Travel Time

Travel time and service reliability are two of the main consideration prospective users would consider when deciding to ride the train. The following analysis reflects the travel times achievable on the existing railway corridor.

3.1.1 CURRENT TRAVEL TIME

In the existing corridor, the train must obey a set of speed limits that ranges from 5 to 40 miles per hour (8 to 65 km/h), and these are dictated by passenger comfort and safe operation on curves in the railway alignment, grade crossings, condition of the signals, and other constraints along the alignment. These are explained in Section 3.2.

Based on the track schematics for this portion of the Victoria subdivision, additional input from SRVI on the location of current slow orders, and the station locations identified in Section 2.3, **Table 3-1** presents estimates of the travel times between stations based on one-way operation of a train towards the current terminal in Victoria. Stops of 0.5 minutes at each intermediate station are assumed.

Table 3-1: One-Way Commuter Rail Travel Time on Existing Tracks

Station	Distance from Victoria (km)	Distance between Points (km)	Travel Time between Points (min)	Cumulative Travel Time (min)	Average Speed over Segment (km/h)
Westhills	17.2				
Langford	13.3	3.9	4.4	4.4	52.2
Atkins	11.1	2.2	4.4	8.8	31.4
Six Mile	8.9	2.2	4.6	13.4	29.2
Esquimalt	3.4	5.5	11.9	25.3	27.2
Victoria	0.0	3.4	10.7	36.0	19.3

This travel time reflects current operating rules in the corridor and does not account for the presence of other trains, which can affect the scheduling of service.

3.1.2 SERVICE RELIABILITY

Reliability is a general term that describes the ability of a service to operate according to its published schedule. The reliability of the service is one of the most important attributes of the service for potential passengers. Commuters will consider the train as a viable alternative to the

automobile only if there is a high confidence of the train meeting its schedule so they can be sure to be at their destination (work) on time.

The potential reliability of the service is determined by the number of tracks as well as the number and length of the sidings and passing locations that the railway provides. Additional tracks, sidings and passing locations provide greater flexibility to operate more frequent trains in two directions and also to recover from schedule deviations. The current E&N railway includes only a single track with limited sidings and passing locations. This is not a particular problem for the way the current service is performed (one inbound and one outbound train per day) but it introduces difficulties to a higher frequency service because trains operating in opposite directions need to be able to pass.

The current sidings limit the passing opportunities to two locations (MP 3.65-4.00, west of Hallowell Road in View Royal and MP 7.95-8.19, west of the Langford VIA station). If only these sidings were retained, outbound a.m. peak trains would have to be held at these sidings until inbound a.m. trains passed, and the opposite would hold true for afternoon service. The travel times between these sidings are an average of 12 minutes. This would increase the round trip time for all trains and also constrain peak direction trains to operate within certain time windows. In addition to routine scheduling issues, the lack of passing locations means unexpected that affect one train could ultimately affects all trains since their operations are linked together by the meet locations and passing requirement. This would be offset by having additional slack in the schedule, which deters passengers and also potentially increases fleet requirements because of lower schedule efficiency.

3.2 Existing Operational Conditions and Constraints

The current conditions of the railway present some constraints to its operation. This section elaborates on the current condition of the corridor and its operational implications.

3.2.1 TRACK INFRASTRUCTURE – GENERAL CONDITION

The corridor was originally constructed over 100 years ago and parts of the current railway require basic repairs to the track, ties and ballast. The current operator has been conducting a cost-constrained program of emergency maintenance to address the worst of the deficiencies, but the corridor cannot realistically support a frequent rail service in its current state. The most significant issues include:

- The track bed is sometimes overgrown with weeds during parts of the year, leading to drainage problems within the ballast.
- The drainage problems and the age of the ties have led to degradation and rot. Ties in this condition do not properly support the rails and areas with a higher percentage of deficient ties result in sway of the train as it passes over. This results in speed limits being placed on train operations.
- The tie plates that secure the rails to the ties are often loose or broken, allowing the rail to move when a train passes over. This is a potential safety problem.
- One of the two passing sidings plus the spur into the VIA maintenance site (the historic round house) appear to be overgrown with weeds and grasses.

The illustrations on the following page depict the degraded corridor condition in the Victoria – Langford segment of the railway. The implications of the track bed and track condition are explored in more detail within the ***Baseline Conditions Update***.

Illustrations (top): Overgrown track bed in Langford (left); Approaching Atkins grade crossing (right); and (bottom): Trackside growth in View Royal (left); weed infestation at spur line to roundhouse (right).

3.2.2 STATIONS

This is the current status of station infrastructure in the Langford-Victoria corridor:

- No stations are present at the conceptual Westhills, Atkins, Six Mile or Esquimalt locations.
- There are small shelter-style flag stops for VIA trains at Langford and Palmer-Fort Victoria. Neither location has any passenger amenities other than partially covered benches. These locations are not conceived as commuter rail stops (as discussed in Section 2.3). This type of stop is illustrated on the next page.
- The City of Langford has recently constructed a new station which comprises an enclosed building and several bus loading areas, but no platform or loading area for the train. This was intended by the City to act as a transit exchange and to ultimately replace the Langford VIA stop near Goldstream Avenue.

- Other than pay parking near the Victoria station (shared with other businesses), none of the stops feature any parking supply.

Beyond Langford, the corridor includes flag stops with limited facilities at several locations including Shawnigan Lake, and a small station building in Duncan.

Illustrations (left): Station building recently constructed by City of Langford at Peatt Avenue, intended to replace the current VIA stop; and (right): shelter-style VIA stop at Palmer-Fort Victoria.

3.2.3 GRADE CROSSINGS AND SPEED RESTRICTIONS

There are 25 grade crossings of the railway between the station in Victoria and Westhills, including 23 arterial and local streets and 2 pedestrian crossings. There are also 12 existing grade-separated crossings, including the Johnson Street lift bridge, 10 other railway bridges over various streets and trails, and one overhead pedestrian bridge. At least one additional crossing, likely at grade, is planned in the western part of Langford.

The type of crossing protection at the grade crossings includes full signals and gates, signals with warning signs, and stop signs with cross-bucks to warn traffic of the presence of the track. The current rail corridor only sees two train movements per day and nearly all crossings are at single track locations, therefore the level of protection is sufficient for the amount of traffic and the speeds to which the trains are restricted.

Exhibit 3-1 is a summary inventory of the crossing locations in the Langford-Victoria segment of the corridor, indicating the locations, types of crossing and protection currently in place. It also shows the speed limits placed on the train operation through this area. Nominally, the speed limits would be 40 miles per hour (64 km/h) for passenger service and 30 miles per hour (48 km/h) for freight, which is achieved only west of the built up portion of Langford. Due to the number of grade crossings and curves in the railway alignment that limit sight distances, allowable speeds are currently lower as indicated.

Exhibit 3-1: Street Crossings and Landmarks – E & N Railway – Victoria to Langford

ID	Location	Subdivision	MP	metres	Type of Crossing	Protection (Existing)	Current Speed	Restrictions	Existing Sidings
0	VIA Station - Victoria	Victoria	0.00	-	station				
1	Harbour (Johnson Street Bridge)				Bridge			5	
2	Pedestrian Trail	Victoria	0.16	254					
3	Johnson St./Esquimalt Rd	Victoria	0.20	322	Underpass		15		
4	Tyee St./Songhees	Victoria	0.37	595		Lights			
5	Saghalie	Victoria	0.57	917					0.38-0.77
6	Catherine St./Kimta	Victoria	0.77	1,239		Lights/Gates			
7	Mary St.	Victoria	0.83	1,335					
8	Russell St.	Victoria	0.88	1,416					
9	Esquimalt Rd.	Victoria	0.95	1,529		Lights			
10	Wilson Rd.	Victoria	1.10	1,770		Lights			
11	Hereward St.	Victoria	1.30	2,092	Underpass				
12	Devonshire/Fairview	Victoria	1.57	2,526				10	
13	Lampson St.	Victoria	1.75	2,816		Lights	30		
14	Hutchinson Ave.	Victoria	2.14	3,443					
15	Intervale Ave.	Victoria	2.29	3,685					
16	Admirals Rd./Colville	Victoria	2.53	4,071		Lights			
17	Maplebank Rd.	Victoria	3.12	5,020			25	10	
18	Thomas Rd.	Victoria	3.37	5,422					
19	Hallowell Rd.	Victoria	3.65	5,873					3.65-4.00
20	Pedestrian Path	Victoria	3.90	6,275	Underpass				
21	Old Island Hwy	Victoria	4.01	6,452	Underpass				
22	Helmcken	Victoria	4.50	7,241	Underpass				
23	Burnett	Victoria	4.81	7,739		Lights			
24	Palmer Station (VIA)	Victoria	4.84	7,788	station				
25	Kislinbury Ln.	Victoria	5.03	8,093					
26	Adams Place	Victoria	5.20	8,367	Underpass				
27	Island Hwy/Burnside Rd	Victoria	5.30	8,528	Underpass				
28	Bryon Rd.	Victoria	5.50	8,850	Underpass				
29	P.J. McNeaney (private)	Victoria	5.63	9,059				10	
30	Six Mile Rd	Victoria	5.80	9,332	Underpass				
31	Jones/Chilco (tunnel closed)	Victoria	5.97	9,606	Underpass				
32	Atkins Rd.	Victoria	6.90	11,102		Lights		10	
33	Pedestrian	Victoria	7.44	11,971	Overhead				
34	Goldstream/Veterans	Victoria	7.90	12,711		Lights			
35	Langford Station (VIA)	Victoria	7.95	12,792	station			10	7.95-8.19
36	Peatt Rd.	Victoria	8.30	13,355		Lights/Gates			
37	Jacklin Rd./Station Ave.	Victoria	8.52	13,709		Lights			
38	Pedestrian - Ed Nixon Trail	Victoria	9.30	14,964			40/30		
39	Langford/Westshore	Victoria	10.30	16,573	future				
40	Humpback Rd.	Victoria	10.70	17,216					

In the exhibit, four grade crossings are identified where the existing VIA train has to reduce speed to 10 miles/hr (16km/hr) because of limited sight distances and the type of protection in place. These locations are generally on curved sections of track where the grade crossing is only marked by a warning sign and has no active signal:

- Mile 1.57 at the crossing with Devonshire – this slow order is in place for approximately 700 meters. East of here, the train may proceed at 15 mph and west of here at 30 mph (mile/hr).
- Mile 3.12 at the Maplebank Rd. crossing – this affects about 200 meters. On either side of this restriction the train may proceed at 25-30 mph.
- Mile 4.2, west of the Old Island Highway underpass – the train slows down from 25mph to 10mph for about 750 meters.

- Mile 5.62 at the McEneaney private crossing – the train reduces speed from 25 mph to 10 mph for approximately 50 meters and then resumes its previous speed.

There is a fifth slow order location at MP 7.95 where trains are crossing the switch onto the siding north of the mainline track. This is adjacent to the current Langford VIA stop.

3.2.4 JOHNSON STREET BRIDGE

In addition to the low level of flexibility that the current infrastructure provides, there is also an element of the railway that inherently reduces the reliability of the E&N railway service. The Johnson Street drawbridge at the entrance to Victoria's inner harbour is located 0.1 miles from the Victoria station. The current rules require trains to stop before the bridge, which lifts to allow boats to get into the harbour, and proceed at 5 miles per hours once they receive clearance.

The City of Victoria has indicated the bridge typically opens six times per day, each time for approximately five minutes. While this is mostly expected to be off-peak, there is a potential that trains and passengers will be isolated at the Victoria terminus from the rest of the line and create delays of schedule that may affect the location of train meets for passing, arrival times and schedule at other stations as well as the ability to coordinate transfers with other transit service at other stations.

The City proposes to replace the current bridge (the "Blue Bridge") with a new structure immediately to the north. New railway tracks would be included on the southern half of the new bridge, which would require only a minor change to the railway alignment. The roadway would be relocated on the north side of the bridge, with the current grade separation at MP 0.20 retained to serve an access road to developments south of the railway. On the east side of the bridge, the reorganization of the roadway to north of the tracks would require the existing Victoria station to be relocated 100-200 metres south, possibly along Wharf Street.

