NORTH VANCOUVER
DISTRICT

Mountain Highway Transportation Assessment (March 2023)

This assessment reviews safety, operational, and geometric conditions on Mountain Highway between Lynn Valley Road and Arborlynn Drive. Mountain Highway is an important multi-modal arterial corridor for the District of North Vancouver (the District), linking the Lynn Valley and Lynn Creek Town Centres. The corridor currently carries approximately 15,000 motor vehicles per day and has previously been identified as a Council priority cycling route. In December 2021, the District's Road Safety Program found that Mountain Highway has a high prevalence of collisions. The corridor has the second most overall, cyclist-involved, and pedestrian-involved collisions of all District corridors, and received the most reported safety concerns.

Findings from this assessment explore how the system functions for all users, presenting existing conditions for walking, rolling, cycling, transit and driving. Safety, operational and geometric issues are documented, as well as future opportunities to improve multi-modal travel. The corridor is further separated into three sections to reflect the changing street character from constrained town centre, to emerging multi-modal and multi-family residential, and finally primary residential with increasing grades.

Key findings from the study include:

- Collision severity is a concern for the corridor, as reported collisions between 2016-2020 were nearly twice as likely to result in injury or fatality than the District average for 2011-2020.
- Prevalent speeding along the majority of the corridor, with the 85th percentile speed regularly exceeding the posted limit by at least 10km/hr. These speeds likely contribute to the increased severity of collisions.
- Motor vehicle traffic operates with minimal delays along the entire corridor during all times of the day. An excess northbound motor vehicle lane remains south of E 24th Street and could be reallocated to support safer street design for all modes while still accommodating existing motor vehicle traffic.
- Transit is an important means of travel along the corridor, accounting for approximately 9% of daily trips and up to 20% of trips during the AM peak period.
- Sidewalk condition along much of the corridor is poor and narrow, with cracks and uneven panels. Sidewalks are only continuous on the west side of the road.
- Dedicated cycling facilities are limited to discontinuous cycling lanes which begin at E 27th Street and terminate south of Ross Road. Despite facilities ending, estimated cycling volumes are 60-100 cyclists per day south of E 27th Street.

A full copy of the Transportation Assessment follows.

MOUNTAIN HIGHWAY

TRANSPORTATION ASSESSMENT

March 30, 2023

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This is a copy of the signed and sealed final report that has been delivered to the District of North Vancouver.

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1.0 INTRODUCTION

Mountain Highway between Lynn Valley Road and Arborlynn Drive is a major arterial in the District of North Vancouver (District). The corridor serves an important multi-modal function providing a direct connection from neighbourhoods south of Highway 1, including the Lynn Creek Town Centre, to the Lynn Valley Town Centre. The corridor has been identified as a Council priority cycle route and the segment north of Whiteley Court has existing painted bike lanes. Sidewalk widths along much of Mountain Highway do not meet existing standards. Transit service frequency in this corridor is 30 minutes or better on weekdays, with up to 10-minute frequency provided southbound during the morning peak.

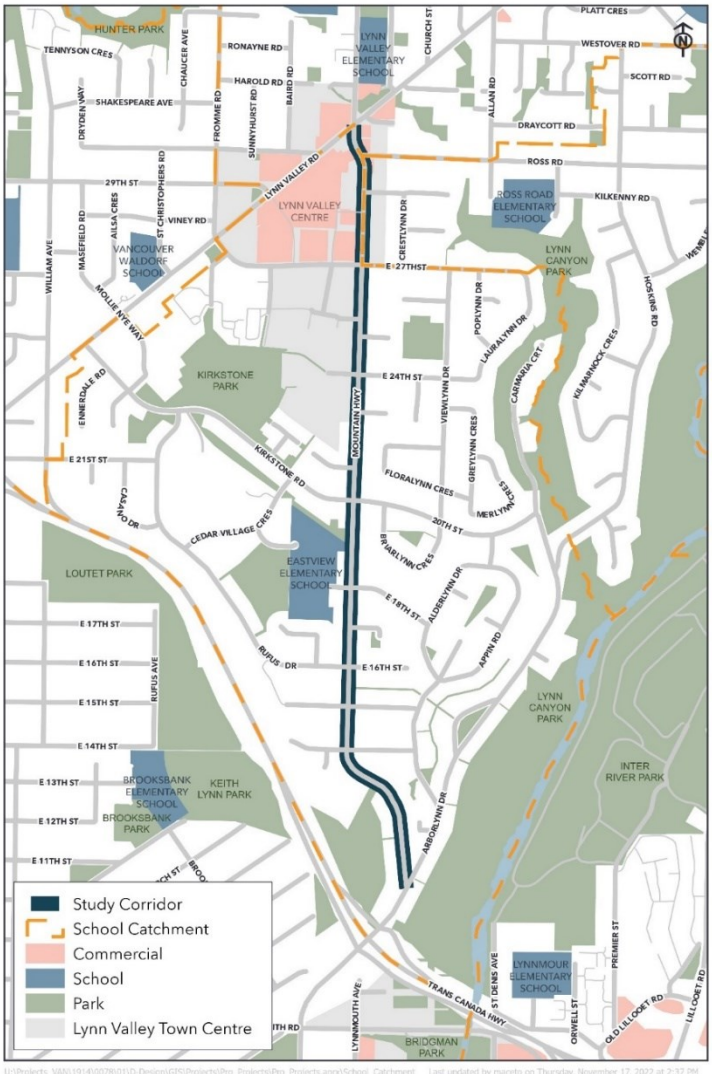

Figure 1. Study Area

Planned infrastructure renewal projects are scheduled along this section of Mountain Highway and will create an opportunity to coordinate investment and construction with street redesign. This technical review documents the existing conditions along Mountain Highway including traffic operations, safety and collisions, transit performance, cycling use and geometric review. The findings from this study will help broaden the understanding of how Mountain Highway is operating as a multi-modal corridor and inform future work along the corridor.

1.1 STUDY GOALS AND OBJECTIVES

The objectives for this study are:

- To understand how Mountain Highway is currently operating as a multi-modal corridor,
- To identify and document multimodal safety, operational, and geometric issues,
- To document conditions, issues, and opportunities to support future concept development, and
- To identify potential intersection improvements (including traffic control and turn lanes).

1.2 POLICY CONTEXT

The study approach and focus areas were informed by direction from Council-approved documents that outline overarching District priorities, including:

- **Official Community Plan (OCP) (2011)**[1] aims to provide greater transportation choice, increasing the District resident trips made by walking, cycling, and transit from 21% in 2011 to over 35% in 2030. Moreover, the OCP includes policies to assess pedestrian, cyclist, and transit needs in all road improvement projects and address design implications accordingly.
    - **Lynn Valley Town Centre**[2] policies espouse a safe and integrated network for all transportation modes with an emphasis on walkability, providing accessible and comfortable sidewalks in the Town Centre, and attractive pedestrian crossings of Mountain Highway. Support for frequent transit service is reinforced through accessible, safe, and attractive transit stops with appropriately located lay-by areas.
- **Targeted Official Community Plan Review Action Plan: 2021–2030 (OCP Action Plan) (2021)**[3] presents eight priority actions to achieve the vision of the OCP. Priority actions include making transit faster and more reliable on the District major routes and creating a continuous and connected network of walking and cycling route to encourage more people of all ages and abilities to walk and cycle. The plan envisions high quality, safe, and comfortable walking, cycling, and transit connections within the District's Town and Village Centres.
- **Transportation Plan (2012)**[4] outlines the need to manage the existing road network to advance safety, accessibility, and efficiency improvements. Goals emphasize providing transportation options for a diversity of modes and users, creating places for people, supporting local trips to lower transportation demand, and enabling sustainable transportation choices. Mountain Highway is identified as a high priority area for sidewalk, safety, and corridor improvements.

Figure 2. Key Transportation Goals (Source: Transportation Plan)

[1] District of North Vancouver Official Community Plan (OCP) (2011), Available Online at: https://www.dnv.org/sites/default/files/edocs/Interactive_OCP_7900_Adopted_June_27_2011.pdf
[2] Lower Lynn Transportation Strategy (2011)- District of North Vancouver, Available Online at: https://www.dnv.org/sites/default/files/edocs/lower-lynn-transportation-strategy-2011.pdf
[3] Targeted Official Community Plan Review Action Plan: 2021-2030 (OCP Action Plan) (2021) - District of North Vancouver, Available Online at: http://app.dnv.org/OpenDocument/Default.aspx?docNum=4860935
[4] The District of North Vancouver Transportation Plan (2012), Available Online at: https://www.dnv.org/sites/default/files/edocs/transportation-plan.pdf

- **Pedestrian Master Plan (2009)**[5] emphasizes a need to provide a well-connected network of pedestrian facilities to encourage active modes of travel throughout the District, increasing the proportion of active trips and decreasing pedestrian-related collisions. The plan prioritizes the provision of sidewalks on both sides of arterial roads (such as Mountain Highway), as well as one side of all collector roads and both sides of collector roads within 100 meters of a school.
- **Bicycle Master Plan (2012)**[6] sets out two key goals to guide the completion of the bike network. First, to establish a bicycle network that strengthens community connections and improves safety, by providing safe routes to accommodate both local and regional bicycle trips and developing facilities for all ages and abilities. Second, to promote cycling as a key part of a sustainable transportation system. Guiding principles for the plan further direct that cyclists be accommodated on roadways wherever possible, more specifically on arterial and collector roads.
- **Council Priority Cycling Routes**[7] were developed with a view to build the backbone of the District cycling network by 2030. A cycling connection between Lynn Valley and Lynn Creek town centres is one of the priority connections, serviced by two routes. The Mountain Highway route offers the most direct connection and does not require coordination with the City of North Vancouver.
- **Integrated North Shore Transportation Planning Project (INSTPP) (2018)**[8] establishes a comprehensive understanding of the transportation challenges that North Shore communities face. It supports a cross-jurisdictional approach that coordinates transportation and land use planning, improves transit service and infrastructure for transit, cycling, and walking, and encourages behaviour change.
- **Community Energy and Emissions Plan (CEEP) (2019)**[9] sets out ambitious targets to reduce greenhouse gas emissions 45% by 2030 and 100% by 2050 (below 2007 levels). To meet these targets, the CEEP directs immediate focus on designing for complete, connected communities and town centres that rely heavily on active transportation and comfortable and efficient transit systems.

[5] Pedestrian Master Plan (2009) - District of North Vancouver, Available Online at: https://www.dnv.org/sites/default/files/edocs/pedestrian-master-plan.pdf
[6] Bicycle Master Plan (2012) - District of North Vancouver, Available Online at: https://www.dnv.org/property-and-development/bicycle-master-plan
[7] DNV Cycles - District of North Vancouver, Available Online at: https://storymaps.arcgis.com/stories/79105122352f458d81ccac2d218165cd
[8] Integrated North Shore Transportation Planning Project (INSTPP) (2018), Available Online at: http://www.instpp.ca/uploads/1/2/1/6/121600566/instpp-full-report.pdf
[9] Community Energy and Emissions Plan (CEEP) (2019) - District of North Vancouver, Available Online at: https://www.dnv.org/sites/default/files/edocs/Community-Energy-Emissions-Plan.pdf

2.0 GENERAL FINDINGS

This section provides an overview of the existing conditions along Mountain Highway between Lynn Valley Road and Arborlynn Drive. In addition to a general overview of the existing conditions along the corridor, observations from site visits completed by the project team are presented.

2.1 EXISTING GEOMETRIC CONDITIONS

This section reviews and summarizes the overall existing geometric conditions of the study corridor. Mountain Highway is a north-south major arterial[10] street between Lynn Valley Road and Arborlynn Drive. **Table 1** summarizes the lane width, road width, right-of-way (ROW), existing walking and biking facilities and average grades for sections along the corridor and shows significant variations along the corridor. For instance, ROW varies from nearly 22.5 m between Lynn Valley Road and Ross Road to approximately 15 m between E 29th Street and E 27th Street.

Mountain Highway has a four-lane cross-section between Lynn Valley Road and Ross Road. South of Ross Road the corridor transitions into a two-lane cross-section until Emery Place / E 24th Street. South of E 24th Street to Arborlynn Drive, Mountain Highway has two motor vehicle travel lanes in the northbound direction and one lane in the southbound direction. The second northbound lane remains as a historic truck climbing lane due to the steep grades. Pavement width along the corridor varies from approximately 13.5 m to 11.5m.

South of Whiteley Court, existing sidewalks along the corridor are narrow and in poor condition. Bike lanes begin north of Whiteley Court, and end prior to Ross Road. In this section there is no sidewalk on the east side of the corridor.

The corridor grades between Lynn Valley Road and Kirkstone Road / E 20th Street are mostly flat however, the grades between south of Kirkstone Road / E 20th Street are significantly steeper with an average grade between 5% – 8 % with sections as steep as 10%.

In addition to the roadway characteristics along the corridor it is worth noting that the following intersections are skewed which may create both safety and operational challenges.

- Lynn Valley Road,
- Ross Road, and
- Arborlynn Drive.

[10] Street Classification (2022) - District of North Vancouver, Available Online at: https://www.geoweb.dnv.org/products/maps/singles/48x28_StreetClassMap.pdf

Table 1: Roadway Characteristics

Segment	Location	Right-of-Way Width (m)	Road Width (m)	Lane Width (m)	Sidewalk Configuration	Bike Lane	Average Grade (%)
E 27th Street – Lynn Valley Road	Lynn Valley Road	~22.5	~13.3	3.3 – 3.5	Both sides	None	~0%
	Ross Road						
	E 29th Street	~14.6	~11.0	3.0 – 4.0	West side only	Painted bike lanes	~0%
	Conifer Street						
E 27th Street – E 24th Street	E 27th Street	~15.1	~11.7	3.2 – 3.5	Both sides	Painted bike lanes	~0%
	Whiteley Court						
	St. Stephens Place	~20.0	~11.1	3.7 – 4.7	Both sides	NB sharrow only	~0%
E 24th Street – Arborlynn Drive	Emery Place / E 24th Street						
	Crayford Close	~19.1	~11.1	3.2 – 4.5	Both sides	None	~0%
	Barlynn Cresecent	~19.5	~12.7	3.3 – 6.1	Both sides	None	~0%
	Kirkstone Road / E 20th Street	~20.1	~12.4	3.3 – 5.7	Both sides	None	-5.4%
	E 18th Street						
	E 17th Street	~20.0	~12.3	3.3 – 5.6	Both sides	None	-7.9%
	E 16th Street	~19.4	~12.2				
	E 15th Street	~20.0	~12.1	3.3 – 5.3	Both sides	None	-8%
	E 14th Street						
	Arborlynn Drive	~20.4	~12.3	3.3 – 4.6	Both sides	None`	

2.2 SITE VISIT

The Urban Systems project team and District of North Vancouver staff conducted two site visits on foot along the study corridor on Wednesday October 26th, 2022, during the midday, and on Monday November 21st, 2022, during the afternoon. The weather was overcast during both site visits. The site observations were intended to provide a preliminary understanding of existing conditions.

The collected field observations included the following: road geometry, traffic operations, sightlines, signage, pedestrian facilities, road users' behaviour, roadside hazards (e.g., utility poles, hydrants, etc.), and curbside usage (e.g., parking). Moreover, the site visit provided preliminary information by way of observing motorist and pedestrian behaviour along the study corridor and observing their interactions.

Key observations include that many homes along the corridor have multiple driveway access points, sidewalks are often in poor condition, and dangerous overtaking was observed during solid waste pick-up. Additional site observations are summarized in **Table 2** by location.

Narrow sidewalk with encroaching hedge.

Missing sidewalk between Ross Rd. and E27th St.

Southbound vehicles crossing dividing line to pass a stopped garbage truck.

Narrow monolithic sidewalk with driveway and hydro pole conflicts.

Figure 3. Site Visit Photos

Table 2. Site Visits Key Observations

Segment	Location	Key Site Observation(s)
E 27th Street – Lynn Valley Road	Lynn Valley Road	○ Northbound queues were observed at Lynn Valley Road intersection building up to Ross Road intersection during the afternoon period. ○ Southbound queues were regarded at Ross Road intersection building up to Lynn Valley Road intersection during the afternoon period. ○ Relatively long queues were spotted at the east leg of Ross Road intersection during the afternoon period. ○ The traffic merge lane at Ross Road intersection was underutilized by motorists.
	Ross Road	
	E 29th Street	○ N/A
	Conifer Street	○ Sightlines were limited at the west leg of Conifer Street for the eastbound left turning movement specifically. ○ A near-miss incident was observed on the Monday site visit. A motorist took a few seconds to decide whether to make a left turn from Conifer Street onto Mountain Highway. After the motorist initiated a turn, they noticed a through vehicle on Mountain Highway. The left-turning vehicle had to brake to avoid a collision.
E 27th Street – E 24th Street	E 27th Street	○ A few pedestrians were noted crossing Mountain Highway (at E 27th Street) after the end of the flash-do-not-walk period.
	Whiteley Court	○ A motorist was seen driving from the middle of the northbound approach (middle of the two lanes) of Mountain Highway, heading northbound left, onto Whiteley Court crossing its receiving lane centerline. ○ South of Whitely Crescent walking on the sidewalks felt uncomfortable due to motorists' speeds, traffic volumes, and proximity to traffic. This was worse on the east side of the street due to the lack of a boulevard separating the sidewalk.
	St. Stephens Place	○ N/A
E 24th Street – Arborlynn Drive	Emery Place / E 24th Street	○ Relatively long southbound queues were noticed at Emery Place intersection during the afternoon period. ○ In the southbound direction (one-lane approach) of Mountain Highway, motorists were observed overtaking a bus.
	Crayford Close	
	Barlynn Cresecent	○ A near-miss incident was observed on the Monday site visit. A motorist took a few seconds to decide whether to make a right turn from Barlynn Crescent onto Mountain Highway. After the motorist initiated a turn, they noticed a through vehicle on Mountain Highway. The right-turning vehicle had to brake to avoid a collision.
	Kirkstone Road / E 20th Street	○ N/A
	E 18th Street	○ School pick-up was observed during the Wednesday site visit. All available parking spaces were used near E 18th Street. ○ Solid waste pick-up was observed during the October site visit. Southbound drivers were observed overtaking the garbage truck by crossing the dividing line creating a risk of a head-on collision.

Segment	Location	Key Site Observation(s)
E 24th Street – Arborlynn Drive	E 17th Street	o The experience of walking on the sidewalks felt uncomfortable due to motorists' speeds, traffic volumes, and proximity to traffic.
	E 16th Street	
	E 15th Street	
	E 14th Street	o The experience of walking on the sidewalks felt uncomfortable from a pedestrian perspective due to the road grades.

3.0 CORRIDOR ANALYSIS

Three distinct sections of the corridor have been identified based on their similar conditions observed during field visits and the operational review, as well as their shared opportunities for future enhancements. The three sections (North, Central, and South) are described in more detail below with key location-based findings from the study. These findings are informed by the detailed technical analysis for each travel mode summarized in **Section 4** and documented in the related appendices. A detailed visual summary for the corridor is provided in **Appendix B**.

3.1 NORTH SECTION (LYNN VALLEY ROAD TO E 27TH STREET)

3.1.1 CONTEXT

The North Section of the corridor, as defined through this study, is located from Lynn Valley Road to E 27th Street. This section is located entirely within the Lynn Valley Town Centre with recent or future redevelopment anticipated on both sides of Mountain Highway.

Properties fronting this section of Mountain Highway are a mix of multi-family residential buildings, commercial businesses, and institutions including both a church and public library. The east side of the corridor has a number of older single-family homes that may be posed for redevelopment in the future.

The road right-of-way through this section is narrow, limiting the opportunity to provide dedicated facilities for all modes of travel. A continuous sidewalk is provided on the west side of the street but is only provided a half block south of Ross Road on the east side of the street. Similarly, painted bike lanes are only provided from just north of E 27th Street to a half block south of Ross Road. Two motor vehicle travel lanes are provided throughout this section in addition to the southbound left turn lane at E 27th and the four-lane cross section between Lynn Valley Road and Ross Road to accommodate turning vehicles.

3.1.2 KEY FINDINGS

Several location specific key findings for the North Section of the corridor have been identified below.

- **Challenging intersection geometry**
    - The intersection with Lynn Valley Road is skewed and relies on a channelized eastbound right turn lane onto Mountain Highway. This intersection was the location with the highest frequency of collisions along the corridor and is a busy intersection for all modes.
    - The Ross Road intersection is also skewed and has a non typical configuration with the west leg providing access into the public underground parkade at Lynn Valley Village. The proximity of the Ross Road and Lynn Valley Road intersections creates additional challenges with traffic queues extending between the two intersections during the peak hours of the day. In addition to the challenging intersection geometry, commercial access and off-street surface parking are near the intersection creating additional conflict points.
- **Discontinuous active transportation network**
    - Half a block south of Ross Road to E 27th Street, no sidewalk is present on the east side of the street. It is evident that people continue to walk on the east side of the street by the path created in the narrow boulevard behind the curb.

    - Existing painted bike lanes stop in advance of Ross Road and do not provide a continuous connection to the existing and planned cycling facilities on Lynn Valley Road. Strava Metro data shows that people cycling still use this section of the corridor where the painted bike lanes have dropped. This gap presents an increased likelihood of collisions between people cycling and motor vehicles.
    - Eight of the 12 reported collisions involving people walking or biking were recorded in this section of the corridor.
- **Transit reliability and motor vehicle traffic operations**
    - Transit vehicles, travelling in the northbound direction through this section, experienced significantly greater variation in travel time than other sections along the corridor.
    - The transit stops, in this section of the corridor, were where the most boardings and alightings occurred.
    - Queue lengths, at Lynn Valley Road in the northbound direction, extended back past the Ross Road intersection during both the AM and PM peak periods.
    - Queue lengths, at Ross Road in the southbound direction, extended up to 45m which approaches the Lynn Valley Road intersection.
    - Through field observations, it was observed that the southbound merge lane on the far side of the Ross Road intersection was underutilized.
    - Queue lengths, at E 27th Street in the southbound through direction, built up to approximately 95m and 120m, during the AM and PM peak periods, respectively approaching Conifer Street to the north.
    - Motor vehicle travel speeds were lower in this section of the corridor when compared to the rest of the corridor with the 85th percentile speed below or just above the posted speed limit of 50 km/h.
- **Road Safety**
    - More than 50% of all collisions reported occurred in this section of the corridor, including three of the five intersections with the highest collision rate.
        - Mountain Highway and Lynn Valley Road was ranked first.
        - Mountain Highway and E 27th Street was ranked fourth.
        - Mountain Highway and Ross Road was ranked fifth.
    - Five of the six reported collisions involving pedestrians were in this section of the corridor, including four collisions involving pedestrians at the Lynn Valley Road intersection.
    - Four of the six reported collisions involving people cycling were in this section of the corridor.
    - Limited sightlines, for eastbound left turning traffic at Conifer Street, were observed during the site visit.
    - At Lynn Valley Road, there are safety concerns regarding right and left turning vehicles.

3.1.3 OPPORTUNITIES

Opportunities exist to add continuous and improved active transportation facilities to increase safety for people walking and biking, enhance the transit experience by providing safe options for people boarding and alighting buses, and reduce conflict points with motor vehicle traffic. Review traffic operations and consider modifications to intersection signal phasing and laning through this section to improve transit reliability and provide dedicated turn lanes if possible.

Consider future development and explore the opportunities to provide an improved cross section and limit access points along Mountain Highway.

3.2 CENTRAL SECTION (E 27TH STREET TO E 24TH STREET)

3.2.1 CONTEXT

The Central Section of the corridor, as defined through this study, is located from E 27th Street to E 24th Street. The west side of the corridor through this section is located within the Lynn Valley Town Centre with recent or future redevelopment anticipated.

Properties along this section of Mountain Highway are a mix of multi-family residential buildings and two churches. Private access from Mountain Highway, along this section, is limited compared to the north and south sections.

The road right-of-way through this section is typically 20 metres or wider allowing for a continuous sidewalk on both sides of the street, although painted bike lanes are only provided north of Whitely Crescent. Three motor vehicle lanes are provided through this section with a single through lane in both the north and southbound directions and left turn lanes for each intersection other than the E 24th Street/Emery Place intersection.

3.2.2 KEY FINDINGS

- **Existing Geometric Conditions**
  - Painted bicycle lanes are provided north of Whitely Crescent.
  - Dedicated left turn lanes are provided at all intersections along this section of the corridor except for E 24th Street.
  - Existing sidewalk on the west side of the street south of Whitely Crescent is in poor condition.
  - Narrow monolithic sidewalk on the east side of the street half a block south of E 27th Street to E 24th Street.
  - St. Stephen's Parish has access off both Mountain Highway and St. Stephen's Place.
- **Traffic operations**
  - The southbound queue at E 24th Street built up to approximately 90m, during both AM and PM peak periods, extending close to St. Stephens Place.
- **Speed**
  - Significant speeding was observed through this section of the corridor with higher speeds observed in the northbound direction.
  - Both the TomTom and the radar-based speed data showed the 85th percentile speeds in the 55km/h – 65 km/h range with higher speeds observed both in the southern portion of this section and outside of peak travel times.
- **Road Safety**
  - Apart from the E 27th Street intersection, which was included in the North Section, none of the five intersections with the highest collision rate were located along this section of the corridor.
  - Fewer collisions along this section of the corridor may be due to the limited number of intersections as well as the reduced frequency of private access points.

3.2.3 OPPORTUNITIES

Opportunities exist to improve the active transportation infrastructure through this section. The southern portion of this section has sidewalks that are in poor condition with overgrown hedges that should be cut back to improve pedestrian comfort. Additionally, extending the cycling facilities all the way to the south end of the corridor will ensure connections for people living in the multi-family developments off Emery Place as well as a connection to the planned active transportation facility connecting to the future Casanno-Loutet overpass and into the City of North Vancouver.

Consider a new mid-block pedestrian crossing to improve connections to transit stops and destinations on both sides of the street. Review the demand for additional left turn lanes at t-intersections along the corridor and consider reallocating the road space for sidewalks and bike facilities to improve the comfort and safety of people walking and biking.

3.3 SOUTH SECTION (E 24TH STREET TO ARBORLYNN DRIVE)

3.3.1 CONTEXT

The South Section of the corridor, as defined through this study, is located from E 24th Street to Arborlynn Drive. This section of the corridor is predominantly outside of the Lynn Valley Town Centre, except for one parcel on the west side of Mountain Highway directly south of E24th Street.

Properties along this section of Mountain Highway are a mix of single-family residential buildings and institutional land use with one elementary school and one church. Frequent driveways provide access to many of the single-family homes.

The road right-of-way through this section is typically 20 metres with sidewalks on both sides of the street. The east sidewalk is directly adjacent to the curb lane for vehicles traveling in the northbound direction, while the west sidewalk is separated from the roadway with a grass boulevard along much of this section. Many sections of the sidewalks are in poor condition and are typically narrower than the desired width from the BC Active Transportation Design Guide[11]. No cycling facilities are provided along this section of the corridor.

Three motor vehicle lanes are provided throughout this section with one southbound lane and two northbound lanes. The second northbound lane was provided as a truck climbing lane due to the steep grades which range from 5 – 12%, although current vehicle weight restrictions prevent heavy trucks from traveling on Mountain Highway between E 20th Street and Arborlynn Drive. Horizontal curves are provided at the south end of this section to reduce the grade along the corridor.

[11] British Columbia Active Transportation Design Guide (2019) – The British Columbia Ministry of Transportation and Infrastructure, available online at: https://www2.gov.bc.ca/assets/gov/driving-and-transportation/funding-engagement-permits/grants-funding/cycling-infrastructure-funding/active-transportation-guide/2019-06-14_bcatdg_compiled_digital.pdf

3.3.2 KEY FINDINGS

- **Existing Geometric Conditions**
  - There are two northbound and one southbound travel lanes between Arborlynn Drive and E 24th Street.
  - Steep grades begin south of E 20th Street (5 – 12% grade)
  - Horizontal curves exist between E 14th Street and Arborlynn Drive
  - Challenging intersection geometry exists at E 14th Street (steep grades and sightline challenges)
  - There are segments where the sidewalk is narrow and in poor condition.
  - There is some on-street parking between E 15th Street and E 24th Street.
- **Traffic operations and Transit Use**
  - Low volume stop-controlled side streets at E 18th Street and E 16th Street experienced high delays during peak hours.
  - The southbound lane at Kirkstone Road / E 20th Street intersection queue built up to nearly 125m and 100m, during the AM and PM peak periods, respectively, reaching Barlynn Crescent.
  - Southbound queues at Arborlynn Drive built up to approximately 115m and 150m, during the AM and PM peak periods, respectively.
  - Transit ridership peaked in both the northbound and southbound direction near Arborlynn Drive with an hourly average of approximately 130 and 95 southbound and northbound transit riders, accounting for over 20% of the total trips along the corridor.
  - Transit stops along this section had short average dwell times.
  - Analysis shows that a full traffic signal is not warranted at E 18th Street where the east and west legs of the intersection experience delay that may exceed 50 seconds during peak travel times.
- **Speed**
  - Significant speeding was observed through this section of the corridor with excessive speeding observed in both directions.
  - Both the TomTom and the radar-based speed data showed the 85th percentile speeds in the 55km/h – 80 km/h range with higher speeds observed in the southbound direction where the grades are steepest and the northbound direction where the grades are not as steep.
  - At E 18th Street, near Eastview elementary school and during school time, the 85th percentile speeds were 65 km/hr – 70 km/hr and 60 km/hr – 65 km/hr in the northbound and southbound directions, respectively.
- **Road Safety**
  - One fatal collision involving a pedestrian was recorded at E 18th Street during the 2016 – 2020 time period reviewed.
  - Both Arborlynn Drive and E 20th Street intersections were among the five intersections with the highest collision frequency along the corridor.
    - Southbound left turning collisions were a problem at the E 20th Street intersection.
    - Southbound rear-end collisions were the predominant collision type at Arborlynn Drive.
  - Overtaking of service vehicles (solid waste collection, transit, etc.) in the southbound curb lane was observed during the site visits creating a risk for head on collisions and side swipe collisions.

