Trans Canada Highway Corridor Management Plan

Drinkwater Road to Cowichan Bay Road

Final Report

Prepared for:

City of Duncan
Cowichan Tribes Council
District of North Cowichan
Cowichan Valley Regional District
South Coast Region of the BC MoT

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October 2005

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1.0 INTRODUCTION

The Trans Canada Highway serves several roles within the Duncan area ranging from the broad provincial and regional movement of vehicles, goods and services on the Island through to more localized access to individual properties. The Trans Canada Highway was originally constructed in the early 1930s. In 1958, the existing highway corridor was constructed as the bypass of Duncan. Over forty years later, this corridor is faced with many of the same issues of the original bypass at a slightly larger scale.

From a Provincial perspective, the Highway is intended to serve as an uncongested, high quality north-south route between Victoria and Nanaimo with limited delay through urban areas. Ultimately, the corridor serves the broader social and economic activity of Vancouver Island and the Province by providing access to resources, communities, provincial parks and other recreational areas. In local context the Trans Canada Highway (from Drinkwater Road to Cowichan Bay Road), in addition to accommodating through traffic, is part of a thriving and valuable commercial corridor offering key services to residents and visitors of the Duncan and Cowichan areas.

Consistent with the experiences along other urban sections of the highway in the Province, ongoing development along the corridor has resulted in a cumulative impact on the overall safety and mobility for all users of the corridor. This will ultimately serve to shorten the life of this valuable asset and at the same time accelerate the need for other costly network improvements. The aesthetic quality and driving conditions experienced along the corridor and connecting roadways are important features that form the 'first impression' for many tourists travelling to and through the community.

The City of Duncan, District of North Cowichan, Cowichan Tribes Council, Cowichan Valley Regional District and the Ministry of Transportation want a strategy to address mobility, safety,

access and aesthetic issues along the Highway corridor as well as surrounding land uses and roadway networks.

1.1 Study Objectives

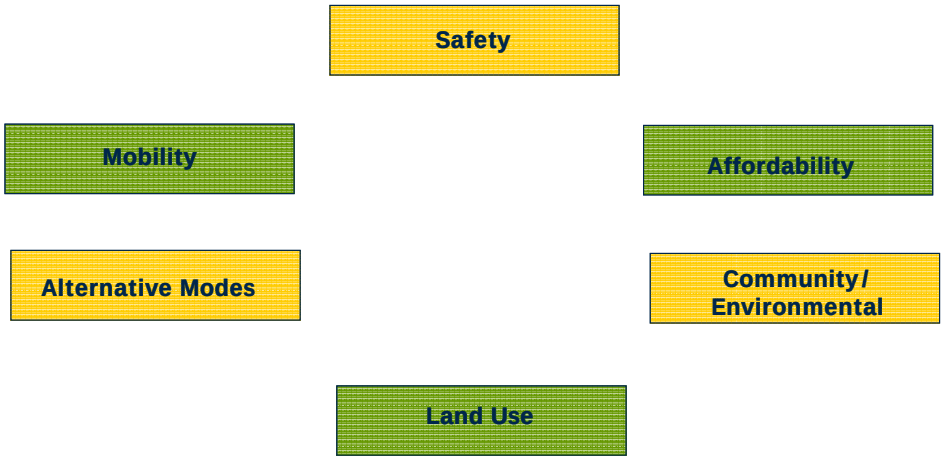
As identified in the Terms of Reference for this project, the study objectives are:

- Identify feasible medium-term and long-term improvements for the highway corridor to maintain or improve upon today's level of service;
- Identify measures to maximize the visual appeal of the highway corridor;
- Advise on support network improvements adjacent to the highway corridor;
- Identify opportunities to manage access on the highway;
- Identify measures to improve pedestrian and cyclist safety within the corridor;
- Identify at a high level long-term corridor location, supporting infrastructure, and access management requirements for corridor protection; and
- Provide phasing plan to achieve long-term goal.

1.2 Corridor Goals

Consistent with the broad role and function of the TCH through the Duncan area, the goals for the corridor as an integral part of the community are equally diverse. The Terms of Reference and discussions with key agencies highlighted many of the primary goals that will be used to assess and shape solutions for the corridor. These goals are briefly highlighted in Figure 1.1 and described as follows.

Figure 1.1 – Corridor Management Plan Goals



- ***To enhance mobility for highway traffic.*** For those travelling through the Duncan area on the TCH, the posted speeds change from 80 km/hr to the north and south to 50 km/h within the urban area. Additionally, travel time through the community is further influenced by a combination of the total traffic, number of signals and accesses along the highway as well as the overall number of vehicles that enter and leave the highway in the Duncan area. On the other hand, much of the local traffic circulating within the area avoids the highway as much as possible because of delays during peak periods of the day. Rather than simply allow congestion to negatively influence provincial, regional and local traffic, agencies have expressed the desire to see corridor mobility maintained and enhanced where possible.

- ***To improve safety for all modes.*** Because of the mixture of local, regional and provincial traffic – along with other users such as cyclists and pedestrians – as well as the corridor characteristics within the Duncan area, safety has been identified by many as a primary concern today. As such, improving safety of the corridor is recognized as an important outcome of the Corridor Management Plan.

- ***To develop integrated solutions for alternative modes.*** Today, the highway is generally recognized as a fairly unpleasant environment to walk or bike – whether alongside or crossing the highway. As land uses along the corridor and adjacent areas have intensified, walking and cycling activity have also increased. In support of the goals for alternative modes and the land uses that surround the corridor, solutions that address and facilitate pedestrians and cyclists should be recognized as integral parts of the strategy.
- ***To ensure that strategies are integrated with surrounding land use patterns.*** Many of the land uses surrounding the corridor are successful and largely well established. In a few areas, some further infill or redevelopment is anticipated over the next ten years. During this period and beyond, the highway will continue to serve an important local access and circulation function, particularly where support roadways and alternative accesses are not available. In this regard, the successful strategy will need preserve this important function either along the highway, or further expansion of the support roadway network. Additionally, corridor solutions will consider enhancements that reflect the local serving function of the highway within the study area.
- ***To identify practical and affordable medium-term stratgeies.*** Many communities expend significant time and effort in developing long-term plans which are developed based on assumptions that significant financial resources are available. Recognizing that further, large-scale improvements on the Island Highway are likely not going to happen in the medium-term, the emphasis for the Corridor Management Plan is to concentrate on those strategies and solutions that are practical and affordable over the next 10 years or so. Although the emphasis is on what can be done in the near-term, consideration will be given toward possible longer term improvement strategies where further planning could begin today.

1.3 Approach

The Corridor Management Plan is separated into five phases. The first two phases provide a complete picture of current and forecast corridor conditions without significant change to the highway or the adjacent transportation system. Phase 3 of the assignment will provide a high level review and assessment of potential long-term directions – for the next 20 to 30 years – that may be preserved in order to increase flexibility and enable further planning that may occur beyond the highway. Much of the effort and focus of the Corridor Management Plan is on medium-term improvements and potential long-term strategies that were identified and evaluated in Phase 4. Optional strategies include everything from initiatives to manage safety and mobility along the existing highway – such as access management and/or support roadways – through to upgrades to the highway and adjacent roadway system that are realistically achievable in the next 10 or so years.

Figure 1.2 – Corridor Management Plan Approach

2.0 WHERE ARE WE TODAY?

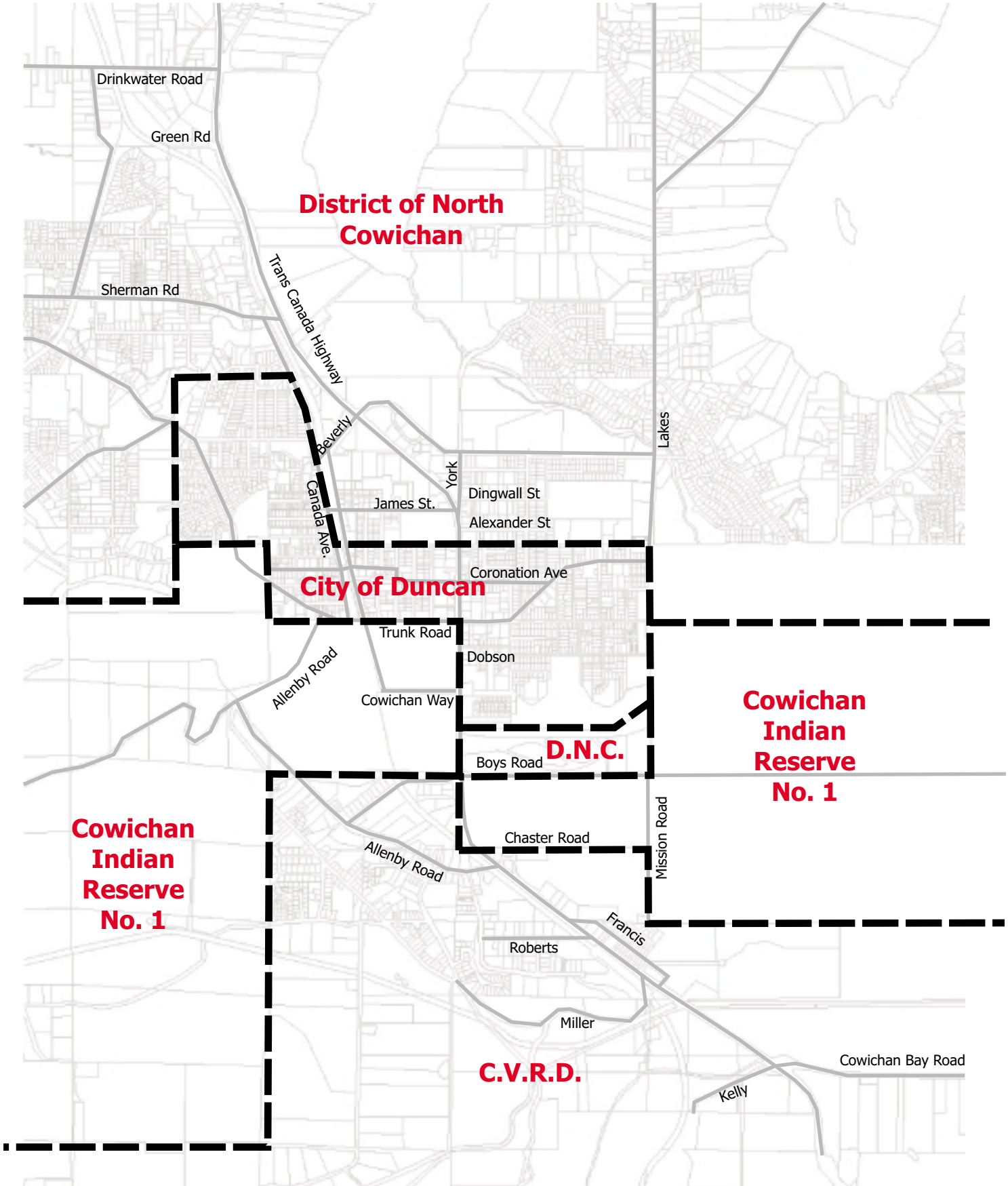
This section of the report highlights the existing conditions along the Trans Canada Highway in the Duncan area. In particular, the review considers the community context, the broader roadway network as well as the highway corridor characteristics in serving all modes of travel.

2.1 Community Overview

The City of Duncan is located approximately 50km south of Nanaimo and 60km north of Victoria. As illustrated below in Figure 2.1, the Duncan area is located midway between these regional centres with the Trans Canada Highway as the only north-south connection to Highway 17 in the south and Highway 19 in the north. In view of its location and overall highway connectivity, historical and forecast traffic on the highway is influenced by economic activity of several Vancouver Island communities – such as Nanaimo and the Capital Region – in addition to local land use patterns.

Figure 2.1 - Vancouver Island Context

Between Drinkwater Road and Cowichan Bay Road, the Trans Canada Highway traverses through four jurisdictions – the City of Duncan, District of North Cowichan, Cowichan Indian Reserve No.1 and the Cowichan Valley Regional District (see Figure 2.2). The multi-jurisdictional nature of the corridor through this area combined with the established land use patterns makes significant change along the existing corridor challenging as experienced through the work on the Vancouver Island Highway.



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Boundary

Figure 2.2: Jurisdictional Boundaries

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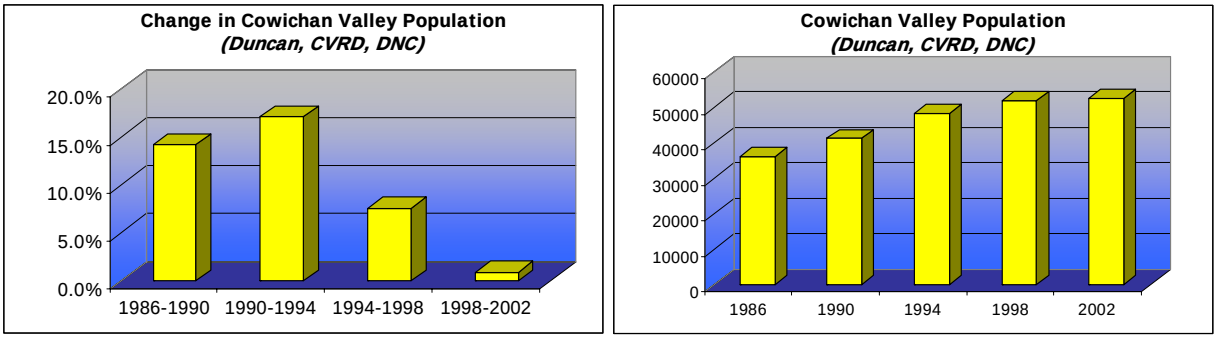
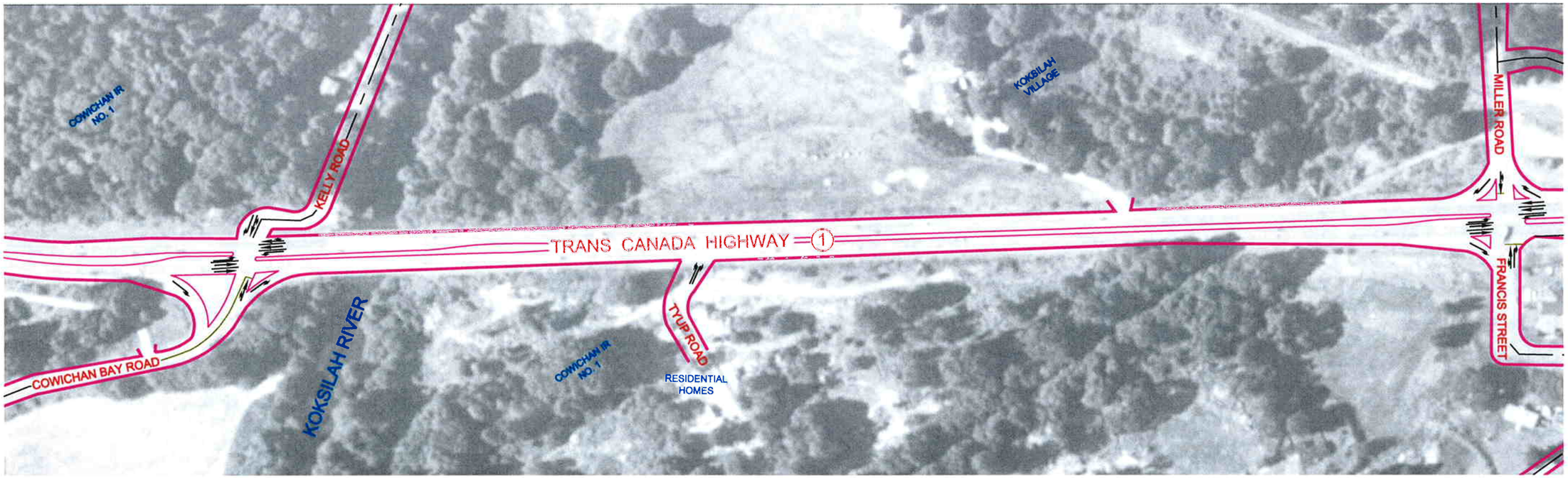
The total population of the Cowichan Valley Regional District, including Duncan, Ladysmith, Lake Cowichan and North Cowichan was approximately 75,000 in 2002. The City of Duncan, District of North Cowichan and other portions of the Cowichan Valley Regional District (east of Lake Cowichan and north of Sooke) had a total population of slightly more than 50,000 people in 2002. This includes the population of Cowichan Tribes. In 2002, the total reported population of the Cowichan Tribes (nine reserves total) was 3,685 (Source: *Registered Indian Population by Sex and Residence 2002*, Indian and Northern Affairs Canada). Since 1986, the population has grown by approximately 16,000 people or 2.4% per year on average. As illustrated in Figure 2.3 below, the most significant growth occurred during the late 80s and early 90s. Since that time, the population levels within the Region have remained relatively constant, with an average growth rate of less than 1% per year.

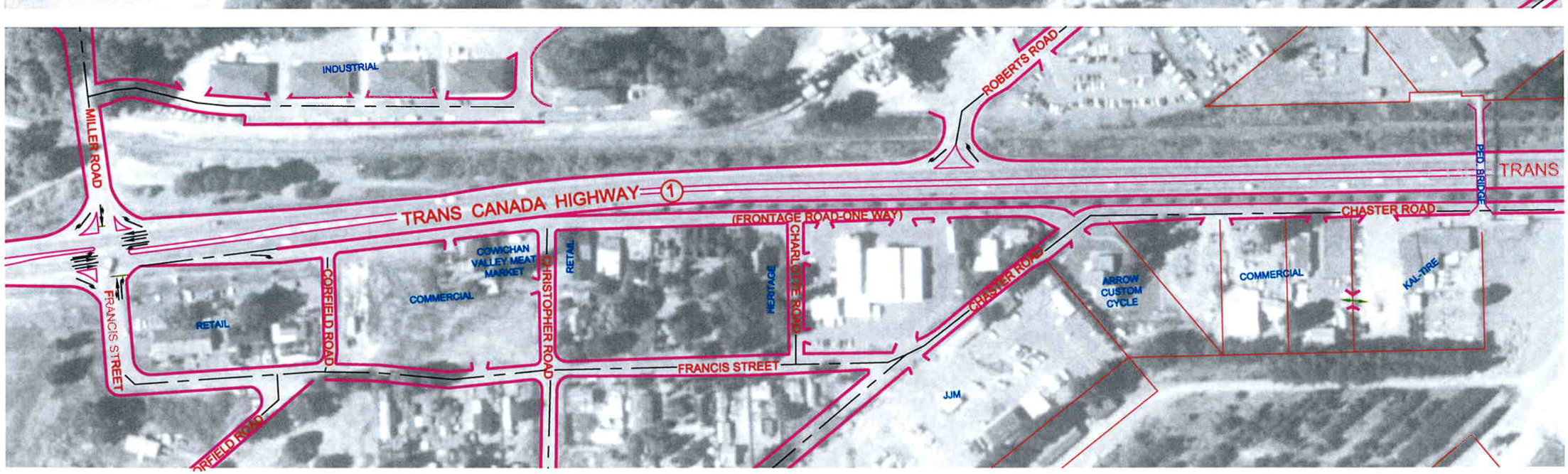
Figure 2.3 - Historical Population Growth Patterns



Source: Population Section, BC Stats, Ministry of Management Services, Government of British Columbia.

As previously indicated, the shape of land uses surrounding the Trans Canada Highway today changes from a predominantly rural character north and south of the study area, to an established, built urban area within the core. Figure 2.4 illustrates the existing land parcels and uses along side the highway in the core study area between Cowichan Bay Road and Beverly Street. Existing and zoned uses for this area are summarized in Appendix A. As illustrated, the land parcels and existing uses are most intense between Cowichan Way and Beverly Street. Property frontages typically range from 15m to 45m between Cowichan Way and James Street and from 80m to a maximum 230m between James Street and Beverly Street. North and south of this section, the property frontages are generally more than 90m. Without sufficient support networks for alternative access and/or reciprocal access agreements between property owners, these parcel sizes often require direct access to the Highway.

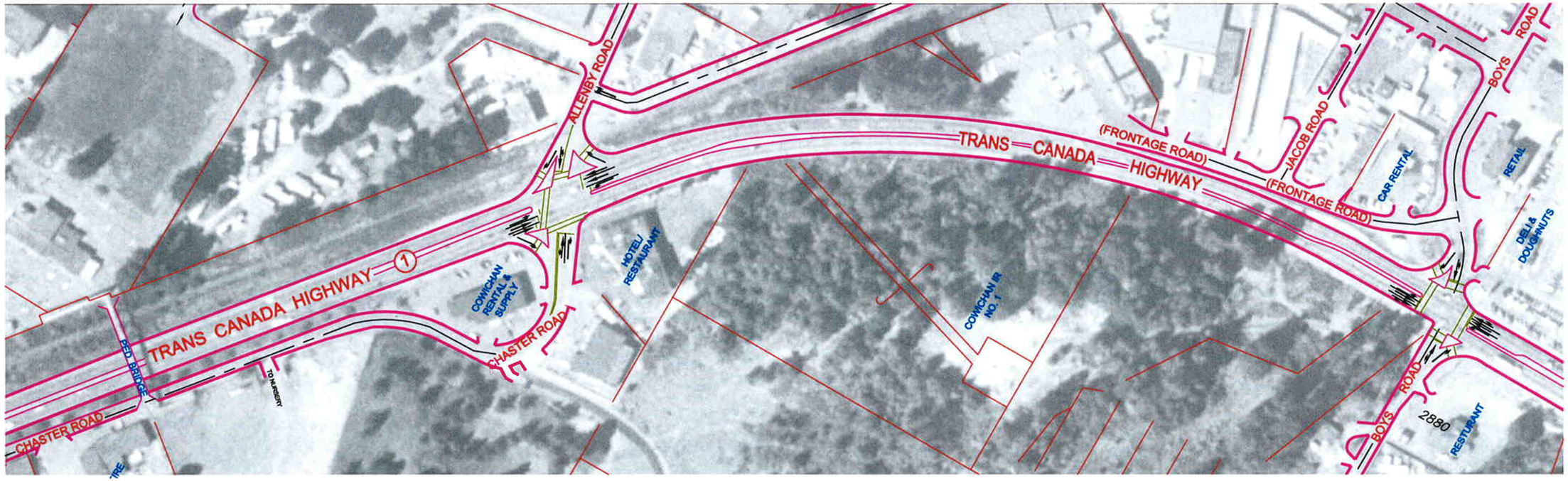


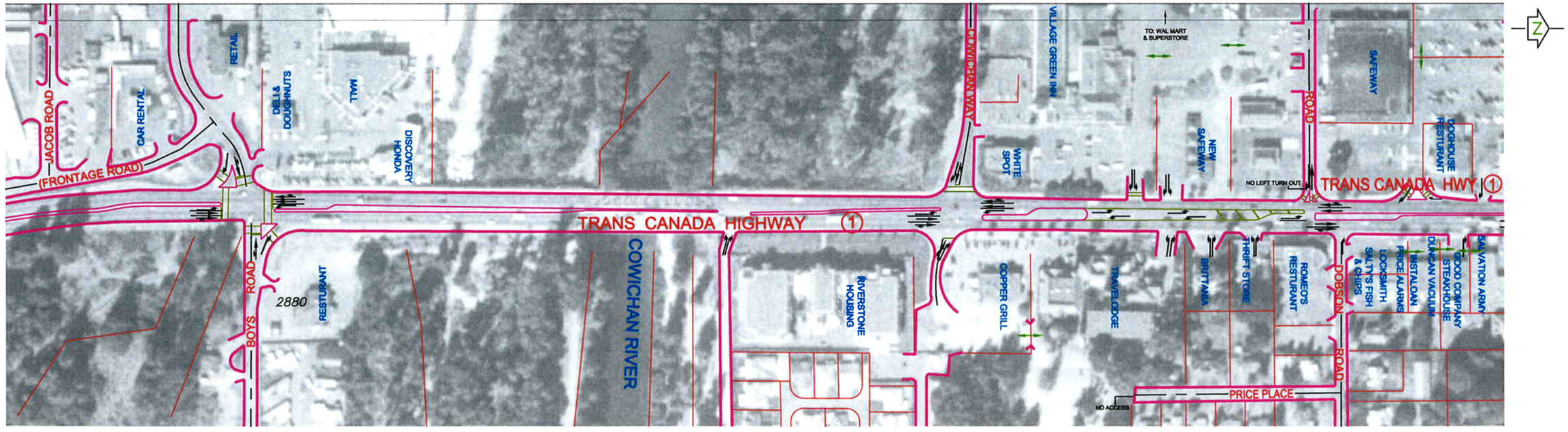


Trans Canada Highway - Corridor Management Plan
Cowichan Bay Road to Pedestrian Bridge

Current Uses & Laning Configuration
Figure 2.4 (1/3)
Scale 1:2,500

LEGEND
- Shared Parking Lot





Trans Canada Highway - Corridor Management Plan

Pedestrian Bridge to Dobson Road

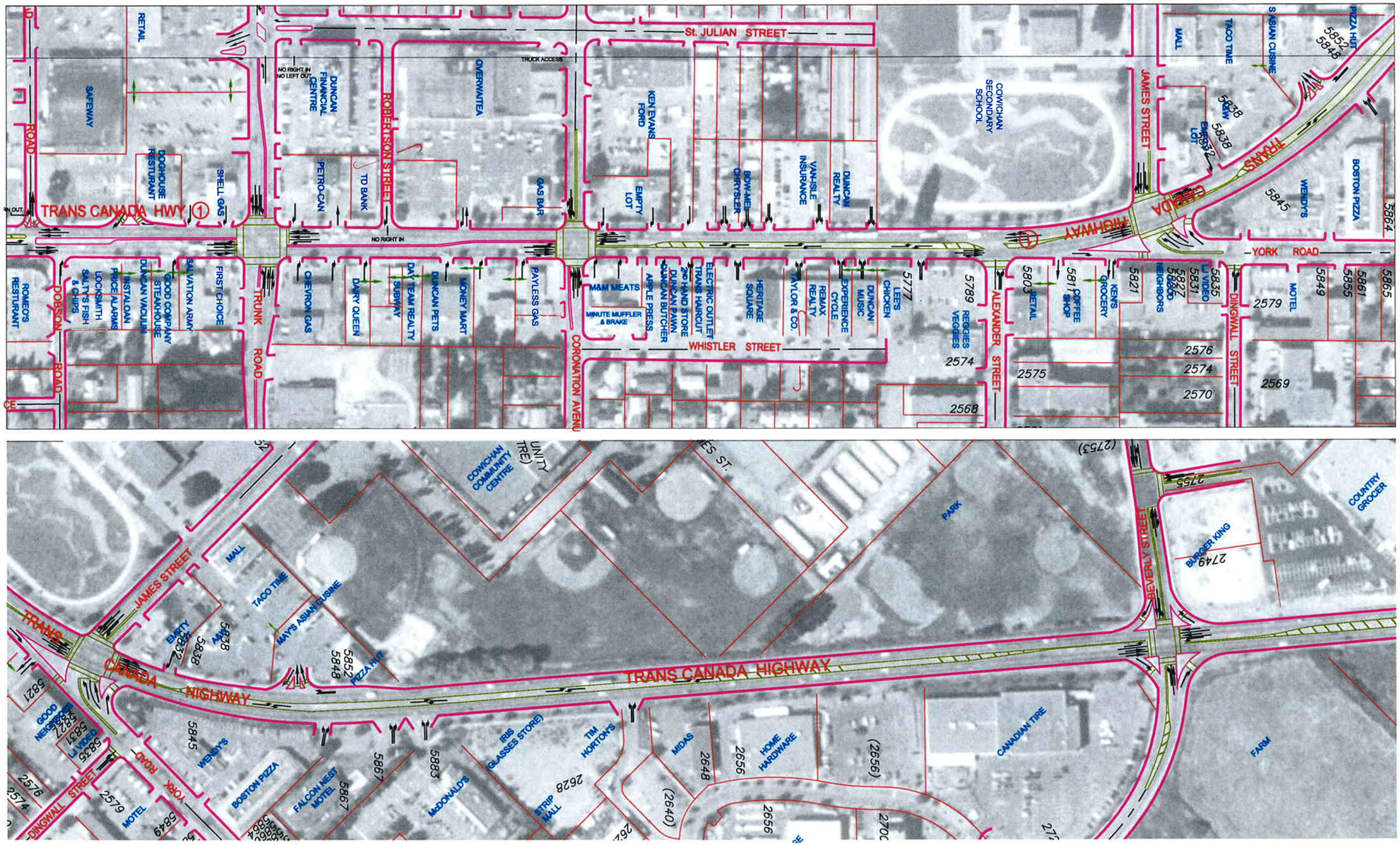
Current Uses & Laning Configuration

Figure 2.4 (2/3)