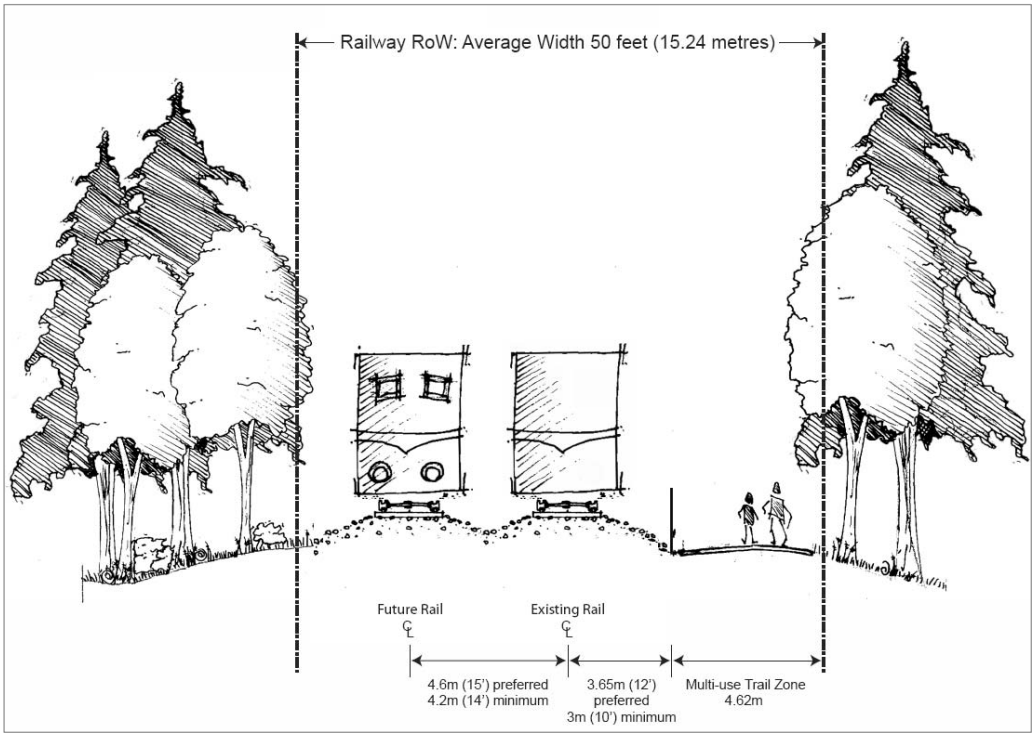
3.2.5 PLANNED RAIL TRAIL

The Island Corridor Foundation (ICF) has signed a 25-year occupancy agreement with the Capital Region District (CRD) to allow for the presence of a rail trail along the E & N railway from the Johnson Street Bridge to Humpback Road in Langford. It is proposed to construct this mixed use facility in stages starting as soon as September 2009.

Design criteria and typical cross sections have been developed to demonstrate how the rail trail would fit within the right of way where it is 100 feet (30.4 m) or 50 feet (15.2 m) wide. In both cases, the cross section depicts safety fencing installed between the track and the trail; therefore, it is assumed that this safety enhancement is included in the rail trail program.

The one area where there was some potential concern is the cross section within the 50-foot right of way. This is depicted in **Exhibit 3-2**, and it relates to the flexibility to construct a second track for passing purposes in the narrowed part of the corridor.

Exhibit 3-2: Proposed Trail in 50-Foot Railway Corridor



Source: Island Corridor Foundation

Assuming that the existing track is in the centre of the railway property, then the multi-use trail zone as depicted would co-exist well with the single track. The illustration shows the fencing set at a clearance of 3 m from the centre of the existing track. The addition of a second track to accommodate passing manoeuvres where trains meet presents a challenge. The recommended distance between the track centrelines is 15 feet (4.6 m) as noted on the diagram. This leaves a distance of 3.0 m from the centreline of the future track to the edge of the right of way. This may require slower operations where buildings or other structures are present at the right of way line, although there are currently few places in the corridor where this holds true.

A review of the 90% designs of the first phase of the E&N Rail Trail revealed several key facts:

- The proposed cross sections for the rail trail within the corridor meet Transport Canada/Railway Association of Canada minimum clearance standards (2.7 metres or greater) from the centre-line of track to the fencing or barrier delineating the trail.
- The planned provision of fencing and barriers by the trail will mitigate trespassing on the tracks and help reduce safety-related risks.
- The planned trail is generally south of the railway tracks but crosses to the north along four separate segments: in Langford, in Esquimalt and twice in Victoria. These crossings have varied impacts. At the most basic level, these crossings preclude passing tracks at these locations since neither side of the existing railway would be clear.
- In five places, the design includes new grade crossings of the trail and the railway track. Given the existing low volume rail traffic, these crossings consist of pre-cast concrete pavers between the tracks to create a level crossing for the trail, plus railings or bollards to slow trail users down and warning signs and crossbucks to alert them to the railway. Notwithstanding any requirements to address safety with the operation of the existing VIA train, increasing the

frequency of train service might warrant crossing lights and bells and possibly active gates to limit intrusion by trail users when it isn't safe. The locations noted from the plans include:

- Between Songhees and Saghalie Road;
- East of Catherine Street
- Between Mary and Catherine Streets
- West of Hereward Road; and
- West of Peatt Avenue.

- The trail would also cross the railway at Admirals Road and at Jacklin Road, making use of the existing and planned intersections. At these locations, trail users would be expected to heed the warning systems for approaching trains (flashing lights and bells, and also gates at Jacklin). These locations represent places where activity would increase but no new physical crossings due to the trail.
- The design for the trail called for the removal of the existing railway siding (not in optimal condition) between Hallowell Road and Old Island Highway. Within the commuter rail concept, this track – west of the main line -- would have been restored and used as a passing location for inbound and outbound trains according to the train movement chart in Section 4.3.2. Constructing a new siding on the other (east) side of the existing track may be constrained by topography and right of way. Because the railway is somewhat above the grade of the surrounding land, putting a new track in on the east side could require new fill slopes extend ing past the property line, or a retained railway embankment. In light of this, CRD will consider locating the trail slightly farther west within the right of way such that a new siding would be feasible between the existing main line and planned trail. The other sidings identified by the concept (based on a train movement analysis at the planning level) do not appear to be directly constrained by the trail.
- The specific placement of the trail is compatible with the concept's commuter rail stations.
- If a commuter rail storage and maintenance facility were located in Langford, then the trail could end up being on the same side of the main railway track. If this were the case, then the siding into the rail facility would cross the trail. Since the commuter rail service is conceptual, a specific site is an unknown right now and this point may never become an issue.

3.3 Service Improvement Options

This section describes a number of incremental commuter rail service options, starting with the existing corridor as a benchmark. It is not recommended to operate a commuter rail service without making improvements to the corridor and investing in supporting facilities.

Under the current conditions a train trip in either direction between Victoria and Westhills would take about 36 minutes (assuming 30 seconds at each stop on the way, and including all the future stations conceived in Section 2). This is a fairly slow service for a 17 km trip and may cause many potential passengers to continue commuting by automobile. In addition, the lack of passing locations means that trains returning in the off-peak direction would be held as long as inbound trains were between these passing locations. Based on the travel time between the existing sidings, an off-peak direction train could be held up to 12 extra minutes waiting for oncoming trains to pass, resulting in a return trip of 48 minutes. Adding 10 minutes per end station for turn-around activities, this would result in a round-trip cycle of 104 minutes per train set. Therefore, this would not only be a slow service, especially in the off-peak direction, it would require four train sets to operate on 30-minute headways due to the schedule inefficiency.

Given the poor service that would result from the existing condition of the corridor, improvements are recommended before contemplating commuter rail operations. The rest of this section presents

ways to improve the travel time of the service and therefore improve the service as a whole. **Table 3-2** provides a matrix of all these options and the main parameters that define them.

Table 3-2: Service Improvement Options and Parameters

Route	Track Conditions	Length(km)	# of Stops	Train Trip Duration (min)
Westhills-Victoria	Existing (Benchmark)	17.2	6	36.0
Westhills-Victoria	Basic Improvements	17.2	6	31.1
Langford-Victoria	Basic Improvements	13.3	4	26.4
Westhills-Victoria	Full Improvements	17.2	6	24.6
Extension to Duncan	Basic Improvements + Extension	64.6	8	79.9

A basic set of improvements would include basic repairs to the corridor, new vehicles and stations, and addressing some of the grade crossing conflicts. The mitigation of the slow order locations could save up to 5 minutes in travel time. However, additional improvements such as sidings would also be needed to reliably achieve this travel time.

A second option to improve travel time is to shorten the commuter train route and to decrease the number of stations. Specifically, one might initially limit the commuter train service to four stations – Victoria, Esquimalt, Six Miles and Langford. Westhills is not yet developed and Atkins does not have the population catchment area and density that usually warrant train service. This suggested improvement has several positive implications on the services the commuter train can provide and therefore on the demand for it and its viability. First, the elimination of Westhills station shortens the train route by almost 4 kilometres. Second, the elimination of the station at Atkins reduces the travel time from Langford to Victoria by almost a minute (stoppage time plus deceleration and acceleration). Overall this option reduces the trip time by nearly 5 additional minutes.

A third and more comprehensive improvement could be to address other grade crossings along the railway and allow the train to operate at higher speeds where feasible. These improvements would include overall, the full improvements could reduce the total travel time to around 25 minutes; thereby, making the rail service much more competitive with other modes.

A final option is to run one daily train trip from Duncan to Victoria in the morning, returning in the evening. Such a train ride would build on the ridership currently seen on the commuter buses operated by BC Transit between Duncan, Shawnigan and Victoria. The travel time beyond Westhills is based on the current VIA operation; the length of this additional segment likely precludes the commuter rail system from driving significant improvements to the corridor that would affect operating speeds – any investments should and would focus on enhancing passenger safety.

4. COMMUTER RAIL SERVICE REQUIREMENTS AND COSTS

This section describes the range of improvements and resulting investments in commuter rail service to address the gaps between the existing corridor and the different levels of commuter rail service defined in Section 3.3. In essence, the following improvements and new infrastructure would be required to operate a full commuter rail service:

- Trains (Vehicles);
- Station Infrastructure and Components;
- Corridor Improvements, such as:
- Restoration of Ballast and Tracks;
- New Tracks and Sidings;
- Grade Crossing Protection;
- Signals/Communications Systems; and
- Maintenance and Storage Facility.

These are discussed in the following sections, followed by planning-level cost estimates for these components.

4.1 Vehicles

This section evaluates the features of existing VIA trains and recommends the main features for the commuter rail vehicles for this E & N corridor service. Specific commuter rail vehicle technology, manufacturer and design requirements will need further evaluation during project development in order to meet project objectives such as minimizing environmental impacts (emissions, noise, etc.), meeting track requirements and achieving a high degree of visual impact to attract passengers.

Existing VIA Trains

Currently, passenger service in the corridor is provided by VIA Rail using Budd cars dating back at least to the 1960's. These rail vehicles have the following characteristics:

- Budd cars are high-floor vehicles, requiring multiple steps up from the station platform. As such, they would rate poorly for accessibility. Passengers often have to be assisted into the train by staff.
- These railcars are self-propelled and capable of double-ended operation,
- They operate at a maximum speed of 40 miles per hour (~ 65 km/h).
- Vehicles have 74 seats, less 4 seats for on-floor baggage, in addition to overhead baggage racks.
- Each car is equipped with a washroom.

The double-ended operation is the key feature to be carried forward into requirements for a set of commuter rail cars for operations in Victoria.

Recommended Features of Trains for Commuter Rail Service

The following features are recommended for vehicles operating the commuter rail service. These features are in addition to any design specifications needed to meet operating requirements.

- Double-ended operations to accommodate a quicker turnaround at the ends of the route.
- Low-floor cars to satisfy accessibility requirements and reduce dwell times at stations.
- Multiple doors per car and wide doorways to reduce dwell times at stations and allow passengers to efficiently board and alight from the train.
- Comfortable seats and efficient seating arrangement to accommodate passenger demand, with overhead or under-seat space for personal belongings.
- Areas to safely secure bicycles, baby carriages and luggage.
- Proper cooling and heating systems, large clear windows, and attractive interiors to enhance passengers' ride.
- Commuter rail trains may offer lavatories on trains, although these are more common on intercity passenger services or systems that operate longer-haul commutes. However, the need for or the number of these facilities on the E & N commuter rail trains could be reduced given the short commuting time between the West Shore and Victoria.
- The Ottawa O-Train, the North County Transit District's Sprinter light rail in San Diego, California, and Westside Express Service in Portland, Oregon, are examples of North American systems that operate diesel multiple unit (DMU) trains sets with these recommended features.