3.3.3 OPPORTUNITIES

Excessive motor vehicle traffic speed is a problem along this section of the corridor. Consider reallocating the second northbound travel lane to allow for a safer street design for all modes while still accommodating the existing motor vehicle traffic. An opportunity to provide cycling facilities and improved pedestrian facilities will improve the safety and comfort of students walking or biking to Eastview Elementary school.

Consider adding dedicated left turn lanes at E 20th Street to improve safety and traffic operations.

4.0 CORRIDOR ANALYSIS BY TRAVEL MODE

This section summarizes the analysis completed for the operational and safety review of Mountain Highway corridor. Recognizing that the study corridor is a multi-modal corridor, the findings are documented by mode of transportation: motor vehicles (light vehicles and trucks), cycling and walking, and transit. Existing geometrics, volumes, speeds, transit usage and reliability, traffic operations, and road safety are explored.

4.1 MOTOR VEHICLES

4.1.1 ON-STREET PARKING REGULATIONS

On-street parking is limited along the corridor, with no parking or no stopping regulations on both sides of the street north of Emery Place / E 24th Street. Between E 15th Street and Emery Place / E 24th Street, unregulated on-street parking is typically provided on the west side of the street. Parking is limited on the east side of the street a section south of Emery Place / E 24th Street to Barlynn Crescent where parking is accommodated other than from Mon–Sat 15:00–18:00. For detailed parking regulation information see **Appendix B.**

4.1.2 TRAFFIC SUMMARY

This section outlines the traffic data collection and analysis, as well as the traffic operational analysis conducted to understand the magnitude of existing vehicle volumes in the study area. The data review includes motor vehicle volume data (radar-recorded data) and intersection turning movement counts (TMCs).

Motor vehicle volume data was collected at three locations during June/July 2022: block 2600 (south of E 27th Street in June 2022), block 1500 (south of E 16th Street in July 2022), and block 1330 (south of E 14th Street in July 2022). During that period, the study corridor had bi-directional AM peak hour volumes of 1,150 to 1,250 vehicle/hour, bi-directional PM peak hour volumes of 850 to 950 vehicle/hour, and approximately 14,500 to 15,500 vehicle/day, which is consistent with typical major arterial daily traffic volumes from the Transportation Association of Canada (TAC) guidelines[12] (10,000 vehicle/day – 30,000 vehicle/day). The percentage of heavy vehicles along the study corridor was between 3% to 3.5% across these locations. Mountain Highway is included in the Regional Truck Network and as an alternate route on the District's dangerous goods routes. However, there are weight restrictions on the segment between E 20th Street and Arborlynn Drive[13].

The profile shows two distinct AM and PM peak periods at 8:00 – 10:00 and 15:00 – 18:00, respectively, aligning with typical commute periods. The corridor served higher volumes in the southbound direction during the morning while it served higher volumes in the northbound during the mid-day and afternoon. Overall, the average daily volumes were approximately 7,300 – 7,700 vehicle/day and 6,700 – 8,100 vehicle/day in the northbound and southbound directions, respectively. For detailed traffic volume figures see **Appendix C.**

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[12] Chiu, M., Clayton, C., Millen, G. et al. 2017. Geometric Design Guide for Canadian Roads: Chapter 2 - Design Controls, Classification and Consistency. Ottawa, ON: Transportation Association of Canada.
[13] Dangerous Goods Routes (2022) - District of North Vancouver, Available Online at: https://www.geoweb.dnv.org/products/maps/singles/Tab_DangerousGoodsRoute.pdf

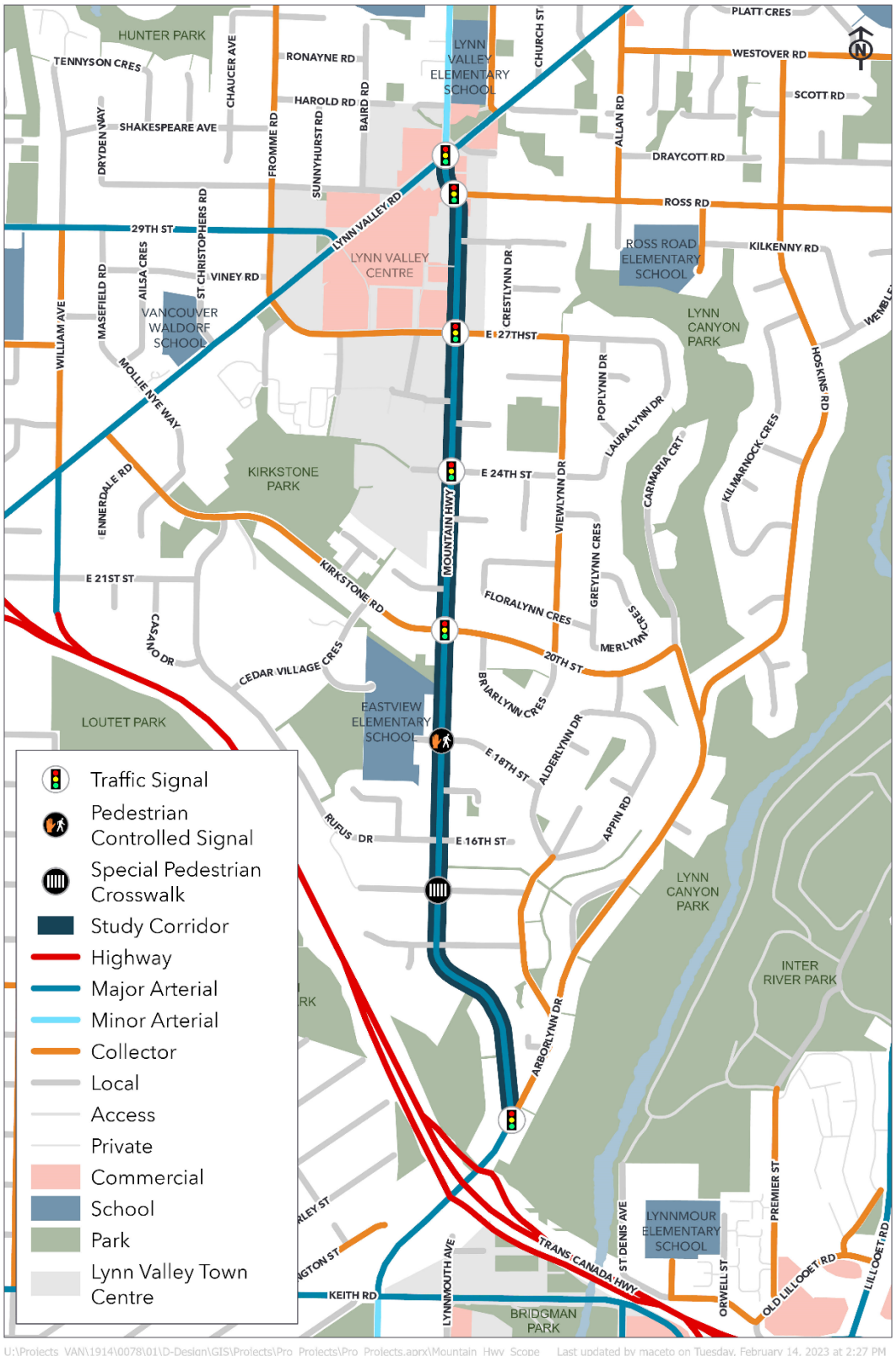


Figure 4. Intersection Operation Type

The type of intersection operation along the study corridor is demonstrated in **Figure 4**. All intersections between Arborlynn Drive and Kirkstone Road / E 20th Street are uncontrolled for traffic on Mountain Highway other than the pedestrian half signal at E 18th Street. This creates a 1.2km long section where motorists are not typically required to stop and may contribute to increased travel speeds.

Traffic operational analysis was completed at the following key Mountain Highway intersections:

- Lynn Valley Road,
- Ross Road,
- E 29th Street,
- E 27th Street,
- Emery Place / E 24th Street,
- Krikstone Road / E 20th Street,
- E 18th Street,
- Rufus Drive / E 16th Street, as well as
- Arborlynn Drive.

Prior to conducting traffic operational analysis, turning movement counts (TMCs) were collected on September 20th, 2022, during the morning and afternoon peak periods and provided to Urban Systems. The counts included breakdowns of passenger vehicle, truck, bike, and pedestrian movements. The AM and PM peak hours were identified at 8:00 AM – 9:00 AM and 16:30 – 17:30, respectively. The northbound volumes were between 400 – 700 vehicle/hour and 600 – 850 vehicle/hour during the AM and PM peak hours, respectively. The southbound volumes were 500 – 1,000 vehicle/hour and 500 – 800 vehicle/hour during the AM and PM peak hours, respectively.

Based on the analysis results all study intersections, except for E 18th Street and E 16th Street intersections, appear to be operating without significant delays at both movement and intersection levels. The analysis showed that the stop-controlled intersections at E 18th Street and E 16th Street may experience delays exceeding 50 seconds during peak hours for the stop controlled east and west legs, although traffic volumes are very low.

The 95th percentile queues, which is defined as the queue length (in metres) that has only a 5-percent probability of being exceeded during the analysis period, were generally reasonable and did not block adjacent intersections for most movements. Long queues were observed southbound at Ross Road, E 27th Street, E 24th Street, E 20th Street, and Arborlynn Drive, as well as long northbound queues at Lynn Valley Road. The long 95th percentile queues are discussed in detail in **Section 3.0**. Refer to **Appendix D** for detailed intersection turning movement analysis results.

Speed Summary

This section outlines the speed data collection and analysis conducted to understand the motor vehicle travel speeds compared to the posted speed limits in the study area. The data review includes motor vehicle speed data (radar-recorded data) and mobile probe data[14].

The speed data was reviewed to determine the average and 85th percentile speed of vehicles travelling along the study corridor. The 85th percentile speed represents the speed at which 85 percent of

[14] Mobile probe data supplied by TomTom.

vehicles are operating at or below and is typically used to compare to the posted speed limit to identify speeding issues.

Similar to the motor vehicle volume data, motor vehicle speed data was reviewed at three locations: block 2600 (south of E 27th Street in June 2022), block 1500 (south of E 16th Street in July 2022), and block 1330 (south of E 14th Street in July 2022). Generally, the speed analysis shows that the 85th percentile speeds consistently exceed the posted 50km/hr speed limit at each of the three locations throughout the day in both directions. The 85th percentile speed is 60 km/hr – 65 km/hr and 60 km/hr – 70 km/hr in the northbound and southbound directions, respectively. This finding highlights consistent speeding issues at the three locations.

Urban Systems compared the findings from the radar-based motor vehicle speed data with mobile probe speed data along the study corridor.[15] Mobile probe data uses aggregated cell phone data to estimate travel speeds along a corridor. The findings from the mobile probe data are consistent with the radar data showing 85th percentile speeds above the posted speed limit for all the corridor other than between Lynn Valley Road and E 29th Street where the 85th percentile speed is typically 50km/h or lower likely due to signal timings and existing road geometrics.

Refer to **Appendix F** for detailed speed analysis results.

4.1.3 ROAD SAFETY

Based on the District's Road Safety Program Memo, Mountain Highway is ranked as the corridor with the second highest overall collision frequency, cyclist-involved collision frequency, and pedestrian-involved collision frequency as well as the corridor with the most road safety concerns reported to the District[16].

This section outlines the collision data analysis conducted in this study based on available Insurance Corporation of British Columbia (ICBC) collision data between 2016 and 2020. The five-year ICBC dataset included 344 total collisions. From this dataset, any reported collision with a parking lot flag or report description stating that it did not occur within the road right-of-way was removed, leaving 286 records remaining for further analysis. **Figure 5** shows the distribution of the 286 collisions with available location information by intersection based on the average number of collisions per year. All of the safety analysis reported following is based off Urban Systems interpretation of the ICBC incident descriptions and cannot be further verified.

[15] TomTom traffic analytics products delivers insights on historical traffic data. In other words, TomTom products measure and provide speed values in five-minute intervals across time of day and day of week, on every road segment and for every direction of traffic based on anonymous GPS traces received daily.
[16] Road Safety Program - Technical Analysis Memo (December 13, 2021) – The District of North Vancouver

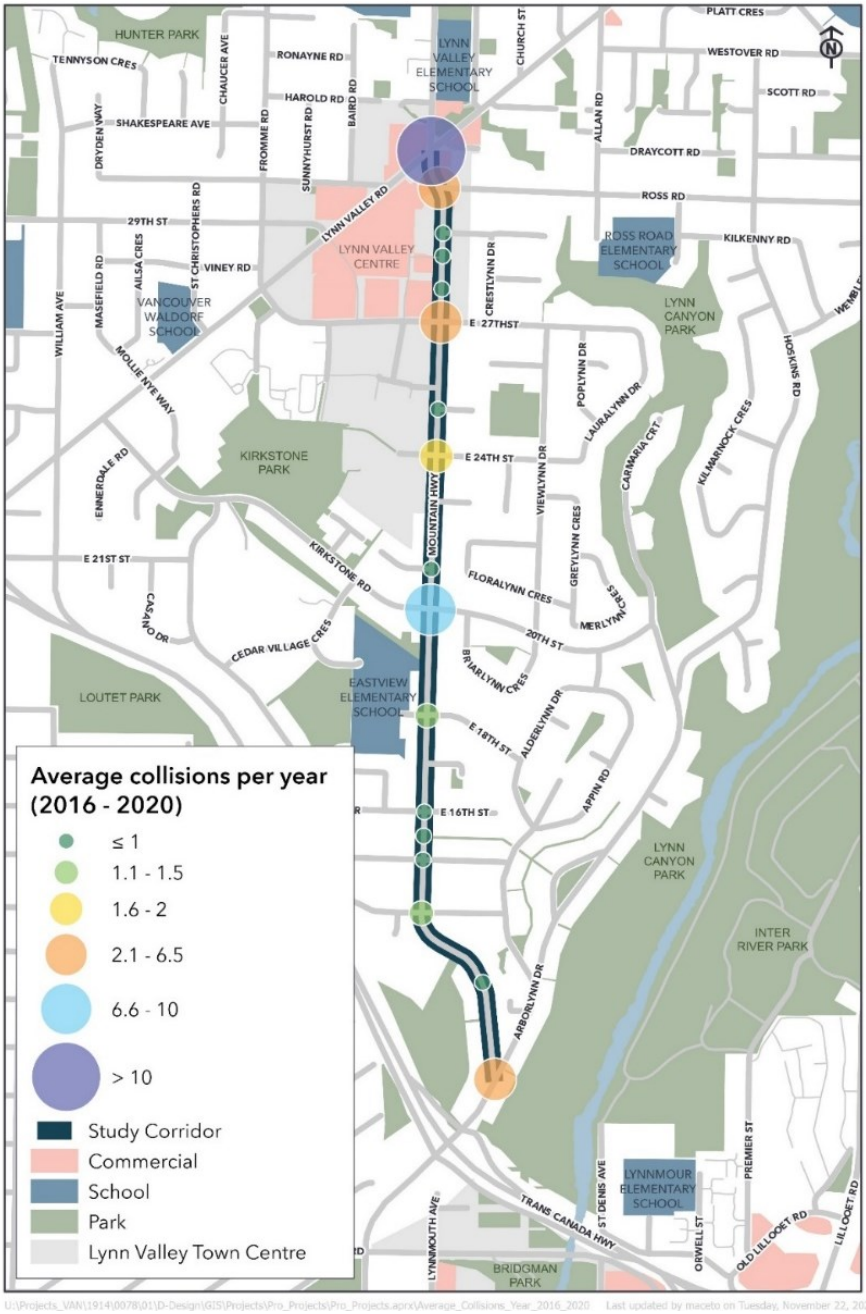


Figure 5. Collision Rate (ICBC: 2016 – 2020)

Figure 6 presents the reported direction of each collision included in the analysis. The number of collisions travelling in the northbound and southbound directions, along Mountain Highway, made up nearly half of the collisions. Of the 12% of total collisions reported turning from Mountain Highway onto a cross-street, half were reported as southbound left turns. Similarly, over half of the collisions turning from a cross-street onto Mountain Highway were eastbound left turns. Approximately 15% of the reported collisions did not provide sufficient information on the collision direction and are categorized as “Unknown Direction”.

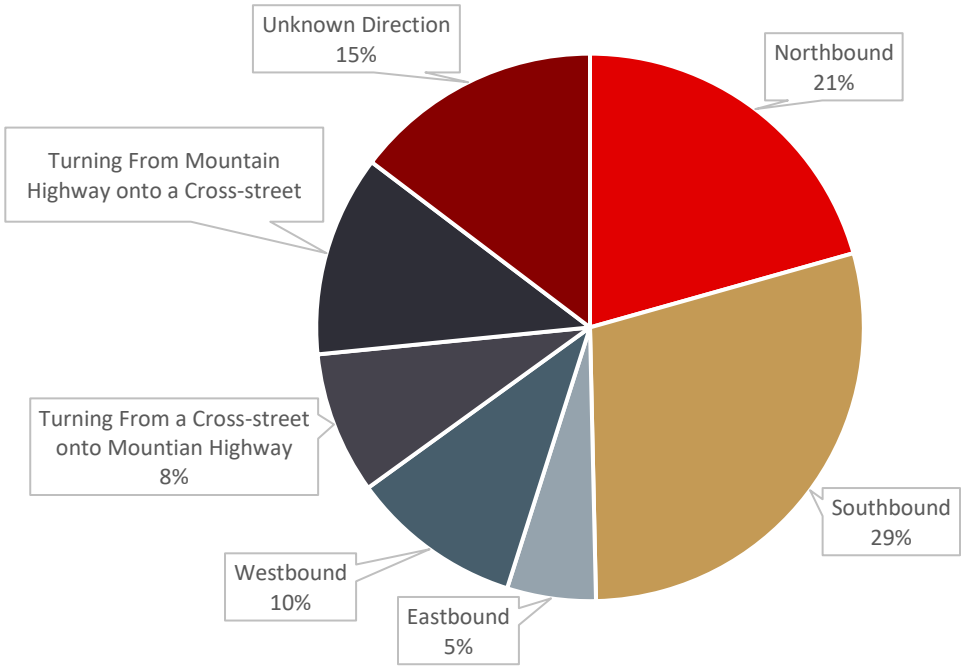


Figure 6. Collision Distribution By Direction (ICBC: 2016 – 2020)

Reviewing collision severity along the study corridor shows 39% of reported collisions caused injury or a fatality, while the remaining 61% of collisions were property damage only. A key finding of this analysis is that collisions on Mountain Highway between 2016-2020 were nearly twice as likely to result in injury or fatality than the District average for 2011-2020.

No observable trend is shown in the total number of collisions along the study corridor during the period reviewed. **Figure 7** shows that the number of property damage only collisions has been improving over the five-year period reviewed going from 46 in 2016 to 26 in 2020. It is worth noting that the COVID-19 pandemic and its lockdown implications started in 2020, resulting in lower levels of travel activity. One fatal collision involving a pedestrian was reported in 2019.

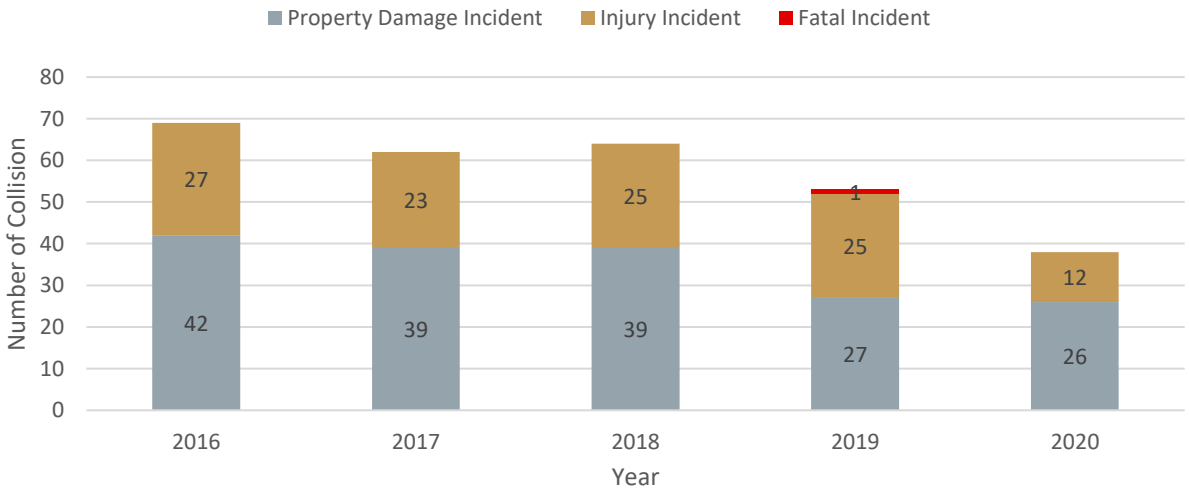


Figure 7. Number of Collision By Year And Severity (ICBC: 2016 – 2020)

Figure 8 shows collisions along the corridor based on month of year and severity. The highest number of collisions were recorded in January (winter), and the lowest number of collisions took place in June (summer). Overall, collision distribution over the remainder of the year does not follow a discernible pattern. However, the collision severity distribution does show that a greater proportion of the collisions during the summer months were injury incidents. August and July saw the highest portion of collisions resulting in injuries at 67% and 48% respectively. The only fatal collision along the study corridor, between 2016 and 2020, took place in December.

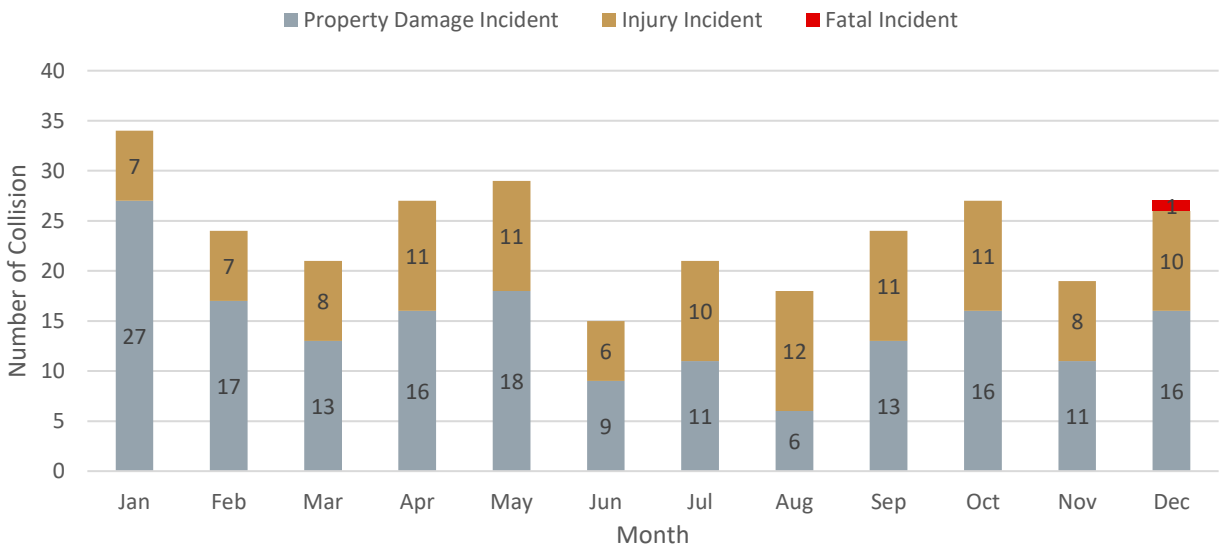


Figure 8. Number of Collision By Month & Severity (ICBC: 2016 – 2020)

More collisions took place during mid-weekdays (Monday – Thursday) as seen in **Figure 9**. Additionally, significantly more collisions occurred during the mid-day and afternoon periods, as exhibited in **Figure 10**. The only fatal collision along the corridor took place on a Monday during the 15:00 and 17:59 period.

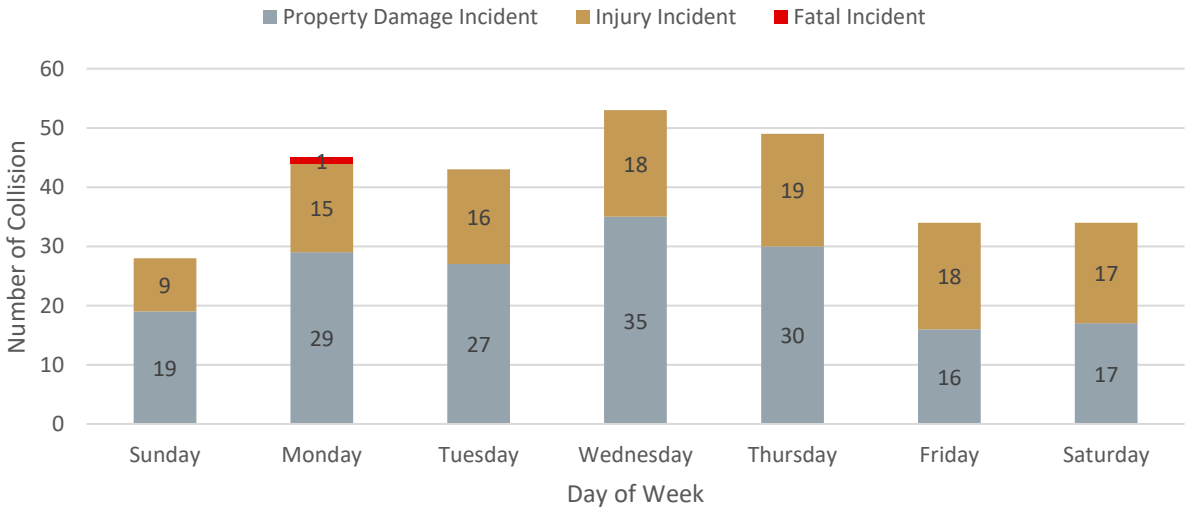


Figure 9. Number of Collision By Day of Week & Severity (ICBC: 2016 – 2020)

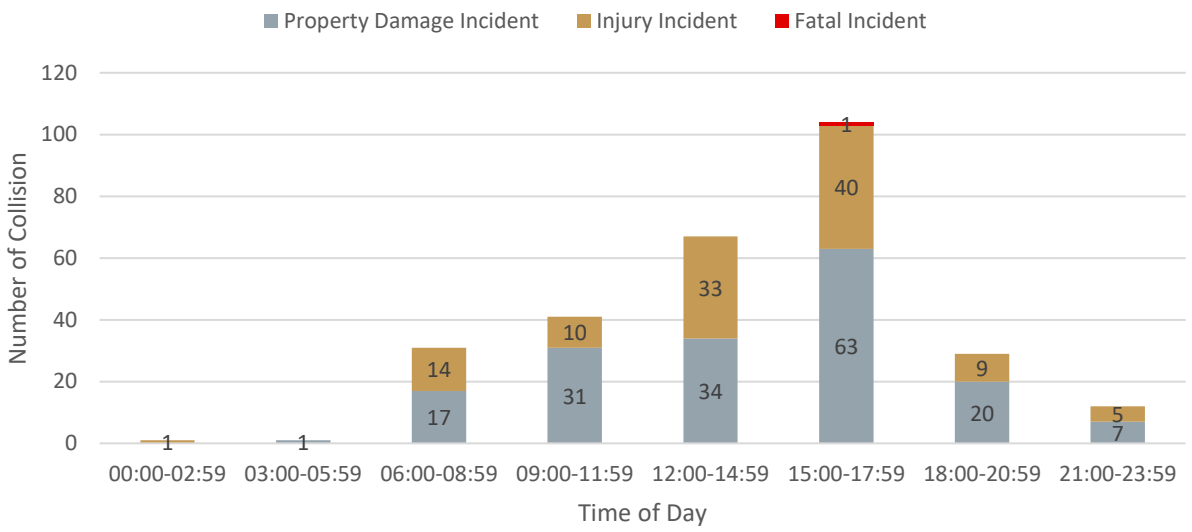


Figure 10. Number of Collision By Time of Day & Severity (ICBC: 2016 – 2020)

Collision Type

The collision analysis conducted in this study further categorizes the reported ICBC collisions following the standard data dictionary of the police-reported Traffic Accident System (TAS) crash data for municipal engineers. Looking at the type of collision can help identify problem locations and designs.

Figure 11 shows that rear-end collisions were the most common type of collision overall, making up 45% of total collisions along the study corridor and accounting for more than double the number of collisions of the second highest collision type, overtaking.