Scale 1:2,500

LEGEND

- Shared Parking Lot



Trans Canada Highway - Corridor Management Plan

Dobson Road to Beverley Street

Current Uses & Laning Configuration

Figure 2.4 (3/3)

Scale 1:2,500

LEGEND

- Shared Parking Lot

2.2 The Network

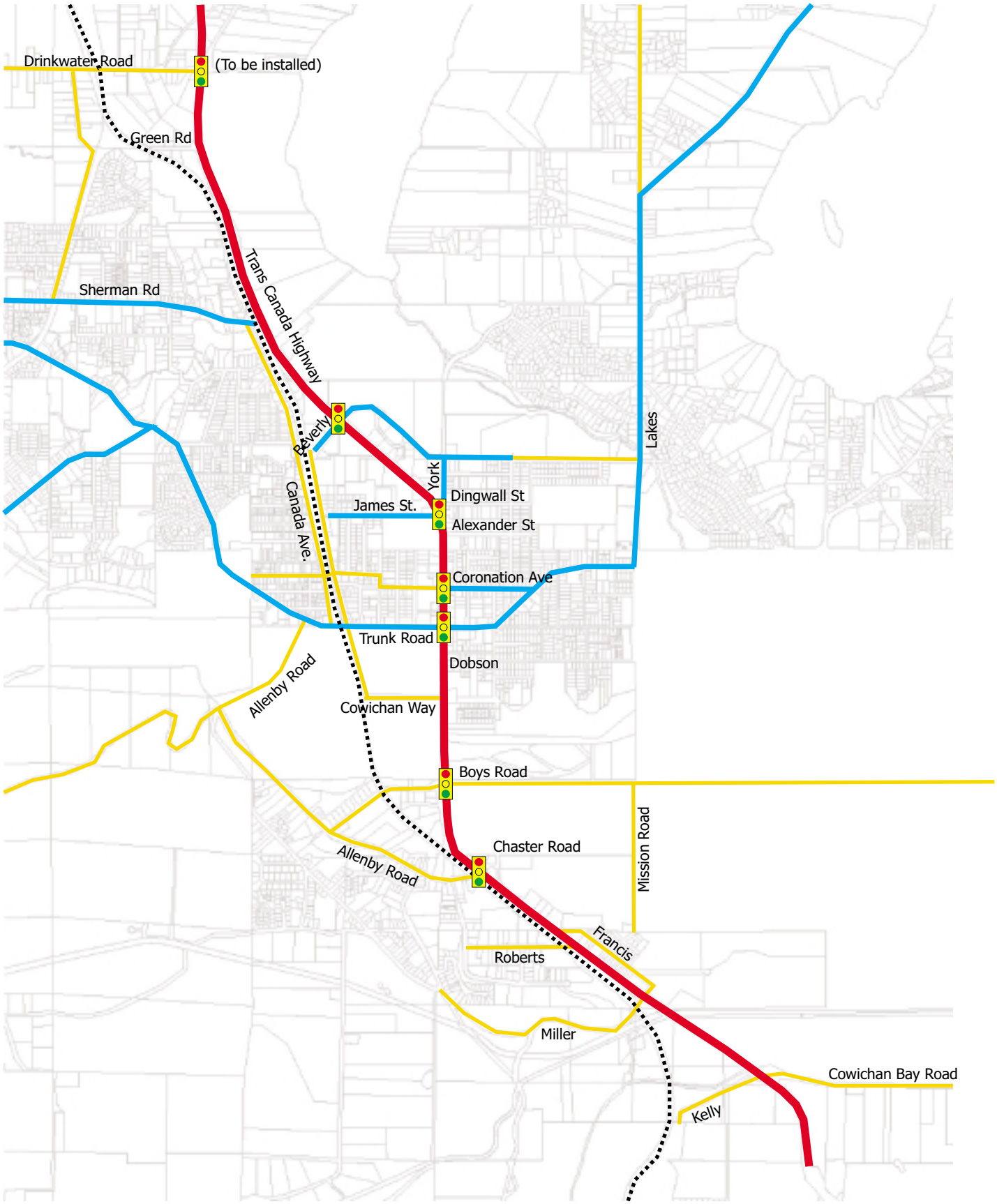
The Trans Canada Highway is a primary highway that was constructed in the early 1930s. In the late 50s, the corridor underwent various improvements that included constructing the Duncan bypass in 1958. Immediately surrounding and crossing the corridor, local roadway networks are also well established as illustrated in Figure 2.5. The roadway network consists of arterials (or majors) and collectors (or minors) as well as a local road system. In general, the east-west corridors crossing the highway are spaced at anywhere from 200m between Coronation Avenue and Truck Road to approximately 750m between Beverly Street and James Street. Each of the major intersections is controlled by traffic control signals. Many of these east-west routes are discontinuous. Further, the network parallel to the highway is very limited, with few continuous north-south alternatives to the Trans Canada Highway. Consistent with other communities where the support roadway network is limited, the lack of north-south alternatives can result in higher than average growth along the Trans Canada Highway than may be experienced in other parts of the roadway network if capacity is available.

2.3 The Highway

This section of the report highlights the primary features and conditions of the Trans Canada Highway within the study area. In particular, the lane arrangements and access configurations are described along with historical daily and peak traffic patterns and conditions.

Highway Configuration

Overall, the Trans Canada Highway is a four lane, primary highway serving north-south travel for Vancouver Island. Between Cowichan Bay Road and Drinkwater Road, the highway changes from an 80km/hr rural, divided highway in the north and south areas to a 50km/hr urban, undivided section with two-way left turn lanes in the core area. Table 2.1 summarizes the overall highway characteristics throughout the study area.



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- Highway
- Arterial/Major
- Collector/Minor
- Railroad

Figure 2.5: Roadway Classifications

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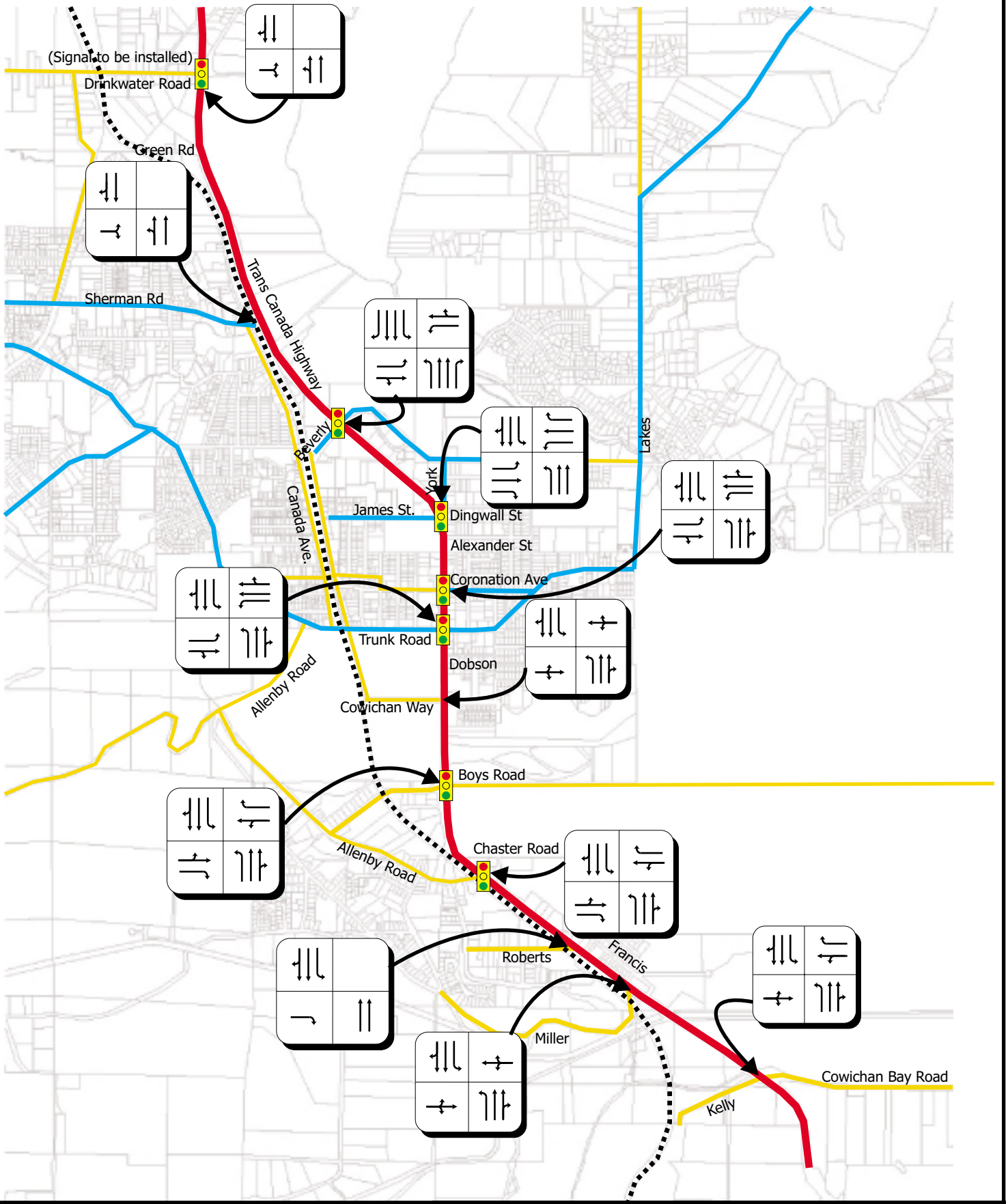
Table 2.1 - Primary Highway Characteristics

Start (South)	End (North)	Posted Speed	Classification	Median Type
Cowichan Bay Road	Allenby Road	80 km/h	RAD	barrier
Allenby Road	Boys Road	60 km/h	RAD	barrier
Boys Road	Cowichan Way (80m north)	50 km/h	UAD	raised
Cowichan Way (105m north)	Dobson Road	50 km/h	UAU	TWLTL
Dobson Road	Coronation Avenue	50 km/h	UAD	raised
Coronation Avenue	Alexander Street	50 km/h	UAU	TWLTL
Alexander Street	York Road	50 km/h	UAU	painted
York Road	300m South Beverly Street	50 km/h	UAU	TWLTL
300m South Beverly Street	Beverly Street	60 km/h	UAU	TWLTL
Beverly Street	West Business Access (250m north of Beverly St)	60 km/h	UAU	painted
West Business Access (250m north of Beverly St)	Drinkwater Road	80 km/h	RAD	barrier

UAD – Urban Arterial Divided *UAU – Urban Arterial Undivided* *RAD – Rural Arterial Divided*

Within the study area, the highway supports connections to several major roads serving the surrounding community. As illustrated in Figure 2.6, most intersections where full movement highway access is permitted are controlled by traffic signals. The spacing between these signals ranges anywhere from slightly more than 200m between Trunk Road and Coronation Avenue to as much as 2km between Beverly Street and Drinkwater Road. Signals at Allenby Road, Boys Road, Trunk Road, Cowichan Way, and James Street are co-ordinated in attempt to provide signal progression for highway through movements.

Along some sections of the Highway, the Esquimalt and Nanaimo Railway (ENR) runs parallel to the highway. In the southern portions of the study area, the ENR railway is located immediately west of the highway between Allenby Road and Miller Road. Further to the north, the railway runs immediately parallel to the highway between Green Road and Berkeley Street. In both cases, the proximity of the at-grade crossings influences the operation of the highway as well as the interconnecting roadway system.



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Signalized Intersection

Lane Configuration

Figure 2.6: Highway Laning Configurations & Controls

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Several properties adjacent to the highway have direct access. In some locations, frontage roads that connect with the highway at strategic locations are provided to support property access, without impacting the highway. For example, a one-way frontage road exists from north of Francis Street to Chaster Road, where the two-way operation begins through to Allenby Road. Further, a short frontage road is located on the west side of the Highway south of Boys Road.

Although direct access to the primary highway system is generally not permitted, partial and full movement accesses exist throughout much of the study area. (Access spacing is illustrated in Appendix B). This arrangement typically increases the vehicle conflicts between through and local traffic patterns, contributing toward overall safety and mobility issues. In addition to the presence of driveways, the spacing and density can also further magnify the issue. For several sections of the Trans Canada Highway, the minimum spacing between driveways is less than 10m, with a density of 25 to 45 accesses per kilometre (see Table 2.2). Although the width of the properties surrounding the corridor has influenced the spacing and density of accesses, these conditions would be typical of a collector or local road system, and would contribute significantly to mobility and safety concerns along the highway.

Table 2.2- Access Spacing

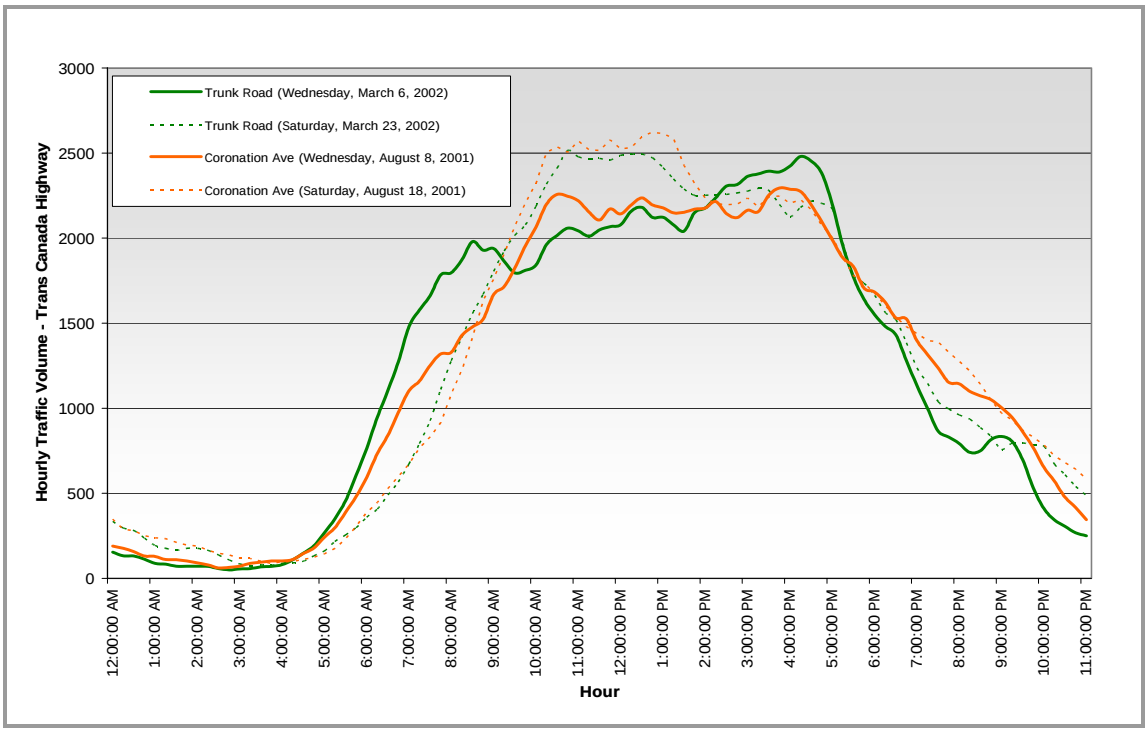
Number of Accesses	Minimum Spacing (m)	Maximum Spacing (m)	Average Spacing (m)	Full Access Density (access/km)	Partial Access Density (access/km)	Total Distance (m)
Boys to Cowichan Way						
0	0	0	0		0.00	425
Cowichan Way to Dobson						
6	5	84	25	26.67		225
Dobson to Coronation East Side (West Side)						
7 (7)	3 (3)	58 (56)	30 (33)		21.54 (21.54)	325 (325)
Coronation to James						
18	3	53	12	46.15		390
James to Beverly						
5	33	322	118	6.85		730

Traffic Characteristics

This section provides highlights of the traffic characteristics and patterns within the study area. The background data described in this section of the report is provided in Appendix C.

- In 2001, the average annual daily traffic (AADT) along the Trans Canada Highway is very similar throughout the study area – with approximately 24,000 and 21,000 vehicles to the south and north respectively, and almost 27,000 within the core area near Coronation Avenue.
- Historically, traffic volumes along the highway have increased on average from 1.5% to 2.0% per year.
- Daily traffic volumes along the highway are slightly higher (less than 10% more than the AADT) during the summer months of June and July.
- During a typical weekday and weekend, the daily traffic volumes along the highway do not vary significantly, with slightly higher traffic levels on Friday.
- Weekday and weekend peak volumes are also relatively consistent, with approximately 2,500 vehicles in both directions. The primary difference is that the weekday peak occurs during the later afternoon (3 pm to 5 pm) while the weekend peak is during the midday period (10 am to 1 pm). The two way peak volume represents approximately 10% of the daily traffic volumes which is consistent with most urban areas. Figure 2.7 illustrates typical weekday and weekend twenty-four hour volume profiles.
- During the morning and afternoon peak hours, truck volumes range anywhere from 60 to 120 vehicles per hour within the study area. This accounts for approximately 5% of the corridor volumes.

Figure 2.7 – Daily Traffic Volume Profiles



Vehicle Mobility

Mobility along and crossing the Trans Canada Highway affects not only the movement of people and goods between communities on the Island, but the quality of life for the communities that surround the corridor. Intersection levels of service (LOS) provide an indication of corridor mobility as measured by delay for each of the signalized intersections along the corridor. Figure 2.8 illustrates the overall PM peak hour levels of service at each signalized intersection within the study area (as well as the delays experienced for each movement through the intersection). Generally, improvements are recommended at signalized intersections that experience LOS E or F.

As previously indicated, the signals between Allenby Road and James Street are co-ordinated to provide signal progression for highway through movements. These results indicate that the majority of signalized intersections operate at acceptable levels of service during the peak period, although some turning movements at each intersection may operate at or beyond the existing capacity. The overall performance at Trunk Road and Beverly Street is poor, with average intersection delay beyond what would be typically desirable, more than 60 seconds per vehicle. It is anticipated that the delays experienced at the major intersections are further impacted by the spacing and density of accesses along much of the highway corridor.

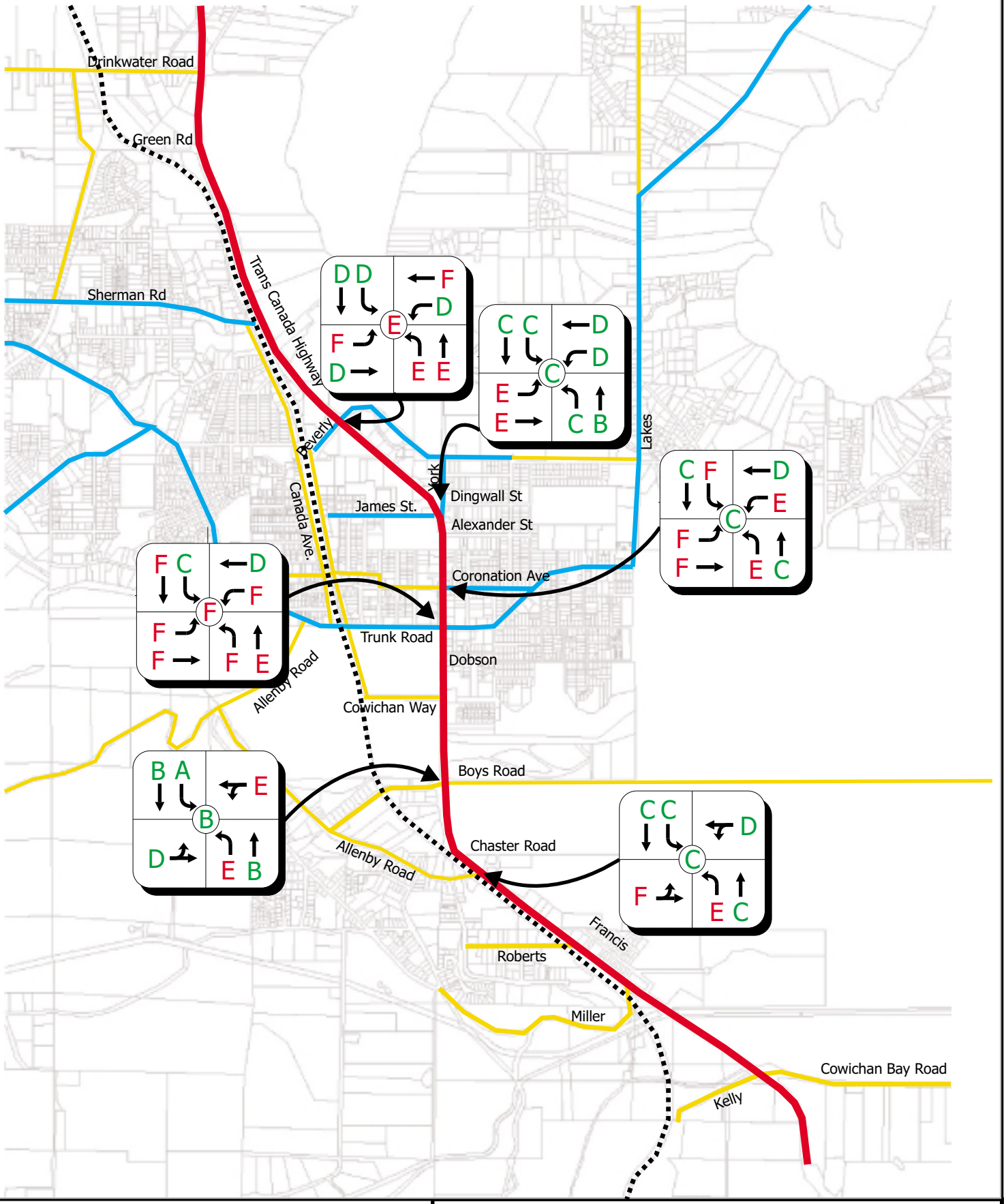


Figure 2.8: Existing PM Signalized Intersection Level of Service (2004)

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The results indicate that overall operation at full movement unsignalized intersections varies throughout the corridor, depending upon traffic volumes on the crossing roads. Crossing road movements generally operate poorly, with failing levels of service (due to delay). Although current overall operation at unsignalized intersections outside the City is good (i.e. Cowichan Bay Road), increases in crossing road volumes will deteriorate intersection performance as the number of available gaps on the highway remains limited.

Another indicator of highway corridor performance is the overall travel time, or average travel speed. Although the goal is not to maximize speeds, actual travel times/speeds today and in future are compared with posted speeds to gauge mobility. Table 2.3 below summarizes the existing posted speed and actual average travel speeds recorded along the highway during peak study periods. The minimum desirable average travel speeds have been identified by the Ministry for other highway corridors in the province for comparative purposes.

Table 2.3 - Peak Period Travel Speed Comparisons

Section	Posted Speed	Avg Speed Observed & Simulated	Minimum Desirable Avg Speed
Cowichan Bay Road to Allenby Road	80 km/hr	65 km/h	75 – 80 km/h
Allenby Road to Trunk Road	50/60 km/hr	50 km/h	30 km/h
Trunk Road to Beverly Street	50/60 km/hr	32 km/h	30 km/h
Beverly Street to Drinkwater Road	60 / 80 km/hr	45 km/h	65 km/h

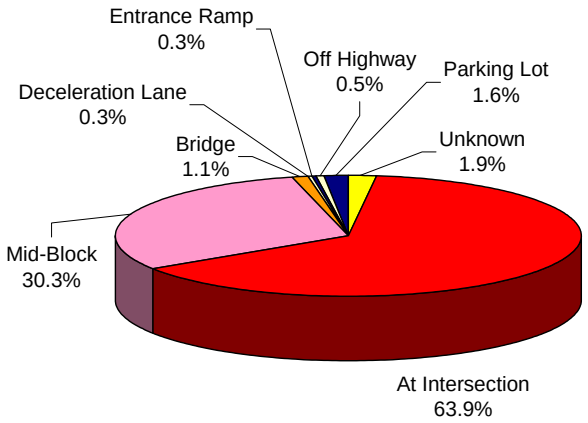
These results indicate that overall average travel speeds are well below the posted speeds as expected and within a reasonable range of the minimum average speeds used on other parts of the province, considering the north and south areas are transitioning to and from a 50km/hr speed zone. This information also indicates that the total travel time through Duncan from Cowichan Bay Road through to Drinkwater is approximately 7 minutes during off-peak periods, and 10 minutes in the peak.

Safety

Corridor safety typically influences all modes of travel. The Ministry of Transportation collision records from the police provide an overview of the vehicle collision patterns along the highway for the purpose of gauging corridor safety and identifying any specific problem areas. The following discussion highlights the primary patterns from reported collisions between 1998 and 2002. Appendix D provides further detail on the summary of collision patterns. It should be recognized that these patterns do not include all collisions as the police do not generally respond to minor collisions.

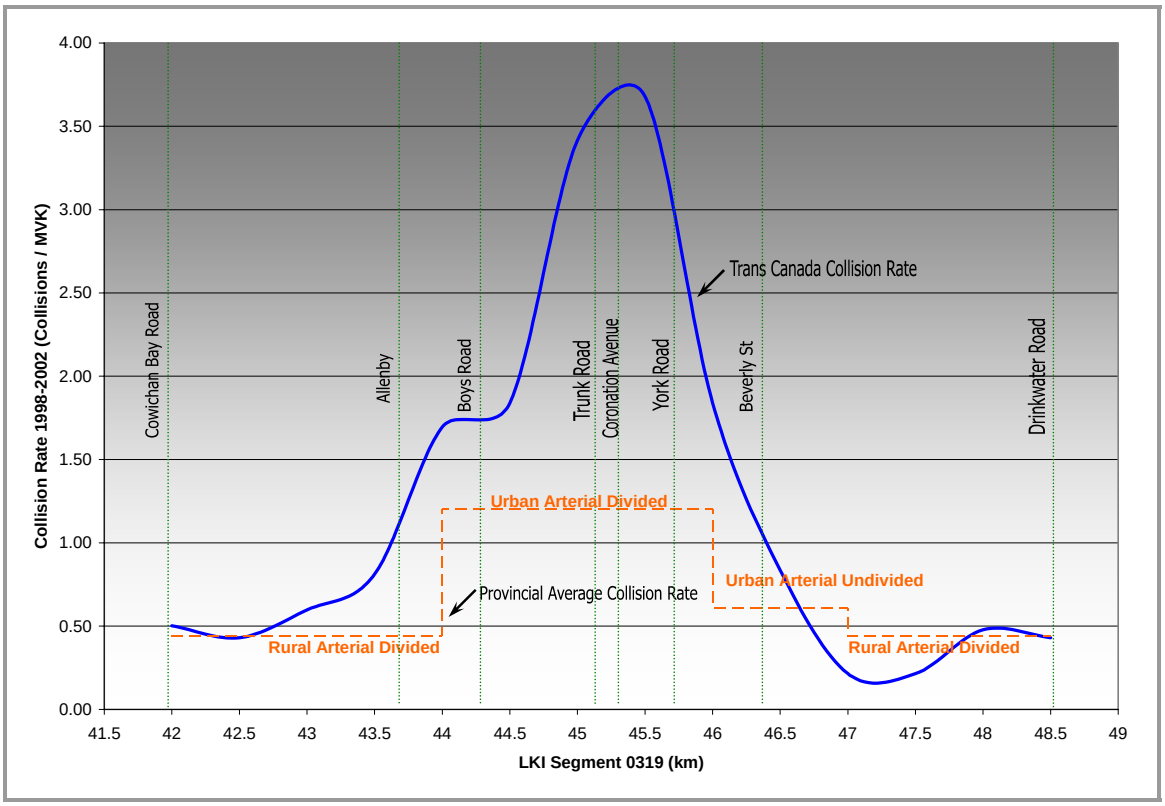
- Approximately 366 collisions were reported between Cowichan Bay Road and Drinkwater, or 73 per year.
- As expected, a large majority of the collisions occurred at the major intersections of Beverly Street, James Street, Coronations Avenue, Trunk Road, Boys Road and Allenby Road.
- Mid-block areas between intersections account for approximately 30% of the total collisions (Figure 2.9).