Exhibit 4-1: Ottawa O-Train Vehicle

Source: www.ottawa.ca

One significant issue that could affect the type of vehicle applicable to the corridor is whether freight service was ever restored to areas overlapping the conceptual commuter rail segment. If this were the case, certain types of self-propelled train such as the O-Train do not strictly meet crash resistance standards in the event of a collision with a freight train. This was handled in Ottawa by including time of day separation of types of railway traffic within the railway's operating plans.

4.2 Station Infrastructure

This section provides a discussion of the range of station design and amenities to be considered for commuter rail on the E & N corridor.

4.2.1 STATION PLATFORM

The length of station platforms is designed to accommodate the longest length of the train to be operated. The platform length requirements are discussed below given estimated average daily ridership of 2,000 passengers, with passenger capacities of 700-1100 per direction, peak hour boardings of 575 passengers and 30-minute headways. The platform length requirements for commuter rail on the E & N corridor will be based on the chosen vehicle technology and the expected passenger demand.

Table 4-1 summarizes the capacity and train length of 4 rail systems in North America that operate different DMU vehicles.

Table 4-1: Characteristics of Other Rail Systems

System	Train Technology	Seating Capacity per Train (2-car train)	Approximate Length of Train (2-car train)
Ottawa O-Train	DMU, single-level (Bombardier Talent)	135 (150 standing)	48 metres
Sprinter (San Diego, CA)	DMU, single-level (Siemens Desiro)	136 (90 standing)	41.7 metres
Westside Express Service (Portland, OR)	DMU, single-level (Colorado Railcar DMU)	148-154 (74 passengers for powered car, or 80 passenger for unpowered car)	52 metres*
Tri-Rail (South Florida)	DMU, bi-level (Colorado Railcar DMU)	330 (two bi-level DMUs)	52 metres*

** Based on 85-feet car length*

The average seating capacity of DMU single-level trains is about 140. Using this average seating capacity and following the common practice for commuter rail service to offer a seat to every passenger, it is estimated that the commuter rail on the E & N corridor will need trains with more than 3 cars or 2 married-pair in order to accommodate 575 peak hour boardings in a single direction. Thus, if operating 4-car (2 married-pair) single-level trains, station platforms will need to be in the order of 100 metres long. This only considers the length of the platform based on the length of the train and does not account for additional platform area needed for buffer zones, station circulation to enter and egress the platform or passenger amenities.

Station platform requirements are typically based on estimated boarding and alighting volumes at each station, circulation requirements and the desired level of service. Detailed design requirements for each station platform will need to be further evaluated using quantitative techniques such as those highlighted in the "Transit Cooperative Research Program (TCRP) Report 100: Transit Capacity and Quality of Service Manual, 2nd Edition". As an example, the following platform sizing exercise is provided. Assuming the 575 peak hour boardings are spread out evenly over the 2 trains and all boardings occur at one station, there could be up to 288 passengers waiting for a train. An average pedestrian area of 0.8 m^2 per passenger provides a level of service where restricted circulation is possible although still within the range of personal level of comfort. In

this case, the platform size at this station needs to be at least 230 m^2. This, however, does not include additional areas needed for station circulation to enter and egress the platform, or passenger amenities.

For the commuter rail on the E & N corridor, shorter station platforms could be considered if one or more of the following is implemented:

- Operate bi-level cars with higher seating capacities;
- Increase frequency of trains to more than 2 trains per hour; or,
- Set a policy where boarding and alighting is only permitted through specific train car doors.

Given that commuter rail service would share the corridor with other passenger rail services and potentially freight traffic, station platforms will need to consider the width of its commuter service vehicles as well as the width requirements of these other service vehicles. For example, almost all of the Ottawa O-Train stations have retractable platform extenders to allow passenger access on and off the trains across a gap because their vehicles are narrower than the freight vehicles that used to operate on those tracks. The extenders retract in order for wider vehicles to pass through the station.

4.2.2 PASSENGER AMENITIES

Typical commuter rail station components include, but are not limited to:

- Shelter or building
- Seating area
- Fare control and vending media
- Stairways, ramps, elevators and escalators, if not at-grade with station access points
- Route and passenger information displays
- Lighting
- Trash receptacles
- Emergency call boxes
- Park-n-ride and kiss-n-ride facilities

The “Transit Cooperative Research Program (TCRP) Report 100: Transit Capacity and Quality of Service Manual, 2nd Edition” summarizes some of the advantages and disadvantages of typical passenger amenities, presented below as Table 4-2.

The level of passenger amenities at commuter rail stations can vary greatly. Stations in urban settings with high-volume demand tend to be major terminal centres with an enclosed building and various transit connections such as Union Station in Toronto, Ontario, while stations in more suburban destinations or serving lower-demand areas offer limited amenities. In addition, stations outside the urban core frequently have parking facilities. Parking facilities and station circulation requirements are not addressed in this section.

Table 4-2: Commuter Rail Station Amenities

Amenity	Advantages	Disadvantages
Shelters	• Provides comfort for waiting passengers • Provides protection from climate (sun, glare, wind, rain, snow) • Help identify the stop/station	• Requires maintenance, trash collection • May be used by graffiti artists
Benches	• Provides comfort for waiting passengers • Help identify the stop/station • Low-cost when compared with installing a shelter	• Requires maintenance • May be used by graffiti artists
Vending Machines	• Provides reading material for waiting passengers	• Increases trash accumulation • May have poor visual appearance • Reduces circulation space • Can be vandalized
Lighting	• Increases visibility • Increases perceptions of comfort and security • Discourages “after hours” use of bus stop facilities by indigents	• Requires maintenance • Can be costly
Trash Receptacles	• Provides place to discard trash • Keeps bus stop and surroundings clean	• May be costly to maintain • May be used by customers of nearby land uses • May have a bad odor • May be removed for security reasons
Telephones	• Convenient for transit patrons • Provides access to transit information and emergency services	• May encourage loitering at bus stop • May encourage illegal activities at bus stop

It is conceived that stations in the commuter rail on the E & N corridor be improved to include, at a minimum:

- Station platform to accommodate commuter train lengths;
- Shelters and benches, or small buildings with seating area;
- Station signage and information boards;
- Lighting, trash receptacles and emergency call boxes;
- Ticket vending machines, although these depend on the fare payment system adopted.

Typically, commuter rail stations offer a limited amount of seating because the frequency of service is low enough that commuting passengers time their arrival at the station with the train schedule. Shelters and benches along the station platform are sufficient for stations on the commuter rail on the E & N corridor, unless a small building is warranted based on demand and local circumstances (e.g. weather, elderly riders, etc.). Simple yet eye-catching station signs, system maps, and local destination information, as oppose to electronic signage, should be included to increase the attractiveness of the station in a cost effective manner.

The current Victoria station is small and has limited capacity, and would not adequately serve the estimated peak hour demand. Improvements to this station range from a new facility with greater capacity to additional shelters and benches adjacent to the current building.

4.2.3 BC TRANSIT EXCHANGES AND PARK AND RIDE

BC Transit reviewed the potential need and feasibility for transit exchanges and parking facilities at each of the commuter rail stations being studied. A range of $11 to $15.5 Million in total capital costs was identified for these related facilities, as follows:

- Victoria (west of Johnston Street) - No costs are provided as there appear to be minimal to no opportunity for adding a park-n-ride lot or bus exchange.
- Esquimalt @ DND = $5M to $6.5M for Exchange/Parking Facility (Land not included);
- Six Mile Road = $6M to $9M for Exchange/Parking Facility (Land not included);
- Langford is already constructed and appears to have minimal to no opportunity for adding a park-n-ride lot.

4.3 Corridor Improvements

This section outlines the improvements to the railway corridor that would be required to support the commuter rail service concepts. These include restoration of the ballast and tracks, new passing tracks and sidings, improvements to grade crossings, signals and communications system, and other wayside improvements. **Appendix A** includes schematics of the existing and conceptual tracks and grade crossings in conjunction with this discussion.

4.3.1 RESTORATION OF BALLAST AND TRACKS

Potentially significant investments are needed in order to bring the tracks and track bed up to standard. Depending on what loading standard has to be met, the potential investment in replacement ties and rails, notwithstanding expansion requirements, would have to be considered. The bridges along the corridor have also been identified as requiring more detailed inspection and potential rehabilitation, although there are fewer of these in the Langford-Victoria segment other than the significant structures over Six Mile Road, Island Highway/Burnside, Helmcken Street, Old Island Highway, Hereward Street, Esquimalt Road and the Johnson Street Bridge.

It is assumed that the ballast from Victoria to Langford would require rebuilding to restore them to a workable condition that would require only routine maintenance going forward. The tracks would be repaired where necessary using the current 85-pound rails where feasible and replacing them where the condition is beyond repair.

4.3.2 NEW PASSING TRACKS AND SIDINGS

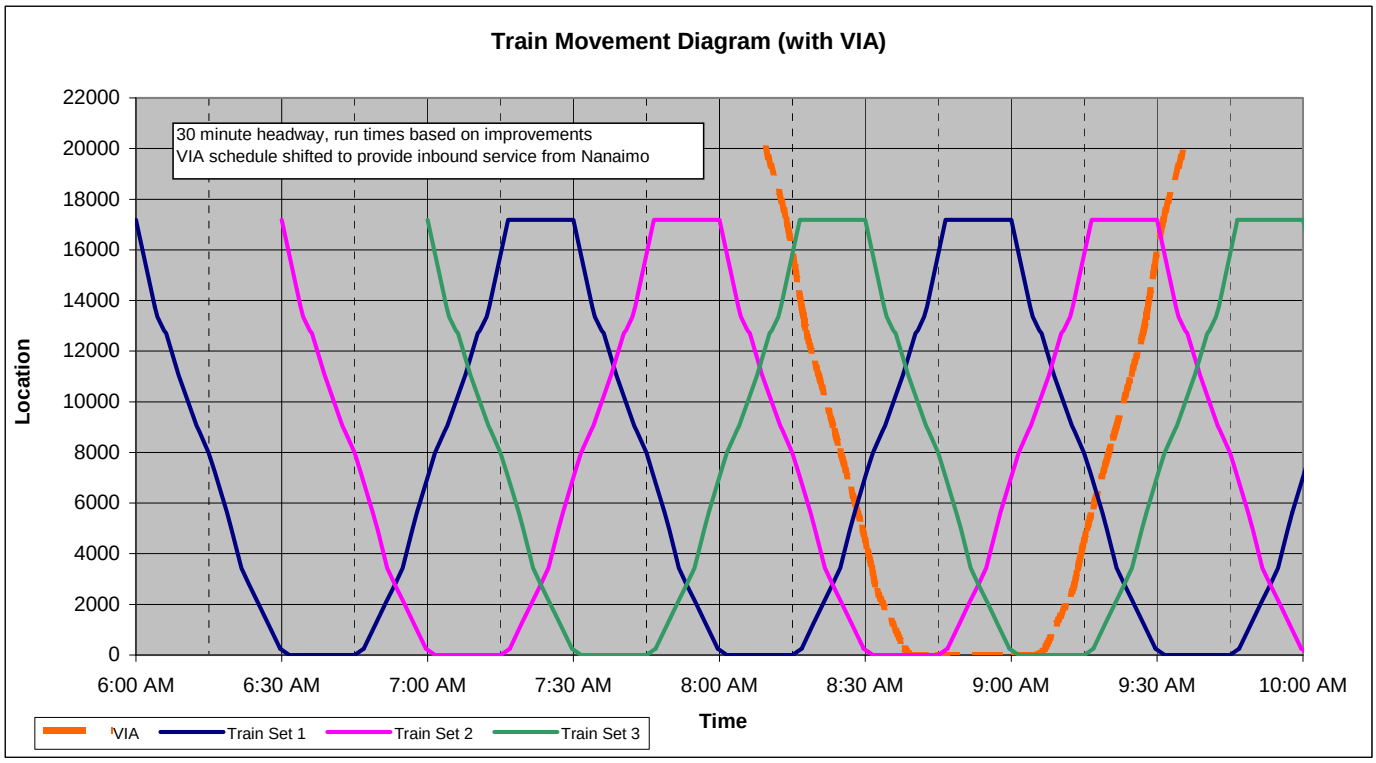
Passing tracks and sidings will have to be installed in order to operate a more frequent train service. The location of those passing tracks/sidings depends on two types of factors; the train schedule and the physical feasibility of locations along the corridor. From a scheduling point of view, passing tracks should be at or near the location where two trains will meet; this is the most efficient location to ensure that the schedule implications of passing are minimal.

Train movement schedules have been prepared based on a service plan that includes three train-sets with 30 minute headway (each round trip of a train set takes 90 minutes with all layovers) starting with morning service at Westhills station departing at 6:00 am. Once the train reaches Victoria, it would lay over there until 6:45 and then make its return trip. Subsequent trains would follow 30 and 60 minutes behind this pattern, and then the first train starts the cycle again at 7:30 am. Two passing tracks would need to be constructed to accommodate local trains meeting.