Most (79%) rear-end collisions took place at intersections, while overtaking collisions were more equally distributed between intersection and mid-block locations, at 55% and 45%, respectively. Overtaking collisions were somewhat more likely to occur in the northbound than the southbound direction, with each respectively accounting for 21% and 17% of all overtaking collisions. The prevalence of northbound and southbound rear-end collisions occurring at mid-block locations was not considerably different. Whereas, rear-end collisions at intersections in the southbound direction accounted for twice as many collisions as in the northbound direction, 32% and 16% of rear-end collisions respectively. The difference between two northbound travel lanes and only one southbound travel lane may contribute to additional rear-end collisions at intersections without dedicated turning lanes but interestingly has not led to an increase in overtaking collisions.

Nearly 44% of the left turn collisions took places at E 20th Street / Kirkstone Road intersection, while 20% of them happened at Lynn Valley Road intersection. Notably, about 64% of the right turn collisions took place at Lynn Valley Road intersection.

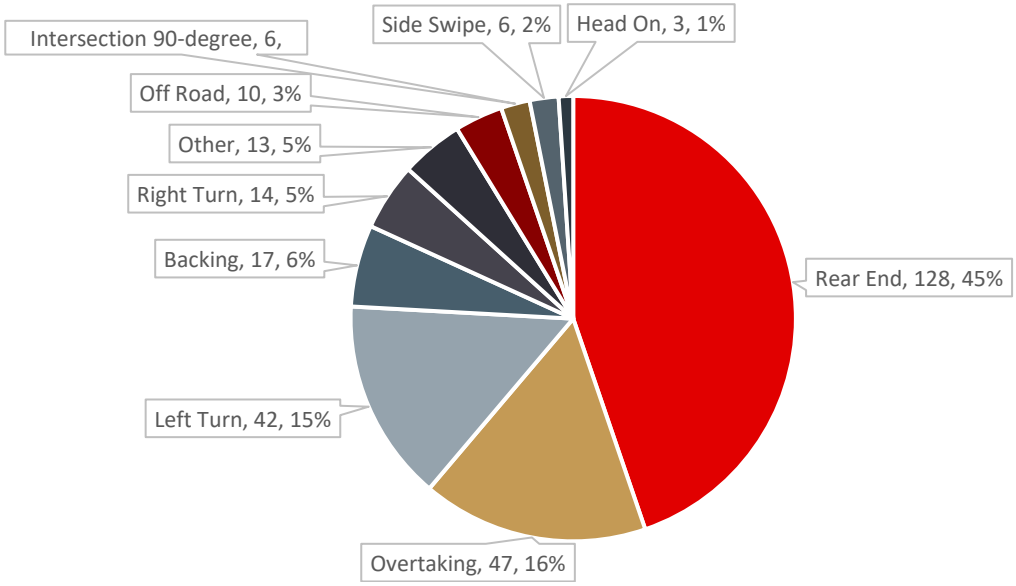


Figure 11. Number of Collision By Type (ICBC: 2016 – 2020)

Furthermore, the five intersection functional areas with the highest collision frequency (number of collisions divide by traffic volume) were identified then categorized by collision configuration. The intersections with the highest collision frequency were also the intersections with the highest collision rate. This indicates that the relationship between total traffic volume at an intersection is directly related to the number of collisions reported for our study corridor. **Table 3** presents the collisions with the highest collision frequency and their dominant collision type. Detailed collision diagrams are provided in **Appendix G.**

Table 3. Top 5 Highest Collision Frequency Intersections

Intersections	Predominant Collision Type	Total Number of Collisions (2016-2020)
Lynn Valley Road	Rear End (37)	66
Kirkstone Road / E 20th Street	Left Turn (15)	36
Arborlynn Drive	Rear End (15)	24
Ross Roadd	Rear End / Overtaking (5)	17
E 27th Street	Rear End (6)	9

4.2 CYCLING AND WALKING

4.2.1 EXISTING GEOMETRIC CONDITIONS

This section reviews and summarizes the existing geometric conditions with a focus on pedestrian and cycling facilities. Existing sidewalks are continuous on the west side of the corridor. The only section without a sidewalk on the east side of the street is from E 27th Street to a half block south of Ross Road. Dedicated cycling facilities are limited to the section north of Whitely Crescent to a half block south of Ross Road; the facility ends just north of the E 27th Street intersection.

Along much of the corridor the existing sidewalk is narrow and in poor condition with cracks and uneven sidewalk panels. South of E 27th Street the sidewalk is typically monolithic on the east side of the street and separated with a narrow boulevard on the west side of the street. The sidewalk on the west side of the street is frequently adjacent to mature hedges which encroach over the sidewalk and contribute to an uncomfortable walking environment.

4.2.2 CYCLING COUNTS AND NETWORK

This section reviews and summarizes historic and existing cycling volumes, with reference to existing cycling connections and the proposed cycling network. The cycling volume data reviewed includes historic tube counts, intersection turning movement counts (TMCs), as well as Strava Metro cycling volume data. Additional cycling demand can be expected when the planned facilities (Casano-Loutet Overpass and Upper Levels Greenway) connecting to the City of North Vancouver are completed in the coming years.

Tube Count Data

Tube count data, including cycling volumes, has been collected periodically at block 2600 (south of E 27th Street) during the spring and fall since 2017. For both northbound and southbound directions, **Figure 12** demonstrates the historic cycling volumes between 2017 and 2021 for the AM peak period, PM peak period, and 24-hour period. During peak hours, the northbound and southbound directions each serviced around 5 – 15 bicycle/hr. The daily two-way cycling volumes were about 60 – 100 bicycle/day.

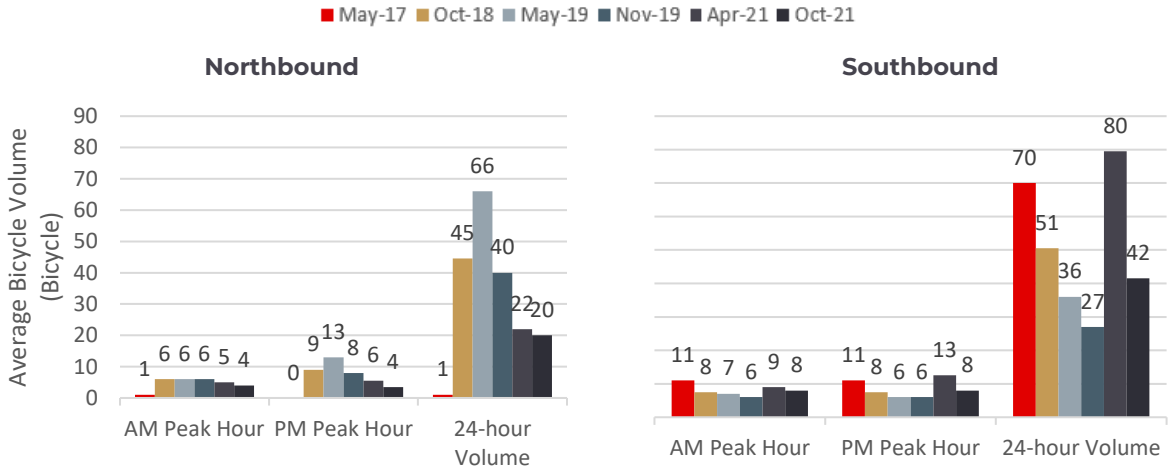


Figure 12. Average Cycling Volumes (Spring and Fall 2017 – 2021) At Block 2600

Turning Movement Count Data

Upon reviewing September 2022 TMCs at multiple intersections along the study corridor, the two-way cycling volumes ranged between approximately 5 – 10 bicycle/hr during peak hours. The counts collected show how bicycle volume varies along the corridor with higher volumes at the north and south ends of the corridor **Table 4**.

Table 4. September 2022 Intersection Bicycle Counts

Segment	Location	AM Peak Hr.	PM Peak Hr.	12 Hour Volume
Lynn Valley Road - E 27th Street	Lynn Valley Road	10	5	90
	Ross Road	6	7	68
	E 29th Street	4	13	69
E 27th Street – E 24th Street	E 27th Street	2	7	39
E 24th Street – Arborlynn Drive	Emery Place / E 24th Street	6	7	57
	Kirkstone Road / E 20th Street	6	6	35
	E 17th Street	4	2	37
	E 16th Street	7	2	46
	Arborlynn Drive	7	6	70

Strava Metro Data

Strava cycling volume data was also reviewed at multiple locations to investigate the cycling activity along the study corridor and parallel routes. Strava is Global Positing System (GPS) fitness tracking app which incorporates social network features, and is primarily used for recording cycling and running activities. Available data reflects Strava user activities and will underrepresent actual cycling volumes since users need to record their trips using a GPS device and upload the trip information onto Strava. Based off the analysis completed the total monthly volume from Strava appears to be significantly lower (300 trips during June of 2022) than what would be expected based of the tube counts completed (70 trips recorded in 24 hours). With that in mind we can only use the Strava data to gain a better understanding of possible distribution of when and where people are riding their bikes.

The analysis shows that parallel routes see significant use especially at the southern end of the corridor where Arborlynn Drive saw equal or more trips recorded on Strava than Mountain Highway between the Mountain Highway intersection and E 20th Street. Other interesting trends show that the most monthly trips recorded through Strava were typically in the warmer months from May to August and that weekends see more trips recorded throughout the year than weekdays. Further Strava Metro analysis findings are available in **Appendix C**.

4.2.3 ROAD SAFETY

Based on the District's Road Safety Program memo (2021)[17], Mountain Highway is ranked as the corridor with the second highest overall collision frequency, cyclist-involved collision frequency, and pedestrian-involved collision frequency. The District memo also identifies the Mountain Highway corridor as having the highest number of road safety concerns received from the public over the period from 2011 to 2021 based on the District's Report a Problem system.

This study further assesses road safety in the study area based on available ICBC collision data between 2016 and 2020. All of the safety analysis reported following is based off Urban Systems interpretation of

[17] Road Safety Program - Technical Analysis Memo (December 13, 2021) – The District of North Vancouver

the ICBC incident descriptions and cannot be further verified. Any reported collision with a parking lot flag or report description stating that it did not occur within the road right-of-way was removed from further analysis.

The five-year ICBC dataset includes 6 pedestrian collisions, 6 cyclist collisions, and 3 motor cyclist collisions. Notably half of all collisions involving people walking and biking took place at Lynn Valley Road intersection with a further two collisions reported at the Ross Road intersection.

With respect to the collision severity, collisions involving vulnerable road users were more likely to result in a casualty[18] compared to the overall corridor collisions. Between 2016 and 2020, 92% of pedestrian and cyclist collisions resulted in a fatality or injury, while 39% of the overall corridor collisions were either fatal or injury collisions. The breakdown of collision severity is illustrated in **Figure 13** and **Figure 14**. The only fatal collision between 2016 and 2020 involved a pedestrian and took place at E 18th Street intersection (near the Eastview Elementary school).

As discussed in the TAC guidelines[19], the relationship of speed to the probability of a collision is not as evident since collisions are complex events that can seldom be attributed to a single factor; however, collision severity increases with speed. For instance, the relationship between vehicle speed and risk of a pedestrian fatality in a collision shows that an impact speed of 50 km/hr is expected to cause a fatal injury approximately 40% of the time, while an impact speed of 70 km/hr is expected to cause a fatal injury approximately 80% of the time. Refer to **Section 4.1.2** for motor vehicle speed analysis. Hence, an anticipation or observation of increase in speed may call for other design improvements to compensate for the expected increase in collision severity.

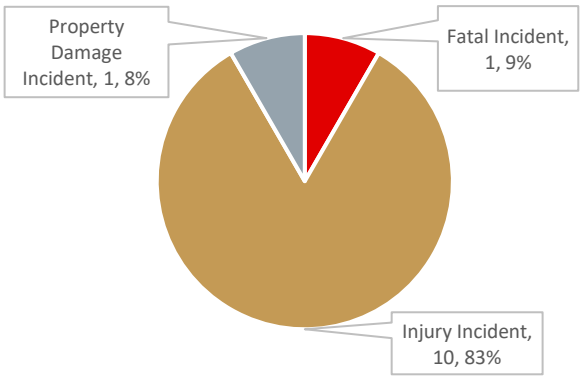


Figure 13. Number of Pedestrian and Cyclist Collision By Severity (ICBC: 2016 – 2020)

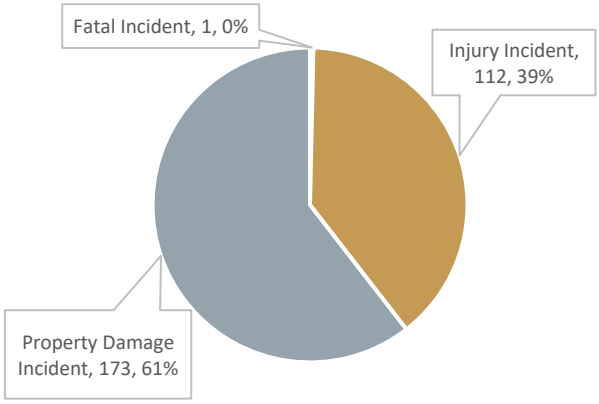


Figure 14. Number of Overall Corridor Collision By Severity (ICBC: 2016 – 2020)

Regarding the time of day, as demonstrated in **Figure 10** (pg.22), half of the pedestrian and cyclist collisions, including the fatality took place between 15:00 and 17:59, coinciding with the afternoon peak period and school pick-up period. Besides that, approximately 20% of the collisions took place during the morning peak period, while about 30% took place during the mid-day peak period.

[18] Casualty collision include collision that result in an injury or fatality.
[19] Chiu, M., Clayton, C., Millen, G. et al. 2017. Geometric Design Guide for Canadian Roads: Chapter 2 - Design Controls, Classification and Consistency. Ottawa, ON: Transportation Association of Canada.

4.3 TRANSIT

4.3.1 EXISTING CONDITIONS

The Mountain Highway corridor is currently served by bus routes 210 (daytime) and 209 (evening), which run between Burrard Station and Upper Lynn Valley. Service frequency of 30 minutes or better is provided on weekdays, while up to 10-minute service frequency is provided southbound in the morning peak. In addition, the north section is also served by multiple bus routes ending at Lynn Valley Town Centre which use Mountain Highway to turn around.

Most of the bus stops southbound along the corridor feature a bus shelter with a bench in addition to the bus stop sign, while most of the northbound stops feature a bus stop sign only. In the southbound direction, the corridor generally features one wide lane that allows motorists to pass stopped buses at transit stops. In the northbound direction, the corridor generally features two travel lanes in which the buses stop in the curb lane at stops.

4.3.2 TRANSIT USAGE

Transit moves a significant number of people along Mountain Highway accounting for approximately 9% of the total trips along the corridor and a peak of over 20% of trips at the south end of the corridor during the AM peak period. Transit usage along the Mountain Highway corridor varies throughout the day. Buses get busier as they travel southbound, while buses get emptier northbound. More passengers travel southbound towards downtown Vancouver in the morning peak, and more passengers travel northbound towards Lynn Valley Town Centre and Upper Lynn Valley in the afternoon peak. Up to 130 passengers per hour are seen during the peak hour in the peak direction (southbound), with up to 80 passengers per hour being seen during the peak hour in the off-peak direction (northbound).

Boarding and alighting activities vary significantly among the stops and time of the day with higher boarding and alighting at the north end of the corridor. Northbound boarding volume and southbound alighting volume along the corridor are significantly lower than the volume of the opposite direction.

The average daily boardings for bus stops along the corridor are summarized in **Figure 15**.

4.3.3 TRANSIT RELIABILITY

Transit reliability refers to the ability of transit to operate on schedule. Travel time variability and dwell times (time spent unloading and loading passengers at bus stops) can be major sources of delay to transit operations. The variation in travel time was reviewed for each of the segments along the corridor, separated by bus stops. Data suggests that the northbound segment between E 27th Street and Lynn Valley Road sees a more significant delay compared with other segments along the corridor.

Dwell time is generally aligned with the number of passengers boarding and alighting at each stop. Dwell time appears to be low at Arborlynn Drive, E 15th Street and E 17th Street stops for the southbound direction (approximately 10 seconds at peak hours and 5 seconds on average throughout the day) and at Arborlynn Drive and E 15th Street stops for the northbound direction.

Variation in runtime (calculated using difference between 80th percentile and 20th percentile runtime for each stop-to-stop pair) throughout the day is summarized in **Figure 16**.

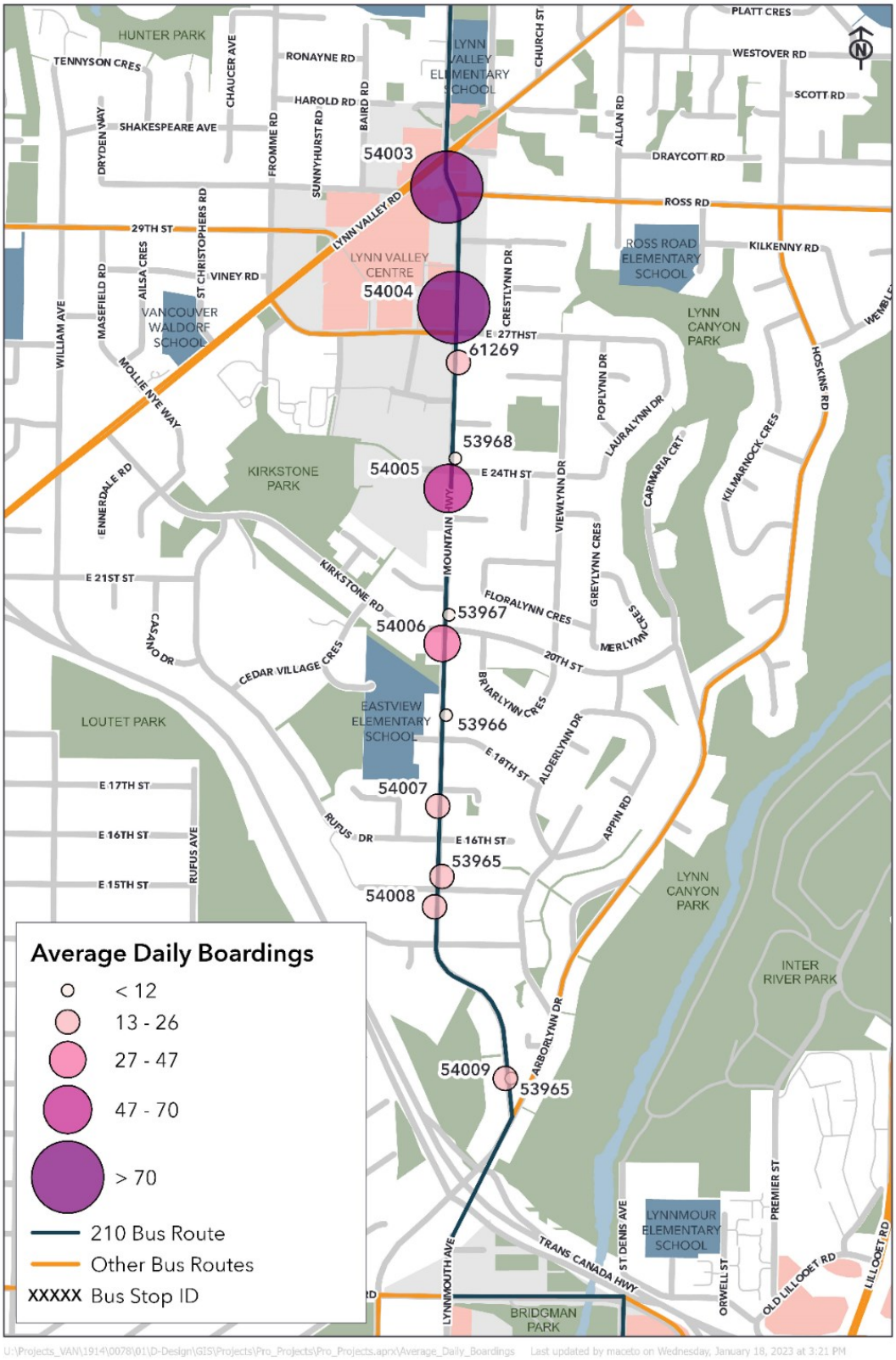


Figure 15 Route 209/210 average daily boardings map (Weekdays, September 2022)

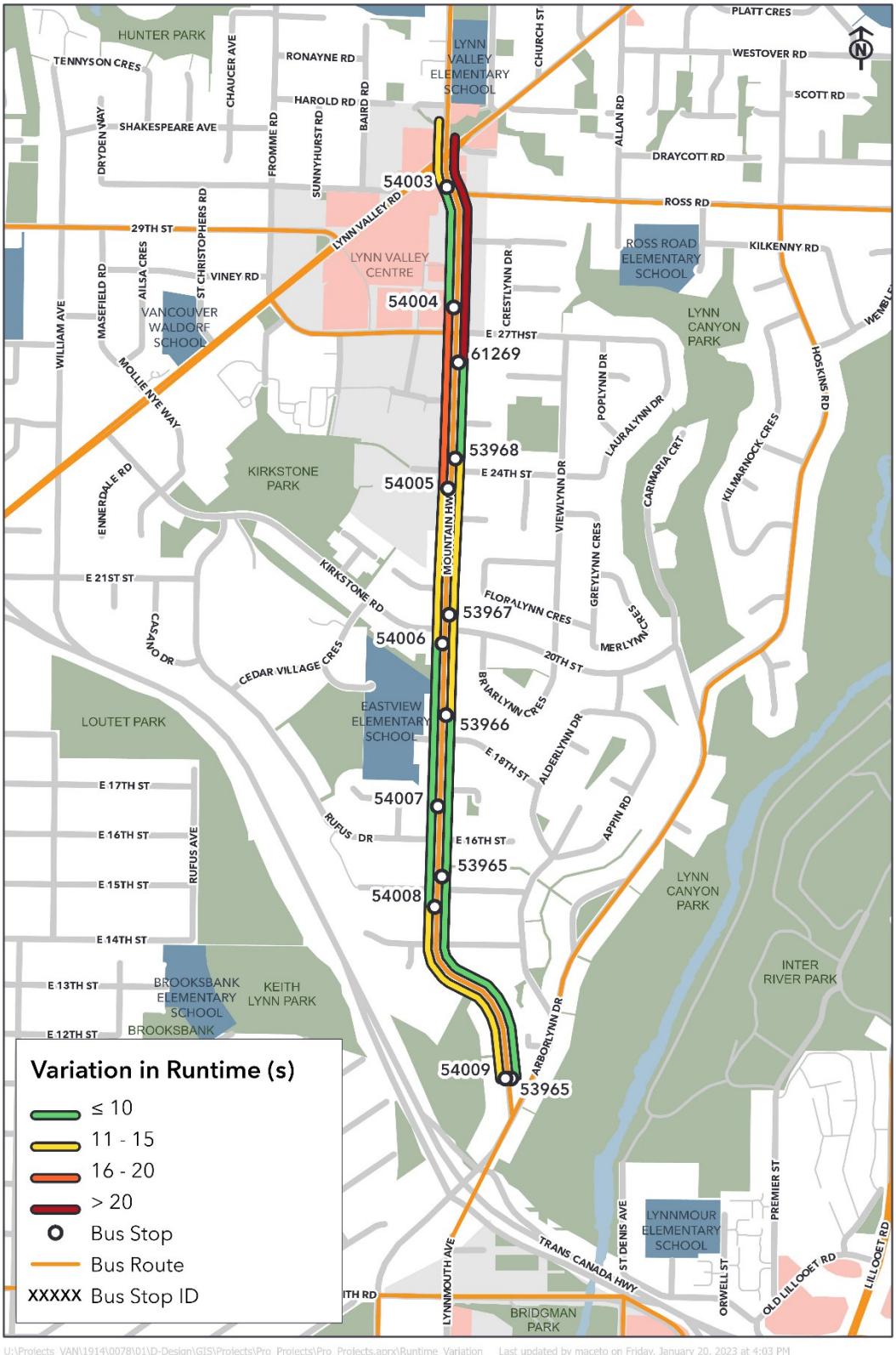


Figure 16. Average dwell time and variation in runtime (Weekdays, September 2022)

5.0 SUMMARY

The existing operational conditions, geometric conditions, and safety data along the Mountain Highway corridor have been analyzed and reviewed to establish a baseline for the corridor and identify opportunities to improve the corridor for all modes. The corridor is a key multi-modal arterial corridor which provides a direct connection between Lynn Valley Town Centre and Highway 1.

Through this study, the corridor has been separated into three different sections each with similar characteristics. The **North Section between Lynn Valley Road and E 27th Street** is in the heart of the Lynn Valley Town Centre with a mix of different commercial, and residential properties fronting the corridor and high volumes of people using all modes leading to complex intersections and a vibrant street life. In the North Section, additional travel lanes are provided at major intersections and both the bicycle and pedestrian network is incomplete. The **Central Section between E 27th Street and E 24th Street** is a transitional section still within the Lynn Valley Town Centre with predominantly residential properties along the corridor. The Central Section of the corridor is the only section where dedicated facilities are provided for all modes of travel. The **Southern Section of the corridor between E24th Street and Arborlynn Drive** is outside of the Lynn Valley Town Centre and is comprised of predominantly single-family homes with driveway access to Mountain Highway. This section of the corridor has two northbound travel lanes as well as some on-street parking plus continuous narrow sidewalks on both sides of the street.

Motor vehicle traffic operates with minimal delays along the entire corridor during all times of the day. Traffic volumes are evenly split between the northbound and southbound directions with slightly higher southbound volume in the morning and northbound in the afternoon. Excess northbound motor vehicle capacity is provided in the northbound direction south of E 24th Street. Through the southern section two northbound travel lanes are provided based off the historical truck climbing lane which is no longer needed due to vehicle weight restrictions along the corridor.

Existing transit use along the corridor is strong with transit accounting for approximately 9% of the total trips along the corridor and a peak of over 20% of trips at the south end of the corridor during the AM peak period. The busiest stops are found in the Lynn Valley Town Centre with stops near the Lynn Valley Road intersection seeing the most boardings and alightings throughout the day.

Speeding is a problem throughout the Mountain Highway Corridor. Based off the available speed data the 85th percentile speed along the corridor is as high as 70 km/h with a majority of the corridor experiencing 85th percentile speeds in excess of the 50 km/h posted speed limit.

Collision severity appears to be a concern along the corridor. Collisions on Mountain Highway between 2016-2020 were nearly twice as likely to result in injury or fatality than the District average for 2011-2020. High observed motor vehicle travel speeds are likely contributing to increased severity of collisions reported along the corridor.

Opportunities exist along the corridor to improve safety and comfort for people using all travel modes. Reallocating existing road space to add continuous facilities for people walking and cycling as well as dedicated turn lanes should be considered along the corridor. Changing the road design may have the benefit of reducing high motor vehicle speeds where excess capacity exists and additionally may improve both traffic operations and safety. Considerations for future development potential may be considered along the corridor with lower cost interim improvements recommended where new development is anticipated.