Figure 2.9 - Distribution of Collisions by Location Type



- Over 60% of the collisions were classified as either rear-ends, left turns or intersection 90 degree collisions.
- Collision rates exceed the provincial averages for similar facilities throughout much of the study area (Figure 2.10).
- With the exception of the section between Beverly Street and Drinkwater Road, the severity of collisions is generally below the provincial averages for much of the highway. This northern section of highway is currently under construction to provide signalization at Drinkwater Road. The section of highway immediately south of Beverly Street is under construction to provide two-way left turn lane between James Street and Beverly Street.

Figure 2.10 - Corridor Collision Rates



Walking and Cycling

Walking and cycling activity along and crossing the Trans Canada Highway corridor is growing, likely a result of increase in development on both sides of the highway. Considering the growing demands along with the volume and type of traffic using the highway and the number of driveways that access the corridor, pedestrians and cyclists generally experience a challenging and unattractive environment. An explicit goal of the Corridor Management Plan is to create a safer and more attractive environment for pedestrians in key areas along and crossing the corridor as well as support planned bicycle facilities. The following discussion highlights some of the existing conditions experienced by pedestrians and cyclists.

- Sidewalks are provided on both sides of the highway for much of the corridor. As summarized in Table 2.4, although there are no gaps in the sidewalk from south of Beverly Street to Boys Road, a 1.0m wide sidewalk without boulevard is provided between McDonalds and James Street on the east side of the highway.

Table 2.4 - Existing Sidewalk Inventory

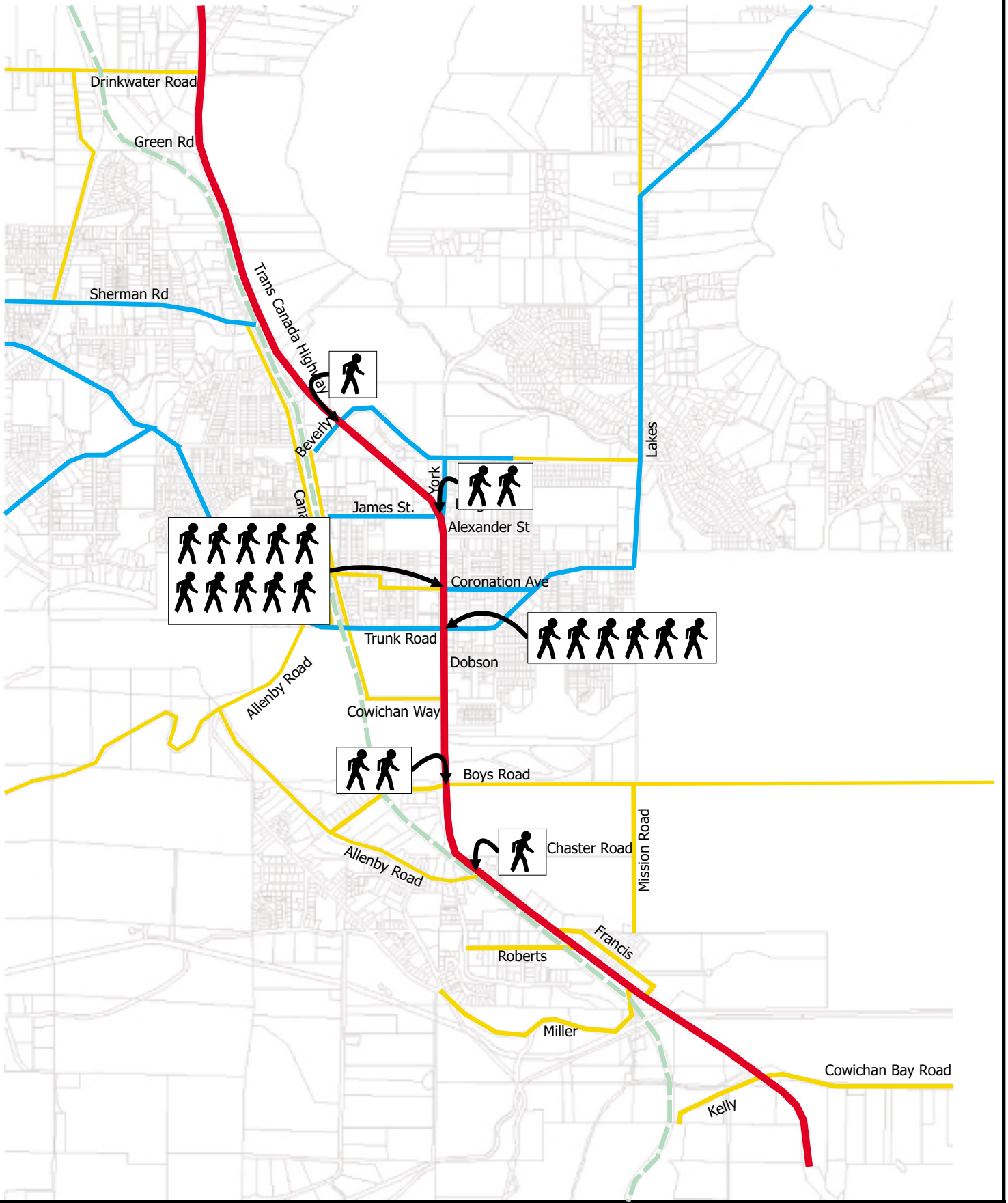
Section (Side of Highway)	East Side		West Side	
	Boulevard Width (m)	Sidewalk Width (m)	Boulevard Width (m)	Sidewalk Width (m)
Beverly Street to Tim Horton's (E)	0	0	0	0
Tim Horton's (E) to McDonalds (E)	5	1.7	0	0
McDonalds (E) to Pizza Hut (W)	0	1.0	0	0
Pizza Hut (W) to Empty Lot (W)	0	1.0	0	1.7
Empty Lot (W) to James Street	0	1.0	0	5.6
James Street to Alexander (E)	0	1.7	0	1.7
Alexander (E) to Duncan Realty (W)	3.5	1.7	0	1.7
Duncan Realty (W) to Coronation Ave	3.5	1.7	3	1.7
Coronation Ave to Robertson (W)	2	1.7	2.5	1.5
Robertson (W) to Trunk Road	2	1.7	1.5	1.5
Trunk Road to Good Company (E)	0	3.5	0	1.7
Good Company (E) to Dobson (E)	2	1.5	0	1.7
Dobson (E) to Boys Road	0	1.7	0	1.7

- The existing sidewalk width of 1.7m or less without any buffer area between the highway for much of the study area significantly reduces the comfort and safety of cyclists along the corridor.
- "Walking areas" along some sidewalks are restricted to accommodate signage and utilities.
- There are no raised median islands along the corridor and at signalized intersections sufficient to provide refuge for pedestrians or cyclists wishing to cross the highway. Any existing raised median islands are approximately 1m wide. Figure 2.11 illustrates the existing median island at Trunk Road.

Figure 2.11 - Existing Median at Trunk Road

- There are no raised median islands along the side streets that provide refuge for pedestrians or cyclists crossing walking along the highway. Refuge is, however, provided by right-turn channelization islands as shown below right (at James Street).

- Pedestrian activity along and crossing the highway is highest in the areas of Coronation Avenue and Trunk Road as illustrated in Figure 2.12 where approximately 30 to 50 pedestrians are reported to use the intersection crosswalks (along and crossing the highway) during the afternoon peak hour.



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5 Pedestrians

Figure 2.12: PM Peak Hour Pedestrian Activity at Intersections

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3.0 WHERE ARE WE GOING?

This section of the report examines those factors that influence demands on the Trans Canada Highway, and reviews anticipated long-term levels of mobility without any change in the highway or local road systems. The broad strategies to address existing and future potential issues and achieve the corridor goals examined in Section 4 of the report.

3.1 The Future Without Major Improvements

Over the next 10 to 20 years, population growth and land use changes in the Duncan area, and increased economic activity and demographic change in other parts of Vancouver Island will contribute toward increased travel demands for all modes along and crossing the Trans Canada Highway. In addition, local roadway network improvements can also serve to support at least a share of the increased traffic – particularly local serving trips. This section briefly highlights those anticipated growth patterns and planned local network improvements in communities surrounding the Trans Canada Highway.

Growth and Development

Although most of the land uses surrounding the core area of the corridor are well established, the following key observations are made regarding future change in population as well as growth in traffic generated within the broader Duncan area.

- Over the last 10 years, annual population growth throughout Vancouver Island has been slightly less that 1% per year, while at approximately 1.3% for Duncan, Cowichan Valley Regional District and the District of North Cowichan. According to BC Stats, these rates of growth are not projected to change significantly over the next 20 years.

Table 3.1 - Annual Population Growth

	Annual Growth (% /yr)	
	Historical (10 yrs)	**Forecast (20 yrs)**
Duncan/CVRD/DNC	1.3%	1.1%
Vancouver Island	0.9%	0.9%

Source: Population Section, BC Stats, Ministry of Management Services, Government of BC

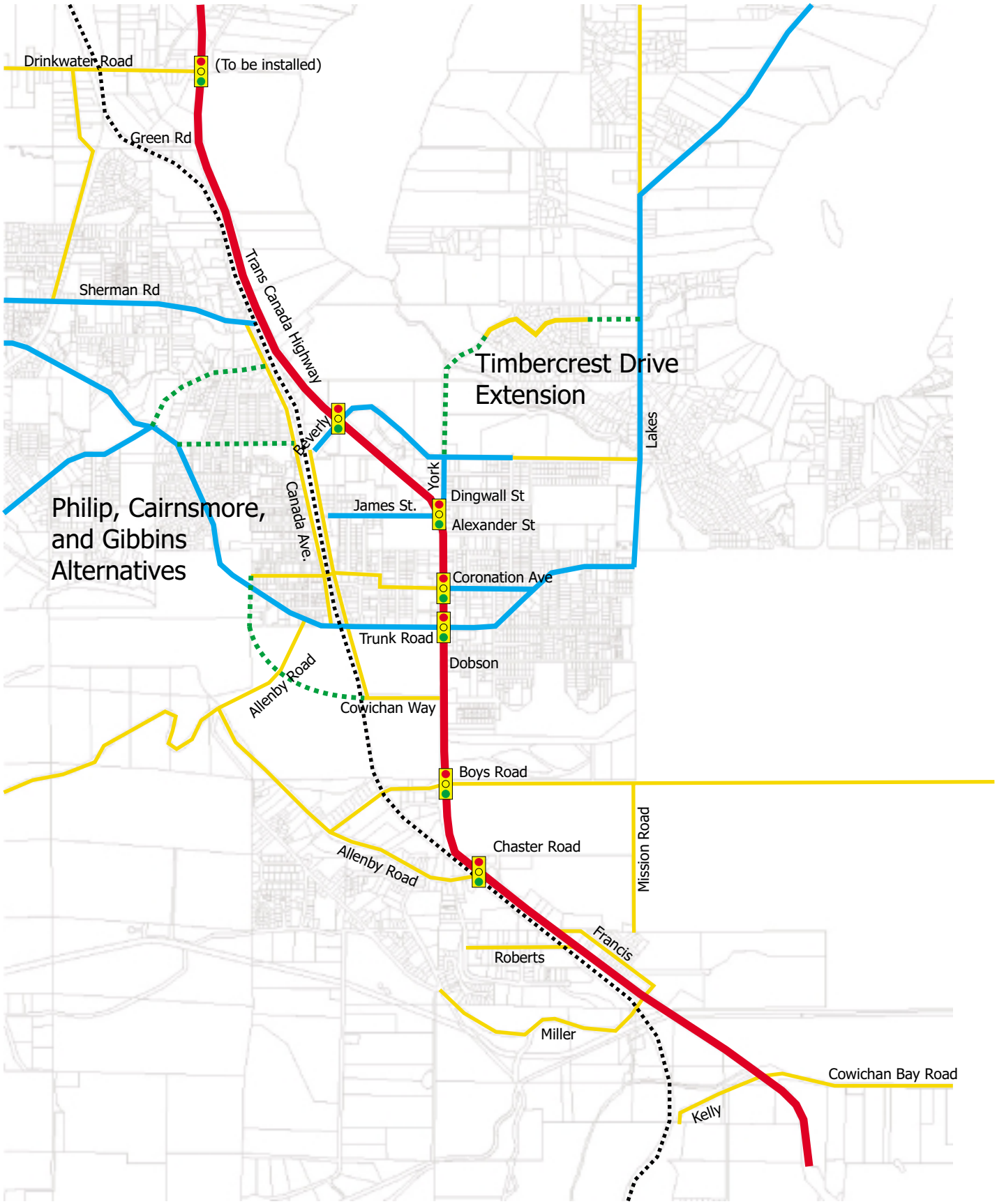
- The rate of historical growth identified by BC Stats is consistent with the historical change in traffic volumes along the Highway which has been less than 1% per year.
- Previous transportation studies have forecast growth of approximately 2% per year for the Duncan area assuming an overall population increase of less than 1% per year and the fact that there are relatively few major roads to support most of the traffic increase.

- Although most land uses immediately surrounding the corridor are established, members of the Steering Committee indicated that some redevelopment is likely in the long-term, with only a few areas where short-term development is anticipated – such as the northwest corner of the highway and Drinkwater Road, between Green Road and Drinkwater Road, northeast side of Cowichan Bay Road and possibly between Allenby Road and Boys Road.

Future Transportation Related Improvements

Future transportation and land use policies and improvements surrounding the Trans Canada Highway could ultimately form part of the strategy for addressing key transportation issues along the highway. This section of the report highlights those local area plans that will have the greatest impact on the highway corridor, some of which are illustrated in Figure 3.1. Those policies and planned improvements summarized below have been identified through previous plans and reports prepared by agencies represented on the Steering Committee.

- **CVRD Cowichan-Koksilah (Electoral Area E and Part of F) OCP (1994):**
  - Trans Canada Highway maintained as restricted access highway – direct access only attainable at or opposite intersection with major local road; and,
  - No new points of access to TCH in the plan area, landscape buffer at least 30m along highway for new developments to improve safety and visual representation of the community along the TCH.
- **City of Duncan OCP (1995):**
  - Minimize direct access to the highway through development approval process;
  - Address alternate network roads around Duncan, possible extension of municipal roads through Cowichan Tribes land, possibility of one-way system for Canada Avenue / Duncan Street, diversion of westbound traffic from Trunk Road onto Coronation Avenue – to maintain highway capacity, higher mobility, accessibility and safety;
  - Complete Cairnsmore/Beverly Street connector;
  - Provide interconnected road system to Cowichan Way north to Canada Avenue and Government Street;
  - Enhance the pedestrian circulation system;
  - Incorporate bicycles as part of the transportation system;
  - Encourage enhanced operation of Cowichan Valley Regional Transit System; and



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- Highway
- Arterial/Major
- Collector/Minor
- Railroad

Figure 3.1 - Future Roads

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- Land use plan – commercial east and west of highway (adjacent property) except just north of Cowichan River on east side where identified as medium density residential.

- **Cowichan Bay Settlement Plan (Electoral Area D) – 1986:**
  - Restrict and reduce the number of local or private road intersections with the TCH
- **District of North Cowichan OCP 2002:**
  - Proposed arterial roads;
    - York Road extension (east of TCH) between Beverly and Timbercrest Drive
    - Philip, Cairnsmore, Gibbins Alternatives (west of TCH) – connect Beverly Street to Cairnsmore Street
    - Maple Bay Road to TCH connection – long term alternate route (to Tzouhalem Road) from Maple Bay to TCH
  - Commercial 'villages' on James Street, York Road;
  - Minimize highway access points; and
  - Encourage tree planting and other landscaping along the highway corridor.

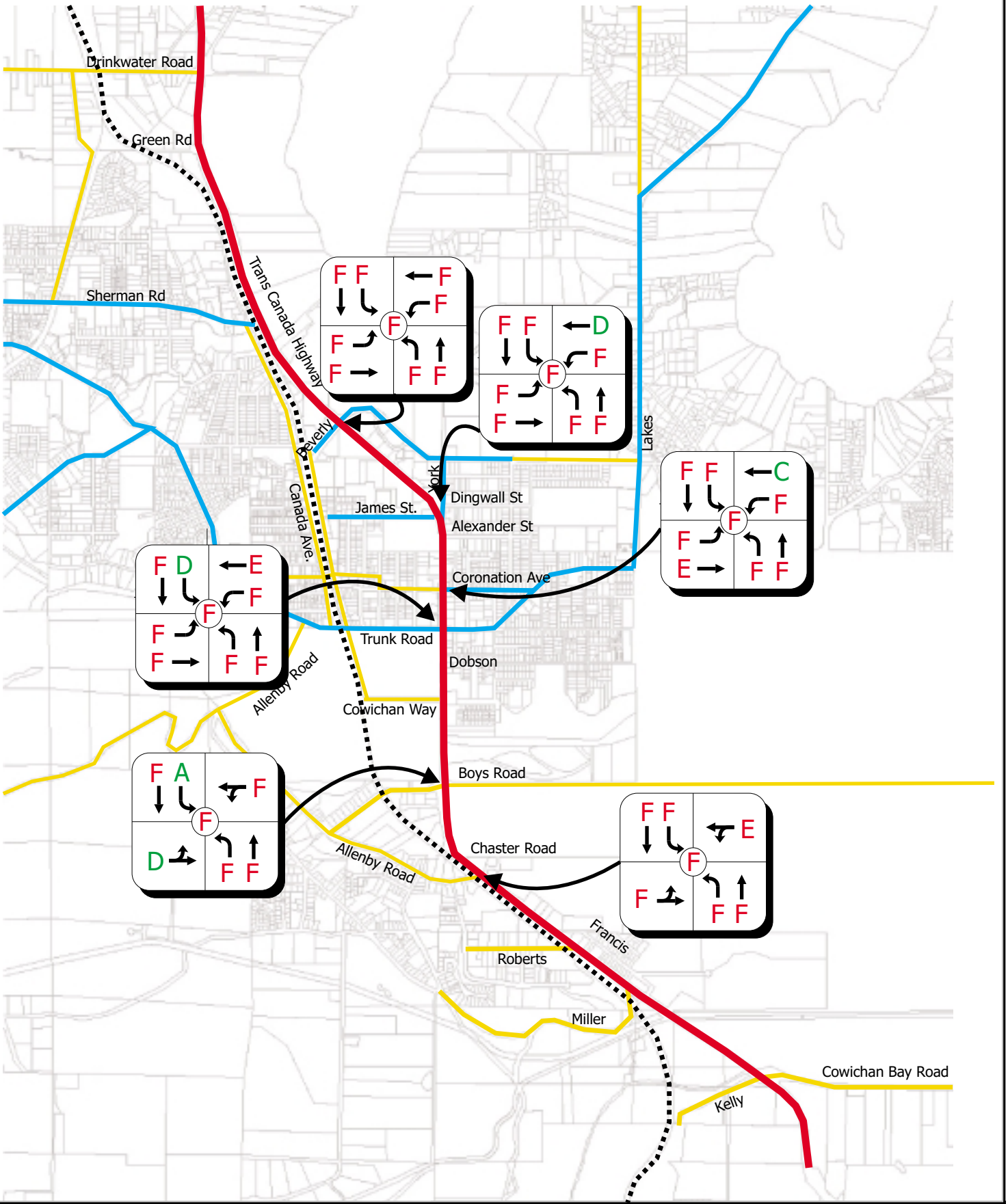
Forecast Highway Conditions

In 20 years from now, highway growth is anticipated to increase by approximately 50%, assuming a 2% growth per year. This will result in an increase in daily traffic to approximately 38,000 vehicles or 3,800 vehicles in both directions during the peak hour. Further, cross-street traffic is also forecast to increase at a similar rate, resulting in greater pressures on the Trans Canada Highway through the broader Duncan area. Figure 3.2 illustrates the forecast peak hour levels of service for each of the signalized intersections along the corridor.

These results clearly demonstrate that long-term growth on the corridor can not be supported by the highway as it currently exists. Each of the signalized intersections and most movements are expected to be operating at LOS F – with an average delay of greater than 60 seconds per vehicle at each intersection. Further, the total travel time through Duncan is projected to increase by 160% - from approximately 10 minutes today to approximately 25 minutes by the year 2024.

3.2 Key Issues to be Addressed

The discussion of existing and forecast conditions highlights several issues that guide the development of the overall improvement strategy. Table 3.2 summarizes those key issues in terms of mobility, safety, pedestrians and cyclists.



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Level of Service

A B C D E F

Figure 3.2: Future PM Signalized Intersection Level of Service (2024)

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Table 3.2 - Key Highway Related Issues

Category	Key Issues	Contributing Factors
Mobility	Support networks	Few alternatives for existing and future potential land uses along corridor – side-street or rear access Limited continuous north-south roadways to serve inter-municipal travel
	Intersection delays	Poor (existing) intersection levels of service at the following locations: • Trunk Road • Beverly Street Significant turning movements on and off highway at most intersections
	Mid-block delays	Access density between Coronation Avenue and James Street is extremely high Access spacing is very low in several areas of the corridor
	Corridor travel times	Forecast growth in traffic along the Highway will increase travel times through the study area by 150%
Safety	Corridor safety levels	Collision rates in the urban sections of the highway are well above the provincial average Lack of transition from expressway to urban area for through traffic likely contributing toward higher than average collision patterns Mixture of through traffic and local traffic traveling within communities increases conflicts
	Intersection safety	Several intersections along the corridor support highest traffic collisions: • Coronation Avenue • Trunk Road • James Street • Boys Road

Category	Key Issues	Contributing Factors
Safety (continued)	Mid-block safety	High proportion of corridor collisions are mid-block in the core area Access spacing and density in core area are below standards for a major road Narrow property frontages without alternative access contribute toward the need for direct access to the highway
	Pedestrian and bicycle safety	Narrow sidewalk (1.0m) between McDonalds and James Street on the east side of the highway No pedestrian refuge facilities crossing major roads No bike lanes
Pedestrian & Cyclists	Comfort	Limited separation between sidewalks and highway Utility poles located in sidewalk areas Walking along corridor generally unattractive No pedestrian and cyclist refuge areas crossing the highway and side streets

3.3 Improvement Strategies to Consider

There is a range of improvement strategies that may be explored as part of the Corridor Management Plan. Some are primarily directed at managing existing facilities with key localized improvements in an attempt to maintain or increase the performance of the existing corridor. Others involve more intensive improvements that may be identified as longer term strategies that may be pursued. This section of the report highlights the broad range of improvement strategies to be discussed with the Working Committee before advancing to the next stage of review. These strategies should be considered a "menu" of initiatives to work together rather than options for consideration.

Access and Intersection Management

Management of intersections and accesses along the highway corridor generally include a range of policies and initiatives to address those mobility and safety issues previously described. The overall concept is largely concentrated on potential strategies to maintain access levels that are desirable for the specific roadway classification. For example, direct property access to highway facilities and major arterial roads is typically discouraged to protect safety and mobility of the corridor.

Although the relationships between access types, spacing and density, and resulting mobility and safety are well documented, accesses along the Trans Canada Highway within the study area have been allowed to develop. In general, these decisions are made to encourage and foster economic activity of local communities. Recognizing the existing situation, changes to these access arrangements where reasonable alternatives do not exist are typically not supportable. In other words, an integrated approach for alternative access and circulation patterns are needed as part of an overall strategy for the established areas of the corridor.

In the fringe areas of the study, intersection and access management policies and strategies are likely more supportable and achievable where municipal and provincial interests can be coordinated with property owners that wish to develop.

The range of potential access and intersection management strategies that may be explored in the Corridor Management Plan are briefly highlighted below. Additional access management strategy information is summarized in Appendix E.

Table 3.3 - Example Access & Intersection Management Techniques

Policies	Design	
Access management guidelines or agreements with community	Install barrier medians	Frontage road systems
Supportive roadway network strategy plans	Install U-turns on Highway as an alternative to direct left-turn lanes	Rear road systems
Circulation & site plan review process	Install "jug handles" to eliminate left turn lanes	Install two-way left turn lanes
Traffic signal spacing criteria	Right-turn deceleration & acceleration lanes	Install left-turn bays
Unsignalized driveway spacing standards	Install continuous right turn lanes	Provide safe turning radii
Unsignalized driveway design standards	Channelize driveways to prohibit turning movements	Sufficient driveway length
Reciprocal access agreements for properties	Barriers to prevent uncontrolled access	Minimum driveway width for safety
Land use policies to maximize frontages along highway		

Intersection Improvements

Mobility and safety issues of a corridor can be addressed though intersection improvements. In the most basic form, intersection improvement may involve *enhanced signal timing and systems* that respond to changing traffic conditions during a given day, or over several years. In some areas, intersection improvements may involve the provision of *new or additional travel lanes* to accommodate through or turning vehicles. These improvements may or may not be done in combination with *intersection turn restrictions*. Although the impacts and costs are likely more significant, consideration may also be given toward *grade-separation of intersections and/or cross-streets* to change traffic characteristics and reduce highway delays.

Corridor Widening

Widening of the highway between Drinkwater Road and Cowichan Bay Road from 4 to 6 lanes may be used to address issues of mobility and travel times through the study area. Although the potential impacts and costs of widening any section of the highway may be significant, recognition and discussion about this approach should occur between agencies.

Support Networks

The Trans Canada Highway is the only continuous north-south connection between Cowichan Bay Road and Drinkwater Road. As such, much of the local traffic within and between area municipal and First Nations land utilizes the highway system as the only alternative. Regardless of the highway improvement strategies, new or improved local area networks are needed to support enhanced mobility within and between local communities.

Corridor Gateways & Pedestrian Improvements

The transition between rural expressway and urban conditions is limited to the posted speed signs on the highway, along with a few other visual changes. For highway traffic wishing to travel through Duncan, the conflicts with local traffic, pedestrians and cyclists are significant impedances and a general frustration. In many cases, the transition to the urban core between Boys Road and Beverly Street are not evident and likely a contributing factor to the higher than average collision patterns through this section of the corridor. *Gateway* treatments that give the visual message to drivers entering the urban area of the highway are potential initiatives that could be used to influence driver behaviour.

In support of the gateway treatments, enhancements to support pedestrian and bicycle facilities in the core parts of the study area may also be considered. *Enhanced crossings* and *buffer areas between the sidewalk and highway areas* may be some of the improvements that may be considered along with any preferred highway improvement option.

Bypass

In 1958, the existing Trans Canada Highway was constructed as the bypass of Duncan. Over 40 years later, this corridor is faced with many of the same issues of the original bypass at a slightly larger scale. Although improvement strategies along the existing highway could address some of the existing issues and extend the life of the asset in the medium-term, another bypass may be considered as a very long-term strategy. Rather than wait for such a time when (and if) financial resources are available, local agencies may begin to protect and perhaps develop sections of a bypass route for ultimate use and upgrade by the province. This approach would obviously build upon the concept of developing a support network as previously discussed and would need to be coordinated with land use plans and policies consistent with that desired for a provincial highway.