An additional complication is introduced when accommodating the VIA service. Assuming that the train might theoretically start service as an inbound train to Victoria, lay over then leave for its northbound trip, this needs to fit within the commuter rail schedule. It has been assumed that the passenger trains moving in the same direction could be separated by 10 to 15 minutes – with VIA departing Victoria in between the commuter rail movements. To allow the VIA train to pass Westhills station, a siding for the local trains would be required. Likewise, at Victoria, a siding would be need to store a local train set and the VIA train since both would be there simultaneously.

Exhibit 4-2 illustrates the scheduled movements of commuter trains and the VIA service. Note that the VIA train has been rescheduled to arrive in time for the morning peak and then depart just after 9 am – a shift of an hour from the 2009 schedule intended to serve a larger passenger market.

Exhibit 4-2: Train Movement Diagram – Conceptual AM Peak Commuter Rail + VIA



The conceptual passing track locations include:

- Between Lampson and Hutchinson 2900 metres MP 1.80 - 2.10
- Between Hallowell and Old Island Highway 5950 metres MP 3.65 - 4.00
- West of Atkins Road crossing 11300 metres MP 6.91 - 7.25
- East of proposed Westshore Parkway 15900 metres MP 9.70 - 10.10

Sidings would be required at the terminal stations to store trains during layover:

- Victoria Station 150 metre additional tail tracks and crossover MP 0.0
- Westhills Station 300 metre siding MP 10.6

4.3.3 GRADE CROSSING UPGRADES

There are 25 level grade crossings between Langford and Victoria, and several of these currently result in slow orders for the passenger train operating on this corridor. In addition, there are other locations where the introduction of more frequent train service may require an upgrade (for example, introduction of lights and bells, or even gates) to the crossing protection.

Exhibit 4-3 shows all the existing and known future crossings of the railway between Langford and Victoria. The exhibit includes the potential minimum improvements to the crossing protection at 17 locations. It also indicates the potential speed limits on the railway corridor provided that the crossing improvements are made. The speed would generally be increased to 40 mph for passenger service except where curves in the railway alignment make a 30 mph limit more practical.

Improvements to the four highlighted crossings (Devonshire, Maplebank, McNeany, and Atkins) would result in the lifting of the slow orders to 10 mph on the approaches, making these the highest priority crossings to improve. In each case, the slow order results from limited sight distances and the installation of lights and gates is assumed.

The installation of lights and gates is also assumed at eleven other locations. This is only required where there are two tracks, and four of these would be at the end points of sidings. The seven other locations are conceived in order to increase operating speeds.

Note that new gates are not considered at certain busier grade crossings with awkward road geometry, including the crossings of Admirals/Coleville, Goldstream/Veterans and Jacklin/Station.

The intersection of Admirals/Coleville is being reconstructed to different geometry by the District of Esquimalt for an approximate cost of $1.2 million, and that improvement is assumed to have taken place by the near future and therefore be present for the purpose of considering commuter rail requirements. The two other intersections are controlled by traffic signals and it is recommended at a minimum that train movements be accompanied by an extended all-red condition for road traffic. (These locations may also trigger a review of grade separation, as discussed in the next paragraphs.)

Exhibit 4-3: Conceptual Grade Crossing Improvements, Victoria – Langford

ID	Location	MP	metres	Proposed Speed w/improv	Potential Improvements	Resulting Protection	Comments
0	VIA Station - Victoria	0.00	-			station	
1	Harbour (Johnson Street Bridge)			5		Bridge	New lift bridge proposed; restriction remains
2	Pedestrian Trail	0.16	254				Realigned future bridge removes this crossing
3	Johnson St./Esquimalt Rd	0.20	322	30		Underpass	
4	Tyee St./Songhees	0.37	595		Lights/Gates	Lights/Gates	To increase speed in residential area
5	Saghalie	0.57	917		Lights/Gates	Lights/Gates	To increase speed in residential area
6	Catherine St./Kimta	0.77	1,239			Lights/Gates	
7	Mary St.	0.83	1,335	40/30	Lights/Gates	Lights/Gates	To increase speed in residential area
8	Russell St.	0.88	1,416		Lights/Gates	Lights/Gates	To increase speed in residential area
9	Esquimalt Rd.	0.95	1,529		Lights/Gates	Lights/Gates	To increase speed in residential area
10	Wilson Rd.	1.10	1,770		Lights/Gates	Lights/Gates	To increase speed in residential area
11	Hereward St.	1.30	2,092			Underpass	
12	Devonshire/Fairview	1.57	2,526		Lights/Gates	Lights/Gates	Improvement to lift slow order
13	Lampson St.	1.75	2,816		Lights/Gates	Lights/Gates	Approach to proposed passing track
14	Hutchinson Ave.	2.14	3,443		Lights/Gates	Lights/Gates	Approach to proposed passing track
15	Intervale Ave.	2.29	3,685		Lights	Lights	Increased safety for added trains
16	Admirals Rd./Colville	2.53	4,071			Lights	
17	Maplebank Rd.	3.12	5,020		Lights/Gates	Lights/Gates	Improvement to lift slow order
18	Thomas Rd.	3.37	5,422		Lights	Lights	
19	Hallowell Rd.	3.65	5,873	30	Lights/Gates	Lights/Gates	Approach to proposed passing track
20	Pedestrian Path	3.90	6,275			Underpass	
21	Old Island Hwy	4.01	6,452			Underpass	
22	Helmcken	4.50	7,241	40/30		Underpass	
23	Burnett	4.81	7,739		Lights/Gates	Lights/Gates	Potential pedestrian traffic
24	Palmer Station (VIA)	4.84	7,788	30		station	
25	Kislinbury Ln.	5.03	8,093		Lights	Lights	Safety at low-medium pedestrian crossing
26	Adams Place	5.20	8,367			Underpass	
27	Island Hwy/Burnside Rd	5.30	8,528			Underpass	
28	Bryon Rd.	5.50	8,850	40/30		Underpass	
29	P.J. McNeaney (private)	5.63	9,059		Lights/Gates	Lights/Gates	Improvement to lift slow order
30	Six Mile Rd	5.80	9,332			Underpass	
31	Jones/Chilco (tunnel closed)	5.97	9,606			Underpass	
32	Atkins Rd.	6.90	11,102	30	Lights/Gates	Lights/Gates	Improvement to lift slow order; prop. passing track
33	Pedestrian	7.44	11,971			Overhead	
34	Goldstream/Veterans	7.90	12,711			Lights	
35	Langford Station (VIA)	7.95	12,792			station	
36	Peatt Rd.	8.30	13,355			Lights/Gates	
37	Jacklin Rd./Station Ave.	8.52	13,709			Lights	
38	Pedestrian - Ed Nixon Trail	9.30	14,964	40/30	Lights	Lights	Increased safety for added trains
39	Langford/Westshore	10.30	16,573		Lights/Gates	Lights/Gates	Approach to proposed passing track
40	Humpback Rd.	10.70	17,216				

Potential for Additional Grade Separations

MoT design guidelines (supplement to TAC Section 1110) indicates when the cross product of trains per day and vehicle traffic crossings exceeds 50,000 per day, flashing light and gates may be required. This is accommodated within the improvements noted in Table 4.3.

However, when the cross product exceeds 200,000 consideration[3] of full grade separation may be required by the BC Safety Authority, depending on the results of more detailed reviews of safety. (Many existing grade crossings across Western Canada exceed this standard and these are addressed incrementally depending on the safety record of each location.) Based on this criterion, grade separation would need to be considered at four locations: Esquimalt Rd, Admirals/Coleville, Goldstream/Veterans, and Jacklin/Station.

Grade separations of arterials at existing railways can cost in the order of $15 to 20 million per location, so if any or all of the locations were identified as critical, the overall cost of the commuter rail system would increase significantly.

[3] The cross-product value was developed to rank grade separation projects for funding.

4.3.4 SIGNALS AND COMMUNICATIONS SYSTEMS

The current regime in the Victoria segment of the railway is an Occupancy Control System (OCS), known as manual block. This involves the train crew contacting the Rail Traffic Controller (RTC) in Nanaimo to obtain clearance to proceed along a section of the railway line. This manual system is sufficient for a railway operation with only two train movements per typical day and a low incidence of trains meeting. The conceptual commuter rail operation would result in over fifty train movements per day and several trains meeting per hour for up to ten hours a day.

It is recommended that a Positive Train Control (PTC) approach be adopted for this operation, which involves placing circuits on the tracks in this part of the corridor, upgrading the signal system, and making some investment in a communications system for the new train sets. The signalling system would account for the conceptual locations of the sidings and stations. Under a PTC operation, there is an operator on board the train with cab signals, and the signal system is automated.

4.3.5 OTHER IMPROVEMENTS – LANGFORD TO DUNCAN

As an initial feasibility test for the concept where commuter rail service would be extended once per day to Duncan, we are starting from a position where limited improvements to the corridor would be carried out beyond safety-related repairs. This 52-km segment is being addressed as part of the condition review of the overall railway corridor and the cost of improvements would be attributed to other lines of business, including any potential freight and intercity passenger traffic. A fall protection system would be recommended for more frequent train operations because there are incidences of rocks and windblown trees on the tracks through the Malahat section.

4.4 Maintenance/Storage Facility

It is assumed that the maintenance and storage facility for trains could be located in Victoria or in Langford. The daily operation of the commuter rail service would require three train sets to meet the 30-minute headway, and a fourth set of equipment is recommended as a spare so that routine maintenance does not impact schedules. It is assumed that the train sets would be similar to the three-car O-Train consist described in Section 4.1.

The light maintenance facility would include:

- Secure enclosure for the vehicle fleet at night;
- A small Operations Centre;
- Employee change/shower facilities;
- Small covered maintenance shop with a pit, large enough for a train set;
- Maintenance equipment such as jacking pads and an in-ground lathe (for wheel truing);
- Washing and cleaning facility (can be outside);
- Wastewater and hazmat treatment system to handle water from the washing and other onsite maintenance activities.

Heaver maintenance is assumed to be carried out through a change-and-exchange program negotiated with suppliers at the time of purchase. This type of program allows for efficiencies of scale where more significant repairs and long-term maintenance (e.g. engines) are sent off the Island rather than building a full maintenance shop for such a small rail fleet.

4.5 Capital and Operating Costs

4.5.1 ORDER OF MAGNITUDE CAPITAL COST ESTIMATE

A Rough-Order-of-Magnitude (ROM) cost range for the commuter rail improvements is shown by **Exhibit 4-4**. This planning-level estimate has been developed in conjunction with the baseline conditions update, and includes restoration of the railway corridor from Victoria to Langford, and additional improvements and equipment related specifically to commuter rail service.