Appendix A: Glossary of Terms

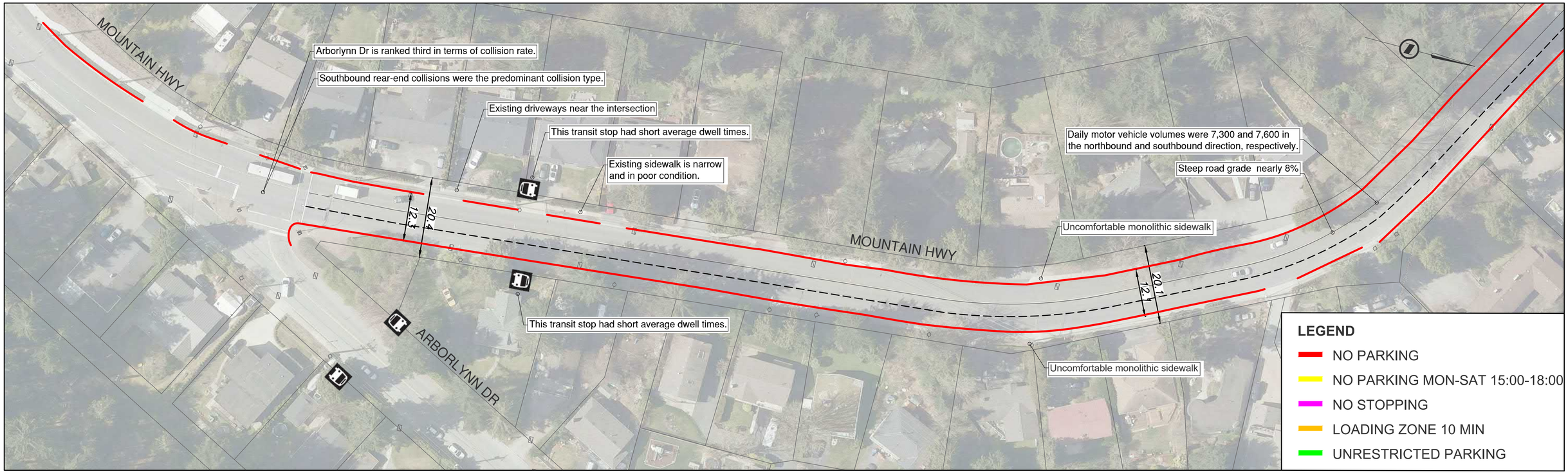
Term	Definition
85th percentile travel speed	The speed at or below which 85% of drivers are observed to travel at a specific location.
Access points/driveways	Locations where public access to private property from street are provided.
Active transportation network	An **active transportation network** includes features such as sidewalks, bicycle lanes, multi-use pathways, and pedestrian bridges that provides connections for people walking, biking and rolling.
AM and PM peak travel times	Typically, motor vehicle traffic creates two peak travel times each day which are called the **AM and PM peak travel times**. This information is typically used for traffic operational analysis.
Arterial road classification	An **arterial road** is a road primarily for through traffic. Typical daily traffic volumes range from 10,000 vehicle/day to 30,000 vehicle/day.
Bi-directional	**Bi-directional** roads or paths allow two streams of travel in opposite directions.
Border	The area adjoining the outer edge of the sidewalk.
Boulevard (furniture zone)	The section of the street between the curb and the sidewalk, or pedestrian through zone, in which landscaping, street furniture and amenities (streetlights, benches, newspaper kiosks, utility poles, tree pits, bicycle parking, etc.) are provided.
British Columbia Active Transportation Design Guide (BCAT)	
Casualty collision	A collision involving at least one injury (fatal or non-fatal).
Channelized right turn	Channelization is the separation and direction of traffic movements and pedestrians into defined paths through use of geometric features such as curbed islands, pavement markings, and traffic control devices. A **channelized right turn** is a separated right turn lane that allows free-flow or nearly free-flow traffic movement.
Collision severity	**Collision severity** is a quantification of the intensity of a collision and is reported as either a property damage only (PDO), injury, or fatal collision in the ICBC dataset.
Curbside usage/activities	**Curbside usage** of the street immediately adjacent to the curb can have an impact on the function and design of bicycle and pedestrian facilities and may present challenges to people with disabilities. Curbside activities include motor vehicle parking, loading, and transit stops.
Cycling facilities (e.g., bike lane, cycle tracks, etc.)	Any pathway or roadway signed specifically to encourage bicycle use, either exclusively or shared with vehicular traffic or pedestrians. A bike lane is a lane intended for the exclusive use of bicycles within a roadway used by motorized vehicles. A cycle track is a bicycle facility physically separated from motor vehicle lanes on the roadway.
District of North Vancouver (District)	
Dwell time	The time a transit vehicle stops to either drop off or pick up passengers at each transit stop. This time is crucial in determining the total amount of time spent travelling on public transit.
Geometric conditions	The street design elements that create street right of way including motor vehicle travel lanes, sidewalks, bike lanes, and boulevard space.
Horizontal curves	A lateral curve placed in the roadway to allow a vehicle to negotiate a change of direction at a gradual rather than a sharp turn.
Insurance Corporation of British Columbia (ICBC)	

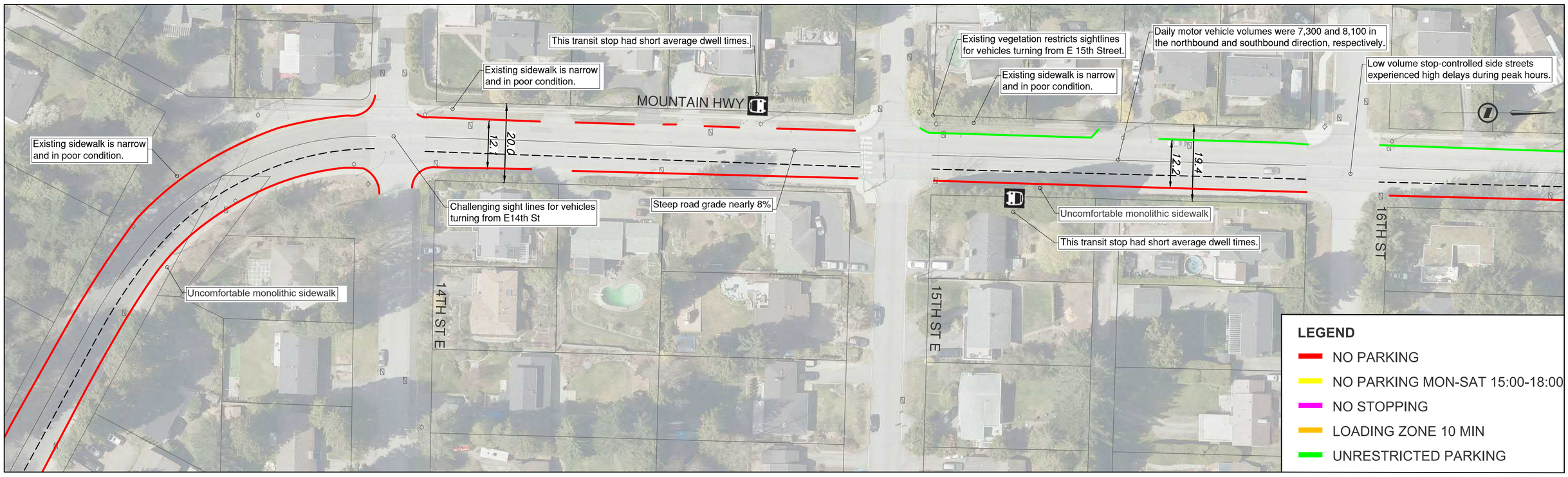
Intersection delay	The additional travel time experienced by a vehicle after it enters the intersection functional area and before it reaches free-flow speed.
Intersection functional area	The **intersection functional area** includes areas upstream and downstream of the intersection, in addition to the intersection's physical area.
Intersection leg/ approach	An **intersection leg/approach** is section of the road connecting to the intersection from one direction.
Intersection turning movement counts	Counts of vehicular, pedestrian and/or bicycle traffic used to understand traffic flow at intersections and facilitate traffic modeling.
Level of Service (LOS)	Is a term used to qualitatively describe the motor vehicle operating conditions of an intersection or specific intersection movement based on average delay experienced by motorists. The level of service of an intersection is designated with a letter, A to F, with A representing the shortest delay and F representing a failing condition.
Lynn Valley Town Centre (LVTC)	
Midblock counts (a.k.a tube count, 24-hour counts, radar-based count)	**Midblock counts** measure the volume of vehicles crossing an arbitrary line, some distance from an intersection. Different terminology is often used to describe the different technology or approach used to collect the mid-block counts including tube counts, radar-based counts, and 24-hour counts.
Mid-block pedestrian crossing	**Mid-block pedestrian crossings** provide people walking a formally designated place to cross a street when intersections are spaced far apart or significant desire lines exist mid-block.
Ministry of Transportation and Infrastructure (MoTI)	
Mobile probe speed data	**Mobile probe speed data** monitors data transmission between cell phones to gather traffic speed and volume data
Monolithic sidewalk (unseparated sidewalk)	A sidewalk directly adjacent to the curb and roadway.
Multi-modal	**Multi-modal** is characterized by several different travel modes.
Passenger vehicle	A motor vehicle that is used to transport people on highways and streets and is typically privately owned.
Queue lengths	The distance from the stop line to the tail of the last vehicle stopped in a single lane during red light within one signal cycle.
Right-of-way (ROW)	The area of land acquired for or devoted to the provision of a road.
Roadside hazards	Any obstacle or other feature encountered within the area adjoining the outer edge of the roadway which, without protection, may cause significant injury to the occupants of a vehicle encountering it.
Sightlines/visibility/sight distance	The unobstructed distance a street user can see along the roadway ahead or at intersections. Intersection sight distance (ISD) is the sight distance to the left and right available to a driver intending to execute a maneuver onto a through roadway from an intersecting roadway.
Skewed intersection	Occurs when streets intersect at angles other than 90 degrees and can create complicated scenarios for pedestrians, bicyclists and motorists.
South Coast British Columbia Transportation Authority (TransLink)	
Stop-controlled	A **stop sign-controlled** intersection is an intersection where entrance from one or more approaches is controlled by a STOP sign.
Traffic accident system (TAS)	A motor vehicle collision categorization system used in British Columbia.
Traffic operational analysis	An evaluation of motor vehicle traffic at a defined intersection. Traffic modeling software and turning movement counts are used to approximate the intersection delay and queue lengths and explore alternative intersection configurations.
Traffic signal warrant	A set criterion that identifies a potential need for a traffic control signal.

Transit alightings	The exit of passengers off a transit vehicle.
Transit boardings	The entry of passengers onto a transit vehicle.
Transit service frequency	The elapsed time between consecutive buses on a defined transit route.
Transportation Association of Canada (TAC)	**Transportation Association of Canada (TAC)** is a not-for-profit, national technical association that focusses on road and highway infrastructure and urban transportation.
Travel time variability (TTV)	The degree of travel time variation for a trip at the same route over a specific period of time. It is the key indicator to measure the performance of the transport system.
Truck climbing lane	An additional lane that is provided for short distances in corridors with steep grades to improve safety, ease congestion, and prevent delays. This lane helps facilitate the passing of trucks or slow-moving vehicles on sustained steep grades.
Vehicle weight restrictions	Limits to the weight of vehicles which travel along a given corridor to ensure that heavy weight vehicles only travel on corridors that are designed to accommodate their weight. Usually measured as maximum gross vehicle weight.
Volume to capacity ratio (V/C)	Measurement of the amount of traffic on a given roadway relative to the amount of traffic the roadway was designed to accommodate.
Vulnerable road users (VRU)	Road users not in a car, bus, or truck, generally considered to include pedestrians, motorcycle riders, cyclists, and users of mobility devices. In the event of a crash, VRUs have little to no protection from crash forces.

Definitions referenced from the TAC Geometric Design Guidelines, BC Active Transportation Design Guide, and the National Association of City Transportation Officials.

Appendix B: Visual Summary





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NOT FOR CONSTRUCTION

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APPROVED :

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DATE : 2023-01-26

NORTH VANCOUVER DISTRICT
MUNICIPAL ENGINEERING DEPARTMENT

SEAL | PEER REVIEW | REF DWG | SURVEY BOOK

MOUNTAIN HIGHWAY
VISUAL SUMMARY
SOUTH SECTION

DRAWING No.
C01
SHEET 1 OF 3
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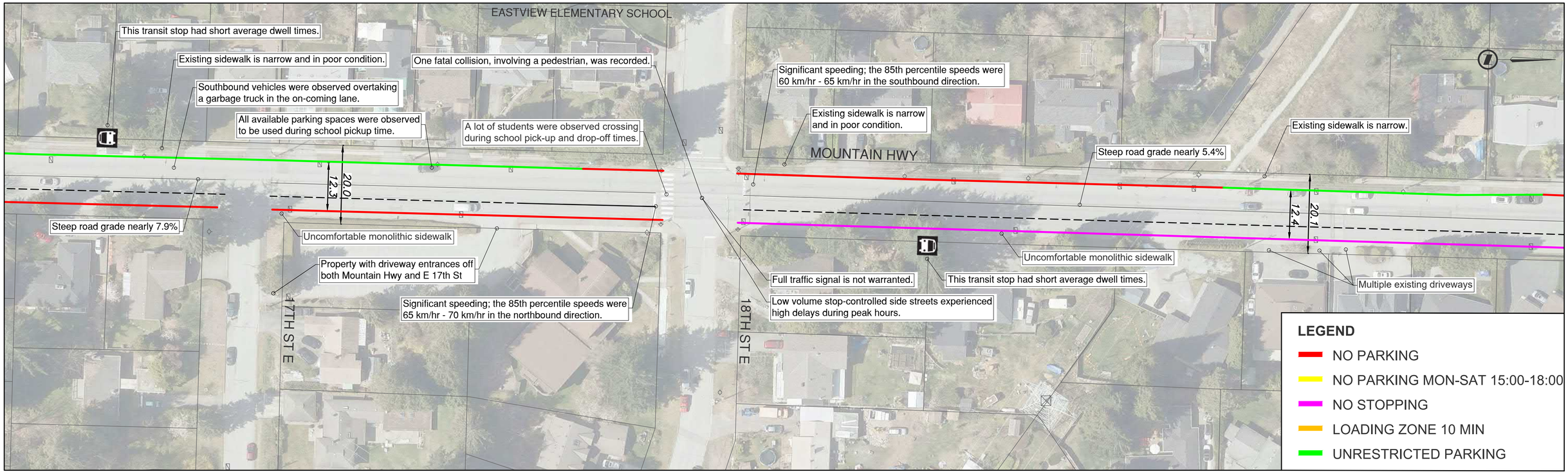
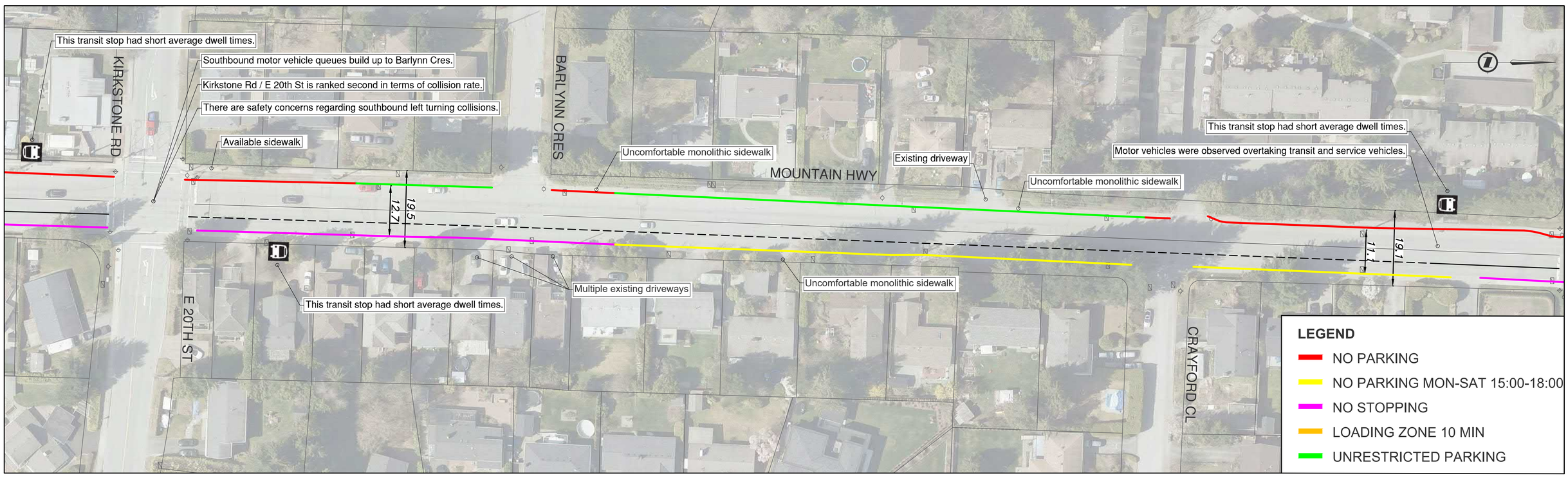
Published : Feb 17, 2023





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NORTH VANCOUVER DISTRICT
MUNICIPAL ENGINEERING DEPARTMENT

SEAL | PEER REVIEW | REF DWG | SURVEY BOOK

MOUNTAIN HIGHWAY
VISUAL SUMMARY
SOUTH SECTION

DRAWING No. C02

SHEET 2 OF 3
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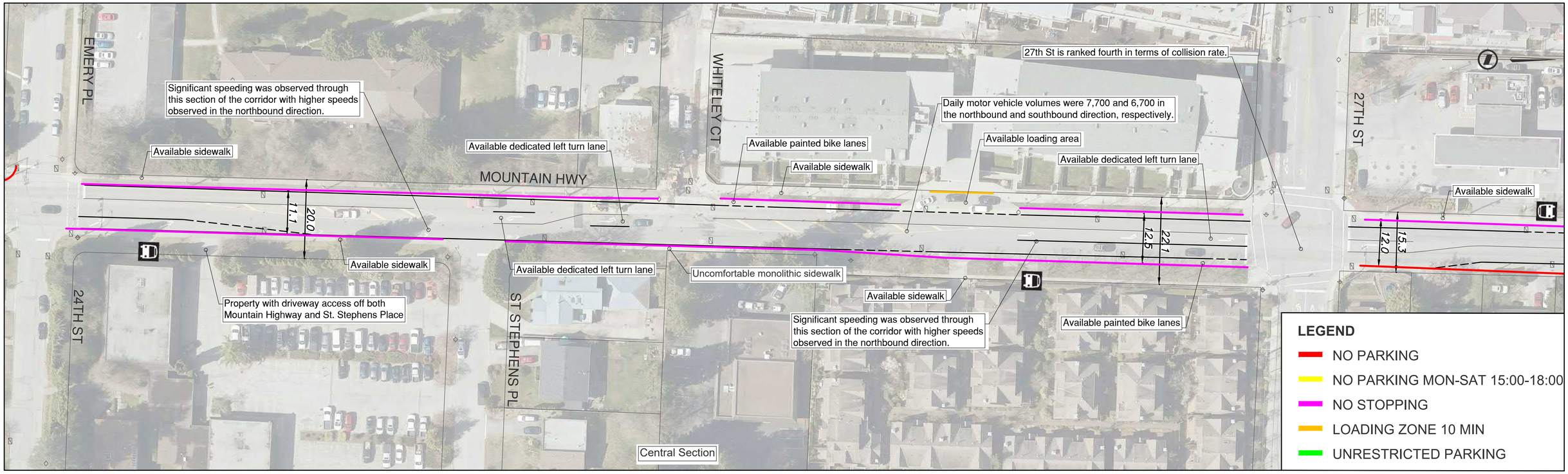

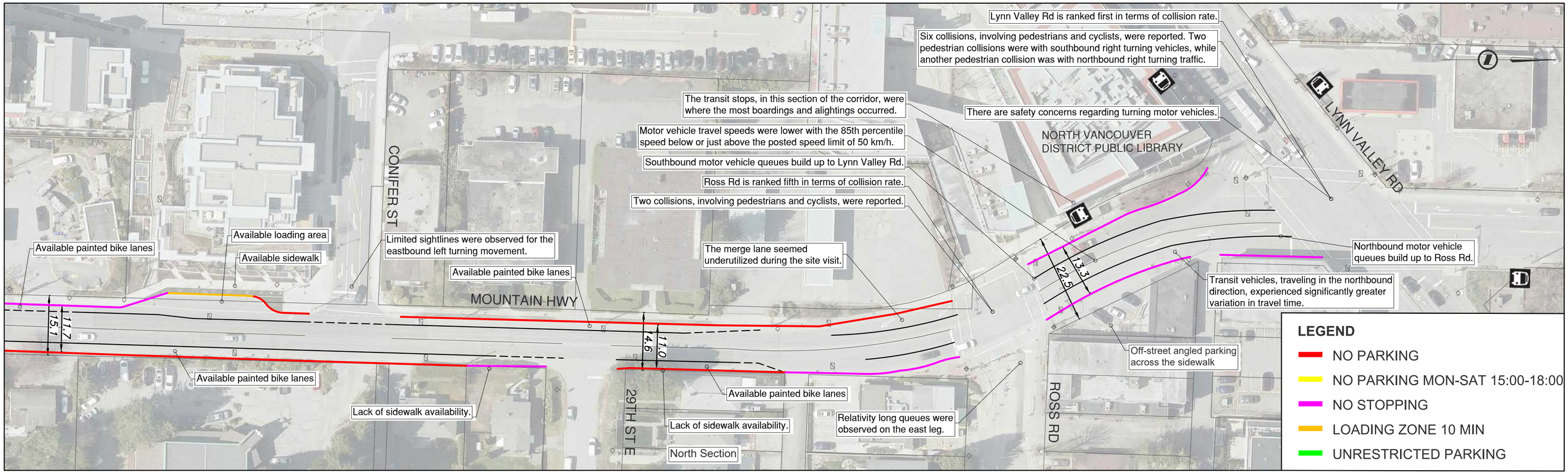

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DATE : 2023-01-26

NORTH VANCOUVER DISTRICT
MUNICIPAL ENGINEERING DEPARTMENT

SEAL | PEER REVIEW | REF DWG | SURVEY BOOK

MOUNTAIN HIGHWAY
VISUAL SUMMARY
CENTRAL & NORTH SECTIONS

DRAWING No.
C03
SHEET 3 OF 3
NOTE: METRIC DRAWING

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Published : Feb 17, 2023

APPENDIX C: VOLUME PROFILE

MOTOR VEHICLE RADAR-BASED COUNT

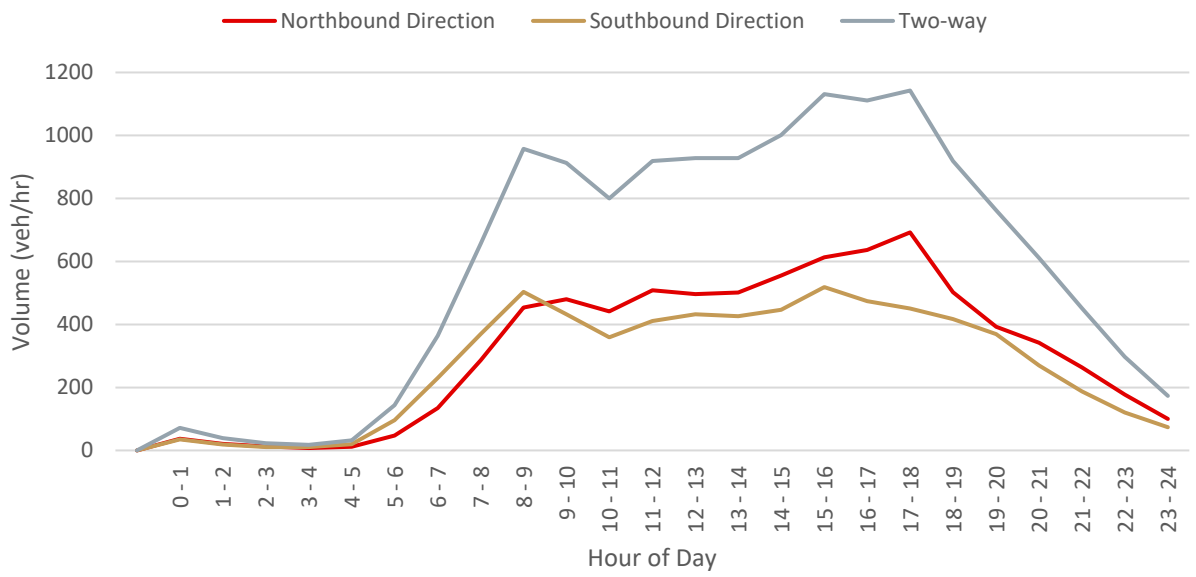


Figure 1. Average Weekly Volume Profile (June 2022) At Block 2600

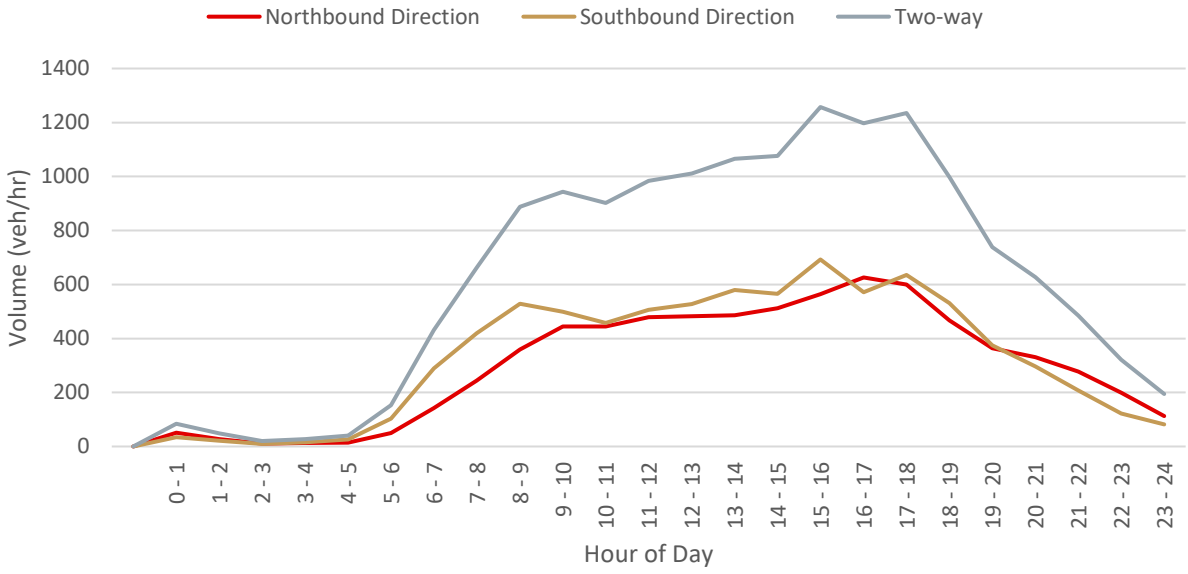


Figure 2. Average Weekly Volume Profile (July 2022) At Block 1500

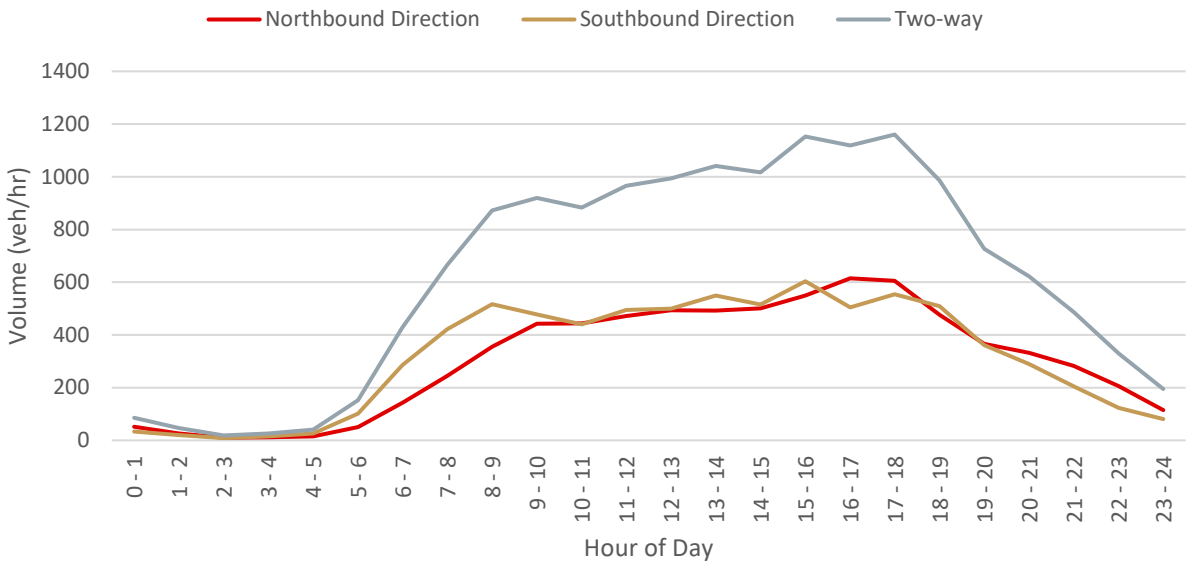


Figure 3. Average Weekly Volume Profile (July 2022) At Block 1330

RADAR-BASED COUNT & STRAVA DATA

In **Figure 4** the data shows the average weekly cycling volume profile at block 2600 in June 2022. The profile shows two distinct AM and PM peak periods at 7:00 – 9:00 and 15:00 – 17:00, respectively, aligning with typical commute periods. The corridor serves higher volumes in the southbound direction during the morning peak period, while it serves higher volumes in the northbound direction during the mid-day and afternoon. Namely, the northbound and southbound cycling volumes were about 5 – 10 bicycle/hr, for each, during peak hours. The daily two-way volume was about 70 bicycle/day.

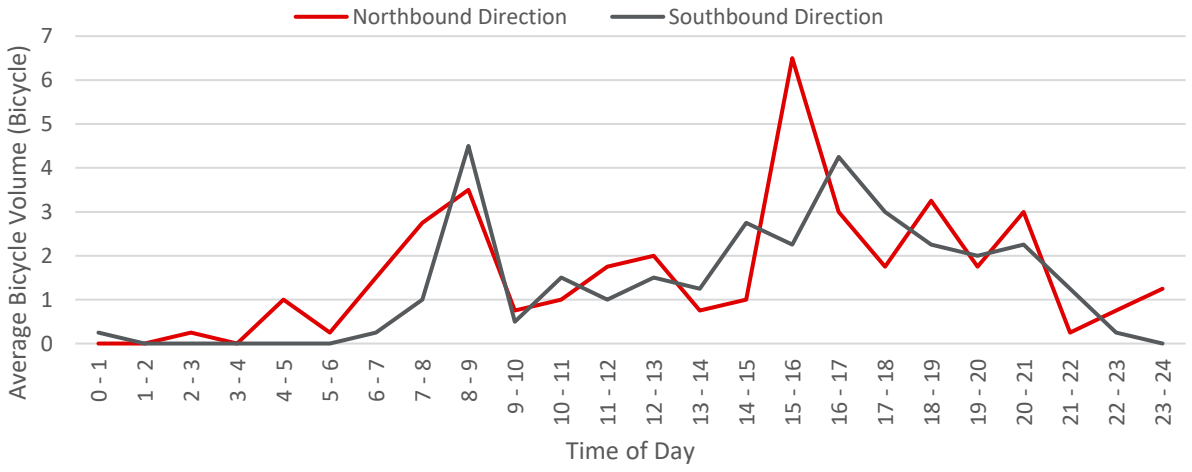


Figure 4. Average Bicycle Volume Profile (June 2022) At Block 2600

Table 1 presents Strava cycling volumes across multiple locations along the study corridor and parallel routes between 2019 and 2022. Count locations are illustrated in **Figure 5**. September was selected as the month to compare the Strava data with since the existing corridor counts were typically completed in both spring and fall and would allow a comparison between the volumes record through Strava and the corridor counts completed by the District.