4.0 OPTIONS IDENTIFICATION AND ASSESSMENT

This section of the report examines various broad options for addressing the key highway related issues outlined in Section 3.3.

The emphasis of this work was to identify improvement strategies that could reasonably be implemented in the medium-term (5 to 10 years) if funding were available and development along the highway corridor is advanced. These improvement strategies largely include what may be referred to as minor capital projects, such as: access management, intersection improvements, corridor enhancements and support roadway network improvements.

It is also recognized, however, that the issues facing the Trans Canada Highway can not be entirely fixed with minor capital projects. As such, planning for longer term possibilities are considered in this report, merely for the purpose of discussion and future planning initiatives. These types of improvements could involve significant corridor widening and/or implementing a north-south, one-way couplet system through the community.

Finally, there are some very broad possibilities for highway bypasses that are also examined within this review. In some cases, these routes may simply represent good choices for local roadway connections to support access and circulation in the overall communities surrounding the highway. Alternatively, some of these routes may be considered further as possible options for highway bypasses of Duncan. In either case, these are not options that would be endorsed or recommended through a study of this nature.

It should be recognized that the long-term improvements or possible by-passes have been defined as potential routes. Optional alignments would need to be examined further at a concept level to reasonably define and reduce potential impacts.

4.1 Medium-Term Strategies

There are several medium-term strategies that may be considered in order to address safety and mobility issues facing the Trans Canada Highway through the study area within the next 10 years or thereabouts. For the purpose of this review, they are packaged as follows:

- Access Management;
- Intersection Improvements;
- Gateway & Pedestrian Improvements;
- One-Way Couplet Crossing the Highway; and
- Support Roadways.

The following sections briefly describe each of the improvement strategies and provide a high level evaluation of transportation, social, environmental, and financial indicators, which are briefly described as follows:

- **Transportation** – Overall operation with the improvement strategy in terms of reduced delays – or increased levels of service – in addition to changes to access, traffic circulation and safety**.** As is the case in most urban environments, the intersection delays influence mobility through urban areas such as along the Trans Canada Highway. The performance of intersections is measured in terms of levels of services (LOS). A LOS A through C indicates that there are few delays. LOS D and E indicate that the intersection experiences greater delay and operating at capacity. LOS F means that the intersection is failing and delays are significant.
- **Social –** Potential impacts to residential, commercial and institutional land uses in terms of property requirements. Beautification opportunities are also identified.
- **Environmental** – Potential impacts to forest, watercourses, parkland and other environmentally significant features.
- **Financial** – Costs and benefits from each improvement strategy discounted over a 25-year period at 6% (the Ministry of Transportation's prescribed rate). Option costs include conceptual construction cost and salvage value, also known as Class D Cost Estimates for the purpose of comparing options. It is noted that the construction costs are conceptual only and do not include property acquisition, utilities or lighting, which may be substantial. The benefits to highway users are expressed in travel time savings, as well as reduced vehicle operating costs and collision costs.

  Financial indicators are summarized by Net Present Value (overall benefits minus the costs) and benefit-cost ratio. Options with positive Net Present Value (NPV) and a benefit-cost ratio greater than 1.0 are favourable. Careful consideration should be given to the investment of public funds where net present value is negative and benefit-cost ratio is less than 1.0. Again, it is noted that costs are conceptual only resulting in potentially overoptimistic NPV and benefit-cost ratio values.

4.1.1 Access Management

Access management is a broad set of measures and considerations aimed at improving public safety and mobility on roadway corridors. This concept is based upon the proven fact that as access related activity levels on higher order facilities becomes more intense, safety and mobility levels will drop. It is typically applied to corridors where the conditions relating to access have deteriorated. Solutions include closing driveways and limiting or altering accesses.

Option Description

The access management solution proposed in this option is a combination of implementing turn restrictions at existing accesses and a policy to achieve further access restrictions and/or closure. With the provision of a centre median barrier, these improvements could contribute toward visual corridor enhancement to improve aesthetics. This may result in a new roadway feel, which in turn may impact driver behaviour. Details of the option are as follows:

- Develop access management policy for the Trans Canada Highway through the entire study limits (Cowichan Bay Road to Drinkwater Road). Policy to limit/prohibit direct access to the highway, examine potential to consolidate existing accesses/egresses.
- Replace existing two-way left-turn sections (3 locations) with landscaped raised medians, restrict existing full-movement accesses to right-in/right-out only (Cowichan Way to Beverly Street). Consider maintaining full-movement access to mid-block roadway between Tim Horton's and Midas (north of York Road).
- Restricted movements accommodated through reciprocal access agreements and existing support roadway network. Ultimately, St. Julian Street could be extended north to James Street to build upon support roadway network. The St. Julian Street extension would only occur in conjunction possible school relocation.

The access management option is illustrated in Figure 4.1.

Evaluation Summary

The following discussion highlights the impacts and benefits of this option.

- **Transportation** – This option would alter 20 full-movement accesses to right-in/right-out only. With these changes, there will be some reduction in overall delay during the peak periods.

  Social – Although there are no residential or commercial property requirements, there will be the potential perception of business loss due to installation of raised median. However, the installation of raised median provides opportunity for beautification. Institutional property would be required with the extension of St. Julian Street – which could be achieved with the possible school relocation.

- **Environmental** – No environmental impacts are expected with this improvement strategy.
- **Financial** – As is the case with most access management strategies, the overall benefits are significant relative to the costs. In particular, the benefits stem mainly from collision reduction due to a reduction in access density. The collision and time savings are achieved at relatively low direct cost and consequently return a high B/C.

Details of the financial account are summarized in Table 4.1

Table 4.1 Financial Indicators – Access Management

Discounted Costs (2004 $ Millions)	
Project Cost	$ 0.66
Salvage Value	- $ 0.13
Total Discounted Cost	**$ 0.53**
Discounted Benefits (2004 $ Millions)	
Delay Reduction	$ 2.40
Collision Reduction	$ 4.40
Vehicle Operating Cost Reduction	$ 0.40
Total Discounted Benefits	**$ 7.10**
Net Present Value (NPV)	$ 6.57
Benefit/Cost Ratio	13.4

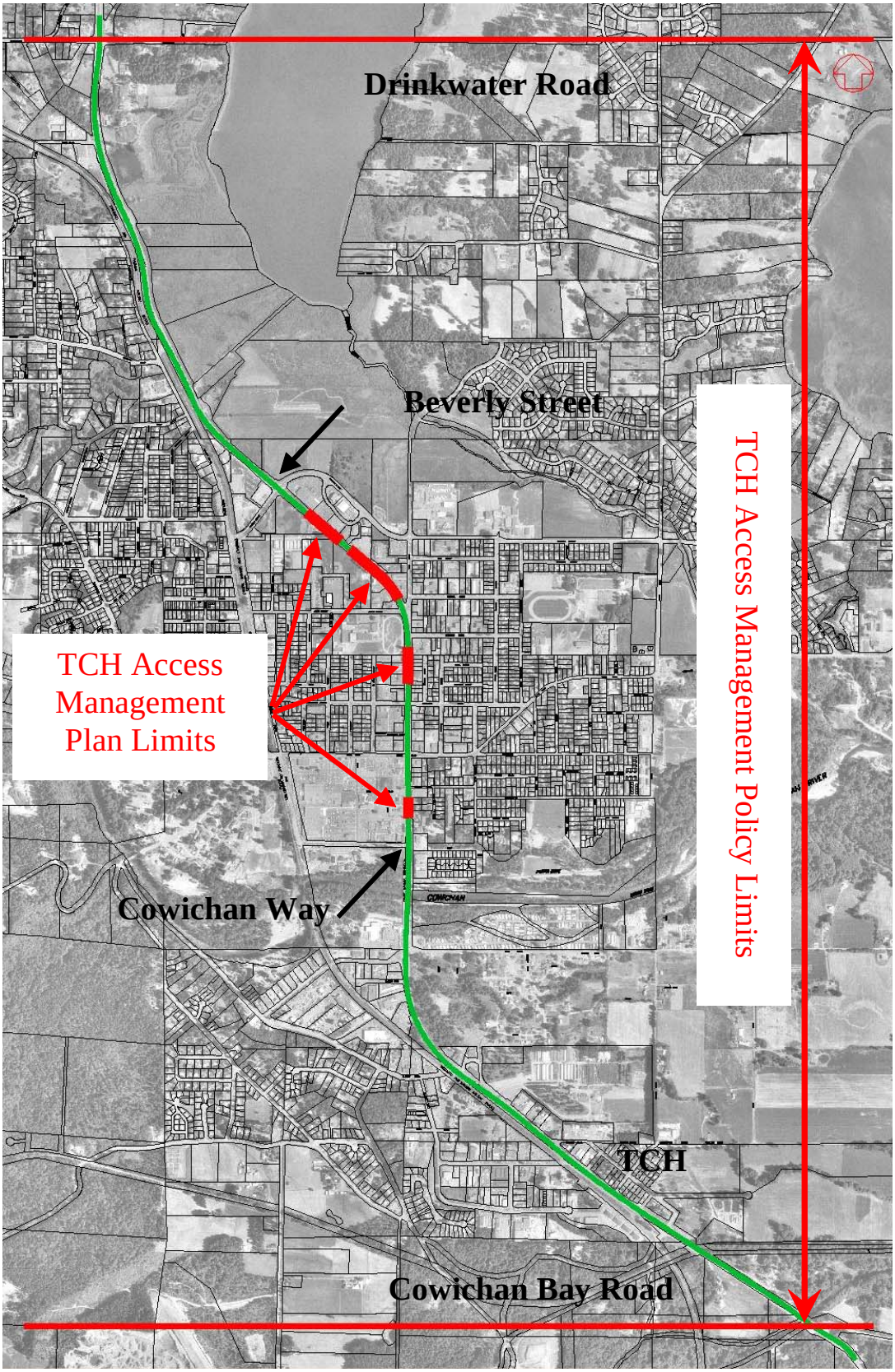

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Figure 4.1: Access Management

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4.1.2 Intersection Improvements

The intersection improvements provide relatively lower cost medium-term solutions to address safety and mobility issues on the highway corridor. Although these options may not serve as long-term solutions, they could be staged with other improvement options to provide longer term benefits.

These improvements include a combination of intersection signalization, provision of auxiliary lanes, changes to signal timing plans, and intersection relocations. Details of each intersection improvement along with the evaluation are briefly highlighted below and illustrated in Figure 4.2.

a) Cowichan Bay Road & Miller Road

This intersection improvement essentially includes relocating the existing full movement Cowichan Bay Road intersection to connect with Miller Road, which is described as follows:

- Restrict the existing Cowichan Bay Road to right-in/right-out at Trans Canada Highway (TCH) and develop an alternate route along abandoned CNR right-of-way through to TCH. The relocation of the road would deal with the closures along Cowichan Bay Road experienced due to flooding during winters, and address safety of left-turns for trucks from WesCan Terminals & Western Forest Products Mill. It is noted that the rail right-of-way is currently in treaty negotiations which may impact the feasibility of this improvement.
- Realign Miller Road intersection to TCH to connect with new Cowichan Bay Road connection at a signalized intersection. Extend Wilson Road north from Kelly Road to connect with realigned Miller Road intersection to connect with TCH. Provide right-turn lanes in both the northbound and southbound directions at the intersection.

The following discussion highlights the evaluation of this option

- **Transportation** –The new signalized intersection at realigned Miller Road / extended Cowichan Bay Road / extended Wilson Road (relocated Kelly Road) is projected to operate with modest delays – LOS B for the 10-year horizon and LOS D for the 20-year horizon. The relocation of access to Kelly Road and Cowichan Bay Road creates limited out-of-way travel impacts. Overall, the signalization of the new Cowichan Bay Road / Miller Road intersection improves access to the Trans-Canada Highway.

  This new signalized intersection would also address safety issues for left-turns for trucks from WesCan Terminals and Western Forest Products Mill.

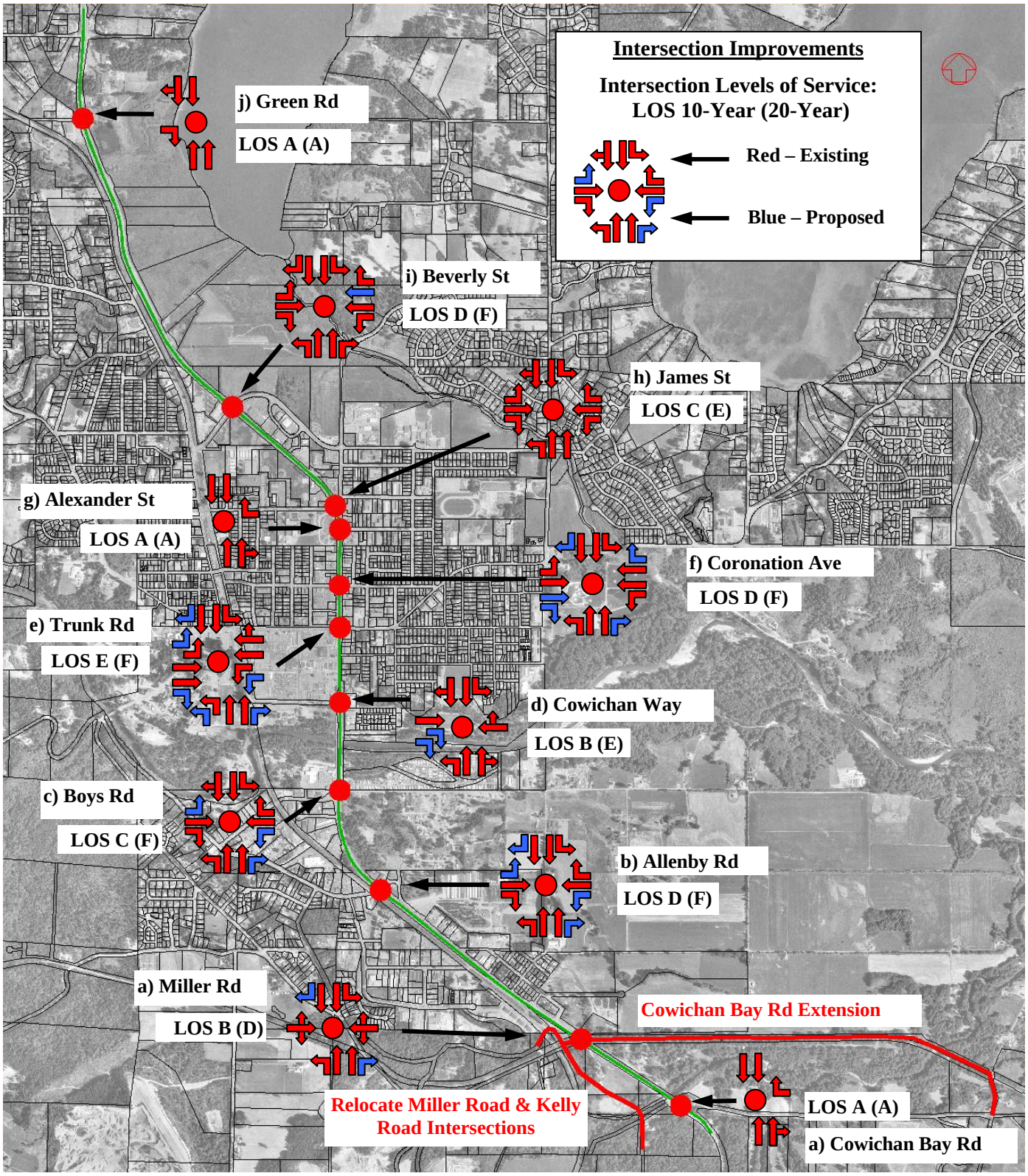

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Figure 4.2: Intersection Improvements

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- **Social** – The Cowichan Bay Road extension requires property along the abandoned CNR right-of-way. As previously noted, the rail right-of-way is currently in treaty negotiations which may impact the feasibility of this improvement.

  The Wilson Road extension and Miller Road realignment may impact approximately seven properties in addition to the CNR right-of-way.

- **Environmental** – Both the Cowichan Bay Road extension and the Wilson Road extension / Miller Road re-alignment may impact existing forest and will likely require improvements to an existing creek crossing.

- **Financial** – Collision savings are realized by consolidating most of the movements from two intersections into one. Time savings are derived from reduced delays at the new Miller intersection. The benefits do not offset the relatively high cost involved in the realignment of the minor roads, resulting in a B/C ratio of 0.2.

Details of the financial account are summarized in Table 4.2

Table 4.2 Financial Indicators - Cowichan Bay Road & Miller Road

Discounted Costs (2004 $ Millions)	
Project Cost	$ 12.26
Salvage Value	-$ 2.42
Total Discounted Cost	**$ 9.84**
Discounted Benefits (2004 $ Millions)	
Delay Reduction	$ 0.8
Vehicle Operating Cost Reduction	$ 0.0
Collision Reduction	$ 1.2
Total Discounted Benefits	**$ 2.1**
Net Present Value (NPV)	-$ 7.75
Benefit/Cost Ratio	0.2

b) Allenby Road

This intersection improvement includes the addition of turn lanes such as a designated eastbound and westbound left-turn lanes, and northbound and southbound right-turn lanes. The northbound left-turn lane may also be extended slightly.

With these improvements, it is projected that this intersection would operate at LOS D and F for the 10-year and 20-year horizons. These results would indicate that major improvements are required to provide acceptable delays in the long-term.

The impacts and benefits of this option are summarized as follows:

- **Transportation** – There are no impacts to access or circulation with this improvement.
- **Social** – This intersection improvement impacts to two commercial properties, and requires the widening of existing railway crossing on west side of highway.
- **Environmental** – There are no environmental impacts with this option.
- **Financial** – The majority of benefits are derived from travel time savings. These time savings stem from the added capacity provided by additional turning lanes and from the high traffic volume. The turning lanes also generate collision benefits by reducing the number of rear end type collisions. The benefits combined with relatively low cost returns a good B/C ratio.

Details of the financial account are summarized in Table 4.3

Table 4.3 Financial Indicators – Allenby Road

Discounted Costs (2004 $ Millions)	
Project Cost	$ 0.20
Salvage Value	-$ 0.04
Total Discounted Cost	**$ 0.16**
Discounted Benefits (2004 $ Millions)	
Delay Reduction	$ 0.7
Vehicle Operating Cost Reduction	$ 0.0
Collision Reduction	$ 0.4
Total Discounted Benefits	**$ 1.1**
Net Present Value (NPV)	$ 0.91
Benefit/Cost Ratio	6.6

c) Boys Road

This intersection improvement includes the provision of a protected/permissive left-turn phasing for northbound and southbound directions, in addition to westbound and eastbound left-turn lanes, as well as a northbound right-turn lane.

- **Transportation** – Once again, the intersection would operate at LOC C and F for the 10 and 20 year horizons. This pattern indicates that major improvements are required to provide acceptable delays in the long-term. No impacts to circulation are anticipated, other than the potential closure of existing access to Discovery Honda immediately west of highway.
- **Social** – Improvements impact two commercial properties and one residential property.
- **Environmental** – Minor impacts to forest on east side of highway.
- **Financial** – Benefits derive equally from time and collision savings. The collision benefits stem from the addition of protected left phasing and the addition of a northbound right turn lane. Eastbound and westbound left-turn lanes combined with the northbound right turn lane contribute to the improved LOS and time savings. Good benefits combined with a relatively low cost return a good B/C ratio.

Details of the financial account are summarized in Table 4.4

Table 4.4 Financial Indicators – Boys Road

Discounted Costs (2004 $ Millions)	
Project Cost	$ 0.20
Salvage Value	-$ 0.04
Total Discounted Cost	**$ 0.16**
Discounted Benefits (2004 $ Millions)	
Delay Reduction	$ 1.4
Vehicle Operating Cost Reduction	$ 0.1
Collision Reduction	$ 1.3
Total Discounted Benefits	**$ 2.7**
Net Present Value (NPV)	$ 2.55
Benefit/Cost Ratio	16.6

d) Cowichan Way

The improvement to the intersection with Cowichan Way includes the provision of signals, and restrictions to eastbound and westbound left-turn movements through signing. In order to accommodate the high traffic volumes, two eastbound right-turn lanes are recommended. The following discussion highlights the benefits and impacts of this intersection improvement.

- **Transportation** – The projected LOS at the 10-year horizon is LOS B and at the 20-year horizon is LOS E. Although the long-term delays are significant, this improvement enhances cross-street access to highway with signalization.
- **Social** – This option may impact one commercial property on west side of highway.
- **Environmental** – Although this improvement may impact several trees on west side of highway, no significant environmental impacts are expected.
- **Financial** –The additional delay attributed toward the unsignalized intersection is not included in the B/C analysis. The analysis assumes the signal is warranted for operational reasons and represents a "do-minimum" case. For analysis purposes, only the safety benefits are included in the benefit calculations. Safety benefits derive from a reduction in right angle and left turn collisions associated with the new signal and restrictions on left turn movements. With a relatively low cost, this project returns a good B/C ratio.

Details of the financial account are summarized in Table 4.5

Table 4.5 Financial Indicators – Cowichan Way

Discounted Costs (2004 $ Millions)	
Project Cost	$0.22
Salvage Value	-$0.04
Total Discounted Cost	**$0.18**
Discounted Benefits (2004 $ Millions)	
Delay Reduction	$0.0
Vehicle Operating Cost Reduction	$0.0
Collision Reduction	$1.7
Total Discounted Benefits	**$1.7**
Net Present Value (NPV)	$1.52
Benefit/Cost Ratio	9.5

e) Trunk Road

The intersection improvements for Trunk Road include the provision of eastbound, northbound and southbound right-turn lanes, in addition to second left-turn lanes northbound, eastbound and westbound. The following discussion highlights the primary benefits and impacts for these improvements at Trunk Road.

- **Transportation** – At the 10-year horizon, the Trunk road intersection will operate at LOS E, and LOS F for the 20-year horizon. As such, major improvements are required to achieve an acceptable LOS at Trunk Road / TCH intersection. These improvements do not impact circulation or access.
- **Social** – This option may impact approximately seven commercial properties including three gas stations.
- **Environmental** – No environmental impacts (assuming minor impact to gas stations) are anticipated with this option.
- **Financial** – Most of the improvements at this intersection are aimed at congestion relief. The savings are derived from a reduction in signal delay due to increased intersection capacity with the additional turn lanes provided. Collision savings result primarily from the addition of new right turn lanes. Existing congestion and heavy volume at this intersection are returning large travel time savings for the capacity related improvements and a relatively high B/C ratio.

Details of the financial account are summarized in Table 4.6

Table 4.6 Financial Indicators – Trunk Road

Discounted Costs (2004 $ Millions)	
Project Cost	$0.31
Salvage Value	-$0.06
Total Discounted Cost	**$0.25**
Discounted Benefits (2004 $ Millions)	
Delay Reduction	$4.2
Vehicle Operating Cost Reduction	$0.2
Collision Reduction	$0.3
Total Discounted Benefits	**$4.6**
Net Present Value (NPV)	$4.40
Benefit/Cost Ratio	18.9

f) Coronation Avenue

In addition to the provision of protected/permissive phasing to the signal, other improvements to the Coronation Avenue intersection include right-turn lanes in all directions, as well as a second eastbound through lane. The following discussion highlights the evaluation of this improvement option.

- **Transportation** – With these improvements, the intersection will operate at LOS D for the 10-year horizon and LOS F in the 20-year horizon. As is the case elsewhere, these patterns would suggest that major improvements are required in order to achieve an acceptable LOS at Coronation Avenue for the long-term. These improvements may impact two accesses on Coronation Avenue within 30m of the intersection.
- **Social** – It is anticipated that this option may impact six commercial properties including two gas stations.
- **Environmental** – No environmental impacts are anticipated with these improvements (assuming minor impact to gas stations).
- **Financial** – Safety and time savings are relatively balanced. Time savings derived from a moderate reduction in signal delay due to increased intersection capacity with the additional turn lanes provided. Collision savings result from the addition of protected/permissive phasing and new right turn lanes.

Details of the financial account are summarized in Table 4.7

Table 4.7 Financial Indicators – Coronation Avenue

Discounted Costs (2004 $ Millions)	
Project Cost	$0.22
Salvage Value	-$0.04
Total Discounted Cost	**$0.18**
Discounted Benefits (2004 $ Millions)	
Delay Reduction	$0.5
Vehicle Operating Cost Reduction	$0.0
Collision Reduction	$0.4
Total Discounted Benefits	**$1.0**
Net Present Value (NPV)	$0.79
Benefit/Cost Ratio	5.4

g) Alexander Street

This option simply involves restricting turning movements to right-in/right-out only at the intersection with the TCH. The benefits and impacts of this improvement are highlighted below.

- **Transportation** – The intersection would operate at LOS A for the next 20 years. It is anticipated that there would be minor impacts to access and circulation.
- **Social** – No property impacts are expected with this improvement.
- **Environmental** – No environmental impacts are anticipated.
- **Financial** – This intersection improvement returns a very high B/C ratio. The cost of prohibiting left-in/left-out movements is minor compared to the potential collision benefits.

Details of the financial account are summarized in Table 4.8

Table 4.8 Financial Indicators – Alexander Street

Discounted Costs (2004 $ Millions)	
Project Cost	$0.05
Salvage Value	-$0.01
Total Discounted Cost	**$0.04**
Discounted Benefits (2004 $ Millions)	
Delay Reduction	$0.0
Vehicle Operating Cost Reduction	$0.0
Collision Reduction	$1.3
Total Discounted Benefits	**$1.3**
Net Present Value (NPV)	$1.21
Benefit/Cost Ratio	33.1

h) James Street

This improvement includes extending the eastbound left-turn land to minimize impacts on through traffic. The impacts and benefits of this option are highlighted as follows.

- **Transportation** – The intersection would operate at LOS C and E for the 10 and 20 year horizons respectively. No impacts to access or circulation are anticipated.
- **Social** – It is expected that there may be a minor impact to one institutional property, which may be relocated.
- **Environmental** – No environmental impacts are expected.

- **Financial** – The benefits are derived primarily from time savings with extending the eastbound left turn lane. Collision benefits are minor since there is no change to the major (TCH) approaches to the intersection. The cost is relatively low and the improvement returns a good B/C ratio.

Details of the financial account are summarized in Table 4.9

Table 4.9 Financial Indicators – James Street

Discounted Costs (2004 $ Millions)	
Project Cost	$0.04
Salvage Value	-$0.01
Total Discounted Cost	**$0.03**
Discounted Benefits (2004 $ Millions)	
Delay Reduction	$0.2
Vehicle Operating Cost Reduction	$0.0
Collision Reduction	$0.0
Total Discounted Benefits	**$0.2**
Net Present Value (NPV)	$0.19
Benefit/Cost Ratio	6.5

i) Beverly Street

This option includes the provision of a second westbound direction through lane. The impacts and benefits of this option are briefly highlighted below.

- **Transportation** – The intersection would operate at LOS D and LOS F for the 10 and 20 year horizons respectively. Major improvements are required to achieve an acceptable LOS in the long-term. This option does not impact vehicle access or circulation.
- **Social** – The improvement may impact one commercial property in northwest quadrant.
- **Environmental** – No environmental impacts are expected with this improvement.
- **Financial** – The additional through westbound lane provides much needed capacity at the intersection contributing to a good reduction in signal delay. There is little or no impact on collision costs. The moderate construction cost and good delay savings combine to return a very good B/C ratio.