Exhibit 4-4: Commuter Rail System, Victoria-Langford – ROM Costs

Improvement Element	**Minimum System** (13km, shorter trains, 4 stations)		**Expanded System** (17km, longer trains, 6 stations)	
	Low	**High**	**Low**	**High**
Site Survey	$ 50,000	$ 50,000	$ 60,000	$ 60,000
Vegetation Removal	$ 110,000	$ 110,000	$ 140,000	$ 140,000
Environmental Remediation	$ 240,000	$ 260,000	$ 320,000	$ 320,000
Slope Protection	$ 140,000	$ 150,000	$ 190,000	$ 190,000
Track/Ballast Rehabilitation	$ 2,140,000	$ 2,280,000	$ 2,850,000	$ 2,850,000
Passing and Tail Tracks	$ 1,860,000	$ 1,860,000	$ 2,480,000	$ 2,480,000
Grade Crossing Upgrades	$ 2,780,000	$ 3,150,000	$ 3,700,000	$ 3,700,000
Signaling/Communications	$ 800,000	$ 850,000	$ 1,060,000	$ 1,060,000
Culverts and Drainage	$ 110,000	$ 110,000	$ 140,000	$ 140,000
Bridge Upgrades (Minor)	$ 200,000	$ 210,000	$ 260,000	$ 260,000
Fencing (Restoration)	$ 70,000	$ 70,000	$ 90,000	$ 90,000
Stations (excluding parking)	$ 1,880,000	$ 2,200,000	$ 3,140,000	$ 3,140,000
Transit Exchanges/Parking	$ 11,000,000	$ 15,500,000	$ 11,000,000	$ 15,500,000
Fare Collection	$ 420,000	$ 450,000	$ 560,000	$ 560,000
Maintenance/Storage Facility	$ 5,970,000	$ 6,370,000	$ 7,960,000	$ 7,960,000
Spare Equipment	$ 2,250,000	$ 2,400,000	$ 3,000,000	$ 3,000,000
Operations Preparation	$ 380,000	$ 400,000	$ 500,000	$ 500,000
Construction Estimate	*$ 30,400,000*	*$ 36,420,000*	*$ 37,450,000*	*$ 41,950,000*
Design, Management, Insurance	$ 7,300,000	$ 8,740,000	$ 8,990,000	$ 8,990,000
Subtotal	$ 37,700,000	$ 45,160,000	$ 46,440,000	$ 50,940,000
Contingencies	$ 9,430,000	$ 11,290,000	$ 11,610,000	$ 12,740,000
Allowance for Grade Separation	*$ -*	*$ 50,000,000*	*$ -*	*$ 70,000,000*
Vehicles (self-propelled)				
4 two-car trains	$ 22,400,000	$ 22,400,000		
4 three-car trains			$ 32,000,000	$ 32,000,000
Total	$ 69,530,000	$ 128,850,000	$ 90,050,000	$ 165,680,000
Allocation to Vehicles and Facilities (including contingency)				
Vehicles	$ 22,400,000	$ 22,400,000	$ 32,000,000	$ 32,000,000
Fixed Facilities	$ 47,130,000	$ 106,450,000	$ 58,050,000	$ 133,680,000
Fixed Facilities, per km	*$ 3,600,000*	*$ 8,200,000*	*$ 3,400,000*	*$ 7,800,000*

The minimum system corresponds to the 4-station scenario ending in Langford (Peatt Avenue), and as such, shorter trains and improvements scaled back to 13 km are included. The 'expanded' system includes 6 stations, longer trains, and addresses the full set of track improvements from earlier in this section.

The estimated costs range from $70 million to $90 million for a basic commuter rail system with 4 to 6 stations. (These costs are shown in the 'low' columns.) The range of average costs for the fixed facilities, $3.4 to $3.6 Million per kilometre, is similar to the implementation costs for the O-Train in Ottawa and the Westside Express Service near Portland. Other commuter rail systems have seen costs as high as $20 million per kilometre where significant corridor and station construction was required, and right of way drove up the average costs.

In addition to the basic costs shown in the 'low' cost estimates, there may be potential grade separation costs. These typically cost $15 to 20 million per location depending on the layout and associated right of way needs. At this conceptual stage of analysis, up to four locations would meet the warrant for a safety review should plans for a commuter rail service be developed further, and at that time BC Safety Authority, using rail safety guidelines adapted from Transport Canada, would make the final determination.

The 'high' range cost estimate also includes the upper range of costs identified for the BC Transit exchanges and park and ride facilities that would likely be required at two or more of the stations. None of the costs shown here explicitly call for right of way (for the maintenance facility and stations, which fall outside the E&N property owned by the Island Corridor Foundation).

These estimates are based on typical costs in North America to install and upgrade railway infrastructure, with a low to high range provided since these costs are based on a service concept and not a design, and because the system is fairly small, unit prices for vehicles and facilities may be higher than typical. Design fees, project and construction management and insurance costs are added as 24% of the construction estimate. The contingency shown below the subtotal is to account for items not called out in the estimates and for potential fluctuations in unit prices.

4.5.2 OPERATING COST ESTIMATE

The operating and maintenance costs of a system would include the operation of the trains and supporting infrastructure and the ongoing maintenance of the vehicles and corridor on which they operate. Given the operating parameters provided by BC Transit for this service, there would be on average 3 trains operating on the line over a 10-hour period each weekday, or roughly 30 revenue-hours of train service being provided to the public. Over the course of a year, this amounts to 7,500 hours of commuter train service.

Average operating costs for commuter rail systems across North America reveal several averages that can be applied to estimate an order of magnitude cost. In 2006 (APTA Transit Fact Book), commuter rail services cost $403.50 per vehicle hour to operate, or $8.32 per vehicle mile. The latter cost is based on systems that are typically faster (and operate over more track) than the concept for Victoria, and applying this would tend to underestimate costs with an hourly basis such as staffing. Instead, the hourly cost was applied. Including an allowance for inflation and correcting for Canadian currency, the estimated cost for Victoria – Westhills would be **$3.5 million** dollars per year in 2009 dollars.

This result is a reasonable starting basis for evaluation, and is comparable to the annual costs for the similarly scaled Portland Westside Express Service. There may be some economies related to the shorter operating distance, where power for the vehicles and maintenance of the corridor might

cost less than average, but there would also likely be higher than average costs for the train crews and maintenance of the vehicles given the small scale of the system (3 active trains and 1 spare).

4.6 Alternative Approach to Service Delivery

Sections 4.1 through 4.5 were prepared in keeping with the objectives of the assignment, to determine the costs of a commuter rail service if it were offered in similar fashion to West Coast Express (Vancouver), Sounder (Seattle region), or West Side Express (Portland region).

It is acknowledged that the intercity trains could also be rescheduled to provide a 'commuter' trip once per day by modifying the operations of the current VIA service. This could also be expanded if additional VIA services were procured. The ridership potential and order of magnitude costs are laid out in the Foundation Paper for this study, based on input from the Island Corridor Foundation and the operator, Southern Railway of Vancouver Island.

5. POTENTIAL RIDERSHIP

The potential ridership resulting from the range of service improvement options is highly variable due to the convergence of several factors that govern the popularity of the service offered:

- The frequency of service during the peak period;
- The availability of off-peak train service or a suitable supplementary service using buses;
- The travel time and costs (fares versus fuel plus parking) relative to the private automobile and relative to other transit alternatives;
- Proximity to origins and destinations, particularly at the destination (usually the work/shopping end); and,
- Availability of parking, transit connections, and accessibility by walking and cycling.

5.1 Estimated Ridership - 2026

The factors relating to the quality of the service have been identified through the analysis in this report, and the socioeconomic factors and characteristics of the travel corridor were studied in more detail as part of the report on passenger forecasts (intercity and commuter rail), also being submitted under this study.

Key findings from that evaluation, as they relate to the options being evaluated here, include:

- The so-called ‘direct demand’ model which looks at population and employment catchment areas, and relative travel times and service factors of the commuter rail concept, produces estimates of 925 to 1190 passengers per day. This model, described in detail in the Passenger Analysis report, is calibrated against mode shares that other commuter rail services achieve relative to their travel markets with a similar train service on offer. This offers an alternative estimate of the ridership potential of such a system;
- Based on the concentration of land uses in the future in Langford, dropping the stations at Westhills and Atkins results in a decreased ridership estimate of 535 passengers per day;
- Extending the service to Duncan once per peak period, assuming the same travel times as the VIA train offers, could add up to 300 passenger trips by train to the basic service offering;
- Transportation Demand Management programs where residents in the catchment areas of the train station are incentivized to the use the train, could nearly double the potential ridership (to 1925 per day) in the most aggressive application.

Exhibit 5-1 summarizes the commuter rail estimates documented in the Passenger Analysis.

Exhibit 5-1: 2026 Commuter Rail Scenario Results

Scenario	Description	Stations	AM Peak Hour	AM Peak Period	Daily	Annual
1. Base	30-minute travel time, 30-minute headway	6 stations, Victoria to Westhills	295	420	1,050	262,500
2. High Frequency	30 minute run time, 20-minute frequency	6 stations, Victoria to Westhills	330	475	1,190	297,500
3. Minimal Work	Run time of 40 minutes (assuming limited improvements to the corridor)	6 stations, Victoria to Westhills	260	370	925	231,250
4. Limited Stop	Same as base, 26 minute run time from Langford	No Westhills or Atkins stop	150	215	535	133,750
5. Duncan	Same time as Base, plus one train to/from Duncan	Base + 2 extra stops for one train	380	540	1,350	337,500
6. TDM	Demand and land use measures to encourage ridership	6 stations, Victoria to Westhills	540	770	1,925	481,250

5.2 Factors Affecting Market Potential

The market potential for this corridor is affected by a number of considerations, including travel patterns along the corridor and the competitiveness of the service with other transit and transportation modes:

- Trips to downtown Victoria make up a shrinking proportion of the travel market served by the E&N Corridor. Trips to uptown locations along Highway 1 are not well served by this corridor.
- Only 20% of regional trips are for work and 80% are for school / shopping / personal. The services as defined would primarily be oriented to work trips and other purposes would rely on BC Transit bus services instead.
- Service ends at the periphery of the downtown area (just east of the Johnson Street Bridge) and requires passengers to walk farther to the final destination than would transit services along Douglas or Blanshard streets.

6. CONCLUSIONS

An initial set of concepts for commuter rail service suggests that significant investments could be required in repairs to the current corridor, new trains, additional tracks and signals, stations, and a maintenance/storage facility. For the system from Westhills to Victoria, these costs could range from $69 to $165 million, including $22 to $32 million for the trains and $47 to $133 million for the facilities within the corridor.

Due to the size of the travel market from the West Shore communities into Victoria, the estimated ridership for this type of service may not justify a commuter rail service as defined by the initial operating parameters. The greatest impediments to higher ridership within the existing market include the slower running speeds of the train and competition from existing transit services along the same general route.

The possibility of operating service through this area as part of an expanded intercity service is discussed elsewhere, in the Passenger Analysis Report, and the Foundation Summary Report. By starting the service off with a more modest investment in vehicles and accepting slower speeds until tracks can be upgraded, a lower cost, lower ridership option would result, but one that might become feasible sooner than a full-fledged urban commuter rail service.

If BC Transit were to implement a commuter rail option from Langford to Victoria, the appropriate service plan, cost and ridership would also depend on integration with other transit services and land use policies around the train station sites. Higher densities of development and a larger commuting population base headed into Esquimalt and Victoria (or in future reverse commuting) would be more supportive of a commuter rail concept than the current situation.

APPENDICES

IBI GROUP

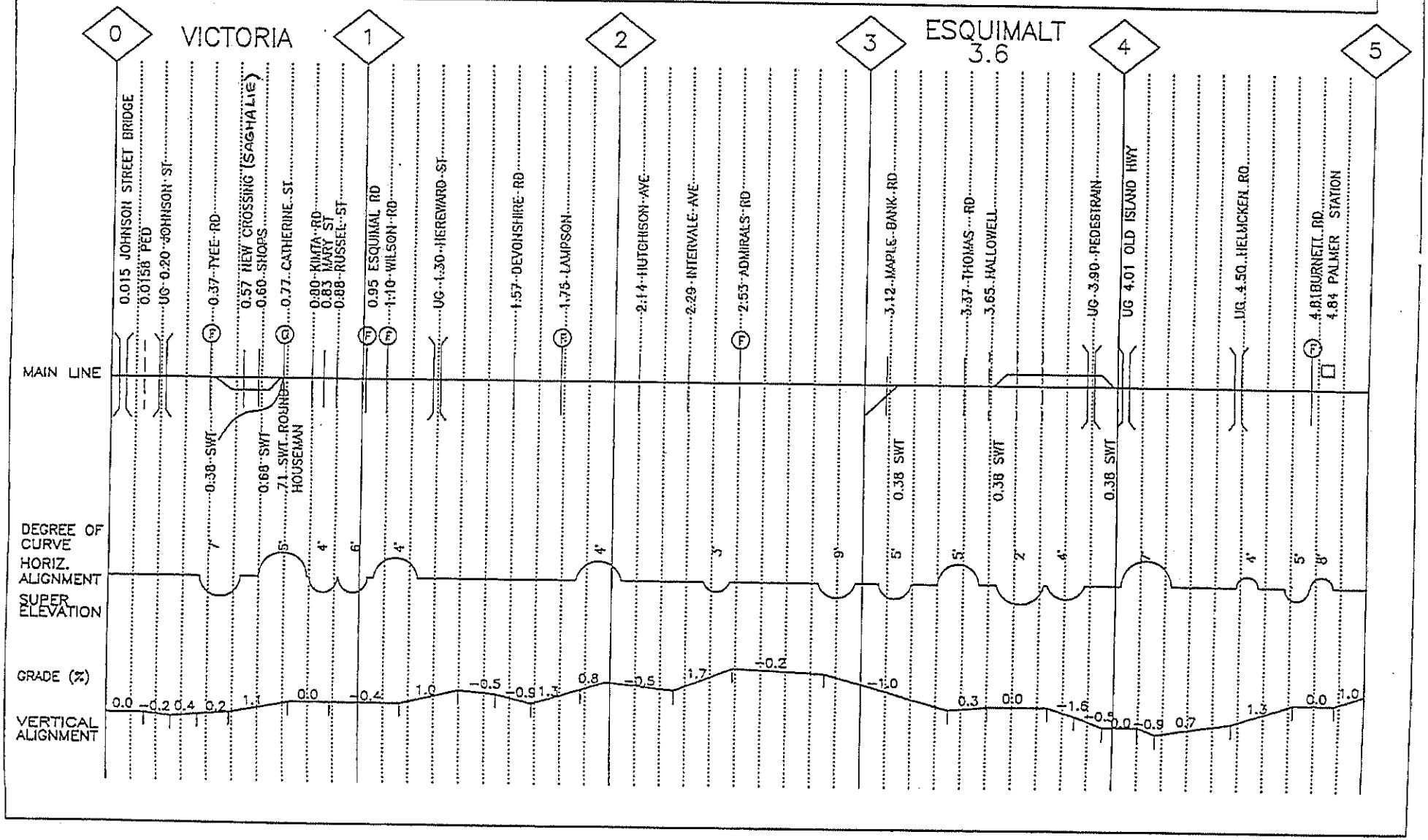
APPENDIX A – TRACK SCHEMATICS

Two sets of track schematics are included for reference:

- The existing condition including the recent addition of a grade crossing with flashing lights, bells and a gate at Peatt Avenue in Langford;
- The conceptual improvements for the basic repairs and improved service concepts, with passing track and grade crossing modifications noted. This is the basis of a more detailed cost estimate being developed for this project.