Available data reflects Strava user activities and will underrepresent actual cycling volumes since users need to record their trips using a GPS device and upload the trip information onto Strava. It should also be noted that Strava has reported a surge in cycling activity in 2020[20]. According to Strava, the COVID-19 pandemic created an exercise boom at a global level. Subsequently, the September 2020 cycling volumes were higher compared to the other reported pre- and post-pandemic years.

When reviewing the Strava data with the cycling counts collected along the corridor it is evident that currently people cycling are using both Mountain Highway and parallel corridors to access their destinations. September 2022 cycling volumes consistently exceeded the September 2019 and 2021 volumes, indicating a continued increase in two-way cycling activity on the corridor. Additional cycling demand can be expected when the planned facilities (Casano-Loutet Overpass and Upper Levels Greenway) connecting to the City of North Vancouver are completed in the coming years.

Table 1. Monthly Two-way Cycling Volumes (Source: Strava data)

Location	Sep 2019	Sep 2020	Sep 2021	Sep 2022
Mountain Highway, Between Lynn Valley Road and Ross Road	305	540	375	395
Mountain Highway, Between E 27th Street and Whiteley Court	235	400	285	330
Mountain Highway, Between E 14th Street and Arborlynn Drive	210	335	180	280
Crestlynn Drive, Between E 29th Street and 27th Street	50	55	80	85
Viewlynn Drive, Between Chuckart Place and E 24th Street / Lauralynn Drive	90	105	95	105
Viewlynn Drive, Between E 24th Street / Lauralynn Drive and Floralynn Crescent	90	115	95	155
Arborlynn Drive, Between Birchlynn Place and Hoskins Road	175	285	220	345
Arborlynn Drive, Between Mountain Highway and Appin Road	170	285	205	450

[20] Strava releases 2020 Year In Sport Data Report – Strava Blog, available online at: https://blog.strava.com/press/yis2020/

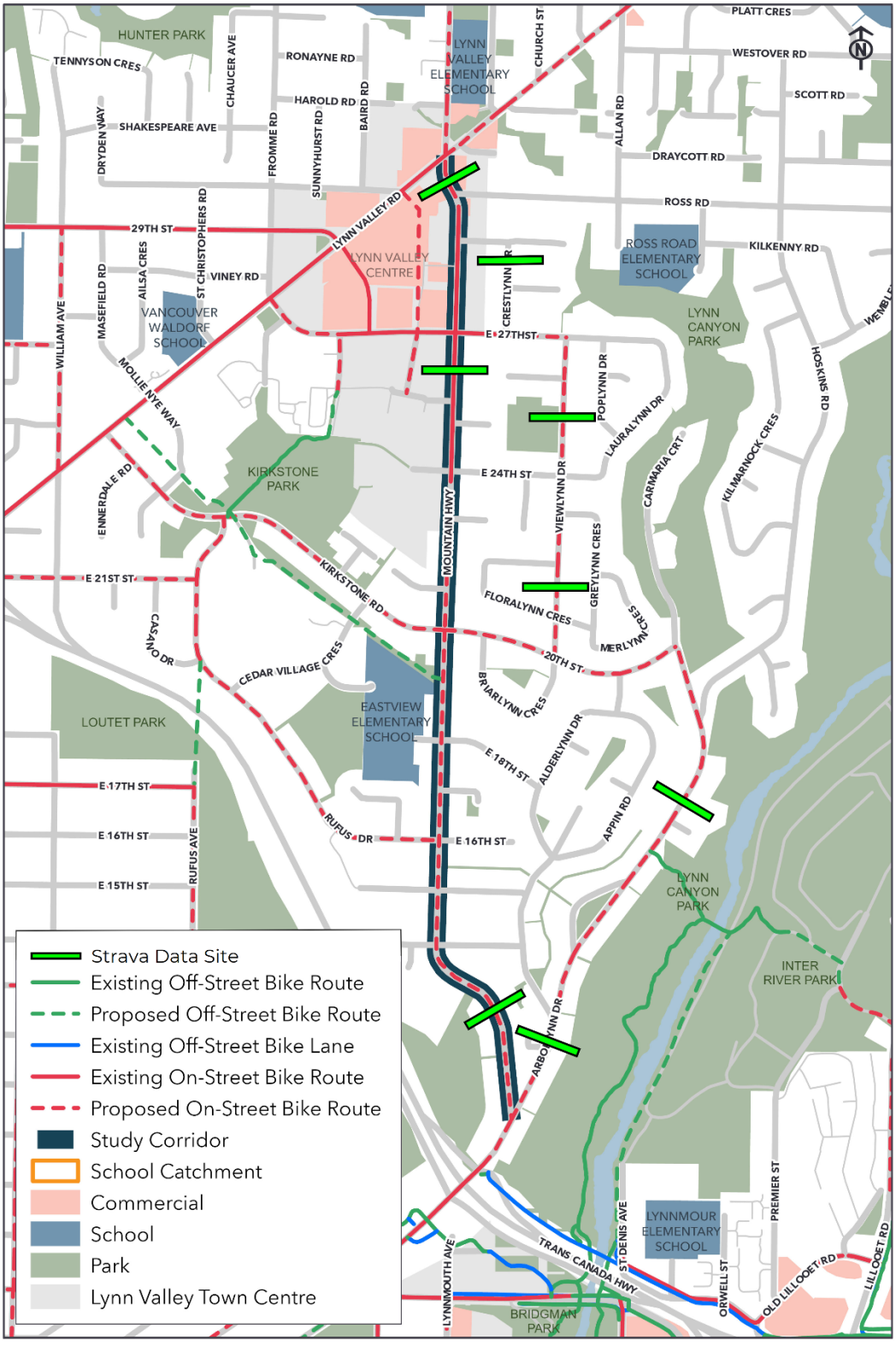


Figure 5. Existing And Proposed Cycling Route

APPENDIX D: MOTOR VEHICLE OPERATIONS

TURNING MOVEMENT COUNT & SYNCHRO ANALYSIS

Synchro 11, a macroscopic traffic analysis tool was used to analyze the traffic operational performance at the study intersections. Synchro is usually used to determine traffic conditions based on volumes, intersection geometry, and traffic control type. The analysis results are typically reported in terms of several measures of effectiveness (MOE) such as the volume-to-capacity (V/C) ratio, average delay, level of service (LOS), and 95th percentile queues.

The level of service (LOS) indicates the average delays experienced by motorists and can be reported at an intersection level and movement level. LOS is expressed using letter grades from "A" through "F", where LOS "A" through LOS "C" represents minimal delays, and LOS "F" represents significant delays (equal to or more than 85 seconds per vehicle for signalized intersections and 50 seconds per vehicle for unsignalized intersections), as illustrated in **Table 1**. LOS "F" often indicates insufficient capacity, and that the intersection or movement is likely operating at a failing condition. Overall intersection operation of LOS "D" or better and minor movement operation of LOS "E" or better are considered an acceptable threshold by many agencies, while operations outside of these thresholds may require improvement.

Table 1. Level of Service (LOS) and Associated Vehicle Delay

LOS	Signalized Intersection	Unsignalized Intersection
A	≤10 sec	≤10 sec
B	10 – 20 sec	10 – 15 sec
C	20 – 35 sec	15 – 25 sec
D	35 – 55 sec	25 – 35 sec
E	55 – 80 sec	35 – 50 sec
F	>80 sec	>50 sec

The volume-to-capacity ratio (v/c) is a measure that reflects the mobility and quality of travel of a facility or a section of a facility. It compares roadway demand (vehicle volumes) with roadway supply (carrying capacity). A v/c ratio of 1.00 indicates that the roadway facility is operating at its capacity. It is generally acceptable when a v/c ratio is equal to or less than 0.90. Additionally, the 95th percentile queue is defined as the queue length (in metres) that has only a 5-percent probability of being exceeded during the analysis period.

Figure 1 illustrates the traffic TMCs at the study intersection during both AM and PM peak hours.

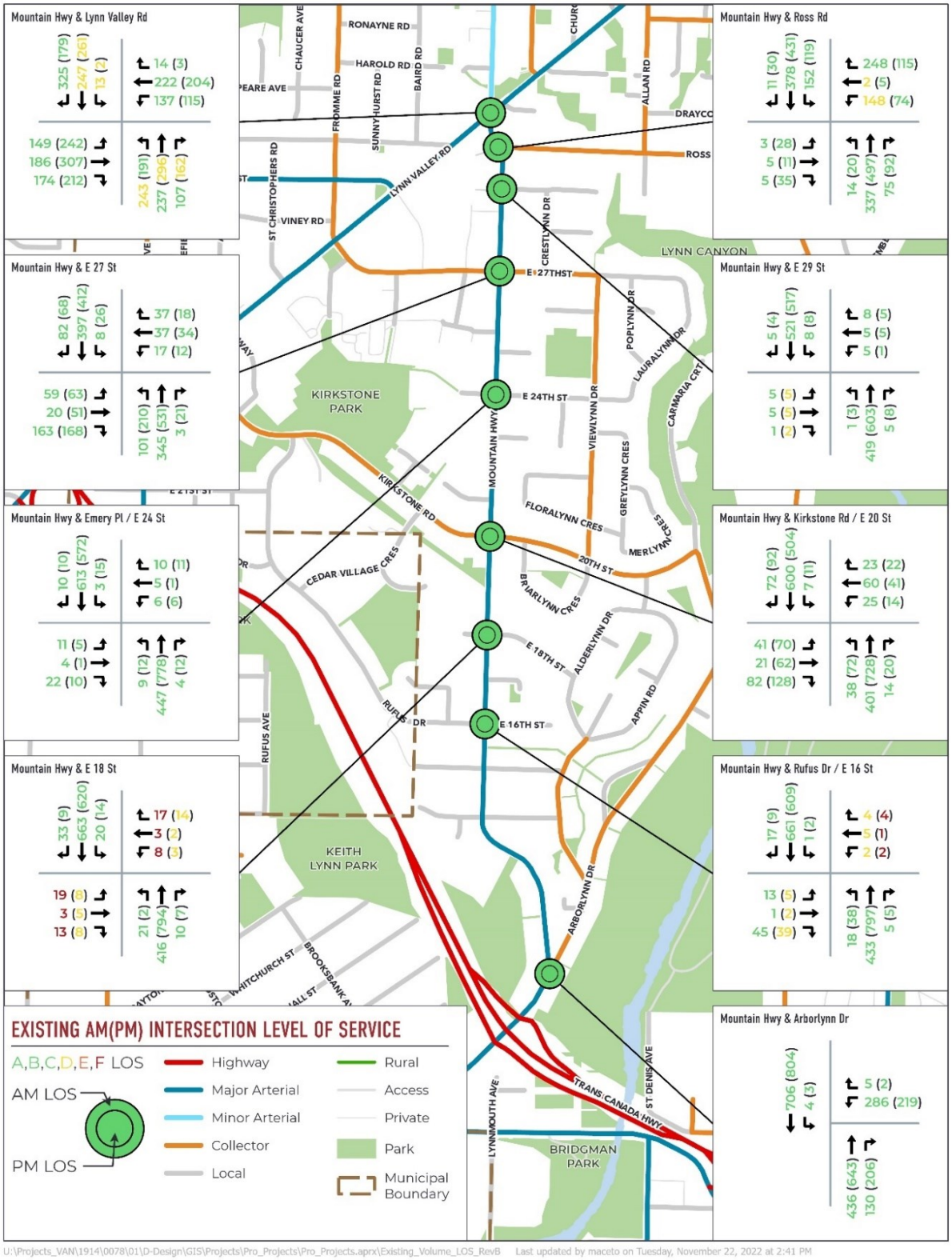
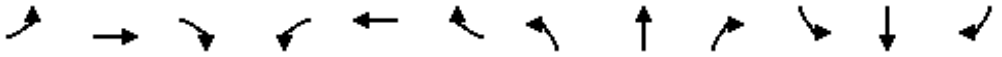


Figure 1. Existing AM (PM) Level Of Service

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	286	5	436	130	4	706
Future Volume (vph)	286	5	436	130	4	706
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0		20.0	0.0	
Storage Lanes	1	0		1	0	
Taper Length (m)	7.5				7.5	
Satd. Flow (prot)	1787	0	3539	1583	0	1879
Flt Permitted	0.954					0.995
Satd. Flow (perm)	1787	0	3539	1549	0	1872
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)	2			109		
Link Speed (k/h)	50		50			50
Link Distance (m)	137.9		84.8			204.2
Travel Time (s)	9.9		6.1			14.7
Confl. Bikes (#/hr)		7		5		
Peak Hour Factor	0.80	0.42	0.92	0.80	0.50	0.92
Heavy Vehicles (%)	1%	0%	2%	2%	0%	1%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	370	0	474	163	0	775
Turn Type	Prot		NA	Free	Perm	NA
Protected Phases	4		6			2
Permitted Phases				Free	2	
Total Split (s)	25.5		50.4		50.4	50.4
Total Lost Time (s)	5.2		5.4			5.4
Act Effct Green (s)	16.4		30.5	58.0		30.5
Actuated g/C Ratio	0.28		0.53	1.00		0.53
v/c Ratio	0.73		0.25	0.11		0.79
Control Delay	30.8		7.9	0.1		18.1
Queue Delay	0.0		0.0	0.0		0.0
Total Delay	30.8		7.9	0.1		18.1
LOS	C		A	A		B
Approach Delay	30.8		5.9			18.1
Approach LOS	C		A			B
Queue Length 50th (m)	35.7		14.1	0.0		65.0
Queue Length 95th (m)	70.0		23.2	0.0		114.3
Internal Link Dist (m)	113.9		60.8			180.2
Turn Bay Length (m)				20.0		
Base Capacity (vph)	657		2811	1549		1486
Starvation Cap Reductn	0		0	0		0
Spillback Cap Reductn	0		0	0		0
Storage Cap Reductn	0		0	0		0
Reduced v/c Ratio	0.56		0.17	0.11		0.52

Intersection Summary			
Area Type:	Other		
Cycle Length: 75.9			
Actuated Cycle Length: 58			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.79			
Intersection Signal Delay: 16.4		Intersection LOS: B	
Intersection Capacity Utilization 65.3%		ICU Level of Service C	
Analysis Period (min) 15			

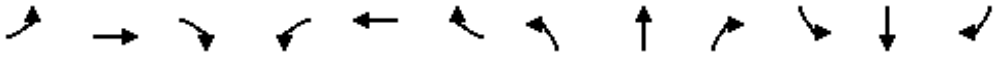
Splits and Phases: 100: Mountain Hwy & Arborlynn Dr



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	1	45	2	5	4	18	433	5	1	661	17
Future Volume (Veh/h)	13	1	45	2	5	4	18	433	5	1	661	17
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.54	0.25	0.75	0.25	1.00	0.33	0.90	0.88	1.00	0.25	0.93	0.53
Hourly flow rate (vph)	24	4	60	8	5	12	20	492	5	4	711	32
Pedestrians		3										
Lane Width (m)		3.6										
Walking Speed (m/s)		1.2										
Percent Blockage		0										
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1038	1275	730	1332	1288	248	746			497		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1038	1275	730	1332	1288	248	746			497		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	86	98	84	91	97	98	98			100		
cM capacity (veh/h)	176	164	368	92	160	758	869			1077		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	88	25	266	251	747
Volume Left	24	8	20	0	4
Volume Right	60	12	0	5	32
cSH	272	187	869	1700	1077
Volume to Capacity	0.32	0.13	0.02	0.15	0.00
Queue Length 95th (m)	10.8	3.6	0.6	0.0	0.1
Control Delay (s)	24.5	27.3	0.9	0.0	0.1
Lane LOS	C	D	A		A
Approach Delay (s)	24.5	27.3	0.5		0.1
Approach LOS	C	D			

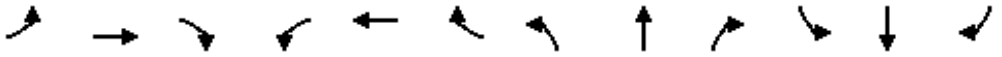
Intersection Summary				
Average Delay	2.3			
Intersection Capacity Utilization	48.4%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	3	13	8	3	17	21	416	10	20	663	33
Future Volume (Veh/h)	19	3	13	8	3	17	21	416	10	20	663	33
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.53	0.38	0.46	0.67	0.50	0.61	0.53	0.91	0.62	0.56	0.92	0.43
Hourly flow rate (vph)	36	8	28	12	6	28	40	457	16	36	721	77
Pedestrians		8			9			102				
Lane Width (m)		3.6			3.6			3.6				
Walking Speed (m/s)		1.2			1.2			1.2				
Percent Blockage		1			1			9				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)											258	
pX, platoon unblocked	0.71	0.71	0.71	0.71	0.71		0.71					
vC, conflicting volume	1179	1402	870	1520	1432	246	806			482		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1046	1361	608	1528	1404	246	518			482		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.2		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	67	92	90	71	93	96	95			97		
cM capacity (veh/h)	110	95	285	41	90	755	743			1048		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	72	46	268	244	834
Volume Left	36	12	40	0	36
Volume Right	28	28	0	16	77
cSH	141	116	743	1700	1048
Volume to Capacity	0.51	0.40	0.05	0.14	0.03
Queue Length 95th (m)	19.5	13.3	1.4	0.0	0.9
Control Delay (s)	54.3	55.1	2.0	0.0	0.9
Lane LOS	F	F	A		A
Approach Delay (s)	54.3	55.1	1.1		0.9
Approach LOS	F	F			

Intersection Summary				
Average Delay	5.3			
Intersection Capacity Utilization	72.9%	ICU Level of Service	C	
Analysis Period (min)	15			



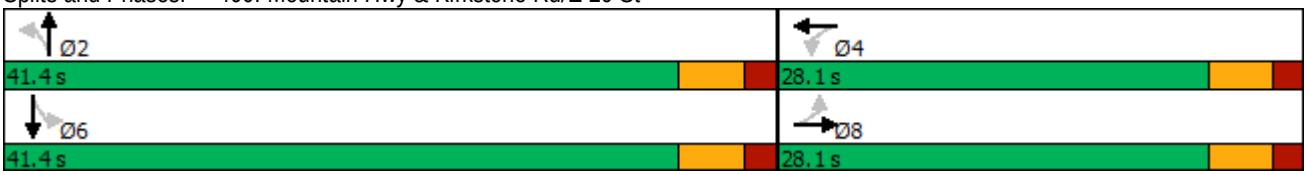
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	21	82	25	60	23	38	401	14	7	600	72
Future Volume (vph)	41	21	82	25	60	23	38	401	14	7	600	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	20.0		0.0	20.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1805	1575	0	1736	1792	0	0	3504	0	0	1818	0
Flt Permitted	0.680			0.670				0.804			0.994	
Satd. Flow (perm)	1285	1575	0	1178	1792	0	0	2826	0	0	1809	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		104			39			8			16	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		178.6			91.5			258.4			367.1	
Travel Time (s)		12.9			6.6			18.6			26.4	
Confl. Peds. (#/hr)	6		26	26		6	59		4	4		59
Confl. Bikes (#/hr)	6					6						
Peak Hour Factor	0.73	0.66	0.79	0.69	0.75	0.57	0.56	0.88	0.70	0.88	0.90	0.71
Heavy Vehicles (%)	0%	0%	2%	4%	0%	0%	0%	2%	0%	0%	1%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	56	136	0	36	120	0	0	544	0	0	776	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		8			4			2			6	
Permitted Phases	8			4			2			6		
Total Split (s)	28.1	28.1		28.1	28.1		41.4	41.4		41.4	41.4	
Total Lost Time (s)	5.1	5.1		5.1	5.1			5.4			5.4	
Act Effct Green (s)	14.0	14.0		14.0	14.0			34.2			34.2	
Actuated g/C Ratio	0.26	0.26		0.26	0.26			0.63			0.63	
v/c Ratio	0.17	0.28		0.12	0.25			0.31			0.68	
Control Delay	18.0	8.3		17.6	13.6			8.0			14.8	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	18.0	8.3		17.6	13.6			8.0			14.8	
LOS	B	A		B	B			A			B	
Approach Delay		11.1			14.5			8.0			14.8	
Approach LOS		B			B			A			B	
Queue Length 50th (m)	4.8	2.7		3.0	6.9			18.9			72.3	
Queue Length 95th (m)	10.5	7.5		7.2	14.9			27.7			#125.3	
Internal Link Dist (m)		154.6			67.5			234.4			343.1	
Turn Bay Length (m)	20.0			20.0								
Base Capacity (vph)	576	763		528	824			1985			1273	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.10	0.18		0.07	0.15			0.27			0.61	

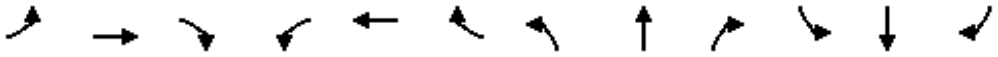
Intersection Summary			
Area Type:	Other		
Cycle Length: 69.5			
Actuated Cycle Length: 54.7			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.68			
Intersection Signal Delay: 12.1		Intersection LOS: B	
Intersection Capacity Utilization 64.2%		ICU Level of Service C	

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 400: Mountain Hwy & Kirkstone Rd/E 20 St

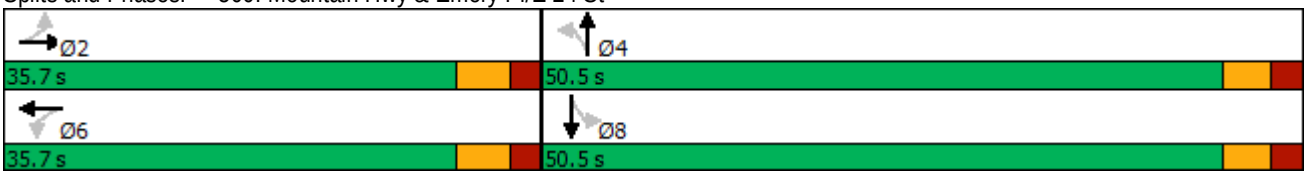


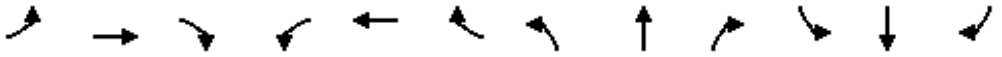


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	11	4	22	6	5	10	9	447	4	3	613	10
Future Volume (vph)	11	4	22	6	5	10	9	447	4	3	613	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Satd. Flow (prot)	0	1665	0	0	1599	0	0	3547	0	0	1875	0
Flt Permitted		0.908			0.828			0.934			0.996	
Satd. Flow (perm)	0	1519	0	0	1338	0	0	3315	0	0	1867	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		36			16			4			1	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		57.7			159.4			367.1			47.6	
Travel Time (s)		4.2			11.5			26.4			3.4	
Confl. Peds. (#/hr)	19		11	11		19	28		12	12		28
Confl. Bikes (#/hr)	5		1	1		5						
Peak Hour Factor	0.69	0.25	0.61	0.38	1.00	0.62	0.56	0.81	0.33	0.50	0.88	0.83
Heavy Vehicles (%)	0%	0%	4%	17%	0%	0%	11%	1%	0%	0%	1%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	68	0	0	37	0	0	580	0	0	715	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6			4			8		
Total Split (s)	35.7	35.7		35.7	35.7		50.5	50.5		50.5	50.5	
Total Lost Time (s)		5.7			5.7			5.5			5.5	
Act Effct Green (s)		8.9			8.9			36.7			36.7	
Actuated g/C Ratio		0.18			0.18			0.74			0.74	
v/c Ratio		0.22			0.15			0.23			0.51	
Control Delay		12.6			14.0			4.7			7.9	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		12.6			14.0			4.7			7.9	
LOS		B			B			A			A	
Approach Delay		12.6			14.0			4.7			7.9	
Approach LOS		B			B			A			A	
Queue Length 50th (m)		2.2			1.4			10.0			31.4	
Queue Length 95th (m)		0.6			8.7			23.9			91.4	
Internal Link Dist (m)		33.7			135.4			343.1			23.6	
Turn Bay Length (m)												
Base Capacity (vph)		965			845			3072			1730	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.07			0.04			0.19			0.41	

Intersection Summary			
Area Type:	Other		
Cycle Length: 86.2			
Actuated Cycle Length: 49.3			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.51			
Intersection Signal Delay: 6.9		Intersection LOS: A	
Intersection Capacity Utilization 53.6%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 500: Mountain Hwy & Emery Pl/E 24 St



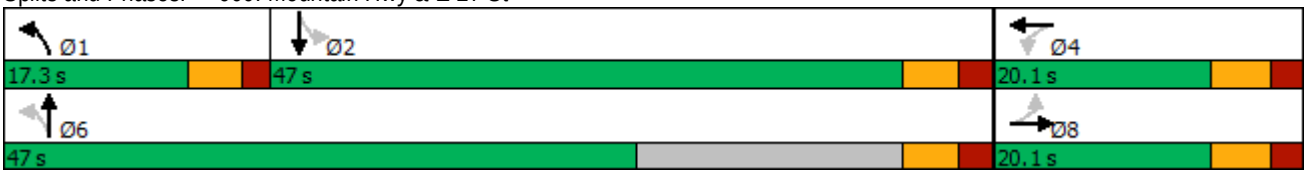


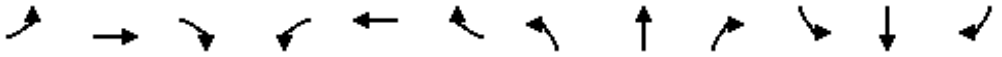
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	59	20	163	17	37	37	101	345	3	8	397	82
Future Volume (vph)	59	20	163	17	37	37	101	345	3	8	397	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	25.0		0.0	20.0		0.0	60.0		0.0	15.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1805	1466	0	1805	1670	0	1805	1856	0	1805	1815	0
Flt Permitted	0.697			0.535			0.250			0.544		
Satd. Flow (perm)	1234	1466	0	942	1670	0	467	1856	0	1016	1815	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		206			46			3			20	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		78.2			107.4			271.8			213.2	
Travel Time (s)		5.6			7.7			19.6			15.4	
Confl. Peds. (#/hr)	33		51	51		33	28		12	12		28
Confl. Bikes (#/hr)	2					2			4	4		
Peak Hour Factor	0.67	0.54	0.79	0.53	0.80	0.80	0.74	0.97	0.38	0.50	0.93	0.81
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	2%	0%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	88	243	0	32	92	0	136	364	0	16	528	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		8			4		1	6			2	
Permitted Phases	8			4			6			2		
Total Split (s)	20.1	20.1		20.1	20.1		17.3	47.0		47.0	47.0	
Total Lost Time (s)	6.1	6.1		6.1	6.1		5.3	6.0		6.0	6.0	
Act Effct Green (s)	13.3	13.3		13.3	13.3		36.7	36.0		25.9	25.9	
Actuated g/C Ratio	0.21	0.21		0.21	0.21		0.59	0.58		0.42	0.42	
v/c Ratio	0.33	0.51		0.16	0.23		0.31	0.34		0.04	0.69	
Control Delay	27.3	10.6		25.1	15.2		7.9	8.1		13.8	21.7	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	27.3	10.6		25.1	15.2		7.9	8.1		13.8	21.7	
LOS	C	B		C	B		A	A		B	C	
Approach Delay		15.0			17.7			8.0			21.5	
Approach LOS		B			B			A			C	
Queue Length 50th (m)	9.0	3.6		3.2	4.5		7.6	24.0		1.4	58.9	
Queue Length 95th (m)	18.2	2.2		6.8	15.4		11.4	38.0		2.7	96.4	
Internal Link Dist (m)		54.2			83.4			247.8			189.2	
Turn Bay Length (m)	25.0			20.0			60.0			15.0		
Base Capacity (vph)	337	551		258	490		551	1633		707	1269	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.26	0.44		0.12	0.19		0.25	0.22		0.02	0.42	

Intersection Summary			
Area Type:	Other		
Cycle Length: 84.4			
Actuated Cycle Length: 62.2			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.69			
Intersection Signal Delay: 15.3		Intersection LOS: B	
Intersection Capacity Utilization 65.0%		ICU Level of Service C	