Details of the financial account are summarized in Table 4.10

Table 4.10 Financial Indicators – Beverly Street

Discounted Costs (2004 $ Millions)	
Project Cost	$0.17
Salvage Value	-$0.03
Total Discounted Cost	**$0.14**
Discounted Benefits (2004 $ Millions)	
Delay Reduction	$1.9
Vehicle Operating Cost Reduction	$0.1
Collision Reduction	$0.0
Total Discounted Benefits	**$2.0**
Net Present Value (NPV)	$1.87
Benefit/Cost Ratio	14.7

j) Green Road

This option includes restricting turning movements to right-in/right-out only at Green Road. Access to and from Green Rod would be supported by 2-lane connection between Green Road and Drinkwater Road. Direct access may be needed for commercial development in short-term (two years) until the Green Road to Drinkwater connection can be made. The impacts and benefits of these options are briefly highlighted below.

- **Transportation** – Minor impacts to access and circulation. Access Green Road via Drinkwater Road.
- **Social** – Impacts to two commercial and two residential/agricultural properties, assuming connection adjacent to existing railway line.
- **Environmental** – No parkland or watercourse impacts.
- **Financial** – Restricting this unsignalized intersection to right-in/right-out only generates collision benefits from a reduction in intersection conflicts. Minor time savings are associated with a slightly higher running speed as impeding left turns are removed from the intersection. As a consequence of the turn restriction a new 2-lane connection to Drinkwater is needed, adding to the cost of the project and returning a lower B/C ratio.

Details of the financial account are summarized in Table 4.11

Table 4.11 Financial Indicators – Green Road

Discounted Costs (2004 $ Millions)	
Project Cost	$1.60
Salvage Value	-$0.32
Total Discounted Cost	**$1.29**
Discounted Benefits (2004 $ Millions)	
Delay Reduction	$0.2
Vehicle Operating Cost Reduction	$0.0
Collision Reduction	$0.7
Total Discounted Benefits	**$1.0**
Net Present Value (NPV)	-$0.29
Benefit/Cost Ratio	0.8

4.1.3 Gateway & Pedestrian Improvements

In addition to the landscaping opportunities identified with the access management option (Section 2.1), this option beautifies the highway right-of-way in order to improve the driving experience and provide a pedestrian-friendly corridor.

Option Description

The solution proposed in this option combines median treatments, signage, sidewalk relocation / boulevard creation, pedestrian overpass, and landscaping. Similar to the access management option (Section 2.1), improvements to aesthetics may provide a new roadway feel, which in turn may impact driver behaviour. Details of this option are as follows:

- Southern Gateway: Median boulevard treatment from Allenby Road through to the Cowichan River Bridge. Highway posted speed changes in this area from 60 km/h to 50 km/h. The treatment would notify drivers that the roadway is changing from rural to urban highway conditions. Duncan Area entry signage would be provided.
- Northern Gateway: Median boulevard treatment from south side of Beverly Street to York Road. Highway posted speed changes to 60km/h north of Beverly Street and to 50 km/h at York Road. As for the southern gateway, this treatment would notify divers that the roadway is changing from rural to urban highway conditions. Duncan Area entry signage would be provided in this area.
- Pedestrian Improvements: Separate pedestrians from roadway edge, desirably using a 2m buffer. Provide boulevard north from Cowichan River Bridge to Alexander Street (east side) or James Street (west side). Sidewalk relocation is required to achieve the 2m buffer as detailed in Table 4.12. In addition, consider providing a pedestrian overpass in the area of existing highway intersection at Robertson Street (landing on easement between Dairy Queen and Subway) or nearby McDonalds.

Table 4.12 Sidewalk Relocation

Highway Section	Sidewalk Relocation to Achieve 2m Boulevard	
	East Side	West Side
James Street to Alexander Street	n/a	2m
Alexander Street to 85m south of Alexander Street	0m	2m
85m south of Alexander Street to Robertson Street	0m	0m
Robertson Street to Trunk Road	0m	0.5m
Trunk Road to 65m south of Trunk Road	2m	2m
65m south of Trunk Road to Dobson Road	0m	2m
Dobson Road to Cowichan River bridge	2m	2m

- Internal Gateway: As identified in the Downtown Revitalization and Gateway Strategy, consider entry features and City of Duncan signs at the intersection of Trans Canada Highway and Trunk Road.
- Highway Beautification: Existing median landscaping opportunities south and north of Cowichan Way and south of Trunk Road to Coronation Avenue. Re-organize public art along the highway to improve visual impact. Opportunity to landscape 2m buffer described above north of the Cowichan River bridge through to Alexander Street / James Street.

The extents of the gateway & pedestrian improvements option is illustrated in Figure 4.3.

Evaluation Summary

Overall evaluation for this option is favourable, with minimal transportation, social and environmental impacts as outlined below.

- **Transportation** – No access or circulation impacts.
- **Social** – No property requirements, other than perceived impacts of restricting direct access to properties. However, this option improves highway character with landscaping, and enhances the pedestrian experience with potential pedestrian overpass and sidewalk buffer (boulevard).
- **Environmental** – No environmental impacts are expected with these improvements.

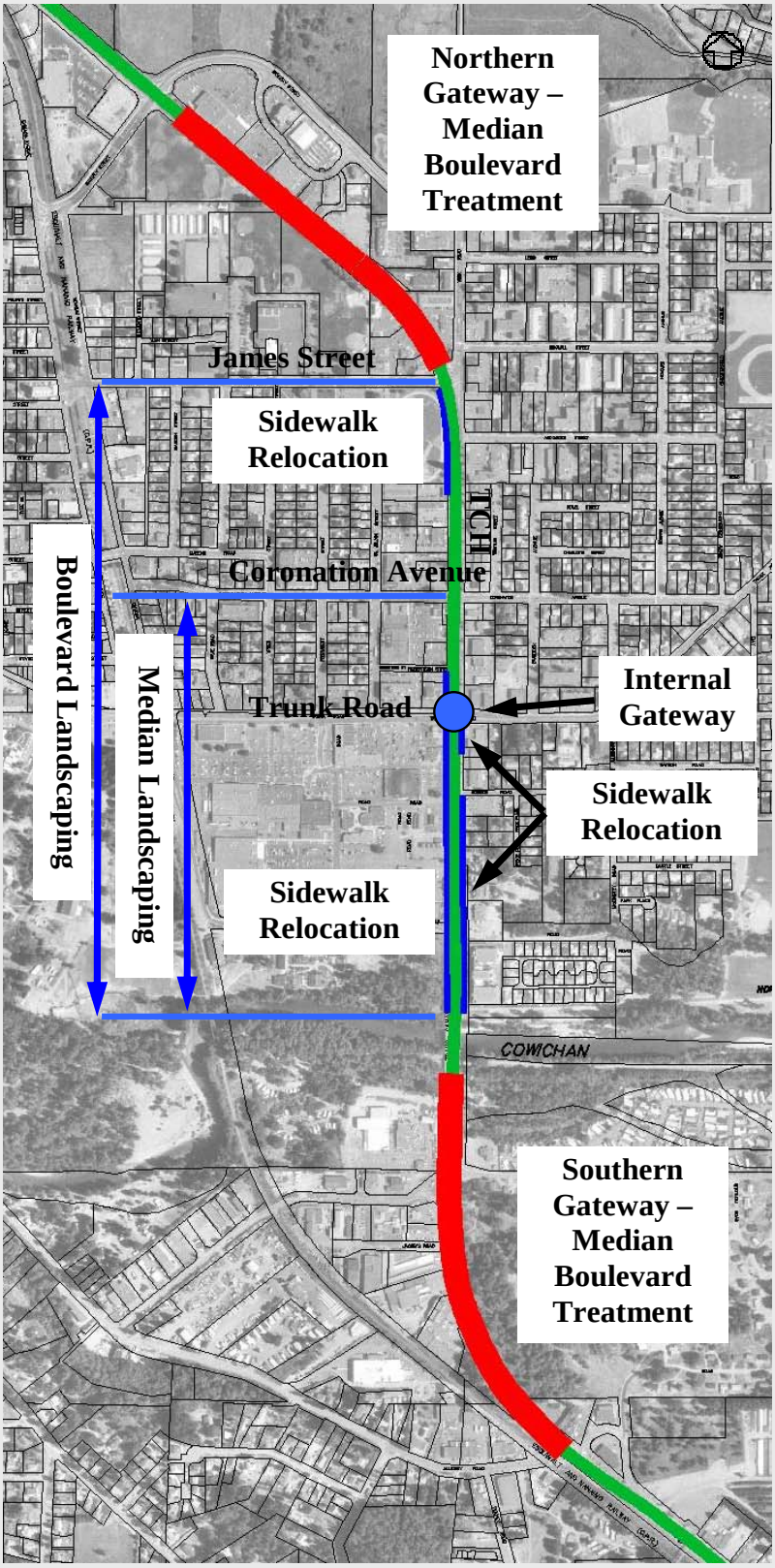

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Figure 4.3: Gateway & Pedestrian Improvements

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- **Financial** – Conceptual cost estimate (excluding utility relocation and property acquisition) for this option is $ 1.5 M. This option is not evaluated from the benefit cost perspective since it involves mainly qualitative improvements to the highway environment through the municipality which do not carry any direct highway user benefits. Gateway treatments would likely be brought in as an additional cost on top of other options.

4.1.4 Trunk Road & Coronation Avenue One-Way Couplet

The Trunk Road & Coronation Avenue one-way couplet is aimed at improving public safety and mobility. Fewer turning movement conflicts arise at signalized intersections, and one-way crossing street traffic allows for increased green time along the highway.

Option Description

The one-way couplet proposed in this option consists of establishing an east-west one-way route using existing roadways. The Trunk Road & Coronation Avenue one-way couplet option is illustrated in Figure 4.4 and described as follows:

- Establish an east-west one-way couplet using Trunk Road and Coronation Avenue/Queens Road east of Duncan Street and west of the intersection of Trunk Road and Coronation Avenue.
- West of the Trans Canada Highway (TCH), the existing four-lane Trunk Road cross-section is fully utilized. At the intersection of the TCH and Trunk Road, one eastbound right-turn lane is added. The two eastbound through lanes carry through east of the TCH to Coronation Avenue.
- East of the TCH, the Coronation Avenue corridor exists as a two-lane roadway with parking lanes on either side. This option uses the entire four-lane section east of the TCH to provide a four-lane westbound cross-section. At the intersection of the TCH and Coronation Avenue, one westbound right-turn lane is added. A second northbound left-turn lane is also added. The two westbound through lanes carry through west of the TCH to Duncan Street (along Ypres Street and Queens Road).
- Re-optimize existing signalized intersections at highway and along the proposed one-way couplet route.
- Signalize intersections of Queens Road at Duncan Street and Trunk Road at Duncan Street / Cowichan Way (as per City of Duncan Downtown Core Parking & Traffic Circulation Study).
- Potential to extend east-west one-way couplet further west to Government Street. Extend Ingram Street to Government Street creating a T-intersection.

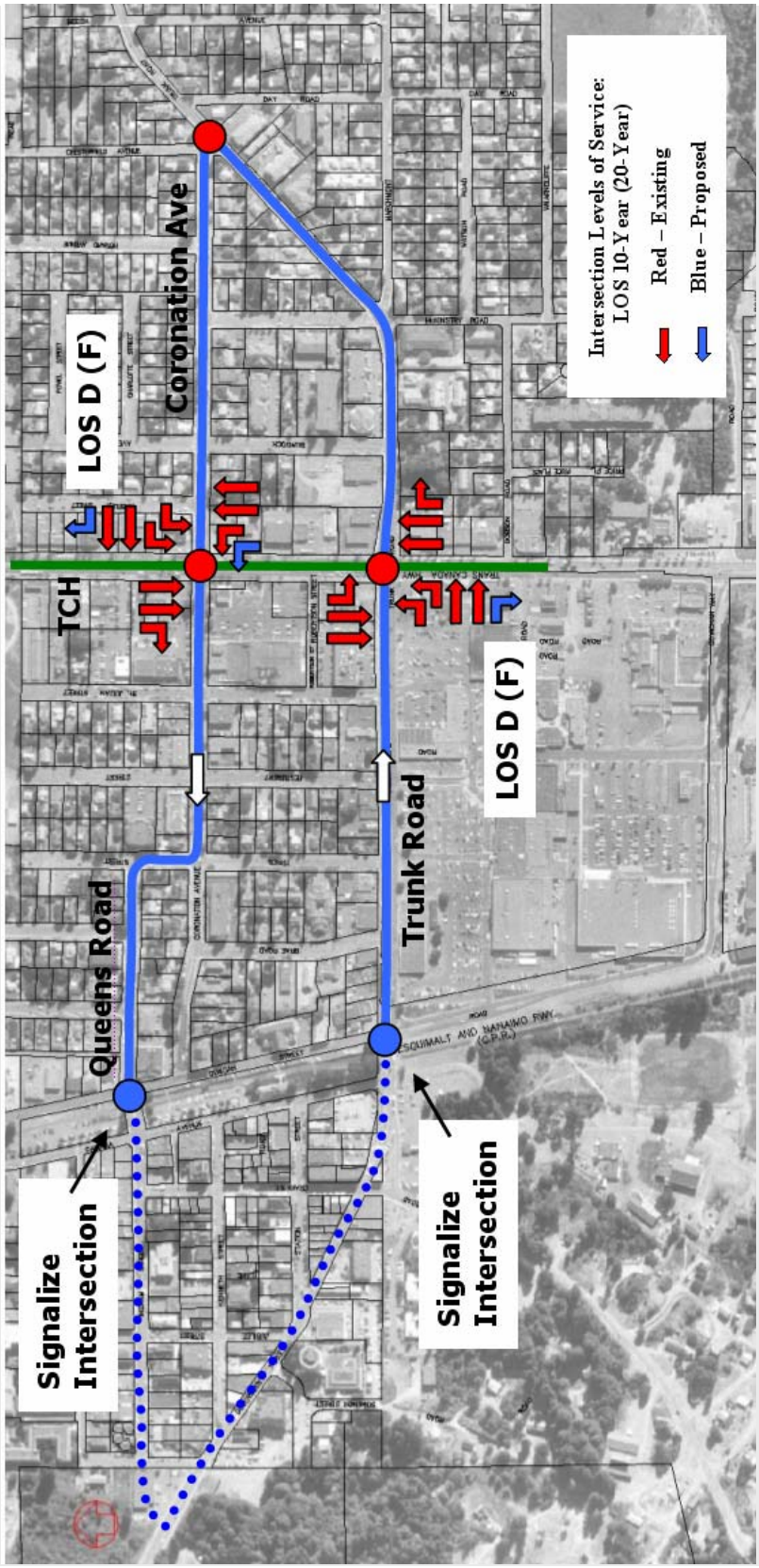

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Figure 4.4: Trunk Road & Coronation Avenue One-Way Couplet

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Evaluation Summary

The overall evaluation for this option is summarized as follows

- **Transportation** – At the 10-year horizon, the levels of service for both the Trunk and Coronation intersections with the highway are projected to operate at LOS D. At the 20-year horizon, both intersections operate at a LOS F. This one-way couplet option may have minor impacts to access and circulation due to one-way street configuration. Several north-south roadways connect Trunk Road and Coronation Avenue (i.e. Festubert Street), thereby minimizing out-of-way travel.
- **Social** – This option may impact five commercial properties at the Coronation Avenue / TCH intersection, and one with the Ingram Street extension.
- **Environmental** – No watercourses or parklands are impacted by this improvement.
- **Financial** – Collision benefits stem from reduced intersection conflicts at Trunk Road/TCH and Coronation Avenue/TCH due to the one-way operation on Trunk Road and Coronation Avenue. There is no reduction in mid-block access conflicts on Highway 1 which remains two-way operation. This is offset by a reduction in access conflicts on Trunk Road and Coronation Avenue which operate as a one-way couplet in the east/west direction. The time savings on Highway 1 stem from the increased intersection capacity on Highway 1 at Trunk Road and Coronation Avenue. The project returns a moderately good B/C ratio.

Details of the financial account are summarized in Table 4.13.

Table 4.13 Financial Indicators – Trunk Road & Coronation Avenue One-Way Couplet

Discounted Costs (2004 $ Millions)	
Project Cost	$3.87
Salvage Value	-$0.76
Total Discounted Cost	**$3.10**
Discounted Benefits (2004 $ Millions)	
Delay Reduction	$7.5
Vehicle Operating Cost Reduction	$0.4
Collision Reduction	$2.9
Total Discounted Benefits	**$10.7**
Net Present Value (NPV)	$7.60
Benefit/Cost Ratio	3.4

4.1.5 Support Roadways

Support roadways are aimed at improving public mobility and safety on the highway corridor. It is expected that these roadways would provide more of the local network to make connections between and within communities more attractive, and may also, therefore, reduce reliance on the highway.

Option Description

The support roadways solutions proposed in this option have been identified through other community plans, studies and discussions. Details of the identified support roadways are illustrated in Figure 4.5 and briefly described below.

- **York Road and Timbercrest Drive Extensions**

  Extend Timbercrest Drive east to connect with Lakes Road. Extend York Road north of Beverly Street to connect with York Road segment located west of Timbercrest Drive.

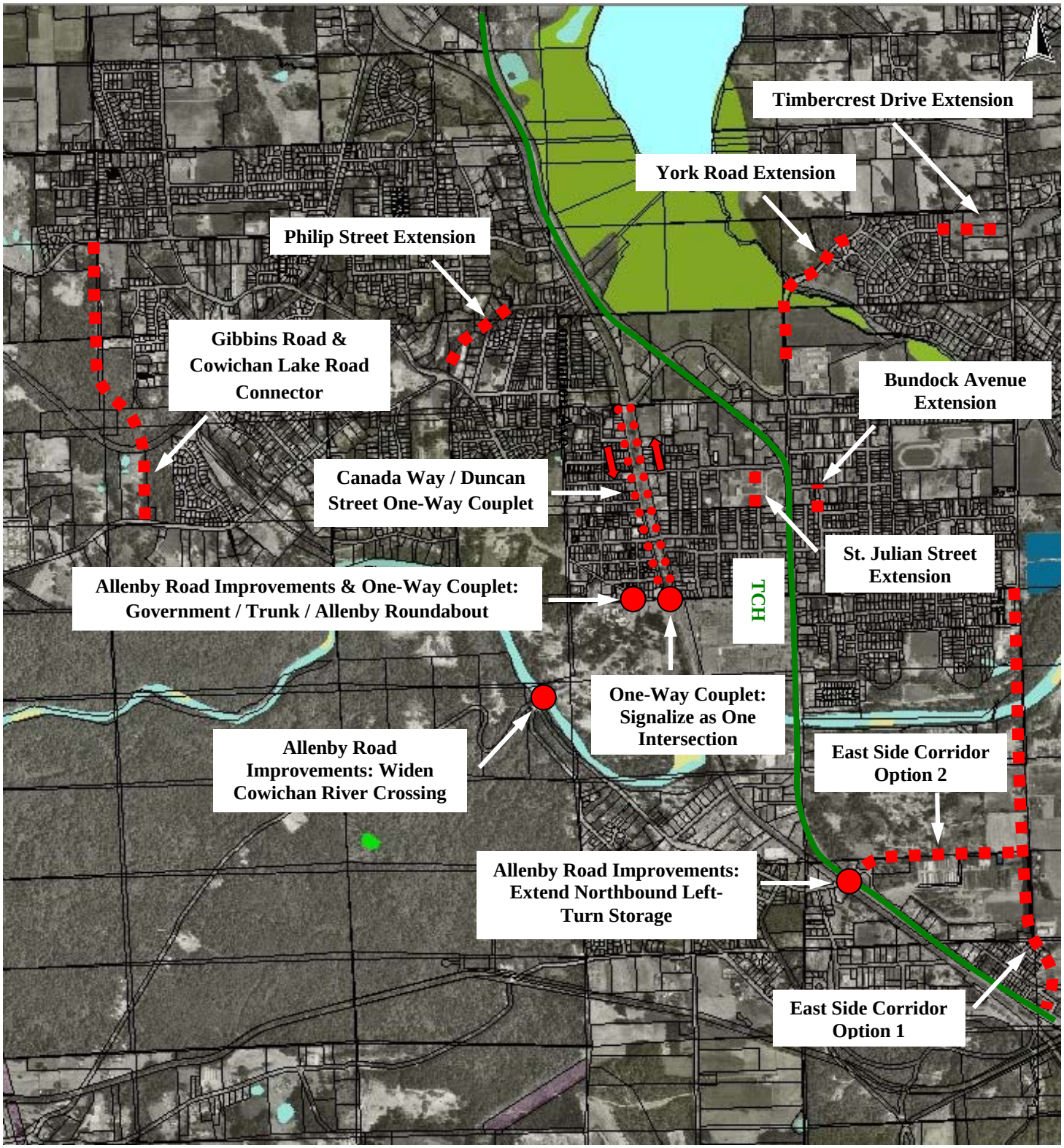

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Figure 4.5: Support Roadways

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- **Gibbins Road & Cowichan Lake Road Connector (west side corridor)**

  Connect Gibbins Road and Cowichan Lake Road via a new roadway intersecting Cowichan Lake Road west of Somenos Road.

- **Philip Street Extension**

  Extend Philip Street to Cowichan Lake Road west of College Street.

- **Allenby Road Improvements**

  Alternative connection to downtown area through:

  - Extended storage area for northbound left turn lane on highway
  - Enhance roadway cross-section and alignment where possible
  - Widen Cowichan River Crossing
  - Government Street/Trunk Road/Allenby Road – new roundabout

- **Canada Way / Duncan Street One-Way Couplet**

  The improvements included within this concept are based on the 2002 Downtown Core Parking and Circulation Study as well as the City of Duncan and Cowichan Tribes Joint Traffic Study. It is noted that the District of North Cowichan confirmed that this treatment was not supported by Council and may therefore, be restricted to the City of Duncan section only. The specific features include:

  - Duncan Street – one-way northbound between Trunk Road and Beverly Street
  - Canada Avenue – one-way southbound between Beverly Street and Trunk
  - Trunk Road at Duncan Street & Canada Avenue - signalize as one intersection
  - Government Street/Trunk Road/Allenby Road – new roundabout
  - Queen's Road/ Duncan Street – new signal
  - James Street / Canada Avenue – new signal
  - Beverly Street & TCH - signal timing alterations to support one-way couplet as required
  - Consider eastbound left turn laning improvements (double left turns) for Beverly Street at TCH and Trunk Road at TCH to support the one-way couplet

- **St. Julian Street**

  Extend northward to James Street in connection with possible school relocation.

- **Bundock Avenue**

  Extend north to Alexander if property is ever re-developed or can be made available. (Building currently occupies lands.)

- **East side Corridor**

  This corridor connects Lakes Road and Mission Road across the Cowichan River (with a new structure). Two options for the route are described below:

  - Option 1: Corridor continues south to Christopher Road and Frontage Road with a possible continuation of Francis Street through to the connection with realigned Miller Road.
  - Option 2: Considers connection directly to the west and south of the Tribes lands to connect with Allenby at the TCH.

4.2 Long-Term Possibilities

Although the medium-term strategies described in Section 4.1 will provide significant benefits, they do not address the long-term (20 year) mobility needs of the Trans Canada Highway through this area. This does not suggest that the those medium-term improvements should not be implemented, but even with the identified intersection improvements, most intersections within the study area between Allenby Road and Beverly Street will experience significant delays in the long-term.

To address the longer term issues, initial consideration was given toward more significant improvement strategies for the highway through the area. These options essentially include:

- Widening the Trans Canada Highway;
- One-Way Highway Couplet; and
- Highway Grade Separation and Ring Road.

Similar to the medium-term options, the following sections briefly describe each of the improvement strategies and provide a high level evaluation of transportation, social, environmental, and financial indicators.

4.2.1 TCH Widening

The highway widening option is aimed at improving public mobility and safety on the corridor.

Option Description

The TCH widening solution proposed in this option includes cross-section changes for both the highway corridor between Cowichan Way and James Street as well as all major cross roads. Details of the option are as illustrated in Figure 4.6 and described below.

- Widen Trans Canada Highway (TCH) from four to six lanes north from Cowichan Way through James Street. Transition from the existing four to proposed six lane cross-section north of James Street and south of Cowichan Way so that six through lanes are provided at both intersections.
- Cowichan Way remains a two-lane roadway east and west of the highway. Improvements at the Cowichan Way intersection with TCH include: intersection signalization; restriction of left-turn movements from Cowichan Way onto TCH (eastbound and westbound); provide southbound right-turn lane; and extend northbound left-turn lane.
- Trunk Road corridor remains a four-lane cross-section on both west and east sides of the TCH. Improvements at the intersection of Trunk Road and TCH include altering the northbound/southbound cross-section from five to nine lanes and the eastbound/westbound cross-section from five to seven lanes. The east/west intersection improvements will extend to approximately St. Julian Street on the west side of the highway and to approximately Bundock Avenue on the east side of the highway. Right-turn lanes will be provided northbound, southbound and eastbound. A second left-turn lane will be provided for both the eastbound and westbound movements.
- West of the TCH, the Coronation Avenue corridor will likely require four-lanes, increased from the existing two-lane section. East of the TCH, the corridor will likely require four lanes during peak periods only. Similar to the Trunk Road / TCH intersection, the northbound/southbound cross-section is increased from five to nine lanes. The eastbound/westbound cross-section is increased from four to seven lanes. Right-turn lanes are provided for all four directions. An additional through lane is also provided for eastbound Coronation Avenue.
- Alter the existing full-movement intersection of Alexander Street and the TCH to right-in/right-out only.
- At the intersection of James Street and the TCH, the highway will be widened to provide three through lanes northbound and southbound. No additional laning changes are proposed.

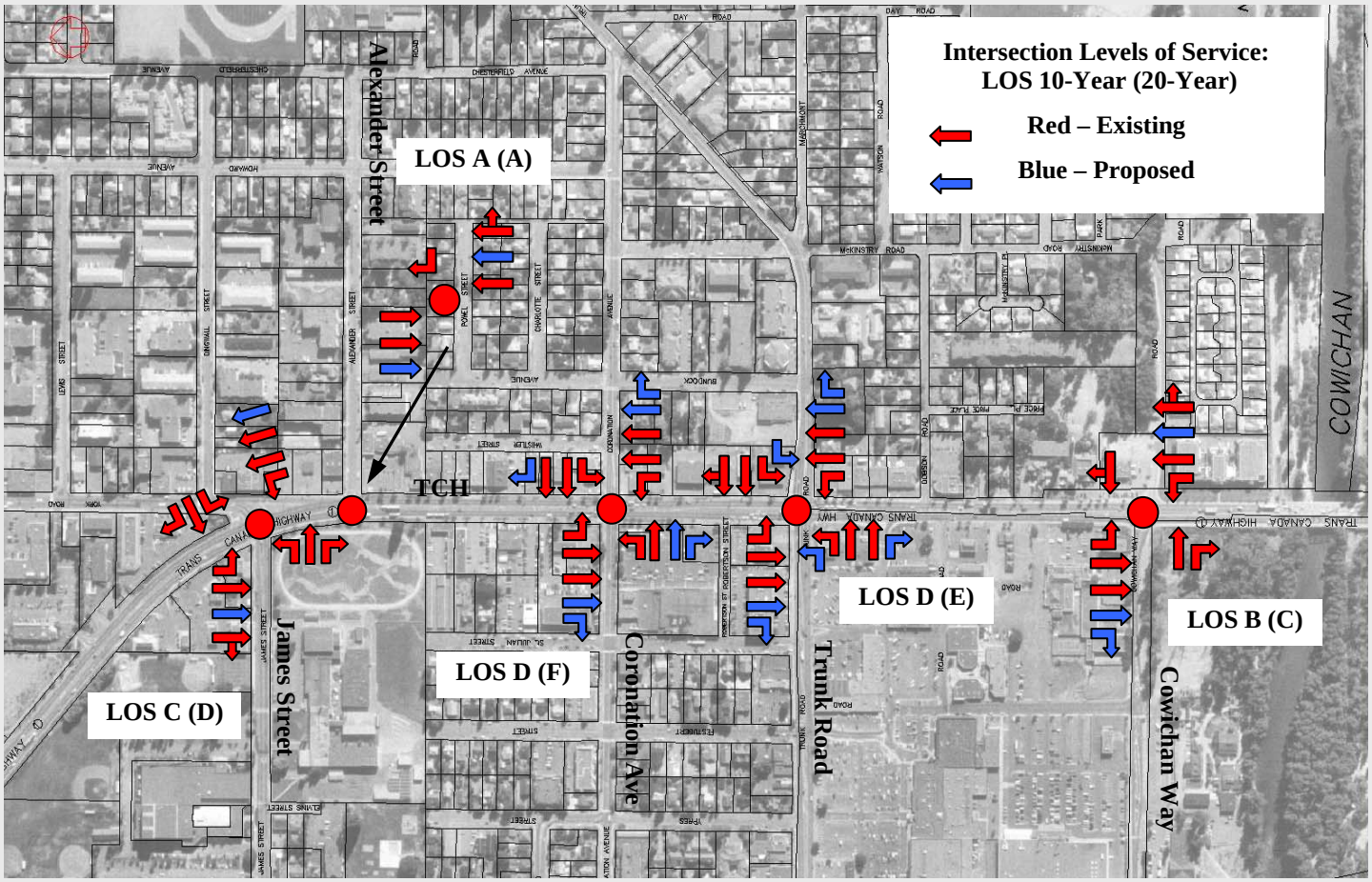

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Figure 4.6: TCH Widening

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Evaluation Summary

The following discussion highlights the impacts and benefits of this option.