CROUCH ENGINEERING®

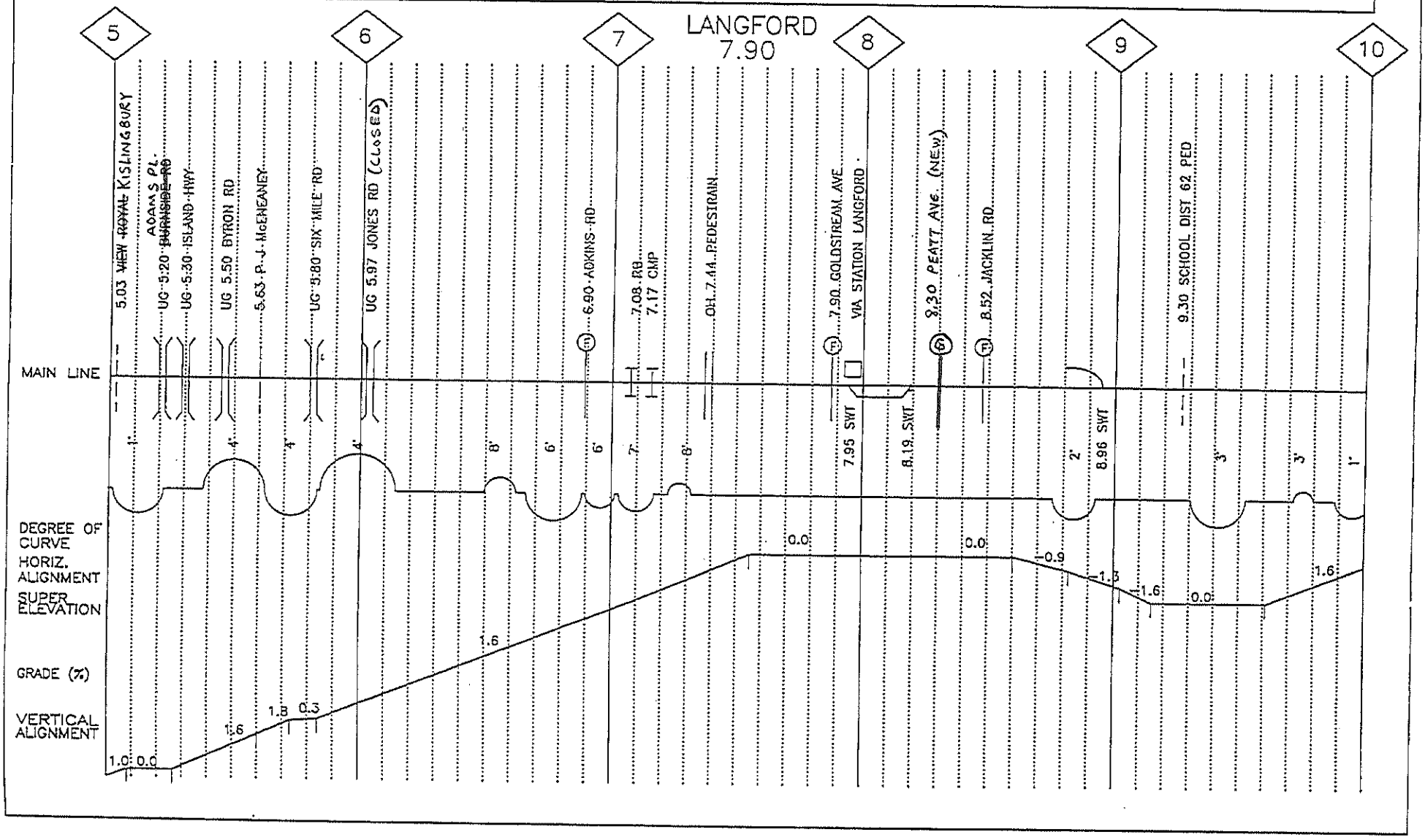
E & N Railway Company Ltd. Track Chart	PAGE: 1 of 28	LAST REVISED DATE: 6-4-2003	E & N VICTORIA MP 0- MP 5
MAIN LINE			
RAIL	85# - Alq		
TIES			
SURFACING			
BALLAST			
W CONTROL			
SPEED	15	30	25
T CONTROL			
GEO CAR			
D CAR			



CROUCH ENGINEERING®

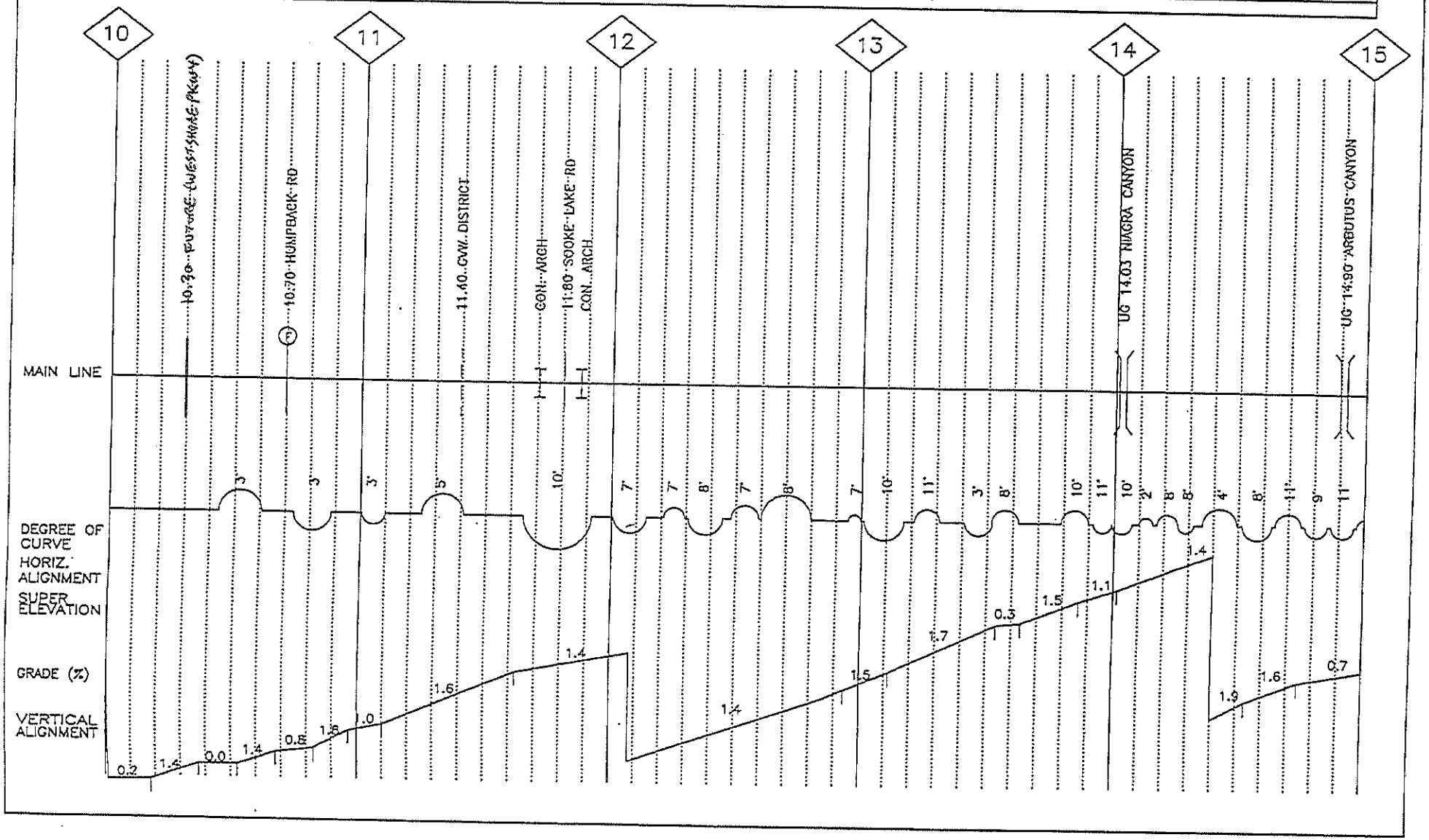
E & N Railway Company Ltd. Track Chart	PAGE: 2 of 28	LAST REVISED DATE: 6-4-2003	E & N VICTORIA MP 5- MP 10

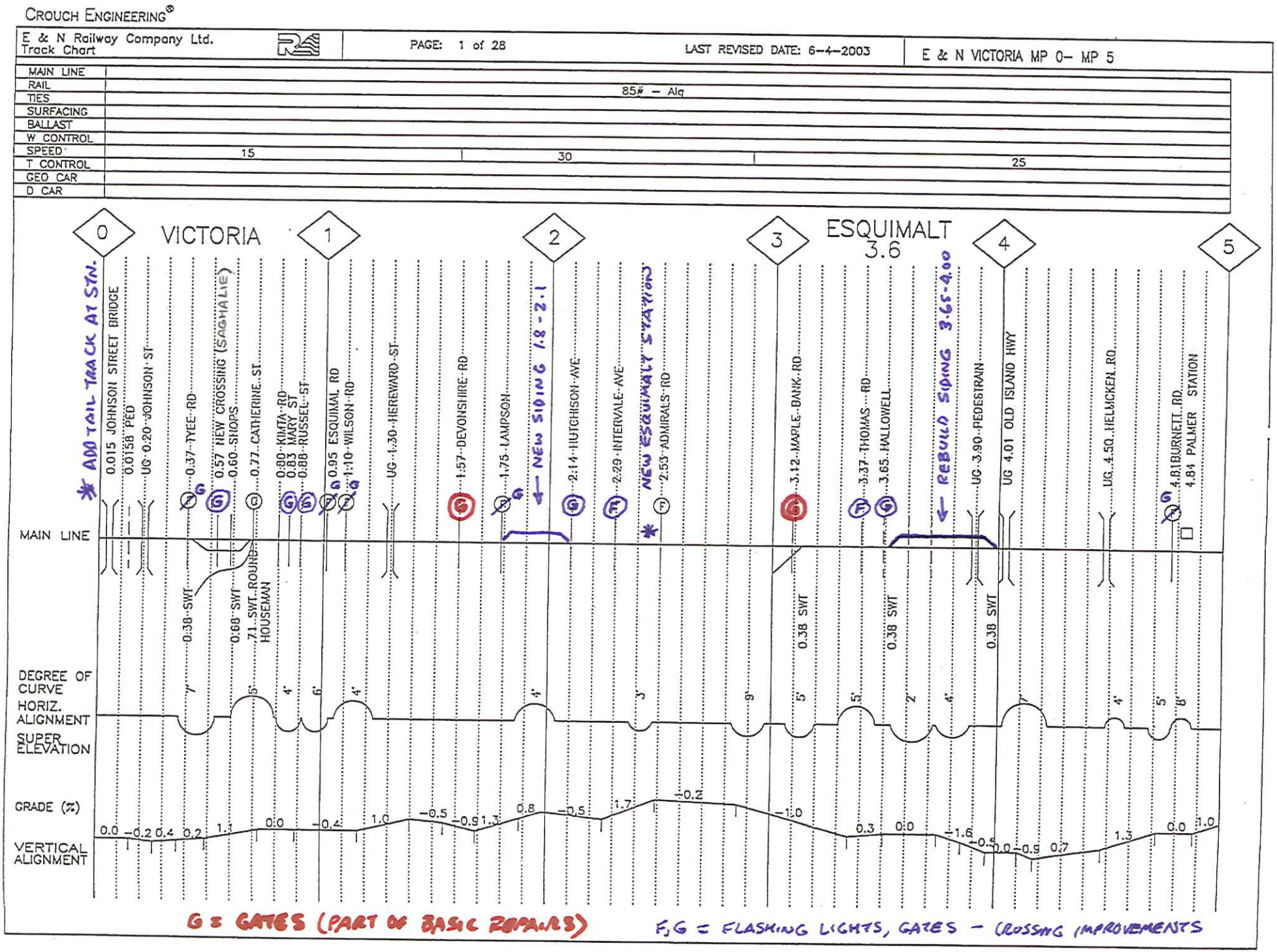
MAIN LINE		
RAIL	100#	85# - Alq
TIES		
SURFACING		
BALLAST		
W CONTROL		
SPEED	25	40 / 30
T CONTROL		
GEO CAR		
D CAR		