Analysis Period (min) 15

Splits and Phases: 600: Mountain Hwy & E 27 St

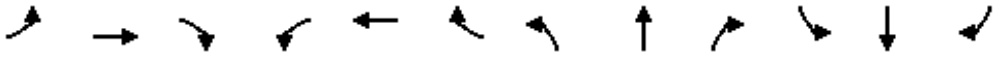




Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	5	1	5	5	8	1	419	5	8	521	5
Future Volume (Veh/h)	5	5	1	5	5	8	1	419	5	8	521	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.62	1.00	0.25	0.62	1.00	0.67	0.25	0.96	0.62	0.50	0.96	1.00
Hourly flow rate (vph)	8	5	4	8	5	12	4	436	8	16	543	5
Pedestrians		28						1			1	
Lane Width (m)		3.6						3.6			3.6	
Walking Speed (m/s)		1.2						1.2			1.2	
Percent Blockage		2						0			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)								213			107	
pX, platoon unblocked	0.94	0.94	0.92	0.94	0.94	0.95	0.92			0.95		
vC, conflicting volume	1069	1058	574	1033	1056	441	576			444		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	929	917	489	891	915	389	491			392		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	98	99	97	98	98	100			99		
cM capacity (veh/h)	214	247	521	236	247	632	968			1122		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	17	25	448	564
Volume Left	8	8	4	16
Volume Right	4	12	8	5
cSH	260	342	968	1122
Volume to Capacity	0.07	0.07	0.00	0.01
Queue Length 95th (m)	1.7	1.9	0.1	0.3
Control Delay (s)	19.8	16.4	0.1	0.4
Lane LOS	C	C	A	A
Approach Delay (s)	19.8	16.4	0.1	0.4
Approach LOS	C	C		

Intersection Summary				
Average Delay	1.0			
Intersection Capacity Utilization	44.1%	ICU Level of Service	A	
Analysis Period (min)	15			

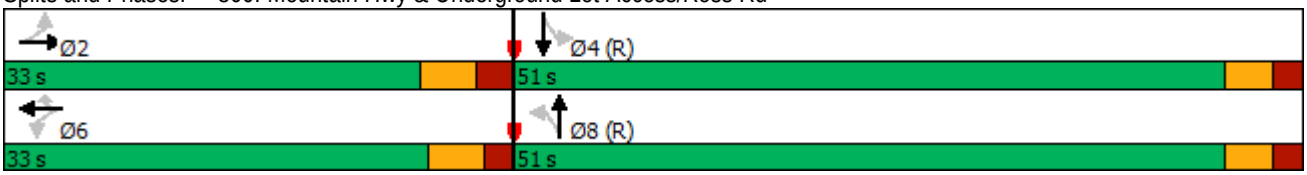


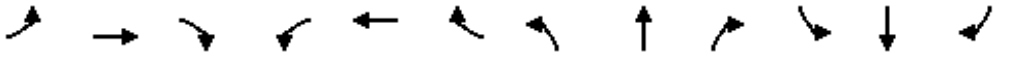
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	3	5	5	148	2	248	14	337	75	152	378	11
Future Volume (vph)	3	5	5	148	2	248	14	337	75	152	378	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		25.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		1	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	0	1750	0	0	1811	1615	0	3402	0	0	3428	0
Flt Permitted		0.874			0.716			0.868			0.679	
Satd. Flow (perm)	0	1535	0	0	1342	1508	0	2958	0	0	2353	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8				282		58			5	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		43.6			343.9			41.7			89.6	
Travel Time (s)		3.1			24.8			3.0			6.5	
Confl. Peds. (#/hr)	40		11	11		40	32		14	14		32
Confl. Bikes (#/hr)	4		2	2		4			2	2		
Peak Hour Factor	0.38	1.00	0.62	0.82	0.50	0.88	0.35	0.98	0.78	0.76	0.91	0.62
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	2%	0%	1%	4%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	21	0	0	184	282	0	480	0	0	633	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Total Split (s)	33.0	33.0		33.0	33.0	33.0	51.0	51.0		51.0	51.0	
Total Lost Time (s)		6.1			5.6	5.6		5.2			5.2	
Act Effct Green (s)		16.8			17.3	17.3		55.9			55.9	
Actuated g/C Ratio		0.20			0.21	0.21		0.67			0.67	
v/c Ratio		0.07			0.67	0.53		0.24			0.40	
Control Delay		18.5			41.6	7.2		6.0			8.2	
Queue Delay		0.0			0.0	0.0		0.0			0.6	
Total Delay		18.5			41.6	7.2		6.0			8.9	
LOS		B			D	A		A			A	
Approach Delay		18.5			20.8			6.0			8.9	
Approach LOS		B			C			A			A	
Queue Length 50th (m)		1.7			28.0	0.0		13.6			23.8	
Queue Length 95th (m)		6.9			22.4	16.2		25.1			42.4	
Internal Link Dist (m)		19.6			319.9			17.7			65.6	
Turn Bay Length (m)						25.0						
Base Capacity (vph)		497			437	681		1987			1567	
Starvation Cap Reductn		0			0	0		0			550	
Spillback Cap Reductn		0			0	0		0			0	
Storage Cap Reductn		0			0	0		0			0	
Reduced v/c Ratio		0.04			0.42	0.41		0.24			0.62	

Intersection Summary	
Area Type:	Other
Cycle Length: 84	
Actuated Cycle Length: 84	
Offset: 30 (36%), Referenced to phase 4:SBTL and 8:NBTL, Start of Green	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.67	
Intersection Signal Delay: 11.6	Intersection LOS: B

Intersection Capacity Utilization 78.9%
ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 800: Mountain Hwy & Underground Lot Access/Ross Rd





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	149	186	174	137	222	14	243	237	107	13	247	325
Future Volume (vph)	149	186	174	137	222	14	243	237	107	13	247	325
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	85.0		0.0	80.0		10.0	0.0		0.0	0.0		35.0
Storage Lanes	1		0	1		1	1		0	0		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1787	3154	0	1770	3447	0	1787	1745	0	0	1859	1599
Flt Permitted	0.565			0.391			0.297				0.953	
Satd. Flow (perm)	1010	3154	0	717	3447	0	536	1745	0	0	1774	1442
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		229			15			28				324
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		136.2			117.3			89.6			114.4	
Travel Time (s)		9.8			8.4			6.5			8.2	
Confl. Peds. (#/hr)	38		31	31		38	85		57	57		85
Confl. Bikes (#/hr)	6		4	4		6			7	7		
Peak Hour Factor	0.74	0.72	0.76	0.90	0.88	0.44	0.92	0.78	0.86	0.65	0.82	0.95
Heavy Vehicles (%)	1%	3%	5%	2%	2%	0%	1%	2%	2%	0%	2%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	201	487	0	152	284	0	264	428	0	0	321	342
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases	5	2		1	6		3	8			4	
Permitted Phases	2			6			8			4		4
Total Split (s)	13.0	32.0		13.0	32.0		12.0	45.0		33.0	33.0	33.0
Total Lost Time (s)	7.8	6.4		7.8	6.4		6.8	6.7			6.7	6.7
Act Effct Green (s)	29.1	23.7		28.1	23.2		39.0	39.1			23.7	23.7
Actuated g/C Ratio	0.32	0.26		0.31	0.26		0.43	0.43			0.26	0.26
v/c Ratio	0.52	0.49		0.51	0.32		0.75	0.55			0.69	0.55
Control Delay	26.5	16.3		26.5	26.8		35.4	20.8			37.6	7.5
Queue Delay	0.0	0.0		0.0	0.0		9.5	9.2			0.0	0.0
Total Delay	26.5	16.3		26.5	26.8		44.9	30.0			37.6	7.5
LOS	C	B		C	C		D	C			D	A
Approach Delay		19.3			26.7			35.7			22.1	
Approach LOS		B			C			D			C	
Queue Length 50th (m)	24.7	20.0		18.1	20.8		30.0	50.7			50.6	2.4
Queue Length 95th (m)	31.8	21.7		30.9	30.3		#67.9	66.2			69.8	23.8
Internal Link Dist (m)		112.2			93.3			65.6			90.4	
Turn Bay Length (m)	85.0			80.0								35.0
Base Capacity (vph)	385	1093		297	1021		351	797			518	650
Starvation Cap Reductn	0	0		0	0		61	330			0	0
Spillback Cap Reductn	0	0		0	0		0	0			0	0
Storage Cap Reductn	0	0		0	0		0	0			0	0
Reduced v/c Ratio	0.52	0.45		0.51	0.28		0.91	0.92			0.62	0.53

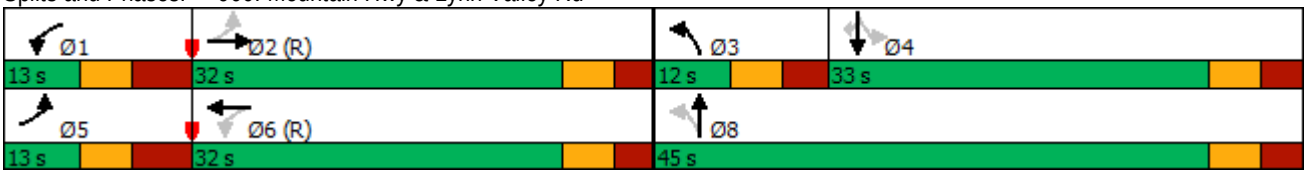
Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.75			
Intersection Signal Delay: 25.9		Intersection LOS: C	

Intersection Capacity Utilization 94.1% ICU Level of Service F

Analysis Period (min) 15

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 900: Mountain Hwy & Lynn Valley Rd

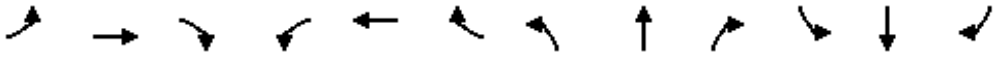


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	219	2	643	206	3	804
Future Volume (vph)	219	2	643	206	3	804
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0		20.0	0.0	
Storage Lanes	1	0		1	0	
Taper Length (m)	7.5				7.5	
Satd. Flow (prot)	1772	0	3574	1583	0	1881
Flt Permitted	0.953					0.998
Satd. Flow (perm)	1772	0	3574	1548	0	1878
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)	1			110		
Link Speed (k/h)	50		50			50
Link Distance (m)	137.9		84.8			204.2
Travel Time (s)	9.9		6.1			14.7
Confl. Peds. (#/hr)		2		3		
Confl. Bikes (#/hr)				3		
Peak Hour Factor	0.84	0.50	0.93	0.85	0.75	0.89
Heavy Vehicles (%)	2%	0%	1%	2%	0%	1%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	265	0	691	242	0	907
Turn Type	Prot		NA	Free	Perm	NA
Protected Phases	4		6			2
Permitted Phases				Free	2	
Total Split (s)	25.5		50.4		50.4	50.4
Total Lost Time (s)	5.2		5.4			5.4
Act Effct Green (s)	14.3		33.8	59.4		33.8
Actuated g/C Ratio	0.24		0.57	1.00		0.57
v/c Ratio	0.62		0.34	0.16		0.85
Control Delay	29.1		7.4	0.2		20.3
Queue Delay	0.0		0.0	0.0		0.0
Total Delay	29.1		7.4	0.2		20.3
LOS	C		A	A		C
Approach Delay	29.1		5.6			20.3
Approach LOS	C		A			C
Queue Length 50th (m)	26.9		19.2	0.0		74.7
Queue Length 95th (m)	52.6		34.5	0.0		150.7
Internal Link Dist (m)	113.9		60.8			180.2
Turn Bay Length (m)				20.0		
Base Capacity (vph)	646		2771	1548		1456
Starvation Cap Reductn	0		0	0		0
Spillback Cap Reductn	0		0	0		0
Storage Cap Reductn	0		0	0		0
Reduced v/c Ratio	0.41		0.25	0.16		0.62

Intersection Summary			
Area Type:	Other		
Cycle Length: 75.9			
Actuated Cycle Length: 59.4			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.85			
Intersection Signal Delay: 14.9		Intersection LOS: B	
Intersection Capacity Utilization 65.8%		ICU Level of Service C	

Analysis Period (min) 15

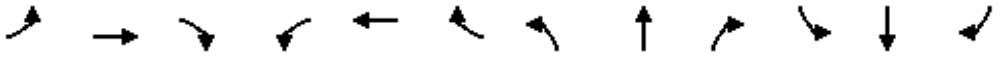
Splits and Phases: 100: Mountain Hwy & Arborlynn Dr



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	2	39	2	1	4	38	797	5	2	609	9
Future Volume (Veh/h)	5	2	39	2	1	4	38	797	5	2	609	9
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.62	0.25	0.81	0.25	1.00	0.50	0.71	0.90	0.62	0.25	0.95	0.56
Hourly flow rate (vph)	8	8	48	8	1	8	54	886	8	8	641	16
Pedestrians		4									1	
Lane Width (m)		3.6									3.6	
Walking Speed (m/s)		1.2									1.2	
Percent Blockage		0									0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1230	1671	653	1715	1675	448	661			894		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1230	1671	653	1715	1675	448	661			894		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	94	91	88	83	99	99	94			99		
cM capacity (veh/h)	125	90	413	46	90	563	934			767		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	64	17	497	451	665
Volume Left	8	8	54	0	8
Volume Right	48	8	0	8	16
cSH	238	86	934	1700	767
Volume to Capacity	0.27	0.20	0.06	0.27	0.01
Queue Length 95th (m)	8.4	5.5	1.5	0.0	0.3
Control Delay (s)	25.6	57.1	1.6	0.0	0.3
Lane LOS	D	F	A		A
Approach Delay (s)	25.6	57.1	0.9		0.3
Approach LOS	D	F			

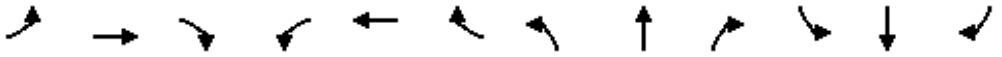
Intersection Summary				
Average Delay	2.1			
Intersection Capacity Utilization	57.9%	ICU Level of Service		B
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	5	8	3	2	14	2	794	7	14	620	9
Future Volume (Veh/h)	8	5	8	3	2	14	2	794	7	14	620	9
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.67	1.00	0.67	0.75	0.25	0.70	0.25	0.92	0.58	0.70	0.97	0.38
Hourly flow rate (vph)	12	5	12	4	8	20	8	863	12	20	639	24
Pedestrians		5			1			22			1	
Lane Width (m)		3.6			3.6			3.6			3.6	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		0			0			2			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)											258	
pX, platoon unblocked	0.84	0.84	0.84	0.84	0.84		0.84					
vC, conflicting volume	1168	1588	678	1614	1594	440	668			876		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1106	1605	522	1635	1612	440	510			876		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	90	94	97	92	91	96	99			97		
cM capacity (veh/h)	122	86	415	51	85	570	892			779		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	29	32	440	444	683
Volume Left	12	4	8	0	20
Volume Right	12	20	0	12	24
cSH	156	154	892	1700	779
Volume to Capacity	0.19	0.21	0.01	0.26	0.03
Queue Length 95th (m)	5.3	6.0	0.2	0.0	0.6
Control Delay (s)	33.2	34.5	0.3	0.0	0.7
Lane LOS	D	D	A		A
Approach Delay (s)	33.2	34.5	0.1		0.7
Approach LOS	D	D			

Intersection Summary				
Average Delay	1.6			
Intersection Capacity Utilization	59.6%	ICU Level of Service	B	
Analysis Period (min)	15			

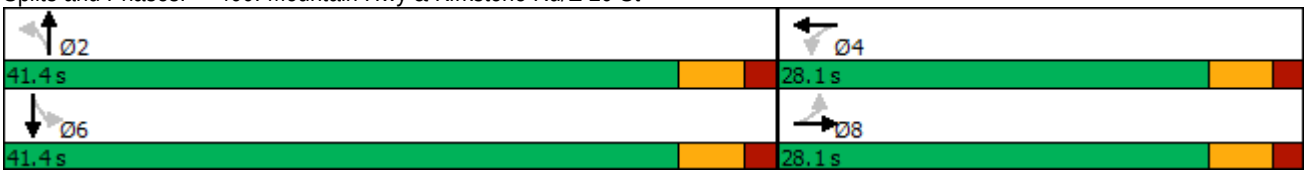


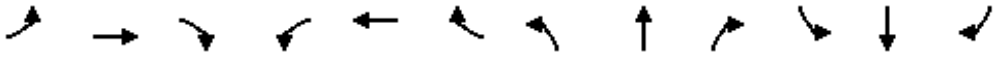
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	70	62	128	14	41	22	72	728	20	11	504	92
Future Volume (vph)	70	62	128	14	41	22	72	728	20	11	504	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	20.0		0.0	20.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1805	1658	0	1805	1783	0	0	3543	0	0	1814	0
Flt Permitted	0.701			0.590				0.832			0.972	
Satd. Flow (perm)	1327	1658	0	1109	1783	0	0	2961	0	0	1765	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		166			32			6			21	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		178.6			91.5			258.4			367.1	
Travel Time (s)		12.9			6.6			18.6			26.4	
Confl. Peds. (#/hr)	4		9	9		4	13		5	5		13
Confl. Bikes (#/hr)	4		2	2		4			2	2		
Peak Hour Factor	0.75	0.85	0.77	0.39	0.75	0.69	0.78	0.86	0.71	0.69	0.86	0.77
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	2%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	93	239	0	36	87	0	0	967	0	0	721	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		8			4			2			6	
Permitted Phases	8			4			2			6		
Total Split (s)	28.1	28.1		28.1	28.1		41.4	41.4		41.4	41.4	
Total Lost Time (s)	5.1	5.1		5.1	5.1			5.4			5.4	
Act Effct Green (s)	10.3	10.3		10.3	10.3			25.0			25.0	
Actuated g/C Ratio	0.22	0.22		0.22	0.22			0.54			0.54	
v/c Ratio	0.32	0.48		0.15	0.21			0.60			0.75	
Control Delay	19.3	9.8		17.4	12.4			9.6			14.6	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	19.3	9.8		17.4	12.4			9.6			14.6	
LOS	B	A		B	B			A			B	
Approach Delay		12.5			13.9			9.6			14.6	
Approach LOS		B			B			A			B	
Queue Length 50th (m)	5.9	4.5		2.2	3.3			22.2			34.6	
Queue Length 95th (m)	16.1	20.0		4.0	11.4			54.0			97.3	
Internal Link Dist (m)		154.6			67.5			234.4			343.1	
Turn Bay Length (m)	20.0			20.0								
Base Capacity (vph)	689	941		576	942			2410			1440	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.13	0.25		0.06	0.09			0.40			0.50	

Intersection Summary			
Area Type:	Other		
Cycle Length: 69.5			
Actuated Cycle Length: 46.3			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.75			
Intersection Signal Delay: 12.0		Intersection LOS: B	
Intersection Capacity Utilization 78.7%		ICU Level of Service D	

Analysis Period (min) 15

Splits and Phases: 400: Mountain Hwy & Kirkstone Rd/E 20 St

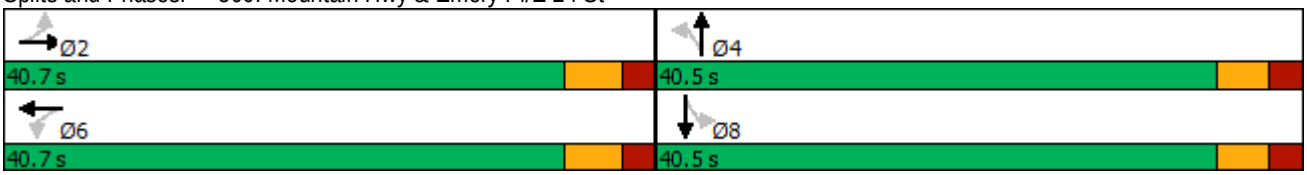


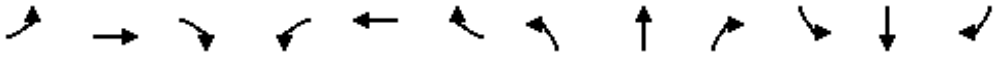


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	1	10	6	1	11	12	778	12	15	572	10
Future Volume (vph)	5	1	10	6	1	11	12	778	12	15	572	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Satd. Flow (prot)	0	1717	0	0	1675	0	0	3560	0	0	1853	0
Flt Permitted		0.861			0.914			0.942			0.966	
Satd. Flow (perm)	0	1496	0	0	1547	0	0	3356	0	0	1794	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		16			24			3			2	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		57.7			159.4			367.1			47.6	
Travel Time (s)		4.2			11.5			26.4			3.4	
Confl. Peds. (#/hr)	11		1	1		11	13		1	1		13
Confl. Bikes (#/hr)	3		4	4		3						
Peak Hour Factor	0.42	0.25	0.62	0.75	0.25	0.46	0.75	0.90	0.75	0.75	0.91	0.62
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	2%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	32	0	0	36	0	0	896	0	0	665	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6			4			8		
Total Split (s)	40.7	40.7		40.7	40.7		40.5	40.5		40.5	40.5	
Total Lost Time (s)		5.7			5.7			5.5			5.5	
Act Effct Green (s)		9.0			9.0			35.0			35.0	
Actuated g/C Ratio		0.21			0.21			0.83			0.83	
v/c Ratio		0.10			0.10			0.32			0.44	
Control Delay		12.6			10.9			4.2			6.2	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		12.6			10.9			4.2			6.2	
LOS		B			B			A			A	
Approach Delay		12.6			10.9			4.2			6.2	
Approach LOS		B			B			A			A	
Queue Length 50th (m)		0.8			0.6			0.0			0.0	
Queue Length 95th (m)		0.9			0.4			46.7			89.9	
Internal Link Dist (m)		33.7			135.4			343.1			23.6	
Turn Bay Length (m)												
Base Capacity (vph)		1279			1324			2865			1531	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.03			0.03			0.31			0.43	

Intersection Summary			
Area Type:	Other		
Cycle Length: 81.2			
Actuated Cycle Length: 42			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.44			
Intersection Signal Delay: 5.3		Intersection LOS: A	
Intersection Capacity Utilization 60.0%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 500: Mountain Hwy & Emery Pl/E 24 St





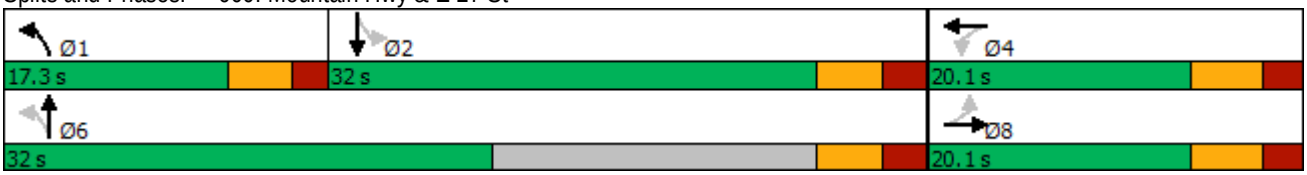
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	63	51	168	12	34	18	210	531	21	26	412	68
Future Volume (vph)	63	51	168	12	34	18	210	531	21	26	412	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	25.0		0.0	20.0		0.0	60.0		0.0	15.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1805	1546	0	1805	1725	0	1805	1865	0	1805	1763	0
Flt Permitted	0.710			0.451			0.223			0.407		
Satd. Flow (perm)	1262	1546	0	812	1725	0	420	1865	0	766	1763	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		183			28			6			16	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		78.2			107.4			271.8			213.2	
Travel Time (s)		5.6			7.7			19.6			15.4	
Confl. Peds. (#/hr)	37		38	38		37	19		12	12		19
Confl. Bikes (#/hr)	2		5	5		2			3	3		
Peak Hour Factor	0.70	0.72	0.84	0.60	0.78	0.64	0.80	0.82	0.71	0.81	0.94	0.81
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	2%	16%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	90	271	0	20	72	0	263	678	0	32	522	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		8			4		1	6			2	
Permitted Phases	8			4			6			2		
Total Split (s)	20.1	20.1		20.1	20.1		17.3	32.0		32.0	32.0	
Total Lost Time (s)	6.1	6.1		6.1	6.1		5.3	6.0		6.0	6.0	
Act Effct Green (s)	11.6	11.6		11.6	11.6		38.6	37.9		23.0	23.0	
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.62	0.61		0.37	0.37	
v/c Ratio	0.38	0.62		0.13	0.21		0.56	0.59		0.11	0.78	
Control Delay	27.6	15.3		23.8	16.4		10.7	10.7		16.4	28.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	27.6	15.3		23.8	16.4		10.7	10.7		16.4	28.6	
LOS	C	B		C	B		B	B		B	C	
Approach Delay		18.4			18.0			10.7			27.9	
Approach LOS		B			B			B			C	
Queue Length 50th (m)	9.3	8.9		2.0	4.3		10.3	37.0		2.3	48.0	
Queue Length 95th (m)	17.2	18.1		5.0	12.3		23.4	74.7		8.1	#119.2	
Internal Link Dist (m)		54.2			83.4			247.8			189.2	
Turn Bay Length (m)	25.0			20.0			60.0			15.0		
Base Capacity (vph)	319	528		205	458		537	1338		329	767	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.28	0.51		0.10	0.16		0.49	0.51		0.10	0.68	

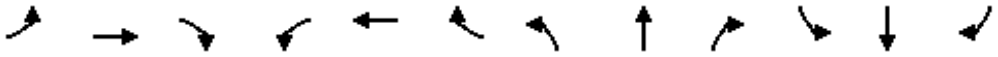
Intersection Summary			
Area Type:	Other		
Cycle Length: 69.4			
Actuated Cycle Length: 61.9			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.78			
Intersection Signal Delay: 17.3		Intersection LOS: B	
Intersection Capacity Utilization 76.5%		ICU Level of Service D	

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 600: Mountain Hwy & E 27 St

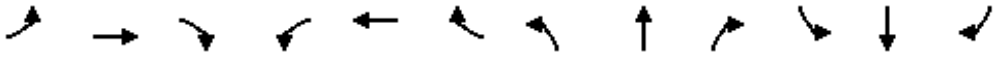




Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	5	2	1	5	5	3	603	8	8	517	4
Future Volume (Veh/h)	5	5	2	1	5	5	3	603	8	8	517	4
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	0.50	0.25	1.00	0.62	0.38	0.84	0.40	0.50	0.85	0.50
Hourly flow rate (vph)	5	5	4	4	5	8	8	718	20	16	608	8
Pedestrians		22			4			2			1	
Lane Width (m)		3.6			3.6			3.6			3.6	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		2			0			0			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)								213			107	
pX, platoon unblocked	0.82	0.82	0.90	0.82	0.82	0.77	0.90			0.77		
vC, conflicting volume	1422	1424	636	1400	1418	733	638			742		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1121	1124	536	1096	1117	503	539			515		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	97	99	97	97	98	99			98		
cM capacity (veh/h)	138	162	482	147	163	439	915			814		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	14	17	746	632
Volume Left	5	4	8	16
Volume Right	4	8	20	8
cSH	185	223	915	814
Volume to Capacity	0.08	0.08	0.01	0.02
Queue Length 95th (m)	1.9	2.0	0.2	0.5
Control Delay (s)	26.0	22.4	0.2	0.5
Lane LOS	D	C	A	A
Approach Delay (s)	26.0	22.4	0.2	0.5
Approach LOS	D	C		

Intersection Summary				
Average Delay	0.9			
Intersection Capacity Utilization	44.5%	ICU Level of Service	A	
Analysis Period (min)	15			

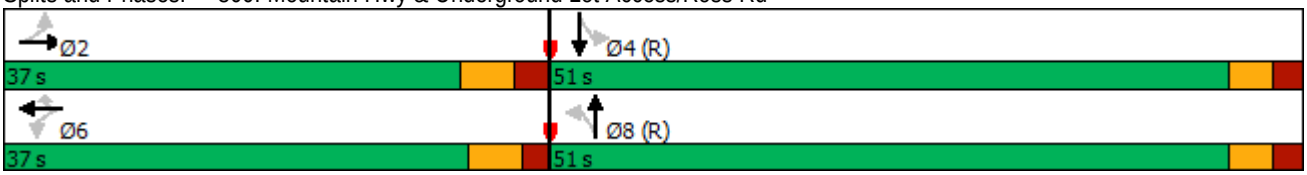


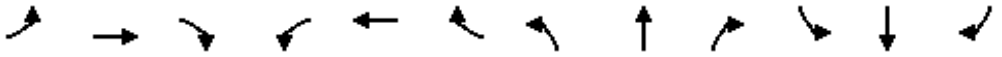
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	28	11	35	74	5	115	20	497	92	119	431	30
Future Volume (vph)	28	11	35	74	5	115	20	497	92	119	431	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		25.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		1	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	0	1716	0	0	1800	1615	0	3457	0	0	3425	0
Flt Permitted		0.869			0.665			0.920			0.685	
Satd. Flow (perm)	0	1496	0	0	1245	1517	0	3185	0	0	2367	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		67				153		43			10	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		43.6			343.9			41.7			89.6	
Travel Time (s)		3.1			24.8			3.0			6.5	
Confl. Peds. (#/hr)	42		7	7		42	30		10	10		30
Confl. Bikes (#/hr)	2		5	5		2			2	2		
Peak Hour Factor	0.70	0.55	0.52	0.83	0.62	0.75	0.83	0.86	0.72	0.89	0.83	0.75
Heavy Vehicles (%)	0%	0%	0%	1%	0%	0%	1%	1%	0%	0%	4%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	127	0	0	97	153	0	730	0	0	693	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		
Total Split (s)	37.0	37.0		37.0	37.0	37.0	51.0	51.0		51.0	51.0	
Total Lost Time (s)		6.1			5.6	5.6		5.2			5.2	
Act Effct Green (s)		17.3			17.8	17.8		59.4			59.4	
Actuated g/C Ratio		0.20			0.20	0.20		0.68			0.68	
v/c Ratio		0.37			0.39	0.36		0.34			0.43	
Control Delay		16.7			32.4	6.8		7.2			8.8	
Queue Delay		0.0			0.0	0.0		0.0			0.7	
Total Delay		16.7			32.4	6.8		7.2			9.5	
LOS		B			C	A		A			A	
Approach Delay		16.7			16.8			7.2			9.5	
Approach LOS		B			B			A			A	
Queue Length 50th (m)		8.3			13.8	0.0		28.6			31.3	
Queue Length 95th (m)		9.0			17.4	7.7		40.1			42.5	
Internal Link Dist (m)		19.6			319.9			17.7			65.6	
Turn Bay Length (m)						25.0						
Base Capacity (vph)		568			444	639		2165			1601	
Starvation Cap Reductn		0			0	0		0			530	
Spillback Cap Reductn		0			0	0		0			0	
Storage Cap Reductn		0			0	0		0			0	
Reduced v/c Ratio		0.22			0.22	0.24		0.34			0.65	