- **Transportation** – At the 10-year horizon, each intersection operates at LOS D or better. At the 20-year horizon, Cowichan Way operates at LOS C, James Street at LOS D, Alexander Street at LOS A, Trunk Road at LOS E and Coronation Avenue at LOS F. This option has minimal impacts to access and circulation.
- **Social** – The widening may impact up to 28 commercial properties: 5 at Cowichan Way, 14 at Trunk Road and 9 at Coronation Avenue. This assumes TCH widening can be achieved within the existing 30m right-of-way.
- **Environmental** – No watercourses or parklands are impacted by this option.
- **Financial** – Adding lanes through the busiest section of the corridor significantly improves intersection capacity, reducing delay and contributing to good time savings. Concurrent with the widening are new right turn lanes at Cowichan Way, Trunk and Coronation, signalization of Cowichan Way and right-in/right-out restriction at Alexander which all contribute to a reduction intersection accidents. The benefits are offset by relatively high cost, returning a moderately positive B/C ratio. It should be noted that the land cost would significantly reduce this B/C ratio.

Details of the financial account are summarized in Table 4.14

Table 4.14 Financial Indicators – Trans Canada Highway Widening

Discounted Costs (2004 $ Millions)	
Project Cost	$5.00
Salvage Value	-$0.99
Total Discounted Cost	**$4.01**
Discounted Benefits (2004 $ Millions)	
Delay Reduction	$3.0
Vehicle Operating Cost Reduction	$0.1
Collision Reduction	$4.1
Total Discounted Benefits	**$7.3**
Net Present Value (NPV)	$3.26
Benefit/Cost Ratio	1.8

4.2.2 One-Way Highway Couplet

The one-way highway couplet system is designed to separate northbound and southbound highway traffic to parallel corridors, thereby reducing conflicts and improving mobility for highway traffic.

The one-way highway couplet concept involves the provision of a new northbound highway alignment parallel to the existing corridor. Details of this option are illustrated in Figure 4.7 and briefly described below.

- Provide separate northbound and southbound Trans Canada Highway (TCH) alignments between Cowichan Way and James Street. Provide three southbound through lanes on existing TCH alignment and three northbound through lanes on new alignment along Bundock Avenue and connections to existing TCH. Potential alternate provides three northbound through lanes on existing TCH alignment and three southbound through lanes on new alignment along St. Julian Street and connections to existing TCH.
- The existing five-lane cross-section of the existing TCH will be fully utilized for the southbound direction. This will include three through lanes and two turning lanes at each intersection between James Street and Cowichan Way. Similarly, a five lane cross-section is anticipated for the northbound TCH corridor to provide three through lanes and two turning lanes at each intersection between Cowichan Way and James Street.
- Trunk Road corridor west of TCH remains a four-lane cross-section. From TCH to Bundock Avenue a six-lane cross-section will be provided in order to accommodate one through lane and one left-turn lane eastbound and westbound, and to develop a back-to-back left-turn lane. Trunk Road will be widened west of the TCH and east of Bundock Avenue to accommodate right-turn lanes. East of McKinstry Road, Trunk Road will remain a two-lane roadway.
- A four-lane cross-section is needed west of the TCH through to Ypres Street along Coronation Avenue. Between the TCH and Bundock Avenue, Coronation Avenue will be widened to five lanes to provide left-turn lanes, and to develop second through lanes in both directions. A westbound right-turn lane will be provided at the intersection of Coronation Avenue and Bundock Avenue. East of Bundock Avenue, the four-lane cross-section will likely narrow to two lanes.
- The intersection of Alexander Street and the TCH will be restricted to right-in/right-out only.
- No direct access between Dobson Road, Charlotte Street, Powel Street, Whistler Street and proposed northbound TCH alignment. Connect Charlotte Street and Powel Street to Alexander Street via an extension of existing Bundock Avenue.

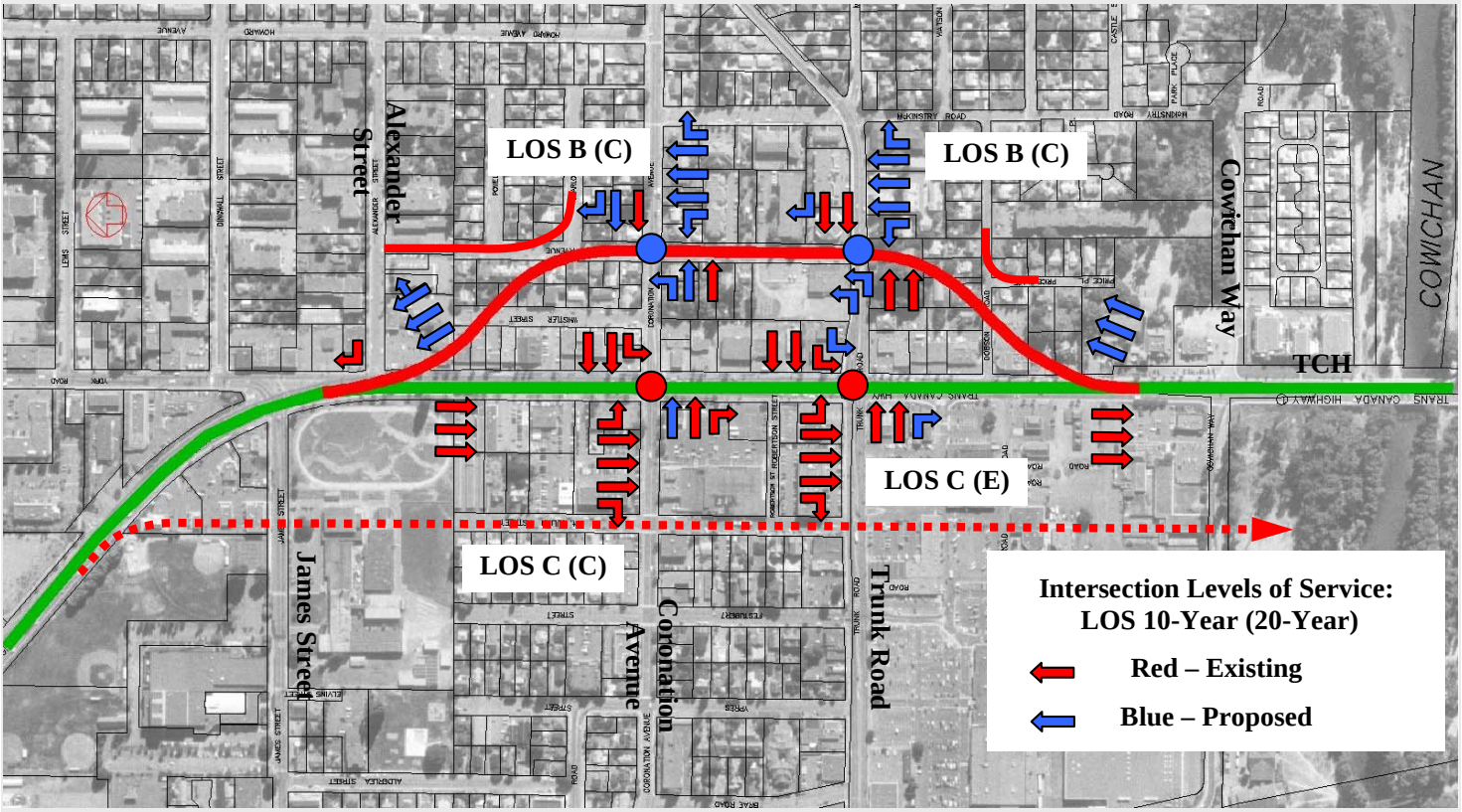

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Figure 4.7: One-Way Highway Couplet

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Evaluation Summary

The following discussion highlights the overall impacts and benefits of this improvement strategy.

- **Transportation** – Each of the four signalized intersections operates at a LOS C or better at the 10-year horizon. At the 20-year horizon, the southbound Trunk Road / TCH intersection operates at LOS E while the remaining TCH intersections operate at LOS C. Minor circulation impacts are anticipated from the one-way system.
- **Social** – It is anticipated that this option requires approximately 20 full property takings and impacts an additional 27 properties. Approximately half of the full property takings are commercial properties, the other half residential.
- **Environmental** – No watercourse / parkland impacts are expected from this improvement strategy.
- **Financial** – A couplet configuration reduces accidents and increases capacity by reducing the number of conflicting movements in the treated section. With fewer turning conflicts, running speed and intersection capacity increase contributing to better time savings than an equivalent 2-way operation. Time savings are offset by a slightly longer traveled distance but remain good. One-way operation means that access traffic no longer has to cross the opposing direction traffic stream. This contributes a large portion of collision benefits because of the high access density in this area. The good benefits return a moderately good B/C ratio but may change considerably when property costs are included.

Details of the financial account are summarized in Table 4.18

Table 4.18 Financial Analysis – One-Way Highway Couplet

Discounted Costs (2004 $ Millions)	
Project Cost	$6.04
Salvage Value	-$1.19
Total Discounted Cost	**$4.84**
Discounted Benefits (2004 $ Millions)	
Delay Reduction	$9.5
Vehicle Operating Cost Reduction	$0.2
Collision Reduction	$7.9
Total Discounted Benefits	**$17.6**
Net Present Value (NPV)	$12.80
Benefit/Cost Ratio	3.6

4.2.3 Highway Grade-Separation & Ring Road

The primary purpose of the grade-separation and ring road concept is to improve public safety and mobility on the highway corridor by eliminating at-grade intersections on the highway facility, reducing conflicts.

Option Description

This strategy essentially creates a four-lane freeway with two grade-separated accesses between Cowichan Way and Beverly Street. Local traffic is served via a ring road and grade separated underpasses. Details of this long-term strategy are illustrated in Figure 4.8, and briefly described below.

Trans Canada Highway

- Transform Trans Canada Highway (TCH) into full access-controlled facility between Cowichan Way and Beverly Street. This includes two full tight-diamond interchanges at Cowichan Way and Beverly Street - a separation of 1.7 km. Two northbound and two southbound through highway lanes will be maintained.
- Between the two interchanges, close intersections at: Somenos Business Park, Alexander Street, Coronation Avenue, Robertson Street, and Dobson Road. Intermediate accesses to be closed with possible re-location: Safeway, Overwaitea, A&W/Pizza Hut, Boston Pizza/Wendy's, Falcon Nest Motel, and McDonald's.
- Provide diamond interchange at Cowichan Way. Cowichan Way corridor west of the interchange will be widened from a two-lane cross-section to a four-lane cross-section to the intersection at Trunk Road. Between the east and west interchange intersections, a five-lane overpass is anticipated. This will provide one through, and two left-turn lanes for eastbound and westbound traffic. East of the east side intersection, a four-lane cross-section will be constructed through to Bundock Avenue or to McKinstry Avenue (alternate option). East of McKinstry (alternate option), Cowichan Way extension is likely a two-lane roadway.
- Provide diamond interchange at Beverly Street. West of the interchange, carry four-lane cross-section to Canada Avenue. A five-lane overpass with two through lanes and developed left-turn lane westbound, and one through lane, one left-turn lane and one developed left-turn lane eastbound would be constructed. East of the overpass, a four-lane cross-section would be constructed to York Road or to Howard Avenue (alternate option).
- At Trunk Road, provide a four-lane overpass/underpass of highway without connections.
- Provide two-lane highway overpass/underpass at James Street without connections.

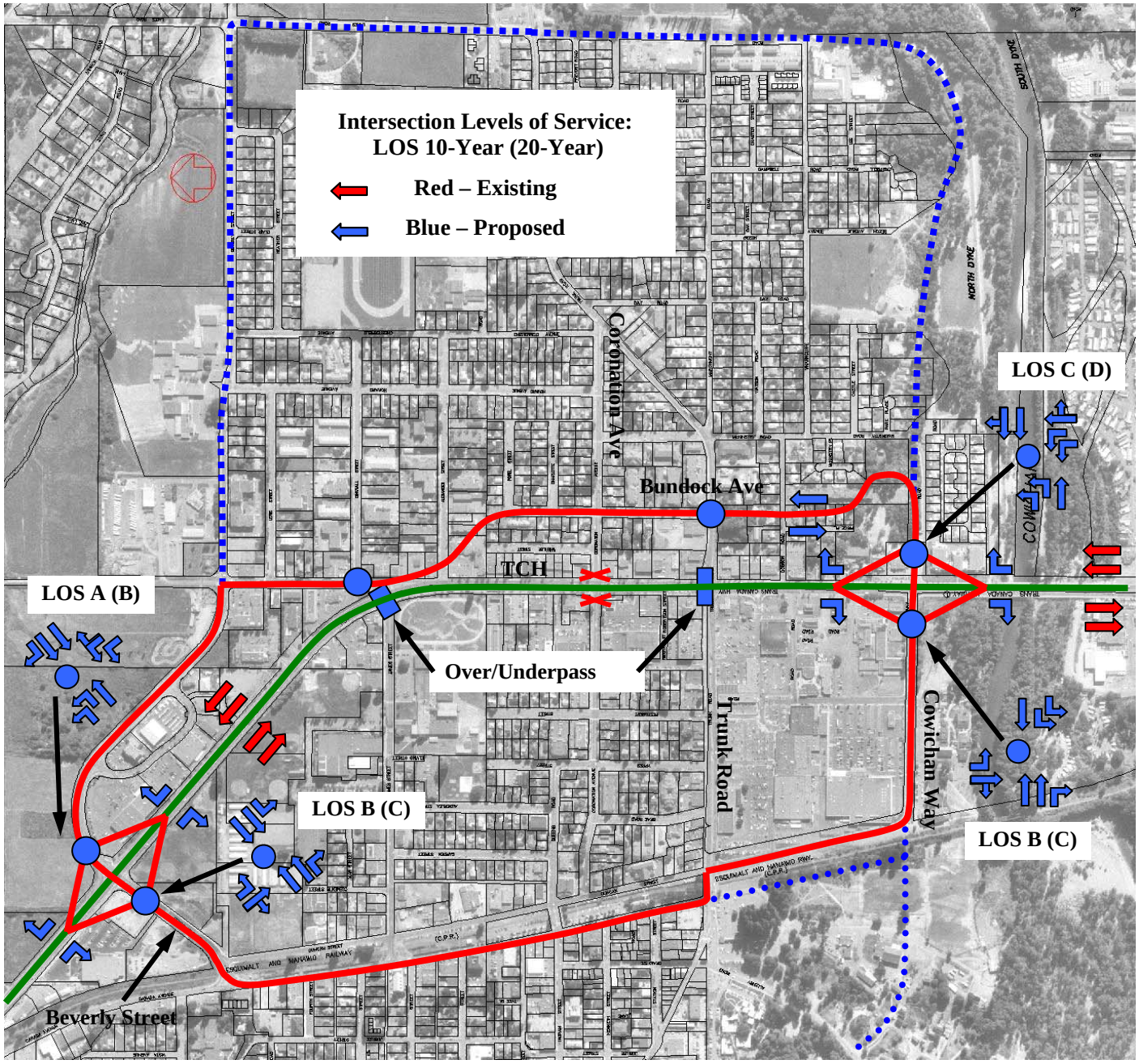

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Figure 4.8: Highway Grade-Separation & Ring Road

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Ring Road Option (and Alternate)

- West of the TCH, the ring road route follows Canada Avenue south to Trunk Road then along Cowichan Way south to the highway. Install a traffic signal at the intersection of Cowichan Way and Duncan Mall. Alternate option refinements west of the TCH include extending Canada Avenue south to Cowichan Way and extending Cowichan Way further west to Allenby Road. Extending Cowichan way west to Allenby Road creates two T-intersections at the end of the Canada Way (end of the couplet) and at Allenby Road.
- East of TCH, extend Cowichan Way to connect to Bundock Avenue, creating a four-legged signalized intersection at Trunk Road. Extend Alexander Street to connect to York Road and close intersection of Alexander at TCH. Signalize new intersection of James Street / York Road / Alexander Street / Dingwall Street.
- Alternate option east of the TCH extends Cowichan Way to connect to Lakes Road and Beverly Street.

Evaluation Summary

The following discussion highlights the benefits and impacts of this option.

- **Transportation** – Overall, the four-lane highway between Beverly Street and Cowichan Way would operate at LOS D in the 20 year horizon as a result of access control and grade separation. However, reduced cross-street connections and direct property access may impact travel distances on municipal road system.
- **Social** – This option may impact upwards of forty properties, whereby half are full property takes. The alternate option (with Cowichan Way extensions to Allenby Road and Lakes Road) requires upwards of fifty property impacts with less than five full property takes. Both options significantly impact commercial development at Beverly Street (interchange location).
- **Environmental** – Significant environmental impacts for potential Cowichan Way extension between McKinstry Road and Lakes Road are expected. Impacts on forest and hatchery are also expected.
- **Financial** – The analysis assumes 60% of base case traffic volume will use this short through route. Collision benefits derive by removing this traffic stream from 6 major intersections and roughly 39 accesses. Time savings are derived from an assumed higher 80 km/hr operating speed and eliminating signal delay at 4 intersections. Good benefits are offset by a high initial cost and the project returns a B/C ratio=1.6. This does not reflect the longer service life of grade separation compared to the other options which will likely need further large capital improvements near the end of the planning period.

Details of the financial account are summarized in Table 4.19.

Table 4.19 Financial Indicators – Highway Grade-Separation & Ring Road

Discounted Costs (2004 $ Millions)	
Project Cost	$53.87
Salvage Value	-$10.64
Total Discounted Cost	**$43.22**
Discounted Benefits (2004 $ Millions)	
Delay Reduction	$44.8
Vehicle Operating Cost Reduction	$19.1
Collision Reduction	$5.4
Total Discounted Benefits	**$69.3**
Net Present Value (NPV)	$26.06
Benefit/Cost Ratio	1.6

4.3 Alternate Routes or Highway Bypasses

Although many of the improvement strategies for the Trans Canada Highway are likely concentrated in and around the existing highway alignment, consideration is also given toward the potential for alternate local connections and/or highway bypass for the TCH.

For the purpose of this assignment, potential north-south routes for a municipal road and/or highway bypass have been identified. It is worth noting that the routes identified are simply for discussion purposes and that significant modifications would be anticipated through future initiatives.

A total of four routes are identified for discussion: two east side routes and two west side routes. For evaluation purposes, a four-lane cross section is assumed for the new highway route. All routes are illustrated in Figure 4.9.

The following sections briefly describe the east side and west side routes and provide broad impacts, benefits and costs as a four lane highway facility. Similar to the medium-term and long-term options, transportation, social, environmental and financial indicators are considered.

4.3.1 East Side Routes

The purpose of the highway/bypass route would be to address existing and forecast mobility problems and improve safety along the existing corridor. Peak hour volumes are estimated at 1150 vehicles per hour for current (2004) conditions, or approximately 12,000 vehicles per day.

Option Description

Both east side routes bypass the existing Trans Canada Highway (TCH) from Cowichan Bay Road in the south to Somenos Road (north of Highway 18) in the north.

From south to north, the short east route crosses Cowichan River east of Lakes Road then travels between Somenos Lake and Quamichan Lake along an extended Lakes Road (Wicks Road) north-south alignment to an interchange at Herd Road where it then heads northwest along a section of Mays Road to reach the TCH at Somenos Road. The short route is just over 11 km in length.

From south to north, the long east route heads northeast from the TCH to cross the Cowichan River and meet Maple Bay Road which it follows east of Quamichan Lake then heads back west (north of Stamps Road) to an interchange at Herd Road and continues west and northwest along a section of Mays Road to reach the TCH at Somenos Road. The long route is less than 15 km in length.

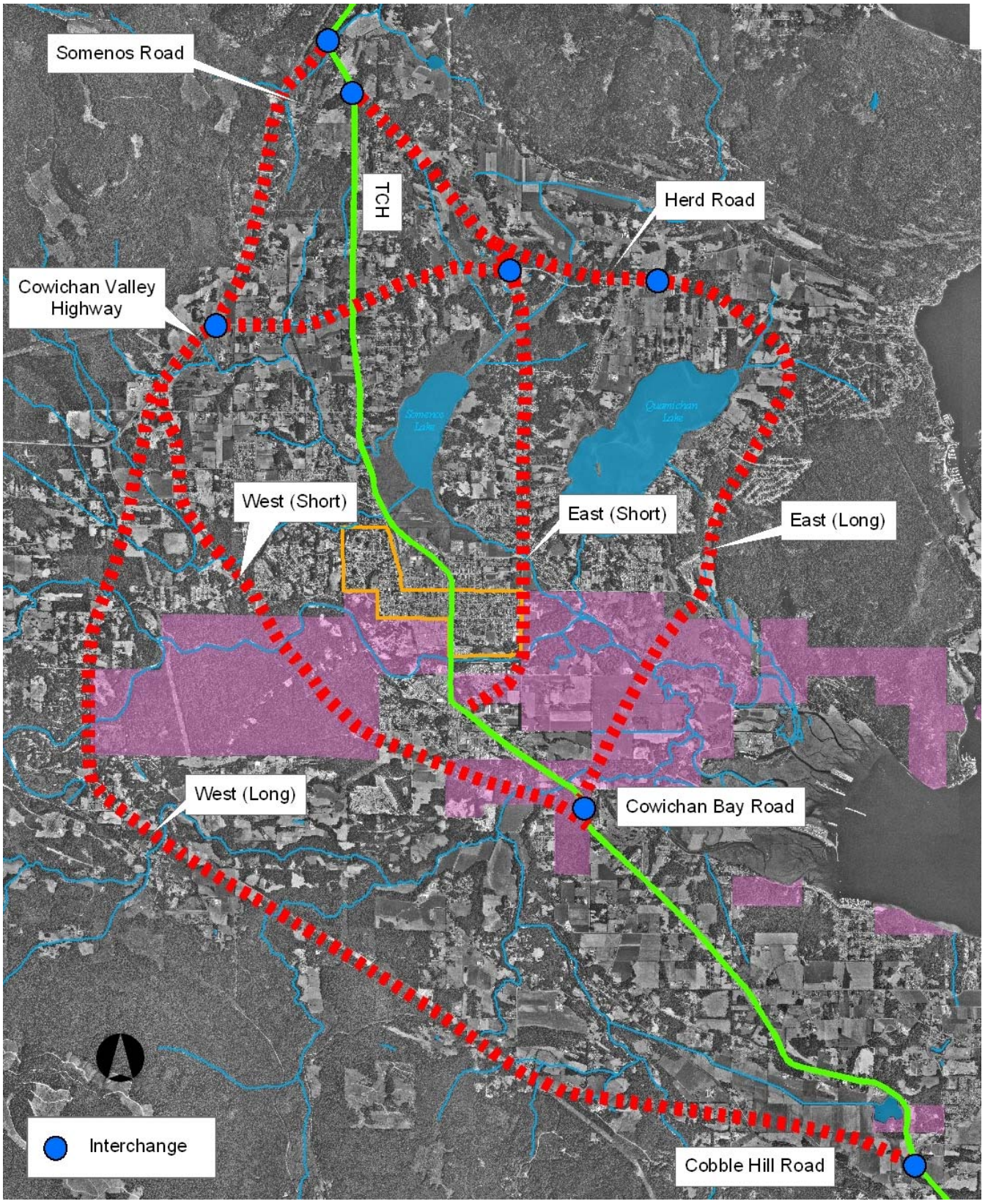
Another option for the northern section of the bypass routes is to follow Herd Road alignment back to the TCH instead of joining the highway at Somenos Road.

Evaluation Summary

As expected, the alternate routes or highway bypasses generate significant social and environmental impacts, which are highlighted as follows.

- **Transportation** – No impacts are expected to access or circulation patterns along the existing corridor. Overall travel time savings are positive for both options as a result of eliminating most of the signal delay for bypass traffic and an increased running speed on the bypasses. However, longer distances will result in increased vehicle operating and collision costs.
- **Social** – There may be a perceived loss of business due to new highway route. It is also expected that the bypass options would have significant property impacts.
- Environmental – Significant environmental impacts are anticipated with the eastern by-passes. The proposed routes require new crossing of the Cowichan River and multiple additional structures over water. The east bypass routes require at least four or five crossings.
- **Financial** – The conceptual project costs for the east bypass routes are in the range of $91 for the short route and $102million for the long route (discounted 2004 $). The significantly higher vehicle operating and collision costs result in a negative B/C ratio for the eastern by-passes. Once again, these costs do not include property, which result in a lower B/C ratio.

In the medium to long-term, these east by-pass routes would likely be of greater benefit as part of the local network supporting travel between these local communities.



Options Identification & Evaluation Report

March 2005

Figure 4.9: Alternate Routes or Highway Bypasses

URBAN SYSTEMS

4.3.2 West Side Routes

As described above, the purpose of the alternate/bypass route is to address existing and forecast mobility problems and improve safety for both the existing route and the proposed bypass roadway. Peak hour volumes are estimated at 1150 vehicles per hour for current (2004) conditions, or approximately 12,000 vehicles per day.

Option Description

From south to north, the short west route leaves the TCH south of Cowichan Bay Road heading west and northwest to cross the Cowichan River. It then continues northwest and north to an interchange with the Cowichan Valley Highway, northeast of the existing intersection between the Cowichan Valley Highway and Drinkwater Road. It then follows the highway alignment to reach Somenos Road which the alignment follows back to the TCH. The short west route is 15 km in length.

From the south to north, the long west route leaves the TCH at Cobble Hill Road heading west to an existing easement following it northwest then continuing northwest and north to an interchange with the Cowichan Valley Highway, northeast of the existing intersection between the Cowichan Valley Highway and Drinkwater Road. It then follows the highway alignment to reach Somenos Road which the alignment follows back to the TCH. The long west route is approximately 24.5 km long.

Another option for the northern section of the bypass routes is to follow the Cowichan Valley Highway alignment back to the TCH instead of joining the highway at Somenos Road.

Evaluation Summary

As expected, the alternate routes or highway bypasses generate significant social and environmental impacts which are highlighted as follows:

- **Transportation** – No impacts to access or circulation are anticipated along the existing corridor. Travel time savings are positive for both options as a result of eliminating most of the signal delay for bypass traffic and an increased running speed on the bypasses. However, the significantly longer distances for the western by-passes increases overall travel distance and reduces safety.
- **Social** – Perceived loss of business due to new route around the City of Duncan. It is also expected that the bypass options would have significant property impacts.
- **Environmental** – Significant environmental impacts are expected from the western by-passes. Proposed routes require new crossing of the Cowichan River and multiple additional structures over water. The west short bypass route requires at least four crossings and the long west bypass route requires at least 11 crossings.