CROUCH ENGINEERING®

E & N Railway Company Ltd. Track Chart	PAGE: 3 of 28	LAST REVISED DATE: 6-5-2003	E & N VICTORIA MP 10– MP 15
MAIN LINE			
RAIL	85# – Alq		
TIES			
SURFACING			
BALLAST			
W CONTROL			
SPEED	40 / 30	25 / 20	
T CONTROL			
GEO CAR			
D CAR			

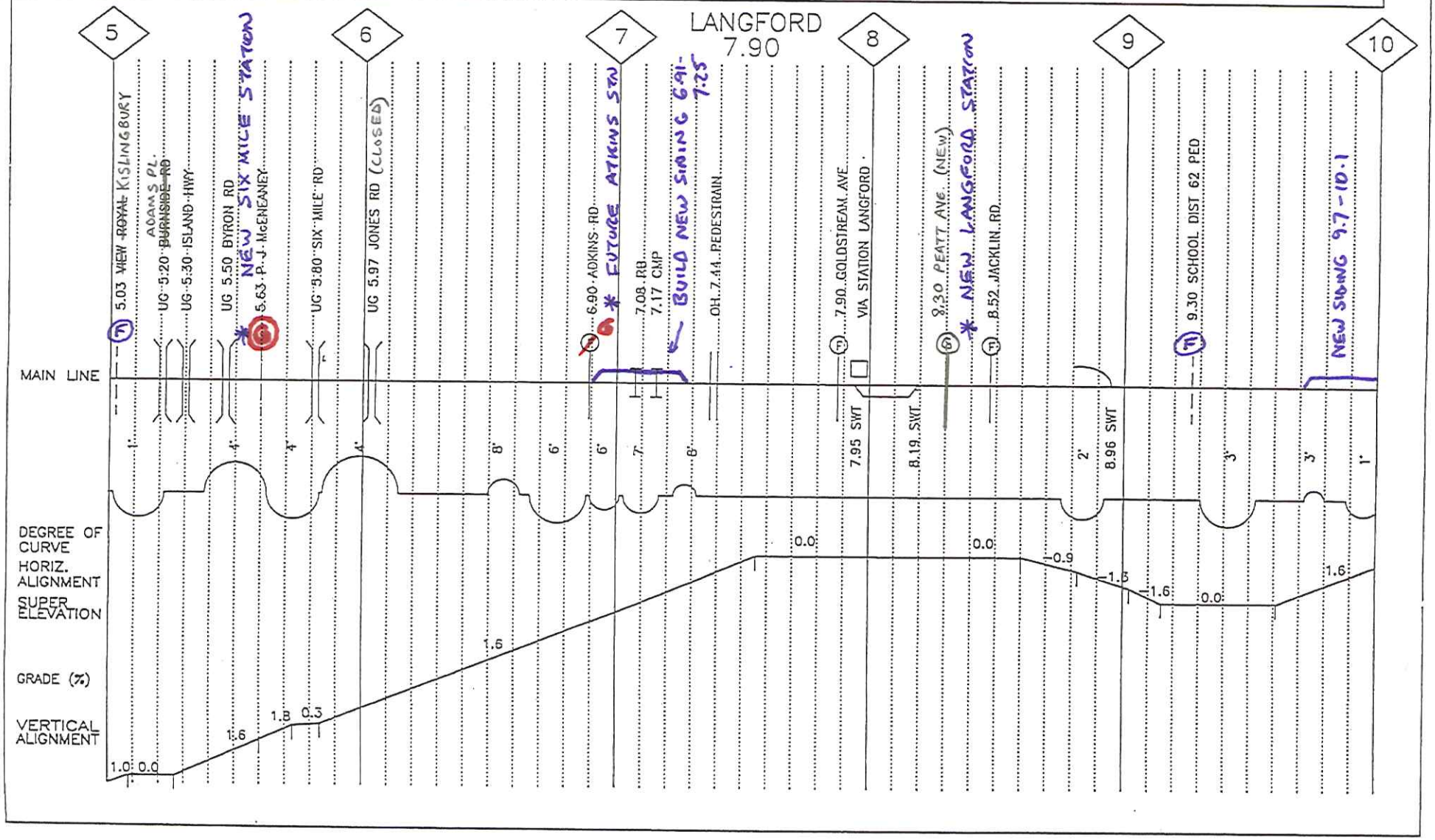



CROUCH ENGINEERING®
E & N Railway Company Ltd.
Track Chart
PAGE: 1 of 28
LAST REVISED DATE: 6-4-2003
E & N VICTORIA MP 0- MP 5
MAIN LINE
RAIL
TIES
SURFACING
BALLAST
W CONTROL
SPEED
T CONTROL
GEO CAR
D CAR
85# - Alq
15
30
25
0
VICTORIA
1
2
3
ESQUIMALT
3.6
4
5
* ADD TAIL TRACK AT STN.
0.015 JOHNSON STREET BRIDGE
0.0158 PED
UG 0.20 JOHNSON ST
0.37 TYEE RD
0.57 NEW CROSSING (SAGHALIE)
0.60 SHOPS
0.77 CATHERINE ST
0.80 KIMTA RD
0.83 MARY ST
0.88 RUSSEL ST
0.95 ESQUIMAL RD
1.10 WILSON RD
UG 1.30 HEREWARD ST
1.57 DEVONSHIRE RD
1.75 LAMPSON
← NEW SIDING 1.8 - 2.1
2.14 HUTCHISON AVE
2.29 INTERVALE AVE
NEW ESQUIMALT STATION
2.53 ADMIRALS RD
3.12 MAPLE BANK RD
3.37 THOMAS RD
3.65 HALLOWELL
← REBUILD SIDING 3.65-4.00
UG 3.90 PEDESTRAIN
UG 4.01 OLD ISLAND HWY
UG 4.50 HELMCKEN RD
4.81 BURNETT RD
4.84 PALMER STATION
MAIN LINE
0.38 SWT
0.68 SWT
.71 SWT ROUND HOUSEMAN
0.38 SWT
0.38 SWT
0.38 SWT
DEGREE OF CURVE
HORIZ. ALIGNMENT
SUPER ELEVATION
GRADE (%)
VERTICAL ALIGNMENT
0.0 -0.2 0.4 0.2 1.1 0.0 -0.4 1.0 -0.5 -0.9 1.3 0.8 -0.5 1.7 -0.2 -1.0 0.3 0.0 -1.6 -0.5 0.0 -0.9 0.7 1.3 0.0 1.0
G = GATES (PART OF BASIC REPAIRS)
F,G = FLASHING LIGHTS, GATES - CROSSING IMPROVEMENTS

CROUCH ENGINEERING®

E & N Railway Company Ltd. Track Chart	PAGE: 2 of 28	LAST REVISED DATE: 5-4-2003	E & N VICTORIA MP 5- MP 10

MAIN LINE			
RAIL	100#	85# – Alq	
TIES			
SURFACING			
BALLAST			
W CONTROL			
SPEED	25		40 / 30
T CONTROL			
GEO CAR			
D CAR			



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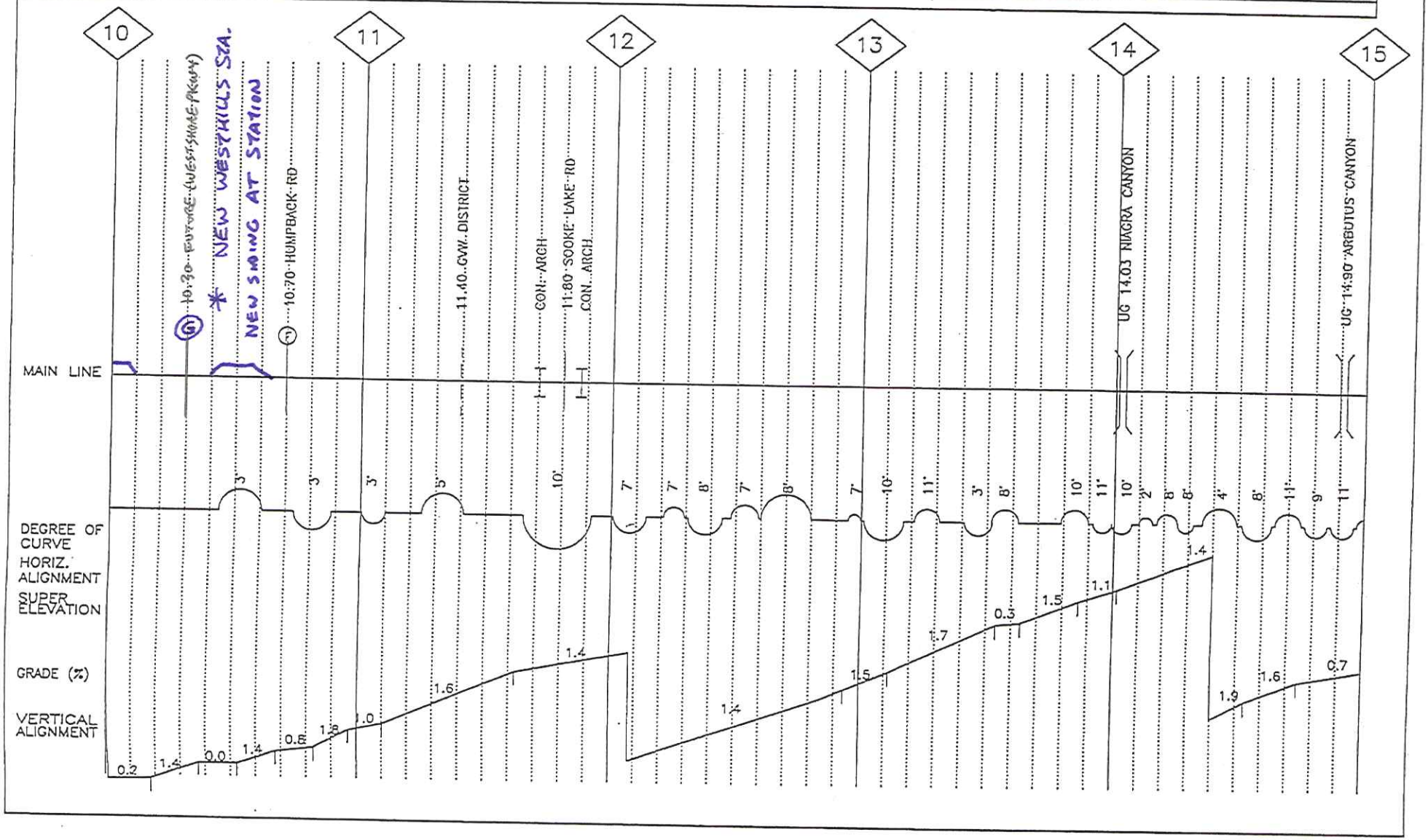
E & N Railway Company Ltd. Track Chart	PAGE: 3 of 28	LAST REVISED DATE: 6-5-2003	E & N VICTORIA MP 10– MP 15
MAIN LINE			
RAIL	85# – Alq		
TIES			
SURFACING			
BALLAST			
W CONTROL			
SPEED	40 / 30	25 / 20	
T CONTROL			
GEO CAR			
D CAR			



APPENDIX B – STATION LOCATION AERIALS

This appendix includes aerial photos of the conceptual stations for the commuter rail service within the Capital Region District. The locations of the stations were identified by a parallel study conducted for BC Transit, and the time and distance calculations were conducted based on these.