Intersection Summary			
Area Type:	Other		
Cycle Length: 88			
Actuated Cycle Length: 88			
Offset: 26 (30%), Referenced to phase 4:SBTL and 8:NBTL, Start of Green			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.43			
Intersection Signal Delay: 10.1		Intersection LOS: B	

Intersection Capacity Utilization 73.4% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 800: Mountain Hwy & Underground Lot Access/Ross Rd





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	242	307	212	115	204	3	191	296	162	2	261	179
Future Volume (vph)	242	307	212	115	204	3	191	296	162	2	261	179
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	85.0		0.0	80.0		10.0	0.0		0.0	0.0		35.0
Storage Lanes	1		0	1		1	1		0	0		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1805	3146	0	1770	3499	0	1805	1749	0	0	1861	1615
Flt Permitted	0.554			0.320			0.260				0.993	
Satd. Flow (perm)	989	3146	0	582	3499	0	468	1749	0	0	1850	1400
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		217			6			37				215
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		136.2			117.3			89.6			114.4	
Travel Time (s)		9.8			8.4			6.5			8.2	
Confl. Peds. (#/hr)	44		59	59		44	119		23	23		119
Confl. Bikes (#/hr)	2		3	3		2			5	5		
Peak Hour Factor	0.94	0.91	0.82	0.86	0.88	0.25	0.84	0.89	0.92	0.50	0.75	0.95
Heavy Vehicles (%)	0%	2%	6%	2%	2%	0%	0%	2%	1%	0%	2%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	257	596	0	134	244	0	227	509	0	0	352	188
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		Perm	NA	Perm
Protected Phases	5	2		1	6		3	8			4	
Permitted Phases	2			6			8			4		4
Total Split (s)	14.0	32.0		13.0	31.0		12.0	45.0		33.0	33.0	33.0
Total Lost Time (s)	7.8	6.1		7.8	6.1		6.8	6.7			6.7	6.7
Act Effct Green (s)	31.2	25.0		27.5	23.1		38.2	38.3			23.9	23.9
Actuated g/C Ratio	0.35	0.28		0.31	0.26		0.42	0.43			0.27	0.27
v/c Ratio	0.62	0.58		0.52	0.27		0.73	0.66			0.72	0.36
Control Delay	29.0	20.2		27.1	27.3		34.1	23.8			38.6	4.5
Queue Delay	0.0	0.0		0.0	0.0		0.0	26.6			0.0	0.0
Total Delay	29.0	20.2		27.1	27.3		34.1	50.5			38.6	4.5
LOS	C	C		C	C		C	D			D	A
Approach Delay		22.9			27.2			45.4			26.7	
Approach LOS		C			C			D			C	
Queue Length 50th (m)	31.6	30.3		15.3	17.9		26.1	66.1			56.1	0.0
Queue Length 95th (m)	#51.8	48.0		26.4	27.4		#45.5	99.5			67.6	11.3
Internal Link Dist (m)		112.2			93.3			65.6			90.4	
Turn Bay Length (m)	85.0			80.0								35.0
Base Capacity (vph)	415	1100		258	1010		312	793			540	561
Starvation Cap Reductn	0	0		0	0		0	295			0	0
Spillback Cap Reductn	0	0		0	0		0	0			0	0
Storage Cap Reductn	0	0		0	0		0	0			0	0
Reduced v/c Ratio	0.62	0.54		0.52	0.24		0.73	1.02			0.65	0.34

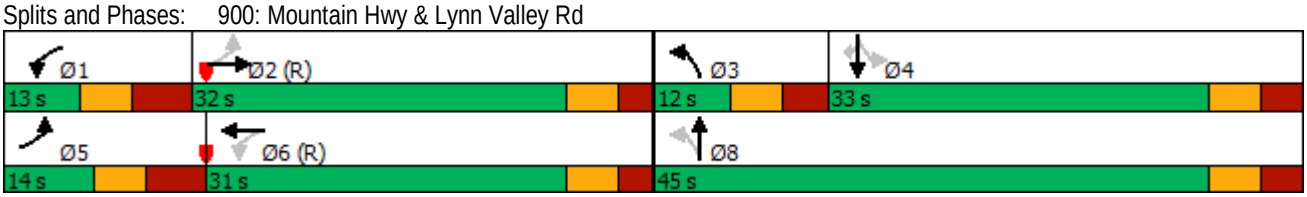
Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.73			
Intersection Signal Delay: 31.0		Intersection LOS: C	

Intersection Capacity Utilization 103.1% ICU Level of Service G

Analysis Period (min) 15

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 900: Mountain Hwy & Lynn Valley Rd



APPENDIX E: TRAFFIC SIGNAL WARRANT

TAC & BC MOTI WARRANTS

The intersection of Mountain Highway and E 18th Street has a half signal with standard red-yellow-green traffic signal for motor vehicles on Mountain Highway (the major road), a stop sign for motorists on E 18th Street (the minor road), and a pedestrian signal with actuation for pedestrians and/or bicyclists on the minor road. This intersection provides access to Eastview Elementary school west of Mountain Highway and is well used by school children crossing Mountain Highway. The District staff requested a traffic signal warrant analysis to be completed to determine if the intersection should be considered for upgrade to a full traffic signal.

The Transportation Association of Canada (TAC) warrant for a traffic control signal was conducted to examine the appropriateness of a full traffic signal. The TAC traffic signal warrant considers several factors to assess the potential need for a traffic signal at a subject intersection, including traffic volumes, pedestrian crossing volumes, laning, and local area demographics. To meet the warrant's requirements, the study intersection needs to meet a minimum threshold of 100 points and the side street traffic volumes need to be greater than 75 vehicles per hour. Under the existing conditions, the TAC traffic signal warrant analysis results in a score of 45 points for the current condition, falling short of the signal warrant threshold, due to low side street traffic volumes. Therefore, a traffic signal is not warranted at this location.

Additionally, the British Columbia Ministry of Transportation and Infrastructure (BC MoTI) traffic signal warrant was conducted to check the appropriateness of a full traffic signal. The BC MoTI traffic signal warrant investigates if the installation of a traffic signal will improve the overall safety and/or operation of the intersection. It consists of nine individual categorized warrants that assess the subject intersection site conditions, including traffic volumes, collision history, and proximity to other signals. **Table 1** summarizes the signal warrant results based on the existing conditions at Mountain Highway and E 18th Street intersection. Under the existing conditions, the BC MoTI traffic signal warrant analysis, none of the warrants are satisfied, falling short of the signal warrant thresholds. Therefore, a traffic signal is not warranted at this location.

Table 1. BC MoTI Traffic Signal Warrant Results Summary at Mountain Highway and E 18th Street Intersection

Warrant Category	Is The Warrant Met?
Warrant 1: Minimum Vehicular Volume	No
Warrant 2: Interruption of Continuous Traffic	No
Warrant 3: Progressive Movement	No
Warrant 4: Collision Experience	No
Warrant 5: System Warrant	No
Warrant 6: Combination Warrant	No
Warrant 7: Four Hour Volume Warrant	No
Warrant 8: Peak Hour Delay	No
Warrant 9: Peak Hour Volume	No

The next section shows detailed TAC and BC MoTI full signal warrant results.

District of North Vancouver - Traffic Signal Warrant Analysis

Main Street (name)	Mountain Hwy	Direction (EW or NS)	NS	Road Authority:	District of North Vancouver
Side Street (name)	E 18th St	Direction (EW or NS)	EW	City:	District of North Vancouver
Quadrant / Int #		Comments	Enter Comments about the analysis here.	Analysis Date:	2022 Dec 14, Wed
for Warrant Calculation Results, please hit 'Page Down'	CHECK SHEET			Count Date:	2022 Sep 20, Tue
				Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Mountain Hwy	NB		1			1		900	2
Mountain Hwy	SB				1			240	1
E 18th St	WB				1				
E 18th St	EB				1				
Are the E 18th St WB right turns significantly impeded by through movements? (y/n)							y		
Are the E 18th St EB right turns significantly impeded by through movements? (y/n)							n		

Demographics		
Elem. School/Mobility Challenged	(y/n)	y
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	y
Metro Area Population	(#)	91,790
Central Business District	(y/n)	n

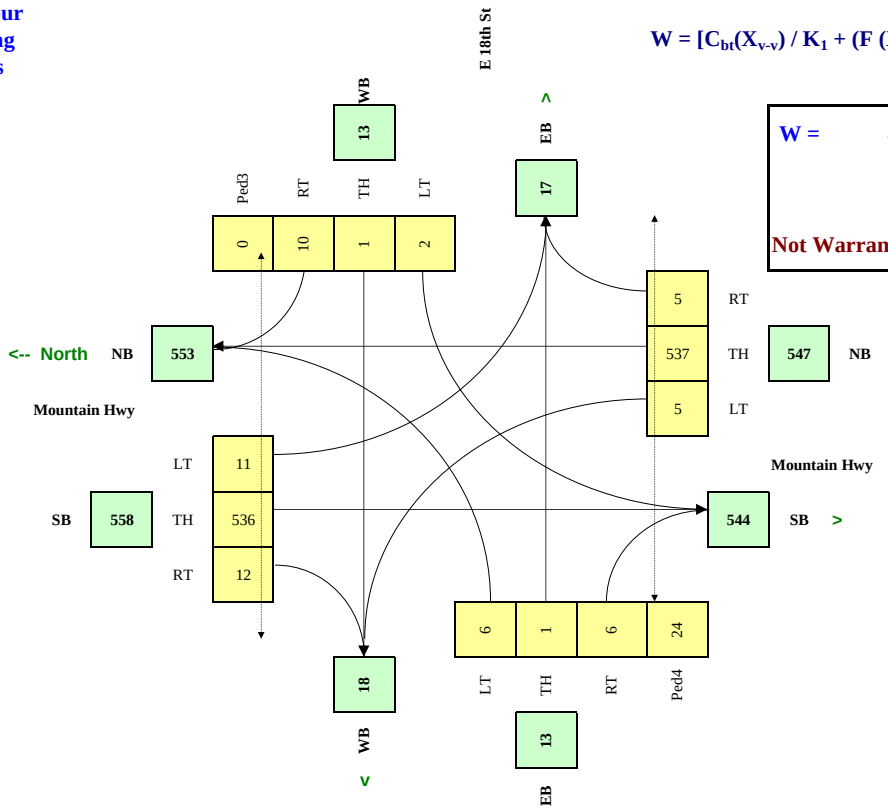
Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Mountain Hwy	NS	50	1.5%	y	0.0
E 18th St	EW		0.0%	n	

Set Peak Hours

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:45 - 8:45	22	382	10	16	655	33	6	4	15	11	4	10	10	7	1	78
8:45 - 9:45	1	403	3	10	558	9	5	0	9	11	0	6	7	4	0	27
11:00 - 12:00	0	429	3	9	392	0	0	0	5	2	0	0	7	1	0	3
12:00 - 13:00	3	458	2	4	435	8	0	1	5	3	1	6	4	2	0	1
16:15 - 17:15	2	755	8	15	608	9	2	3	13	7	0	9	6	3	1	10
17:15 - 18:15	3	794	3	12	567	10	1	0	10	3	0	6	10	5	0	26
Total (6-hour peak)	**31**	**3,221**	**29**	**66**	**3,215**	**69**	**14**	**8**	**57**	**37**	**5**	**37**	**44**	**22**	**2**	**145**
Average (6-hour peak)	**5**	**537**	**5**	**11**	**536**	**12**	**2**	**1**	**10**	**6**	**1**	**6**	**7**	**4**	**0**	**24**

Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$



W = 45 Veh 13 Ped 32

Not Warranted - Vs<75

RESET SHEET

MINISTRY OF TRANSPORTATION

Traffic Signal Warrant

Intersection Location:	Mountain Highway And E 18th Street		
District	District of North Vancouver	Traffic Count Data:	Sep 20, 2022
Completed by:	NH	Warrant Date:	December 14, 2022

Data Requirements

Adjacent Land Use (Circle one):	Urban	Rural
Population of Built Up Area:	91,790	
Signal Correctable Accident F .	0	

Major Street:	Mountain Highway	Minor Street:	E 18th Street
Number of Incoming Lanes on Each Approach:		Number of Incoming Lanes on Each Approach:	
NorthBound:	2	Eastbound:	1
Southbound:	1	Westbound:	1

Existing Traffic Volumes (by Approach)

7 hours traffic volume on an average day

Time Period	Southbound	Northbound	Total of Both
7am to 8am	473	295	768
8am to 9am	716	447	1163
9am to 10am	523	395	918
12pm to 1pm	447	463	910
3pm to 4pm	789	619	1408
4pm to 5pm	627	702	1329
5pm to 6pm	591	832	1423

Existing Traffic Volumes (by Approach)

7 hours traffic volume on an average day

Time Period	Eastbound	Westbound	Higher of Each
7am to 8am	3	9	9
8am to 9am	35	28	35
9am to 10am	4	12	12
12pm to 1pm	10	6	10
3pm to 4pm	32	14	32
4pm to 5pm	17	15	17
5pm to 6pm	12	12	12

Highest of 4 consecutive hours on an average day

Time Period	Southbound	Northbound	Total of Both
3pm to 4pm	789	619	1408
4pm to 5pm	627	702	1329
5pm to 6pm	591	832	1423
6pm to 7pm	504	606	1110

Highest of 4 consecutive hours on an average day

Time Period	Eastbound	Westbound	Higher of Each
3pm to 4pm	32	14	32
4pm to 5pm	17	15	17
5pm to 6pm	12	12	12
6pm to 7pm	3	11	11

Peak hour traffic volumes on an average day

Time Period	Southbound	Northbound	Total of Both
4:30pm to 5:30pm	643	803	1446

Peak hour traffic volumes on an average day

Time Period	Eastbound	Westbound	Higher of Each
4:30pm to 5:30pm	16	19	19

Major Route:	Yes	No	Existing Peak Hour Delay (veh-hr) ++ :		
Posted or 85th Percentile Speed (km/hr)*:	65 - 70		Eastbound	0.15	delay from Synchro (s): 33.2
Distance to Nearest Signal (m):	~240		Westbound	0.18	delay from Synchro (s): 34.5
Traffic Direction:	2-way	1-way	Major Route:	Yes	No

** Actual observed speed is higher than the poted speed limit.*

+ Growth factors for the major route were calculated by using historical AADT data, growth factors for the minor route were calculated by taking the average of the growth factors along both directions of the major route.

++ Peak hour delays were calculated using the Synchro software.

Questions which we do not have information on are left blank, and questions which are "Not Applicable" are crossed-out.

WARRANT NO.1 Minimum Vehicular Volume

Number of Incoming Lanes on Approach		Large Urban Areas (> 10,000 population)				Small Urban Areas (<10,000 population)	
		Posted or 85th Percentile Speed					
		=< 70 km/hr		> 70 km/hr			
		Peak 7 Hour Volume (vph)		Peak 7 Hour Volume (vph)		Peak 7 Hour Volume (vph)	
Major	Minor	Major	Minor	Major	Minor	Major	Minor
1	1	500	150	350	105	350	105
2 or more	1	600	150	420	105	420	105
2 or more	2 or more	600	200	420	140	420	140
1	2 or more	500	200	350	140	350	140

Existing Scenario to be Considered			
Number of Incoming Lanes on Approach		Minimum Volumes	
Major	Minor	Major	Minor
2 or more	1	600	150

Existing Traffic Volumes (by Approach)

7 hours traffic volume on an average day

Time Period	Total of Both Major Approaches	Higher than Minimum?
7am to 8am	768	Yes
8am to 9am	1163	Yes
9am to 10am	918	Yes
12pm to 1pm	910	Yes
3pm to 4pm	1408	Yes
4pm to 5pm	1329	Yes
5pm to 6pm	1423	Yes

Existing Traffic Volumes (by Approach)

7 hours traffic volume on an average day

Time Period	Higher of Each Minor Approaches	Higher than Minimum?
7am to 8am	9	No
8am to 9am	35	No
9am to 10am	12	No
12pm to 1pm	10	No
3pm to 4pm	32	No
4pm to 5pm	17	No
5pm to 6pm	12	No

Warrant Satisfied? Yes | No

Rationale: The minor approach does not equal nor exceed the minimum volume criteria during 7 hours of an average day. Therefore, the warrant is not satisfied.

WARRANT NO.2 Interruption of Continuous Traffic

Number of Incoming Lanes on Approach		Large Urban Areas (> 10,000 population)				Small Urban Areas (<10,000 population)	
		Posted or 85th Percentile Speed					
		=< 70 km/hr		> 70 km/hr			
		Peak 7 Hour Volume (vph)		Peak 7 Hour Volume (vph)		Peak 7 Hour Volume (vph)	
Major	Minor	Major	Minor	Major	Minor	Major	Minor
1	1	750	75	525	50	525	50
2 or more	1	900	75	630	50	630	50
2 or more	2 or more	900	100	630	70	630	70
1	2 or more	750	100	525	70	525	70

Existing Scenario to be Considered			
Number of Incoming Lanes on Approach		Minimum Volumes	
Major	Minor	Major	Minor
2 or more	1	900	75

Existing Traffic Volumes (by Approach)

7 hours traffic volume on an average day

Time Period	Total of Both Major Approaches	Higher than Minimum?
7am to 8am	768	No
8am to 9am	1163	Yes
9am to 10am	918	Yes
12pm to 1pm	910	Yes
3pm to 4pm	1408	Yes
4pm to 5pm	1329	Yes
5pm to 6pm	1423	Yes

Existing Traffic Volumes (by Approach)

7 hours traffic volume on an average day

Time Period	Higher of Each Minor Approaches	Higher than Minimum?
7am to 8am	9	No
8am to 9am	35	No
9am to 10am	12	No
12pm to 1pm	10	No
3pm to 4pm	32	No
4pm to 5pm	17	No
5pm to 6pm	12	No

Warrant Satisfied? Yes | No

Rationale: The minor approach does not equal nor exceed the minimum volume criteria during 7 hours of an average day. Therefore, the warrant is not satisfied.

WARRANT NO.3 Progressive Movement

1) Is the distance to the nearest signal greater than or equal to 300m? Yes **No**

~~One Way~~

~~Are the adjacent signals so far apart that they do not provide a necessary degree of vehicle platooning and speed control?~~ ~~Yes~~ ~~No~~

Two Way

Do the adjacent signals constitute a progressive system? **Yes** No

Are the adjacent signals so far apart that they do not provide a necessary degree of vehicle platooning and speed control? Yes **No**

Warrant Satisfied? Yes **No**

Rationale: The adjacent signals constitute a progressive system; however, the nearest (Kirkstone Rd) signal is at a distance less than 300m. Therefore, the warrant is not satisfied.

WARRANT NO.4 Accident Experience (based on ICBC Claims Data)

1) Have five or more reported accidents of types susceptible to correction by traffic signals occurred within a 12 month period, with each accident involving personal injury or damage exceeding $1000? Yes **No**

~~2) Have adequate trials of less restrictive remedies with satisfactory observance and enforcement failed to reduce the accident frequency?~~ ~~Yes~~ ~~No~~

3) Will the installation of a signal allow progressive traffic flow? **Yes** No

Warrant Satisfied? Yes **No**

Rationale: There were not five or more reported accidents of types susceptible to correction by traffic signals occurred within a 12 month period between 2016 and 2020. Therefore, the warrant is not satisfied.

WARRANT NO.5 System Warrant

1) Are both the major and minor streets "Major Routes"? Yes **No**

~~1.2) Does the total Peak Hour Volume over all approaches equal or exceed 1000 vph?~~ ~~Yes~~ ~~No~~

~~1.3) Are one or more of Warrants 1,2,6,7 and 9 satisfied using Projected 5 Year Volumes?~~ ~~Yes~~ ~~No~~

~~1.4) Does the Peak 5 Hour Weekend Volume equal or exceed 1000~~ ~~Yes~~ ~~No~~

Warrant Satisfied? Yes **No**

Rationale: Mountain Highway is the only major route. Therefore, the warrant is not satisfied.

WARRANT NO.6 Combination Warrant

1) Have other measures been tried which cause less delay and invonvenience to traffic than traffic signals?

Yes	No

Minimum Vehicular Volume

Number of Incoming Lanes on Approach		Large Urban Areas (> 10,000 population)				Small Urban Areas (<10,000 population)	
		Posted or 85th Percentile Speed					
		=< 70 km/hr		> 70 km/hr			
		Peak 7 Hour Volume (vph)		Peak 7 Hour Volume (vph)		Peak 7 Hour Volume (vph)	
Major	Minor	Major	Minor	Major	Minor	Major	Minor
1	1	500	150	350	105	350	105
2 or more	1	600	150	420	105	420	105
2 or more	2 or more	600	200	420	140	420	140
1	2 or more	500	200	350	140	350	140

Existing Scenario to be Considered			
Number of Incoming Lanes on Approach		Minimum Volumes	
Major	Minor	Major	Minor
2 or more	1	480	120

Existing Traffic Volumes (by Approach)

7 hours traffic volume on an average day

Time Period	Total of Both Major Approaches	Higher than Minimum?
7am to 8am	768	Yes
8am to 9am	1163	Yes
9am to 10am	918	Yes
12pm to 1pm	910	Yes
3pm to 4pm	1408	Yes
4pm to 5pm	1329	Yes
5pm to 6pm	1423	Yes

Existing Traffic Volumes (by Approach)

7 hours traffic volume on an average day

Time Period	Higher of Each Minor Approaches	Higher than Minimum?
7am to 8am	9	No
8am to 9am	35	No
9am to 10am	12	No
12pm to 1pm	10	No
3pm to 4pm	32	No
4pm to 5pm	17	No
5pm to 6pm	12	No

Interruption of Continuous Traffic

Number of Incoming Lanes on Approach		Large Urban Areas (> 10000 population)				Small Urban Areas	
		Posted or 85th Percentile Speed					
		=< 70 km/hr		> 70 km/hr			
		Peak 7 Hour Volume (vph)		Peak 7 Hour Volume (vph)		Peak 7 Hour Volume (vph)	
Major	Minor	Major	Minor	Major	Minor	Major	Minor
1	1	600	120	420	85	420	85
2 or more	1	720	120	500	85	500	85
2 or more	2 or more	720	160	500	110	500	110
1	2 or more	600	160	420	110	420	110

Existing Scenario to be Considered			
Number of Incoming Lanes		Minimum Volumes	
Major	Minor	Major	Minor
2 or more	1	576	96

Existing Traffic Volumes (by Approach)

7 hours traffic volume on an average day

Time Period	Total of Both Major Approaches	Higher than Minimum?
7am to 8am	768	Yes
8am to 9am	1163	Yes
9am to 10am	918	Yes
12pm to 1pm	910	Yes
3pm to 4pm	1408	Yes
4pm to 5pm	1329	Yes
5pm to 6pm	1423	Yes

Existing Traffic Volumes (by Approach)

7 hours traffic volume on an average day

Time Period	Higher of Each Minor Approaches	Higher than Minimum?
7am to 8am	9	No
8am to 9am	35	No
9am to 10am	12	No
12pm to 1pm	10	No
3pm to 4pm	32	No
4pm to 5pm	17	No
5pm to 6pm	12	No

Warrant Satisfied? Yes | No

Rationale: None of the the Minimum Vehicular Volume and Interruption of Continuous Traffic Warrants is satisfied to the extent of 80 percent or more of the stated values. Therefore, the warrant is not satisfied.

WARRANT NO.7 Four Hour Volumes

	Posted or 85th Percentile Speed	
	=< 70 km/hr	> 70 km/hr
Rural	Figure 1	Figure 2
Large Urban (>10,000 pop.)	Figure 1	Figure 2
Small Urban (<10,000 pop.)	Figure 2	Figure 2

Existing Scenario to be Considered	
Location Type	Figure
Large Urban (>10,000 pop.)	Figure 1

Highest of 4 consecutive hours on an average day

Time Period	Southbound	Northbound	Total of Both
3pm to 4pm	789	619	1408
4pm to 5pm	627	702	1329
5pm to 6pm	591	832	1423
6pm to 7pm	504	606	1110

Highest of 4 consecutive hours on an average day

Time Period	Eastbound	Westbound	Higher of Each
3pm to 4pm	32	14	32
4pm to 5pm	17	15	17
5pm to 6pm	12	12	12
6pm to 7pm	3	11	11

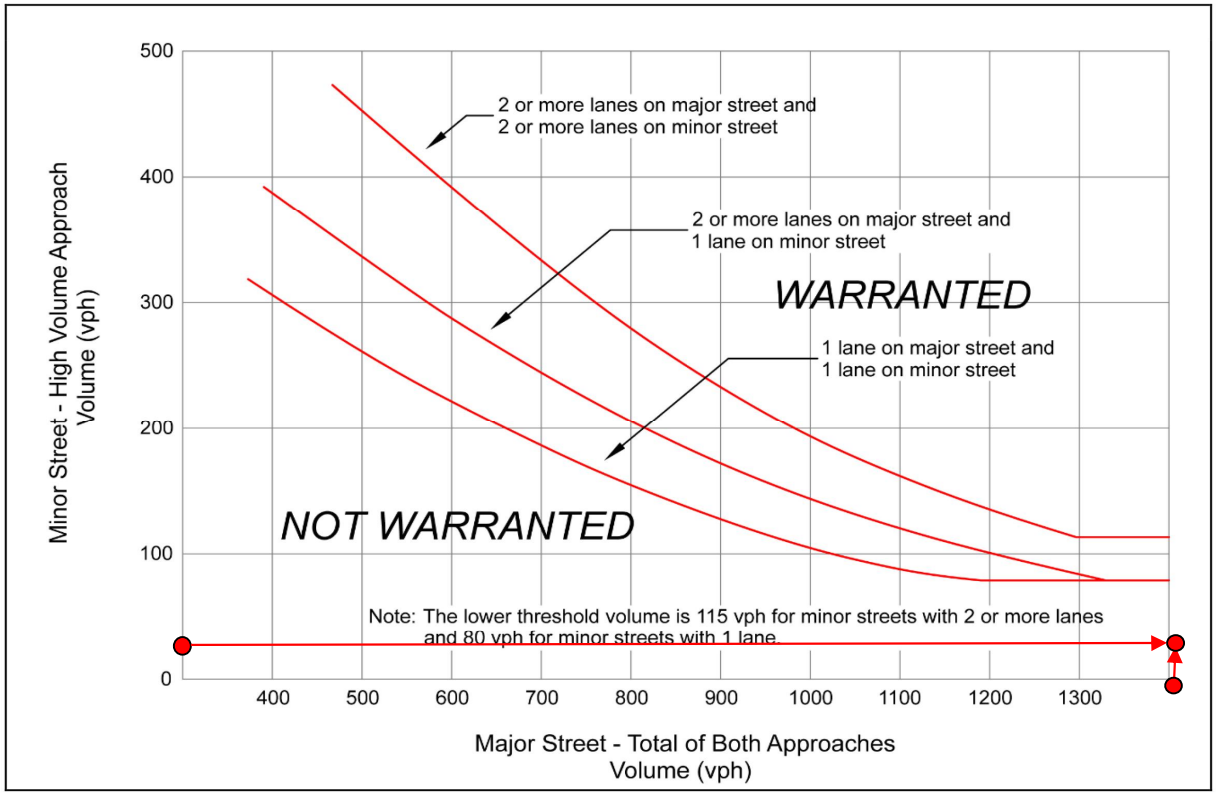


Figure 1. Warrant 7: Four-hour volumes 1.

Warrant Satisfied? Yes **No**

Rationale: None of the four consecutive hours exceed or equal to the appropriate threshold. Therefore, the warrant is not satisfied.

WARRANT NO.8 Peak Hour Delay

	Number of Minor Street Incoming Lanes on Approach with Highest Peak Hour Delay	
	1	2 or more
Minimum Peak Hour Delay (veh-hr)	4	5
Minimum Peak Hour Traffic (vph)	100	150

Number of Intersection Approaches	Minimum total Peak Hour Traffic for All Approaches Combined (vph)
3	650
4 or more	800

Existing Scenario to be Considered	
Minimum Peak Hour Delay (veh-hr)	4
Minimum Peak Hour Traffic (vph)	100
Minimum total Peak Hour Traffic for All Approaches Combined (vph)	800

Peak hour traffic volumes on an average day

Time Period	Southbound	Northbound	Total of Both
4:30pm to 5:30pm	643	803	1446

Peak hour traffic volumes on an average day

Time Period	Eastbound	Westbound	Higher of Each
4:30pm to 5:30pm	16	19	19

Existing Peak Hour Delay (veh-hr):

Eastbound:	0.15
Westbound:	0.18

Warrant Satisfied? Yes | No

Rationale: None of the minor street approaches experinces delay equals or exceeds the threshold. Also, None of the minor street approaches has volumes equals or exceeds the threshold. Therefore, the warrant is not satisfied.