- **Financial** – The conceptual project costs for the west bypass routes are in the range of $113 for the short route and $151 million for the long route (discounted 2004 $). The significantly higher vehicle operating and collision costs result in a negative B/C ratio for the eastern by-passes. Once again, these costs do not include property, which result in a lower B/C ratio.

Appendix A

Corridor Zoning

Trans Canada Highway - Corridor Management Plan

Cowichan Bay Road to Pedestrian Bridge

ZONING

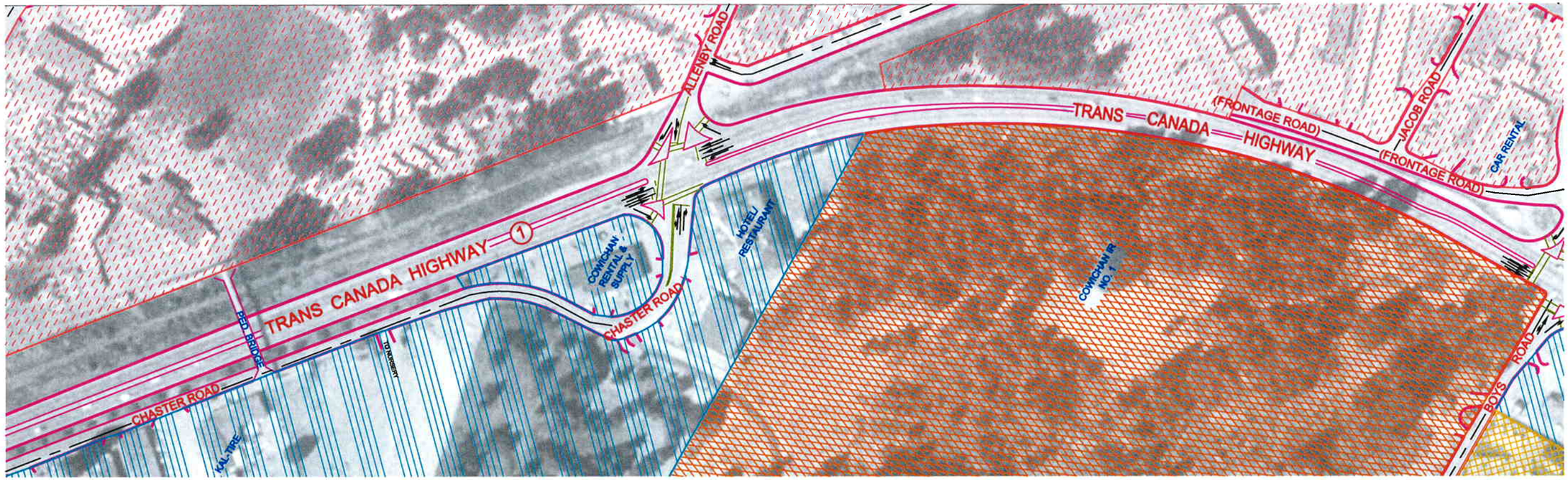
Appendix A

Scale 1:2,500

LEGEND

COMMERCIAL | PUBLIC USE | INSTITUTIONAL | AGRICULTURAL

FIRST NATIONS | INDUSTRIAL | RESIDENTIAL



Trans Canada Highway - Corridor Management Plan

Pedestrian Bridge to Dobson Road

ZONING

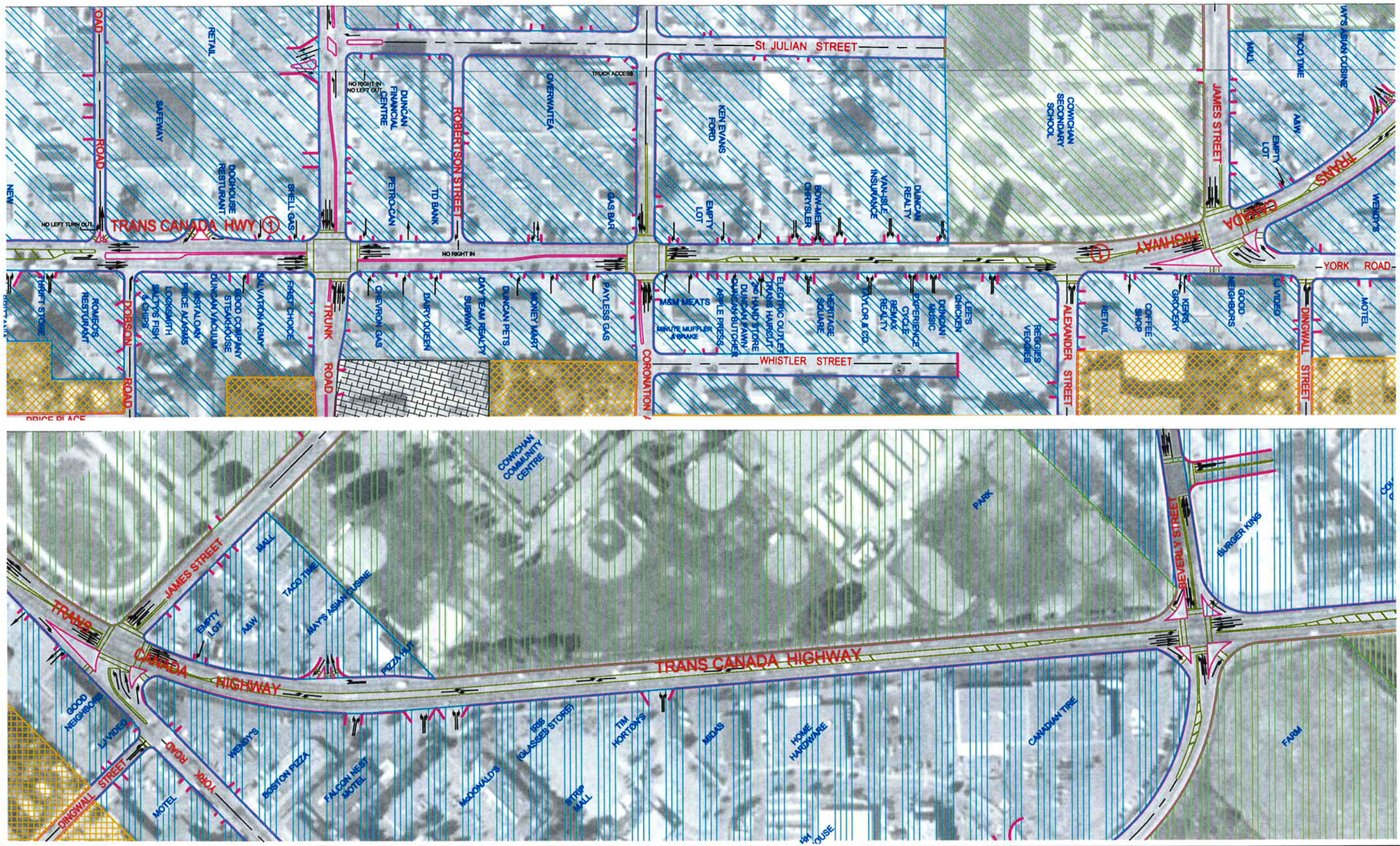
Appendix A

Scale 1:2,500

LEGEND

COMMERCIAL | PUBLIC USE | INSTITUTIONAL | AGRICU-LTURAL

FIRST NATIONS | INDUSTRIAL | RESIDENTIAL



Trans Canada Highway - Corridor Management Plan

Dobson Road to Beverley Street

ZONING

Appendix A

Scale 1:2,500

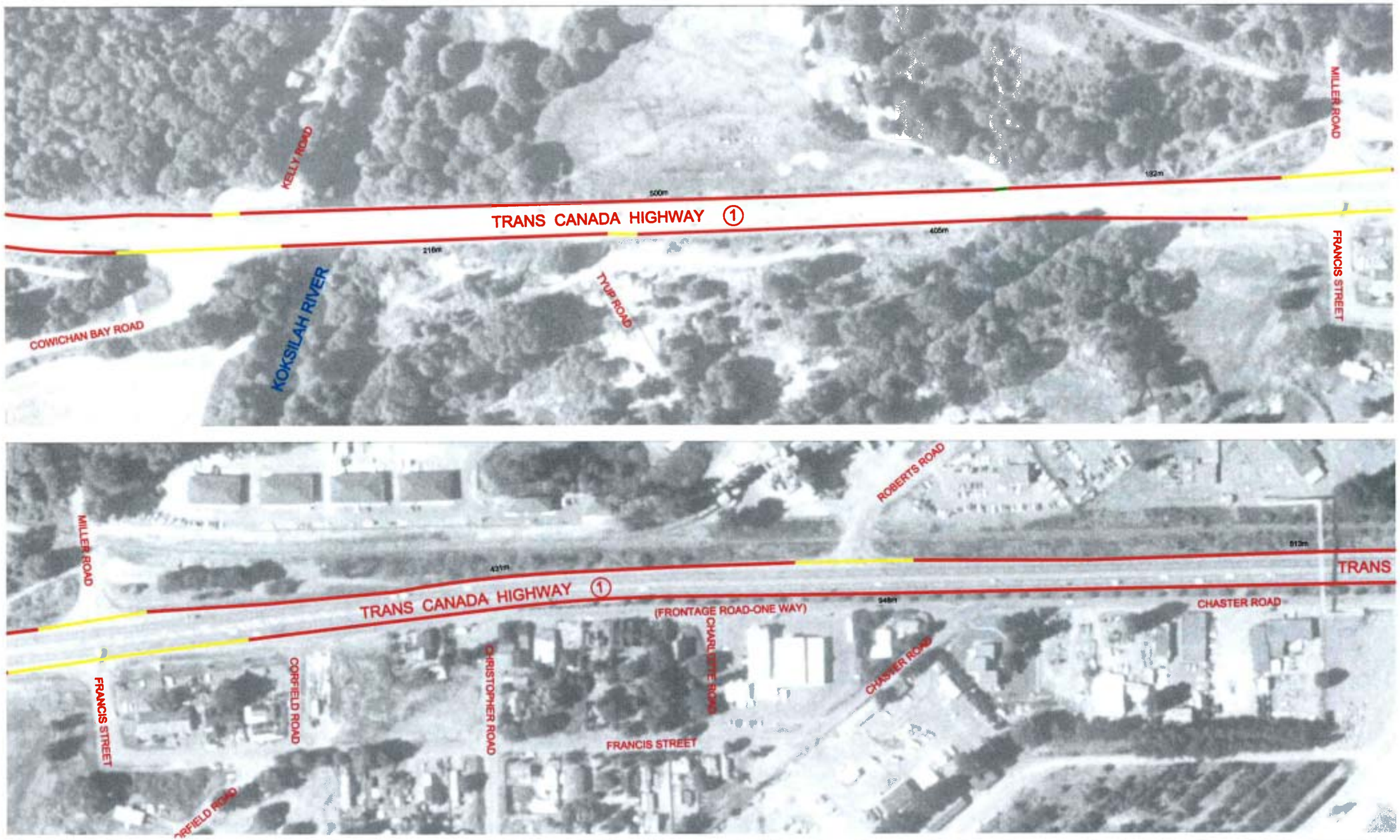
LEGEND

COMMERCIAL | PUBLIC USE | INSTITUTIONAL | AGRICULTURAL

FIRST NATIONS | INDUSTRIAL | RESIDENTIAL

Appendix B

Access Spacing



Trans Canada Highway - Corridor Management Plan

Cowichan Bay Road to Pedestrian Bridge

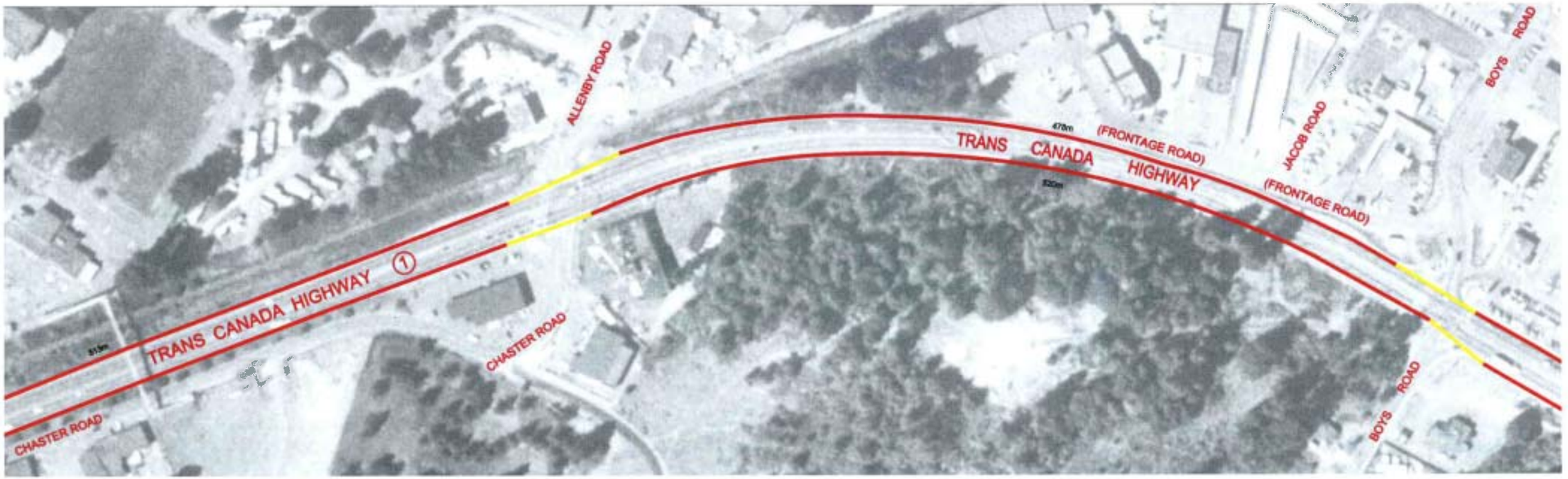
Access Spacing

Appendix B

Scale 1:2,500

LEGEND

- Edge of Road
- Intersection
- Driveway



Trans Canada Highway - Corridor Management Plan

Pedestrian Bridge to Dobson Road

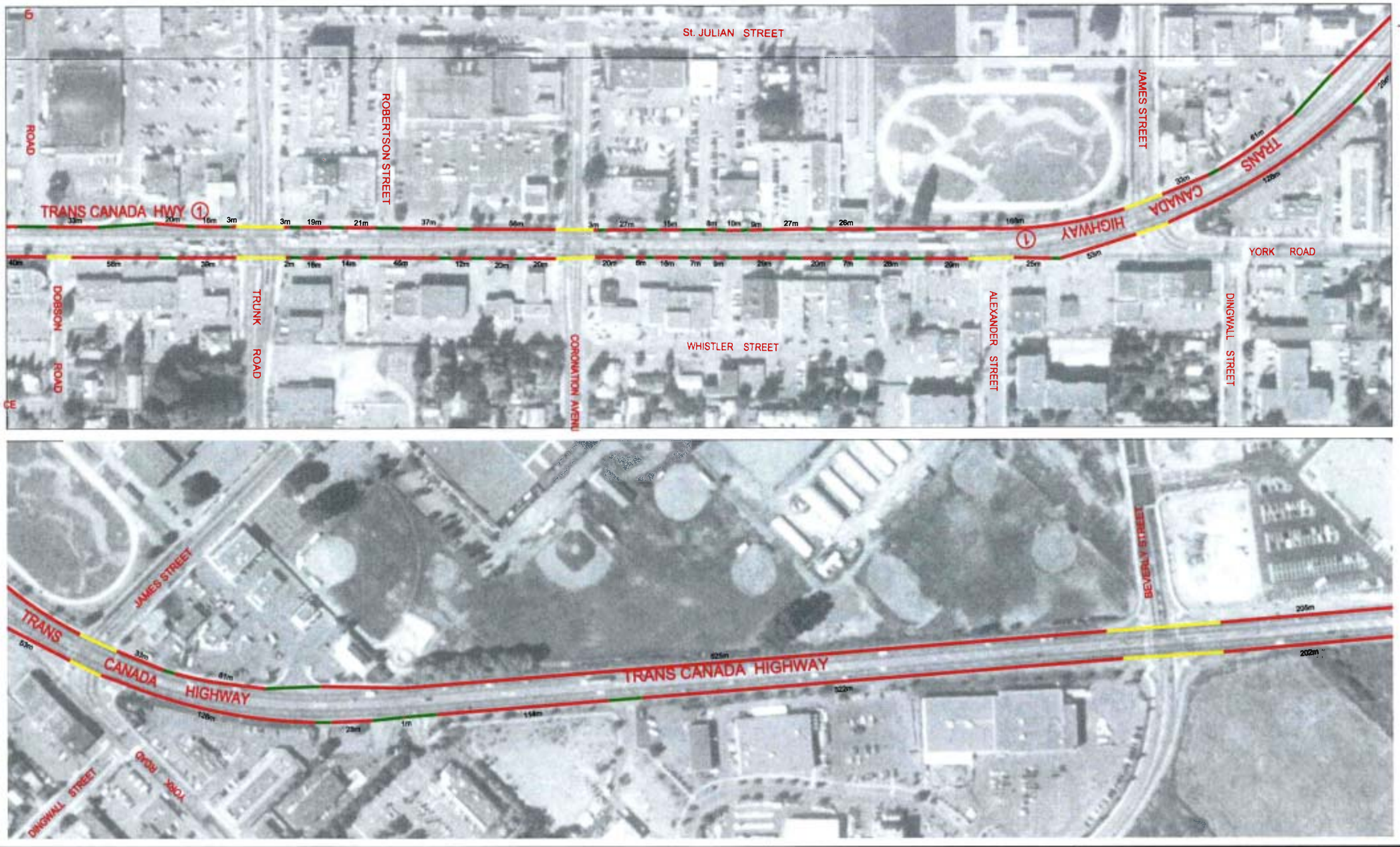
Access Spacing

Appendix B

Scale 1:2,500

LEGEND

- Edge of Road
- Intersection
- Driveway



Trans Canada Highway - Corridor Management Plan

Dobson Road to Beverley Street

Access Spacing

Appendix B

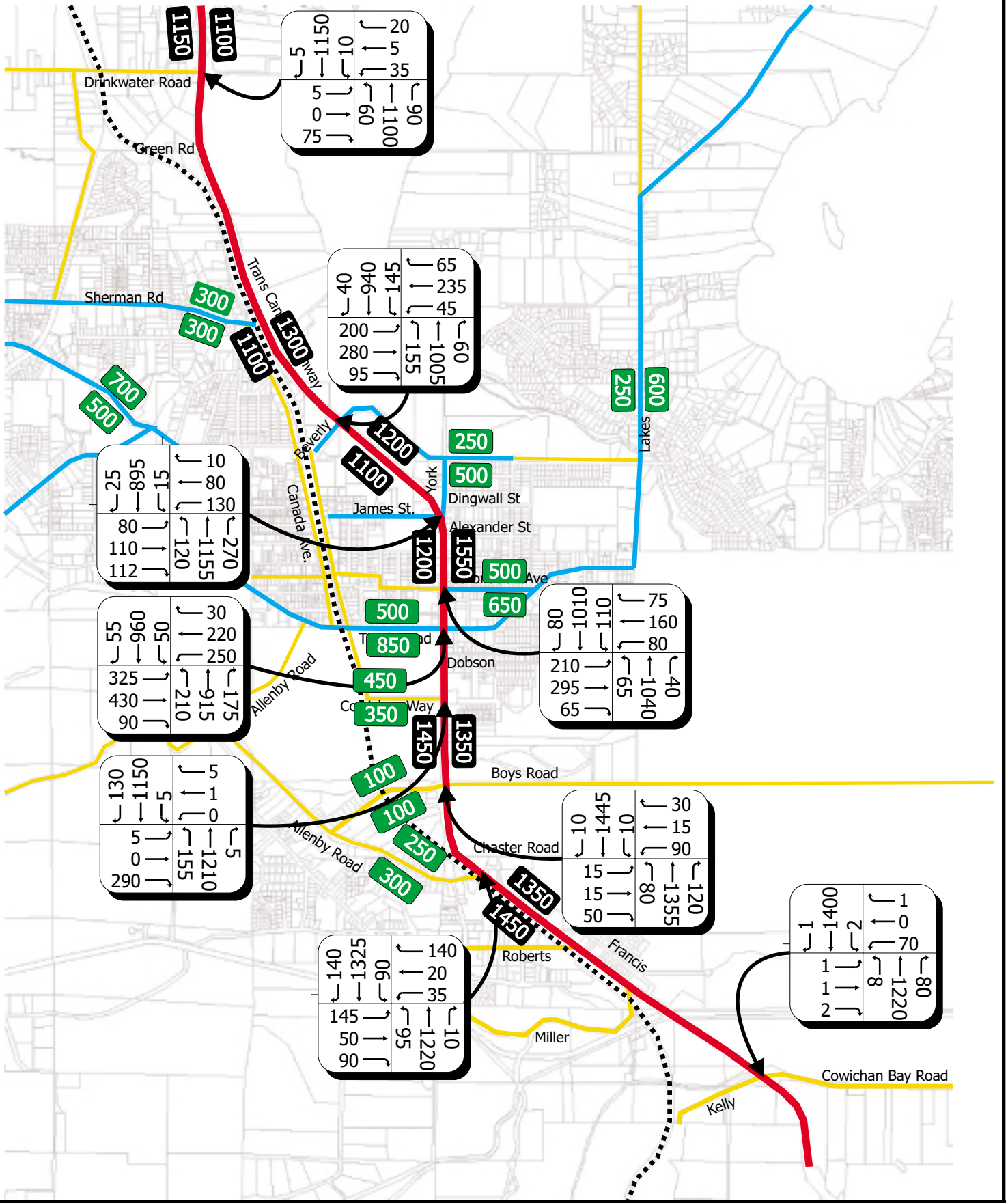
Scale 1:2,500

LEGEND

- Edge of Road
- Intersection
- Driveway

Appendix C

Traffic Characteristics



Legend

*Source: Duncan Signal Corridor Boulevard Transportation

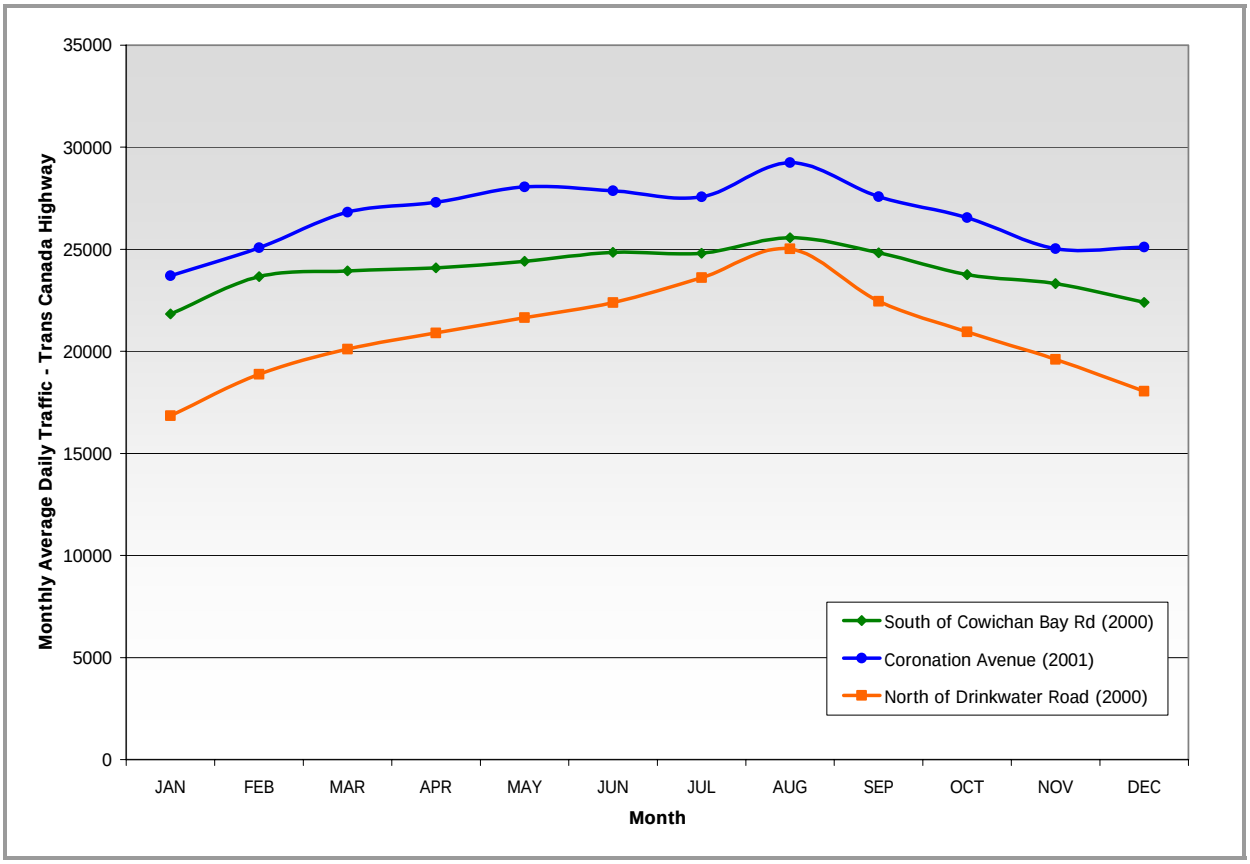
Appendix C: PM Peak Hour Corridor Volumes (August 2003*)

URBANSYSTEMS.

June 2004

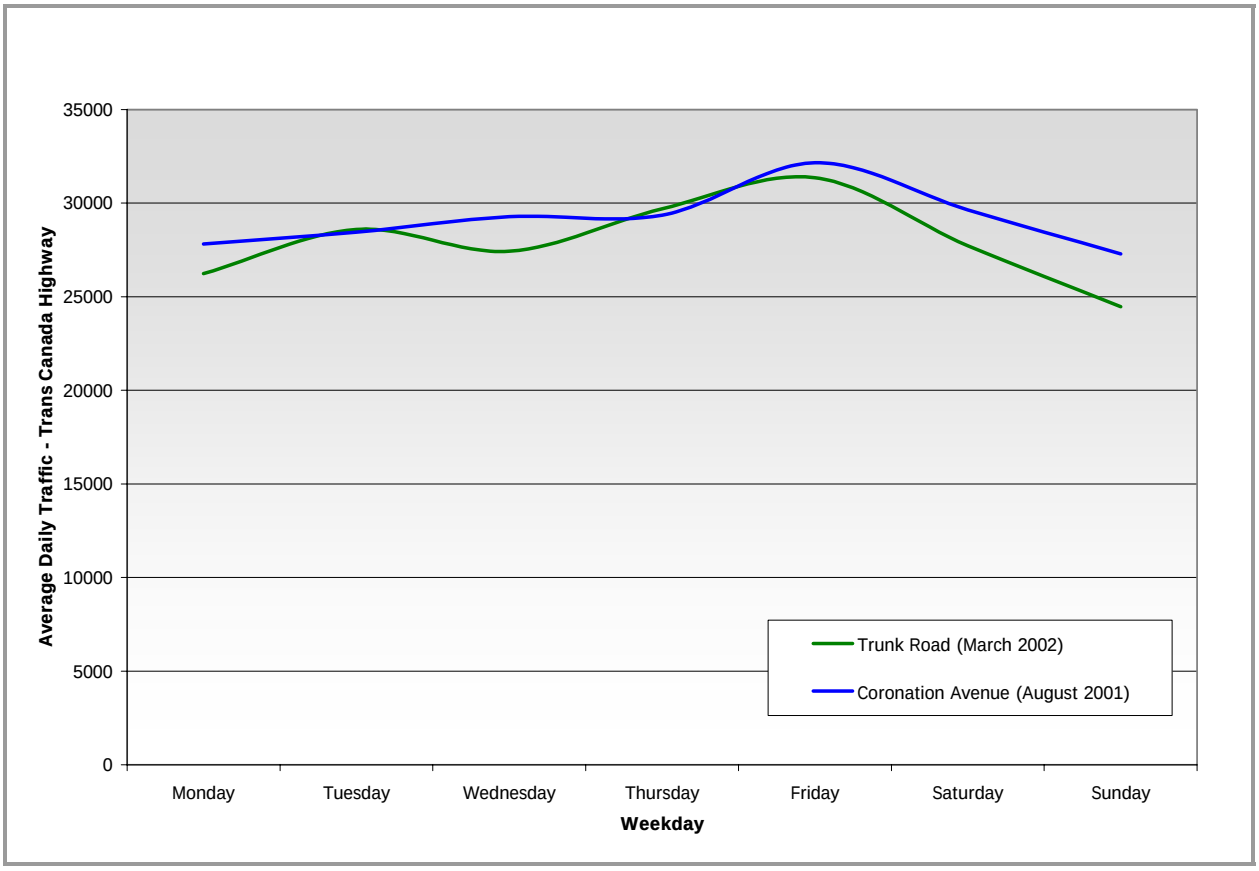
Seasonal Traffic Data

Seasonal traffic data was obtained at three locations within study area (count station 12-055 1 km north of Drinkwater Road, count station 12-067 2.2 km south of Cowichan Bay Road and at Coronation Avenue). The following figure illustrates the seasonal variations in traffic volumes along the highway corridor.