Note that the appendix does not include an aerial of the Victoria station because the current station is subject to relocation due to replacement plans for the nearby Johnson Street Bridge. The final location of the Victoria station is still unresolved and a brief discussion on the matter is presented in Appendix C.

The station locations include:

- Esquimalt – east of Admirals Road (Exhibit B.1);
- Six Mile – southeast of the Trans Canada/Burnside/Island Highway interchange (Exhibit B.2);
- Atkins – southwest of grade crossing with Atkins Road
- Langford – midway between Jacklin and Peatt Avenue
- Westhills – between Humpback and future Westshore Parkway

Exhibit B.1 – Esquimalt Station

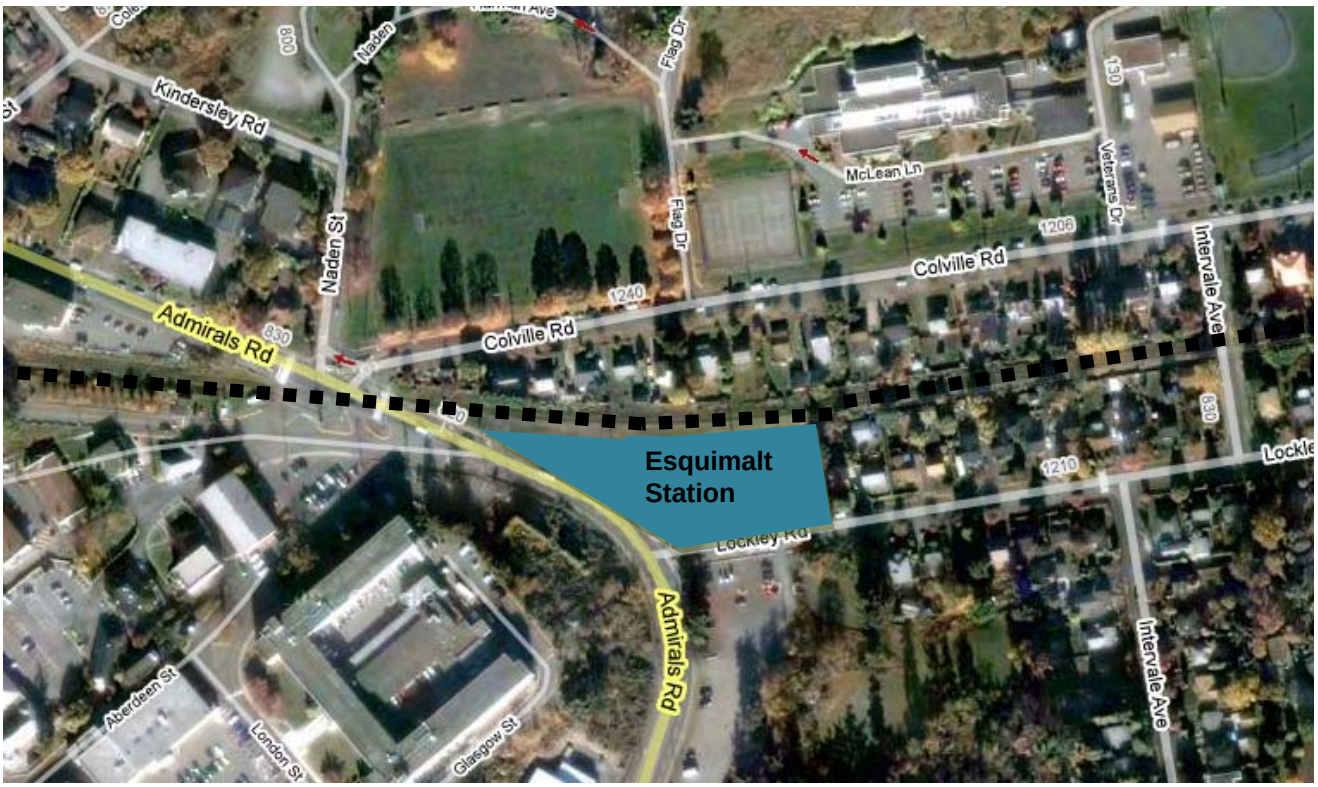


Exhibit B.2 – Six Mile Station

Exhibit B.3 – Atkins Station

Exhibit B.4 – Langford Station

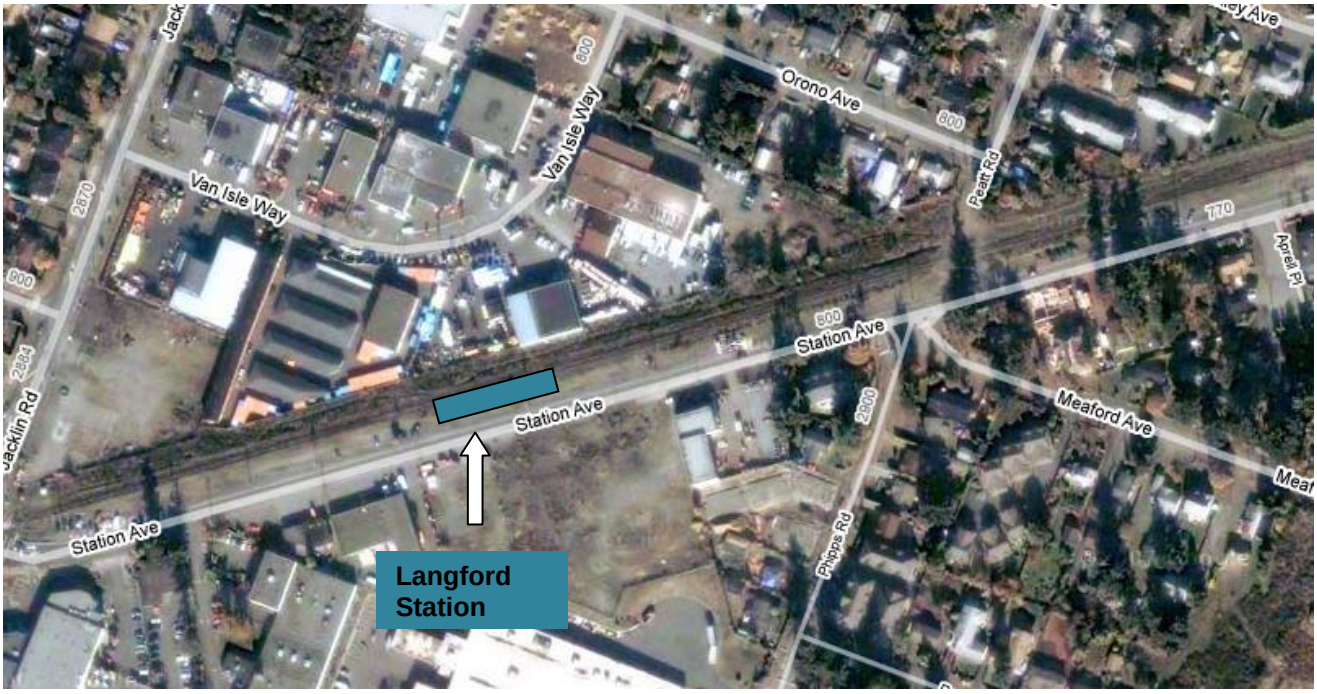


Exhibit B.5 – Westhills Station

Note that the exact location and footprint of the Westhills station have not been determined yet.

APPENDIX C – VICTORIA TERMINUS OPTIONS

The current Victoria station is located on the north side of Pandora Ave. about 150m east of the Johnson St. Bridge. It is unlikely that the station will remain in that spot in the future, because of plans by the City of Victoria to change the location of the railway track on the Johnson St. Bridge. In addition, there are several service considerations that may push the station location a few hundred meters east or west of its current location. The purpose of this appendix is to depict the different location options and to discuss the opportunities and challenges that each of them entail. The possible locations for the station include:

- Southeast of Johnson St. bridge
- West of Johnson St. bridge
- Douglas St.

Southeast of Johnson St. Bridge

The City of Victoria has a plan to replace the Johnson St. Bridge with a new bridge. Part of the plan is to change the location of the traffic lanes/railway tracks on the bridge so that the railway tracks will be on the south side of the bridge rather than the current arrangement in which the tracks are on the north side of the bridge. The new arrangement of lanes/tracks means that the current location of the Victoria train station (marked as point A in Exhibit C.1) is no longer practical; therefore, current plans suggest station relocation to a point southeast of the bridge (denoted as point B in Exhibit C.1).

Exhibit C.1 – Current and Potential Victoria Stations

The relocation of the station from point A to point B should not result in significant service changes to passengers, because of the close proximity of the two locations; however, it might result in some operational difficulties to the train. As can be seen in Exhibit C.1, the new station location would dictate that the tracks would make a sharp southbound turn after crossing the new bridge (orange arrow. The curve in the tracks pushes the station location and any tail track further south past of Johnson Street and potentially into right of way not contemplated as part of the Bridge replacement project by the City. A tail track and crossover would be at an end station if a more frequent service is envisioned, since more than one train should be accommodated at the station during a single time span. The ideal track plan would be to create sidings on both sides of the station with a crossover north or south of the station, so that a train could pull into and depart from either side of the station.

While the suggested station (at point B) is serviceable, it does not address two service issues that also impact the station in the current location. The issues are that the service is affected by the Johnson St. bridge and that the station is quite far from the major transit demand that is located around Douglas St.

1. Johnson St. bridge - The rules require trains to stop before the bridge, which lifts to allow boats to get into the harbour, and proceed at 5 miles per hour once they receive clearance. These rules are not supposed to be changed with the new bridge, which means that the bridge that is typically opened about six times per day, each time for approximately five minutes, could possibly have reliability implications on train schedule. While this is mostly expected to happen at off-peak hours, there is a potential that trains and passengers will be isolated at the Victoria terminus from the rest of the line and create delays of schedule that may affect the location of train meets for passing, arrival times and schedule at other stations as well as the ability to coordinate transfers with other transit services at other stations.

2. Distance from Douglas St. – Douglas St. is a major commuting destination in the area since about a third of the region's employment is located there[4]. However, the current station is located about 0.5 km from this major trip attractor. This distance could be a deterrent for potential passengers that need to walk, often in the rain, to get to the train. The suggested new location of the train will not improve significantly the accessibility of the station.

West of Johnson St. Bridge

Currently there are two potential locations on the West side of the Johnson St. bridge (marked as C1 and C2 on Exhibit C.1). The proximity of these locations to each other means that the service they would provide to passengers is quite similar. The main benefit of ending the train service west of the Johnson bridge is that by doing so the unpredictability of the service will be greatly reduced allowing higher reliability and a tighter schedule. However, this location for the Victoria station presents fundamental difficulties with regard to the accessibility of the service. The station is farther away (by about 0.2 additional km) from Douglas St. compared to the current station location, making it quite unlikely that many people will walk from the train station to work. This means that the new station location will either reduce the ridership potential of the train or that a shuttle service will have to operate between the station and Douglas St. in order to accommodate passengers.

Relocating the Victoria station to the other side of the bridge could therefore result in a low ridership potential or an additional expenses for a shuttle service to bring passengers from the downtown to the train station.

Douglas St.

This alternative provides an extended line and a station in the Victoria downtown at Johnson & Douglas (depicted in exhibit C.2). This station creates an opportunity to provide a very accessible

[4] *West Shore Tram line Assessment*, C4CR Group, 2008

service to a large number of possible train riders; however, the alternative also presents many issues with regard to the type of vehicles and operations of the train line:

- Unless a Station with a platform is to be constructed in the middle of a downtown street and close lanes of Johnson Street to vehicle traffic, the trains that serve the station (and therefore the line as a whole) will have to be restricted to streetcar type cars. Even so, one or two lanes might be taken from the general purpose traffic since trains would lay over at the station and room for a streetside stop would be needed. Moreover, these cars will not be able to work on electricity unless the whole corridor is electrified. While identifying streetcars that operate on other types of energy is possible, the unique fleet requirements could result in extra costs and compatibility issues.
- The operation of a train on a downtown street may present some planning questions and could have negative affects for car and transit traffic in the downtown, for example:
  - Assuming that the train tracks will run down the middle of the street, at times of layover in the schedule (occur quite a bit during peak hours) there will be a parked train car in the middle of the street, blocking a whole lane. If the train were three cars long, it might block a north-south cross street or significant building access points depending on its location;
  - There could be conflicts between giving priority to the traffic (and transit) movement on Douglas St. compared to giving priority to the train.
  - The additional distance and the complexity of train riding in a downtown setting would result in longer travel times and probably in a lower reliability level.

Exhibit C.2 – Potential Johnson St. Station Location