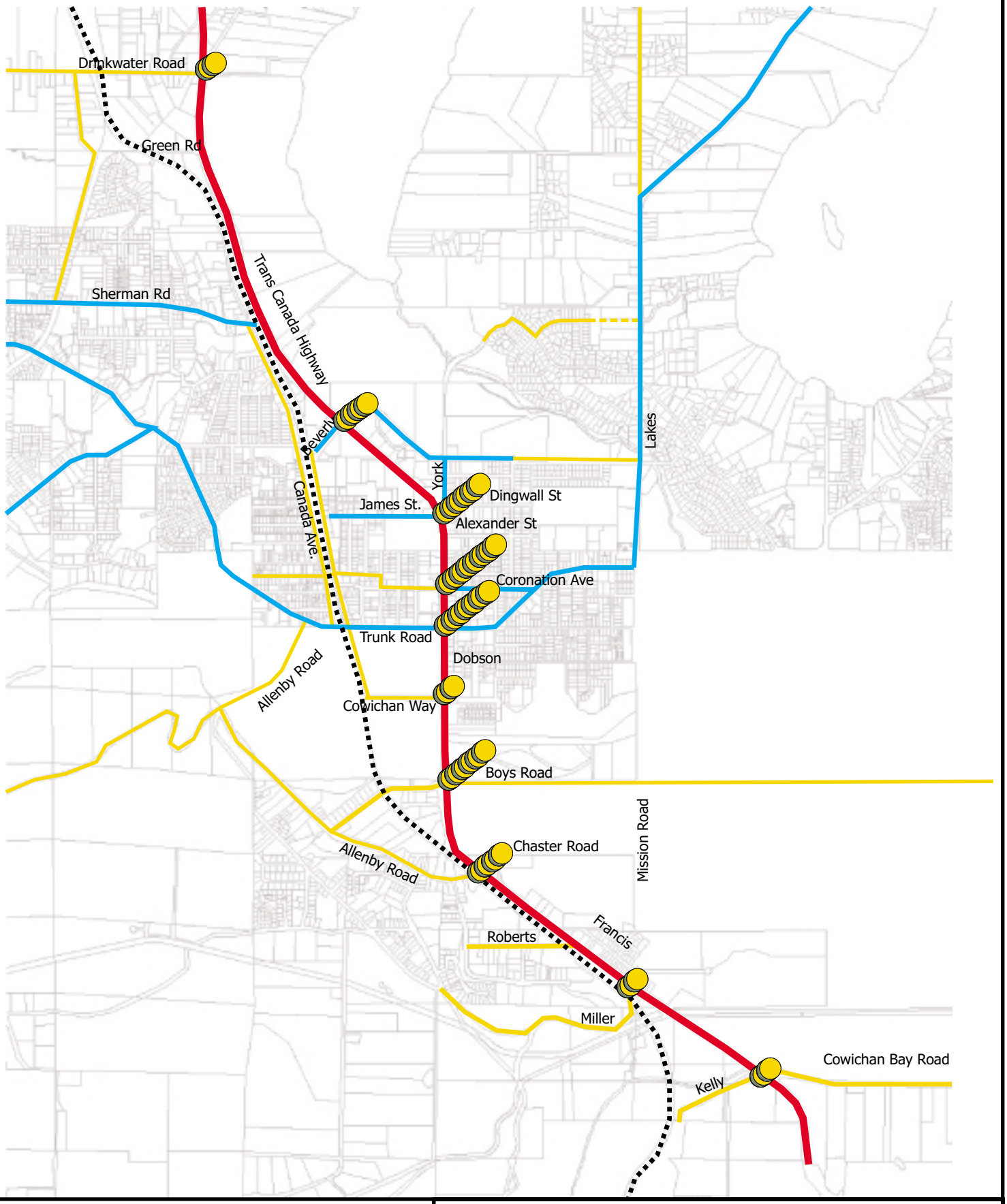
Historical Weekly Traffic Distribution

Weekday peak derived from traffic signal data obtained at Trunk Road and Coronation Avenue. Both locations suggest that highway traffic is greatest on Fridays. This is illustrated in the figure below.



Appendix D

Corridor Safety



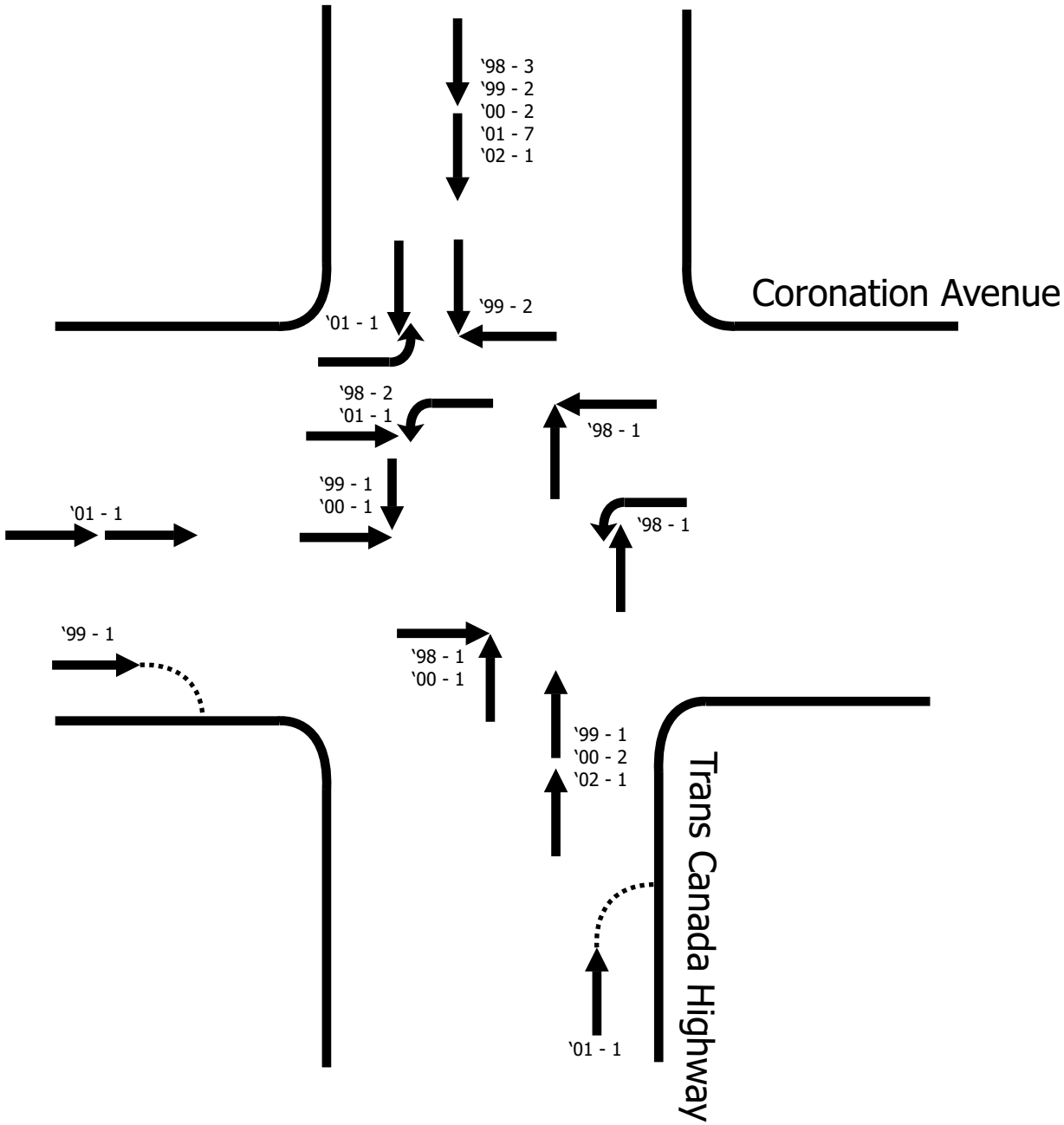
Legend

5 Collisions

Appendix D: Collisions Along Highway 1 at Major Intersections From 1998-2002

URBANSYSTEMS.

June 2004



Legend

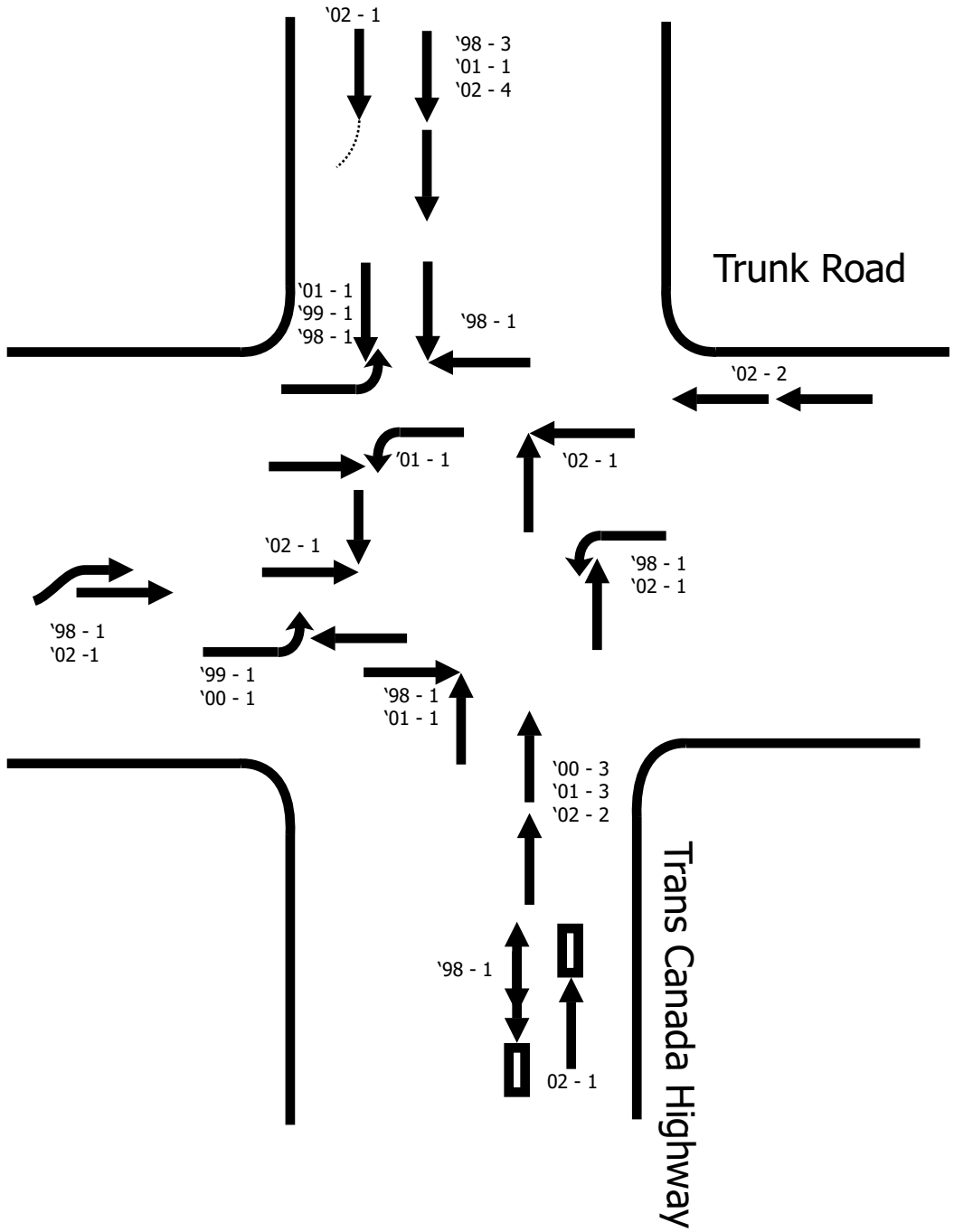
Overtaking

Parked Car

Appendix D: Coronation Rd and Highway 1
Spatial and Type Distribution of Collisions

URBANSYSTEMS.

July 2004



Legend

Overtaking

Parked Car

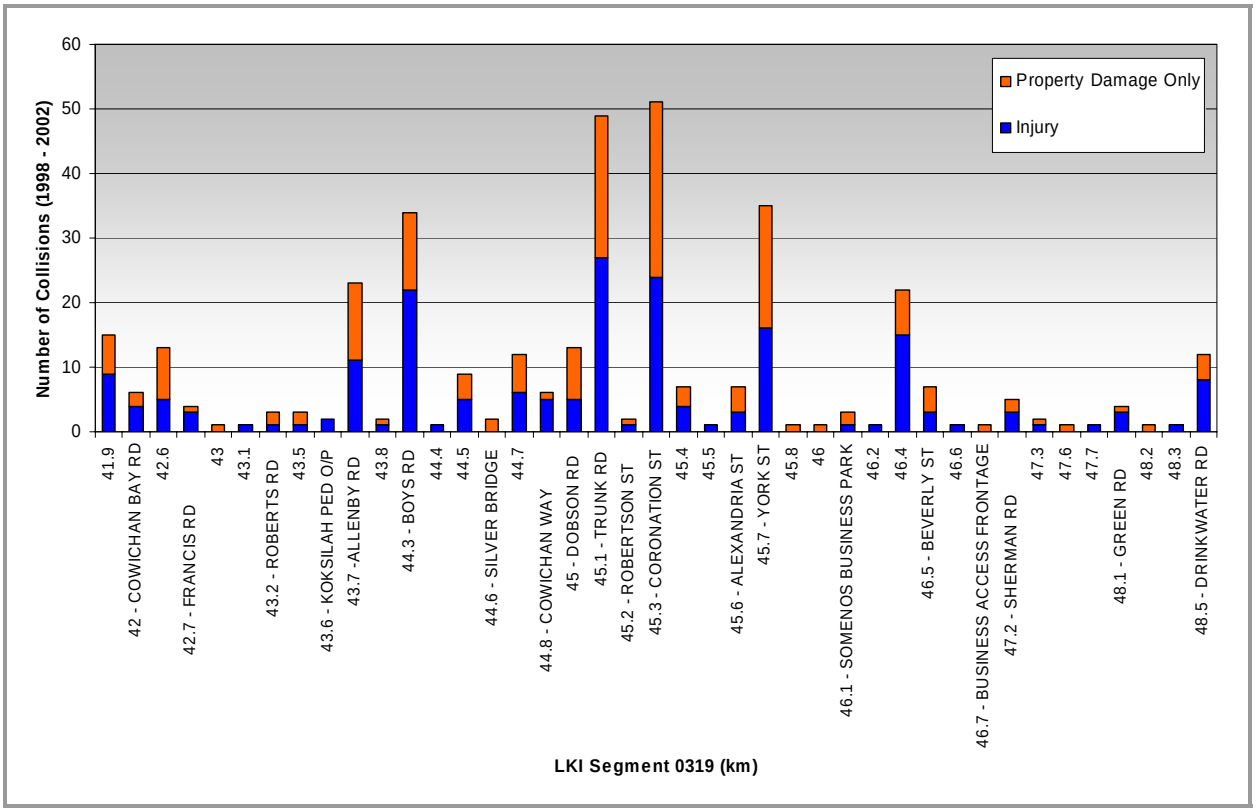
Appendix D: Trunk Road and Highway 1
Spatial and Type Distribution of Collisions

URBANSYSTEMS.

July 2004

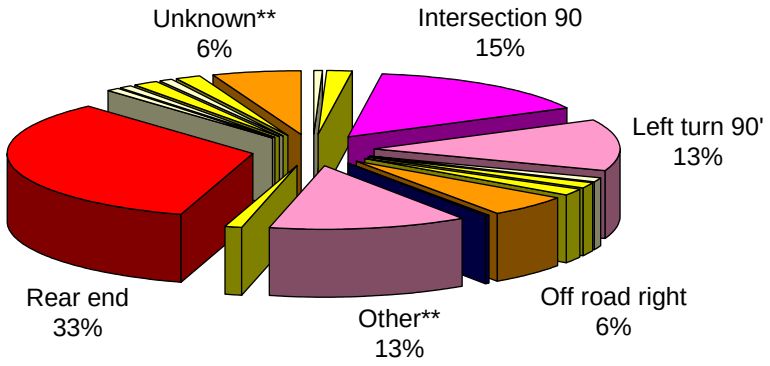
Collision Distribution

The following figure depicts the distribution of collisions along the length of the corridor (LKI segment) by collision type.



Collision Types

Top three types of collision: rear end, left turn and intersection 90 account for 61% of the total types of collisions. These collisions typically occur at intersections and accesses.

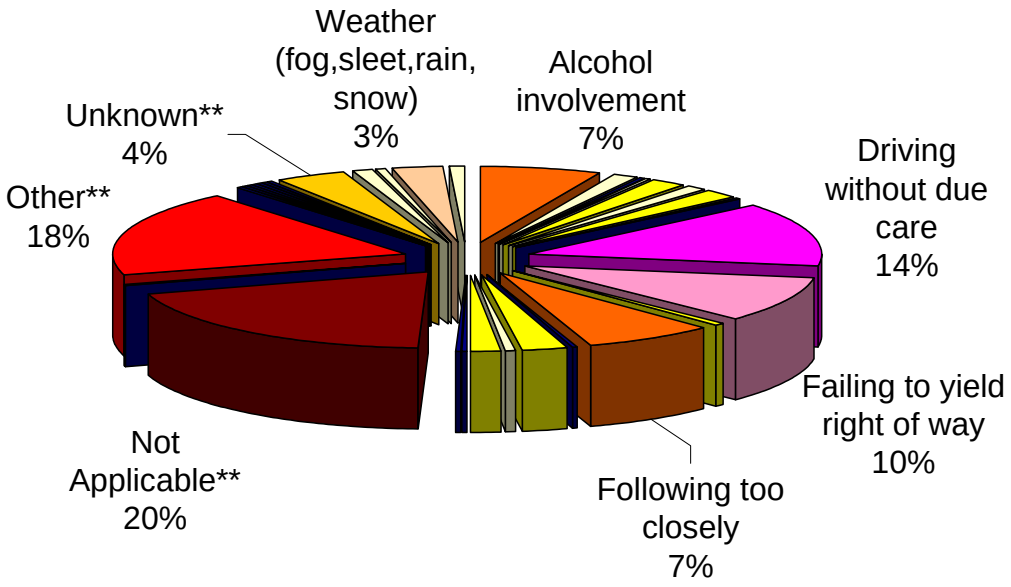


Collision types at top ten intersections (approximately 26% of corridor collisions):

	km	Head on	Intersection 90	Left turn	Off road	Other	Overtaking	Rear end	Right turn	Side swipe	Unknown	Grand Total
COWICHAN BAY RD	44.3	1	4	8	3	2	1	9	4			**32**
	Percentage	*3%*	*13%*	*25%*	*9%*	*6%*	*3%*	*28%*	*13%*			*31%*
FRANCIS RD	44.7		2	3		2		5	2	1	2	**17**
	Percentage		*12%*	*18%*		*12%*		*29%*	*12%*	*6%*	*12%*	*17%*
ROBERTS RD	48.5		3	1		5		2			1	**12**
	Percentage		*25%*	*8%*		*42%*		*17%*			*8%*	*12%*
ALLENBY RD	42.7					1		6	1		1	**9**
	Percentage					*11%*		*67%*	*11%*		*11%*	*9%*
BOYS RD	42			2		2		3			1	**8**
	Percentage			*25%*		*25%*		*38%*			*13%*	*8%*
COWICHAN WAY	44.5					1		2	2			**5**
	Percentage					*20%*		*40%*	*40%*			*5%*
DOBSON RD	44.8	1	1	1		1		1				**5**
	Percentage	*20%*	*20%*			*20%*		*20%*				*5%*
TRUNK RD	48.8			3	1				1			**5**
	Percentage			*60%*	*20%*				*20%*			*5%*
ROBERTSON ST	41.6			1	1	1			1	1		**5**
	Percentage				*20%*	*20%*			*20%*	*20%*		*5%*
CORONATION ST	44.4	1						1		1	1	**4**
	Percentage	*25%*						*25%*		*25%*	*25%*	*4%*
	Grand Total	**3**	**10**	**19**	**5**	**15**	**1**	**29**	**11**	**3**	**6**	**102**
	Percentage	*3%*	*10%*	*19%*	*5%*	*15%*	*1%*	*28%*	*11%*	*3%*	*6%*	*100%*

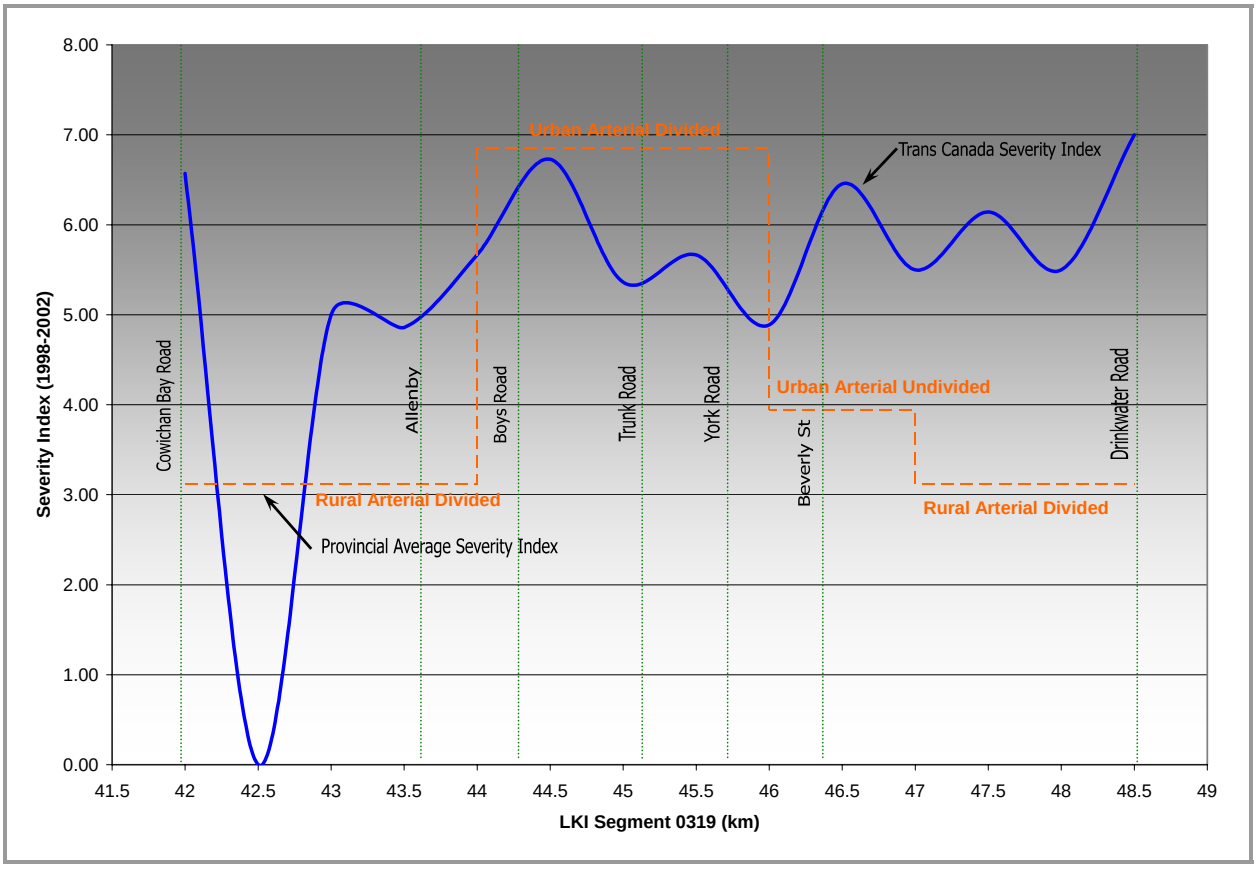
Primary Causes of Collisions

The majority of primary causes of collisions is undetermined or unknown. The highway cause of collisions which was noted is "Failing to yield to the right of way".



Collision Severity

Collision rate within the City of Duncan (Boys Road to James Street) is higher than provincial average, but severity is lower. Higher posted speed limits outside the City accompanied by highway standard roadways is most probably a factor to the high severity rate outside the City limits (south of Boys Road and north of Beverly Street).



Appendix E

Access Management Strategies

Access Management "Toolbox"

Categories of Access Management

- Limit conflicts
- Separate conflicts
- Remove turning from through traffic
- Reduce conflicting volumes
- Improve driveway operations

Access Management "Toolbox" – *Limit Conflicts*

- Install a nontraversable median
- Close a median opening
- Construct a directional median opening
- Install a divisional island to prevent entry into left-turn bay where weaving length is inadequate
- Install a physical barrier to eliminate uncontrolled access along property frontage
- Locate access opposite signalized 3-way intersection
- Install channelizing island to discourage turn manoeuvre
- Install nontraversable median with indirect left-turns
- Grade separated access

Access Management "Toolbox" – *Separate Conflicts*

- Minimum access spacing
- Minimum corner clearance
- Minimum property line clearance
- Limit the number of accesses per property
- Designate the access for each property
- Consolidate access drives
- Optimize driveway spacing

Access Management "Toolbox" – *Remove Turning from Through Traffic*

- Install a left-turn deceleration bay at existing median openings
- Install an isolated left-turn bay
- Install a nontraversable median with left-turn bays
- Install a right-turn deceleration bay
- Install a continuous right-turn lane
- Increase the length of existing turn bay
- Install a median storage for left-turn egress vehicles
- Install an alternating left-turn land
- Install a continuous two-way left-turn lane

Access Management "Toolbox" – *Reduce Turn Volumes*

- Provide connection between adjacent parcels
- Require adequate internal circulation
- Provide alternative access
- Provide a supporting circulation system

Access Management "Toolbox" – *Improve Roadway Operations*

- Long, uniform signal spacing
- Install access on the cross-road
- Provide visual cues of access drives and public street intersections
- Prohibit on-street parking
- Provide adequate sight distances
- Control the merge of left-turn egress vehicles
- Install channelizing island to control the right-turn merge
- Install right-turn acceleration lane
- Shared access
- Convert parallel streets to one-way pair
- Provide a frontage road
- Construct a bypass
- Recess gates used by large vehicles

Access Management "Toolbox" – *Improve Driveway Operations*

- Smooth vertical geometrics
- Adequate driveway throat width and curb return radii
- Provide adequate sight distance
- Additional egress lane
- Quality driveway construction
- Define the ingress and egress sides of the access drive