WARRANT NO.9 Peak Hour Volumes

Location Type	Large Urban Areas (> 10000 population)	
	Posted or 85th Percentile Speed	
	=< 70 km/hr	> 70 km/hr
Rural	Figure 3	Figure 4
Large Urban (>10000 pop.)	Figure 3	Figure 4
Small Urban (<10000 pop.)	Figure 4	Figure 4

Existing Scenario to be Considered	
Location Type	Figure
Large Urban (>10000 pop.)	Figure 3

Peak hour traffic volumes on an average day

Time Period	Southbound	Northbound	Total of Both
4:30pm to 5:30pm	643	803	1446

Peak hour traffic volumes on an average day

Time Period	Eastbound	Westbound	Higher of Each
4:30pm to 5:30pm	16	19	19

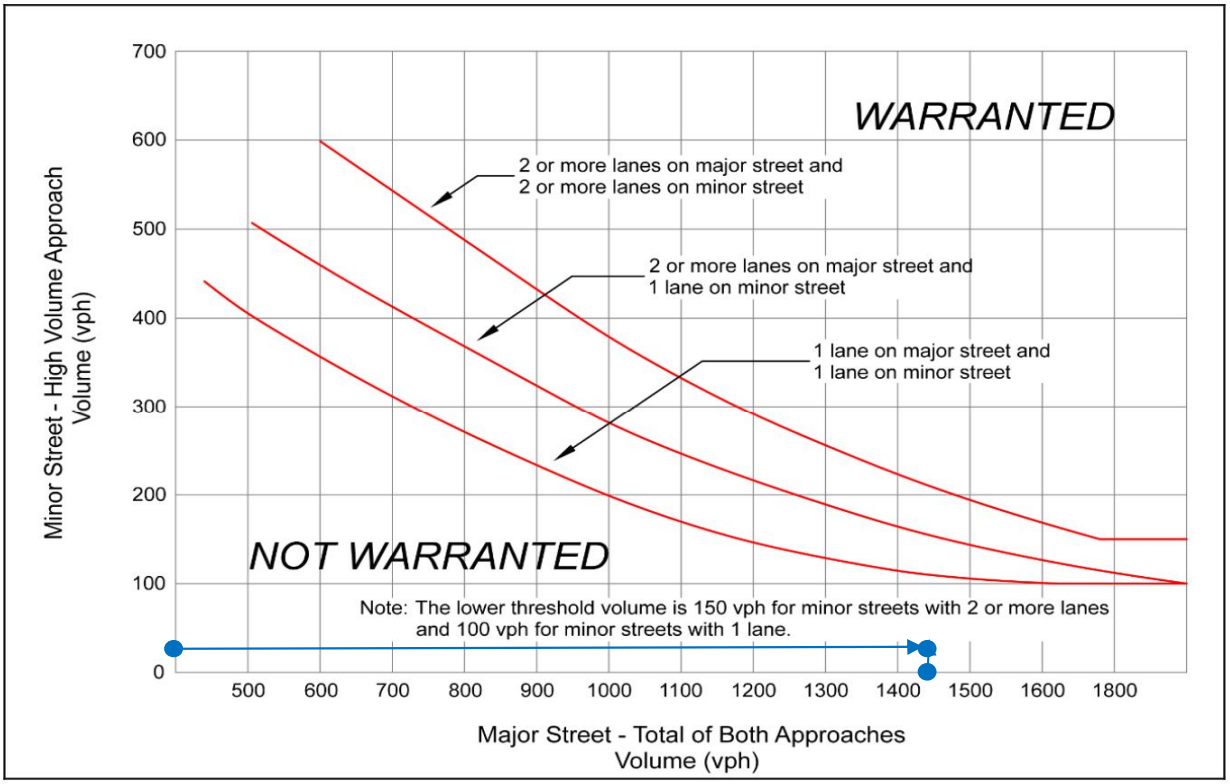


Figure 3. Warrant 9: Peak hour volumes 1.

Warrant Satisfied? Yes | No

Rationale: The minor approach peak hour volume does not exceed or equal to the required threshold. Therefore, the warrant is not satisfied.

Summary

Warrant		
1) Minimum Vehicular Volume	[ ] Satisfied	[x] Not Satisfied
2) Interruption of Continuous Traffic	[ ] Satisfied	[x] Not Satisfied
3) Progressive Movement	[ ] Satisfied	[x] Not Satisfied
4) Accident Experience	[ ] Satisfied	[x] Not Satisfied
5) System Warrant	[ ] Satisfied	[x] Not Satisfied
6) Combination Warrant	[ ] Satisfied	[x] Not Satisfied
7) Four Hour Volume	[ ] Satisfied	[x] Not Satisfied
8) Peak Hour Delay	[ ] Satisfied	[x] Not Satisfied
9) Peak Hour Volume	[ ] Satisfied	[x] Not Satisfied

Comments:

This intersection may not warrant the installation of a traffic signal.

APPENDIX F: MOTOR VEHICLE SPEED PROFILE

RADAR-BASED COUNT

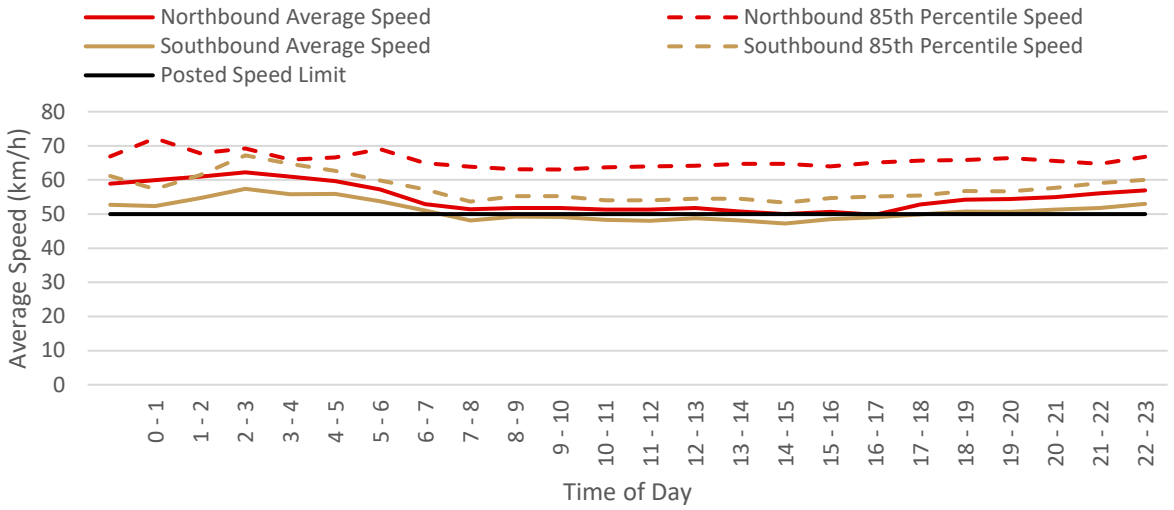


Figure 1. Average Weekly Speed (June 2022) At Block 2600

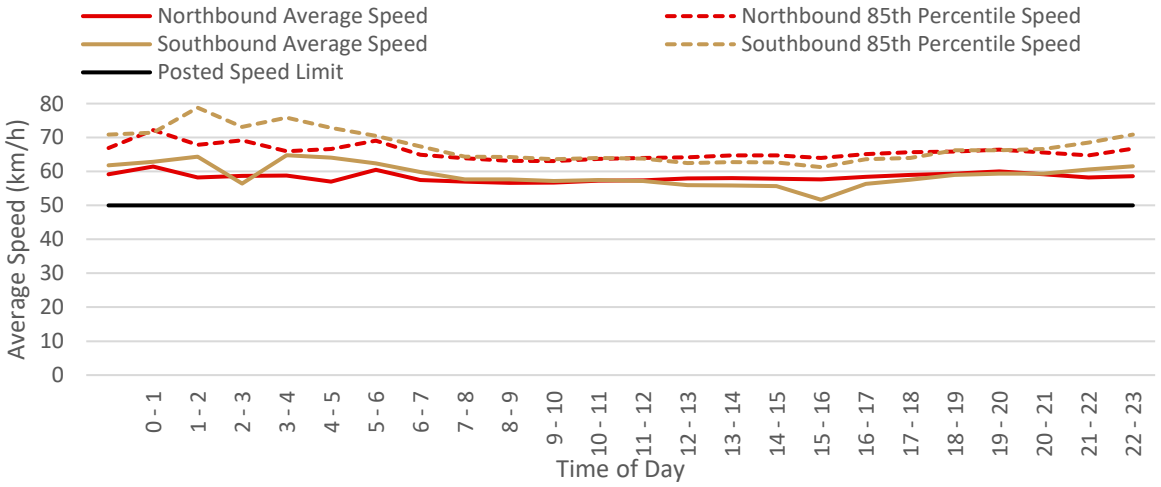


Figure 2. Average Weekly Speed (July 2022) At Block 1500

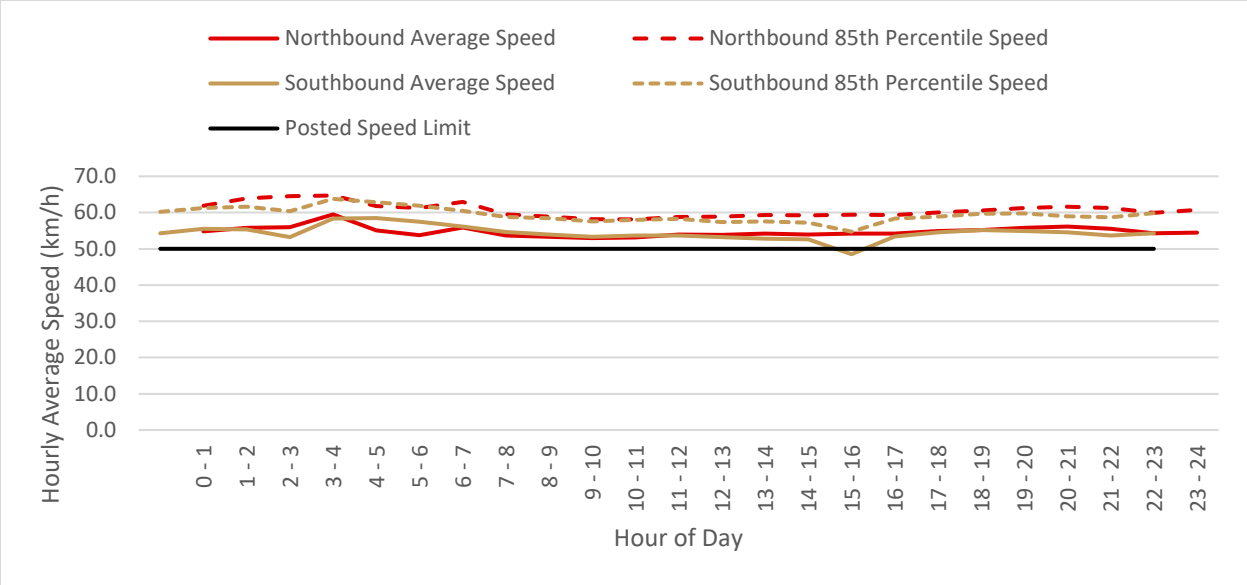


Figure 3. Average Weekly Speed (July 2022) At Block 1330

TOMTOM SPEED PROBE-BASED DATA

85th Percentile Speed Profile

Sep 2022

Scale

Lowest speed	50 kph	Highest speed

Northbound

Segment ID	Segment End Distance (m)	Intersection @	Speed Limit(kph)	00:00-05:00	05:00-06:00	06:00-07:00	07:00-08:00	08:00-09:00	09:00-10:00	10:00-11:00	11:00-12:00	12;00-13:00	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00	18:00-19:00	19:00-20:00	20:00-24:00	Average 85th Percentile Speed
1	26	Arborlynn Dr	50	60	58	57	55	52	52	53	53	53	53	54	53	54	54	56	56	58	55
2	46	-	50	61	60	60	57	53	53	55	54	55	56	56	55	56	57	58	57	59	57
3	72	-	50	63	61	61	59	55	55	56	56	57	57	58	57	58	58	60	60	61	58
4	342	-	50	64	62	62	61	58	58	58	58	59	59	59	59	60	60	62	61	62	60
5	495	E 14 St	50	60	58	59	59	57	56	57	57	57	56	57	57	57	57	59	58	58	58
6	623	E 15 St	50	65	66	66	66	64	63	63	65	64	64	64	65	65	65	66	65	66	65
7	677	-	50	66	66	65	65	63	62	63	63	63	62	63	63	63	63	65	65	65	64
8	737	E 16 St	50	68	68	66	67	64	64	64	65	65	65	64	65	65	64	67	66	67	66
9	852	E 17 St	50	70	68	66	67	63	64	63	64	64	65	64	64	64	64	67	66	67	65
10	968	E 18 St	50	74	72	71	71	67	69	69	70	70	70	67	69	68	69	71	70	72	70
11	1109	-	50	70	68	66	66	61	62	62	63	63	63	62	61	62	62	64	64	66	64
12	1223	E 20 St	50	68	67	64	62	55	57	58	58	58	58	56	54	55	55	59	59	63	59
13	1320	-	50	76	70	73	70	64	65	66	67	66	67	65	65	65	64	66	68	71	68
14	1483	Crayford Close	50	69	66	65	63	59	59	59	59	60	60	59	59	60	59	60	60	65	61
15	1591	E 24 St	50	72	66	67	66	61	62	64	63	63	64	64	62	63	62	64	65	67	64
16	1705	St Stephens Pl	50	69	64	61	60	55	56	57	58	57	58	56	56	56	56	57	58	62	59
17	1829	Whiteley Ct	50	70	65	65	63	58	59	59	60	60	60	59	58	58	57	59	60	64	61
18	1914	E 27 St	50	63	59	55	53	48	49	50	51	50	51	50	49	49	48	50	51	57	52
19	1954	-	50	64	62	57	53	49	50	51	52	52	53	52	50	50	50	52	53	57	53
20	2018	-	50	65	63	59	55	51	52	53	53	53	53	52	52	52	52	53	54	58	55
21	2127	Conifer St	50	63	59	55	54	50	51	52	52	52	52	51	50	50	50	52	53	56	53
22	2190	E 29 St	50	62	55	57	55	52	53	52	53	52	52	52	50	50	49	51	53	56	53
23	2238	-	50	53	49	47	44	40	43	42	43	42	42	41	39	40	38	41	44	48	43
24	2270	-	50	46	44	42	39	34	37	37	38	37	37	35	34	35	34	36	39	42	38
25	2289	Ross Rd	50	42	40	40	36	32	34	34	35	34	35	33	32	32	32	34	36	38	35
26	2325	Lynn Valley Rd	50	31	33	34	35	31	32	33	33	32	34	31	30	32	32	33	34	35	33
27	2336	-	50	43	43	42	41	38	39	39	39	38	39	39	38	39	39	39	41	42	40

85th Percentile Speed Profile

Sep 2022

Scale

Lowest speed	50 kph	Highest speed

Southbound

Segment ID	Segment End Distance (m)	Intersection @	Speed Limit(kph)	00:00-05:00	05:00-06:00	06:00-07:00	07:00-08:00	08:00-09:00	09:00-10:00	10:00-11:00	11:00-12:00	12;00-13:00	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00	18:00-19:00	19:00-20:00	20:00-24:00	Average 85th Percentile Speed
1	26	Arborlynn Dr	50	69	66	64	58	53	58	59	59	58	57	56	50	55	56	59	60	63	59
2	46	-	50	69	67	65	59	53	59	59	59	58	57	56	51	56	57	60	61	64	59
3	72	-	50	71	69	67	62	57	61	61	61	60	59	58	55	58	59	61	62	66	62
4	342	-	50	67	66	65	57	51	56	58	56	56	56	53	49	54	56	59	59	63	58
5	495	E 14 St	50	57	59	55	54	52	52	52	52	52	52	51	51	51	52	53	53	54	53
6	623	E 15 St	50	66	65	62	61	58	59	59	58	58	57	57	56	57	58	59	59	60	59
7	677	-	50	75	74	70	68	64	66	67	66	66	65	65	63	64	65	67	66	69	67
8	737	E 16 St	50	76	77	73	71	67	68	70	69	68	68	68	66	68	68	69	69	72	70
9	852	E 17 St	50	74	72	68	63	58	61	62	61	60	60	59	58	59	61	62	62	66	63
10	968	E 18 St	50	70	71	66	62	57	59	61	60	60	60	58	57	58	59	60	60	64	61
11	1109	-	50	70	70	66	62	56	60	61	61	60	60	57	56	58	58	60	60	65	61
12	1223	E 20 St	50	69	67	63	59	53	57	59	58	58	58	56	53	55	56	58	58	62	59
13	1320	-	50	72	68	64	57	49	55	56	56	55	56	51	46	50	50	53	54	63	56
14	1483	Crayford Close	50	63	62	58	54	50	53	54	54	53	54	52	49	51	51	53	53	57	54
15	1591	E 24 St	50	68	68	64	60	57	60	61	60	60	60	59	57	59	59	60	60	62	61
16	1705	St Stephens Pl	50	62	63	58	53	50	54	54	54	53	54	52	50	52	52	54	53	57	54
17	1829	Whiteley Ct	50	66	64	59	55	53	55	55	55	54	54	53	52	53	54	55	54	58	56
18	1914	E 27 St	50	64	63	59	54	51	53	53	53	51	52	52	50	52	52	52	53	57	54
19	1954	-	50	65	65	58	54	49	53	53	52	51	51	50	47	48	51	51	52	59	53
20	2018	-	50	66	67	60	53	49	52	53	52	51	51	49	45	48	50	51	53	60	54
21	2127	Conifer St	50	63	57	54	51	47	49	50	50	48	49	48	46	48	48	49	50	54	51
22	2190	E 29 St	50	61	59	56	53	51	51	51	51	50	50	51	49	50	50	50	51	54	52
23	2238	-	50	55	56	52	49	47	47	47	47	46	46	47	45	46	45	46	48	49	48
24	2270	-	50	48	48	46	41	37	40	38	37	38	38	38	36	37	36	38	40	42	40
25	2289	Ross Rd	50	44	44	42	38	33	36	35	34	34	34	34	32	34	33	34	36	38	36
26	2325	Lynn Valley Rd	50	40	41	40	36	33	35	35	34	34	33	33	32	33	33	34	35	38	35
27	2336	-	50	39	41	41	37	34	34	35	34	34	34	33	32	33	34	34	34	38	35

APPENDIX G: ROAD SAFETY

VULNERABLE ROAD USERS COLLISION SITES

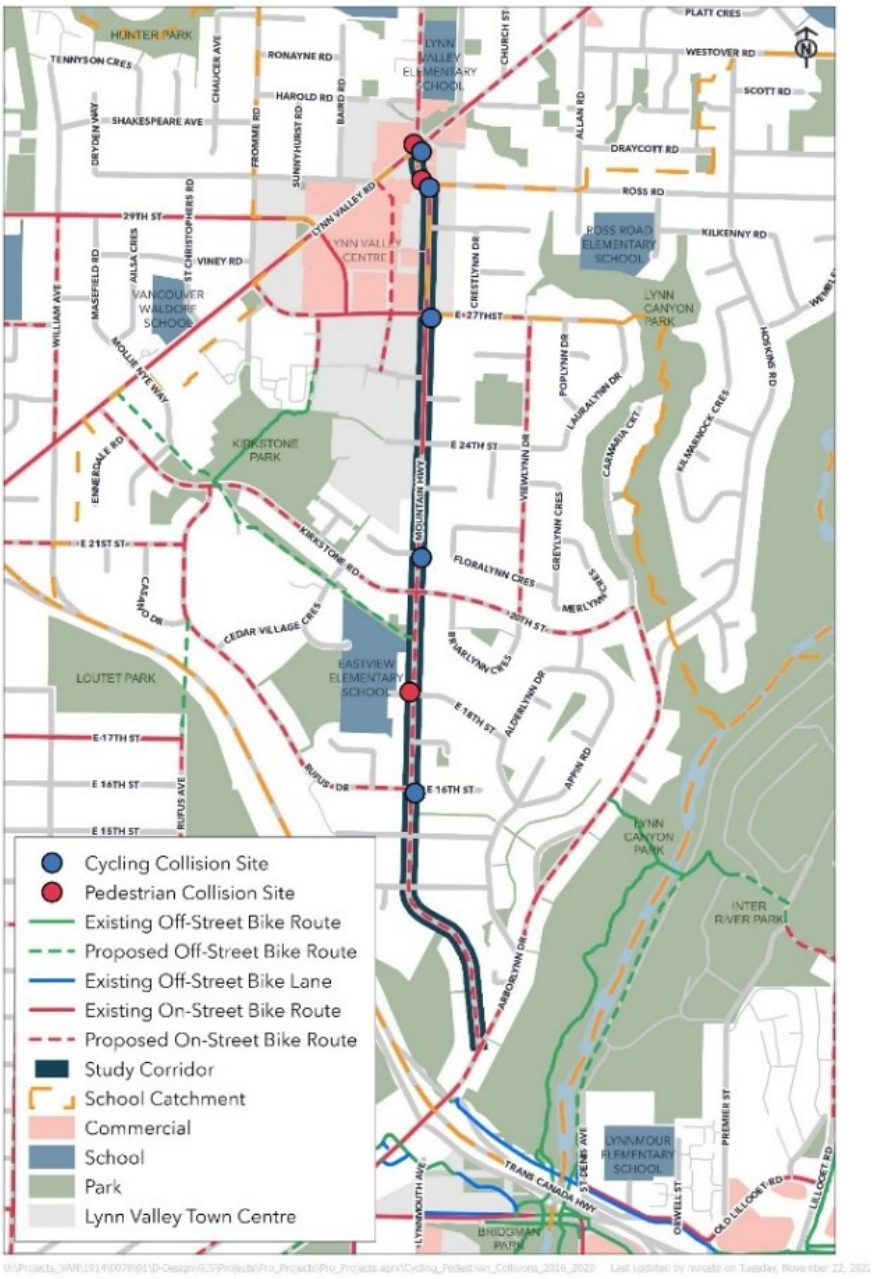


Figure 1. Cycling And Pedestrian Collision Sites (ICBC: 2016 – 2020)

TOP FIVE LOCATIONS COLLISION RATE

Figure through **Figure** show intersection collision diagrams for the classified collision types shown in the legend below. It should be noted that the functional area of the intersection used for this analysis generally extends both upstream and downstream from the physical intersection area and includes any auxiliary lanes and their associated channelization.

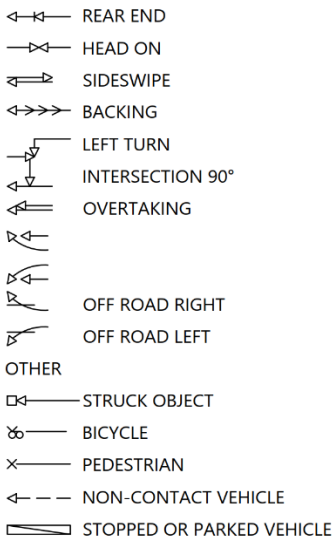


Figure 2 Legend of collision types shown

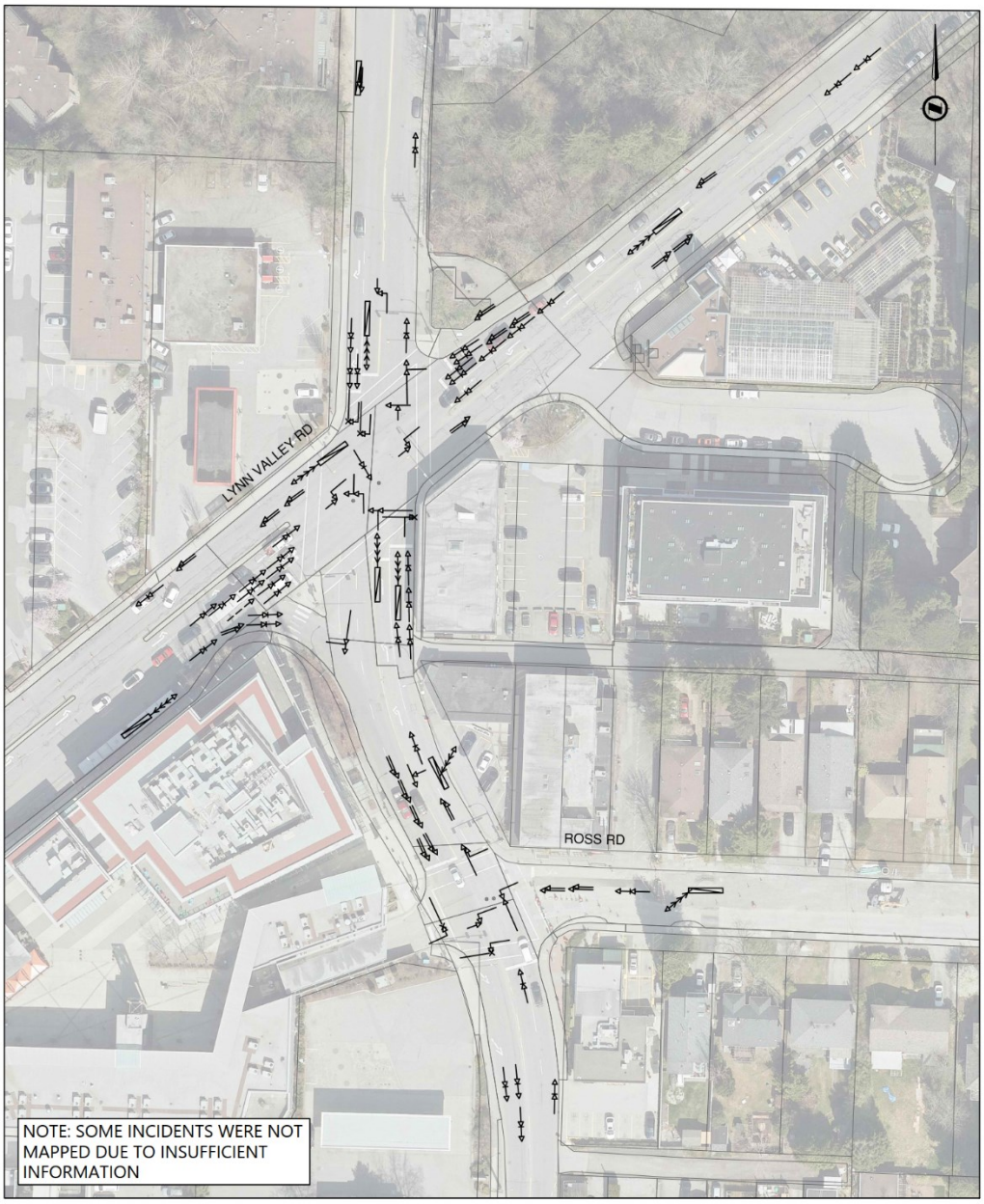


Figure 3. Collision Diagram at Mountain Highway Intersections at Lynn Valley Road and Ross Road

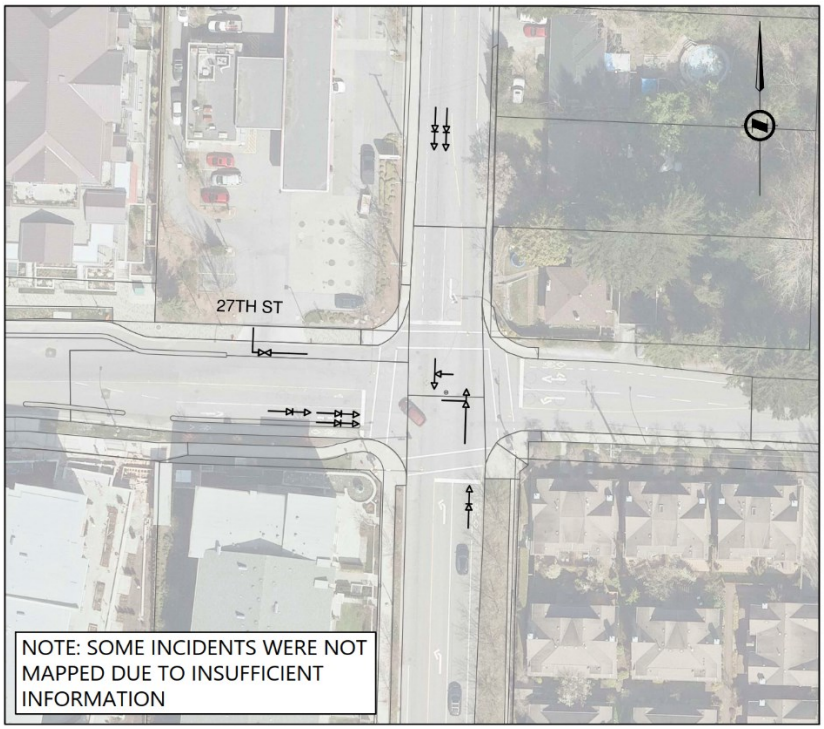


Figure 4. Collision Diagram at Mountain Highway and E 27th Street Intersection

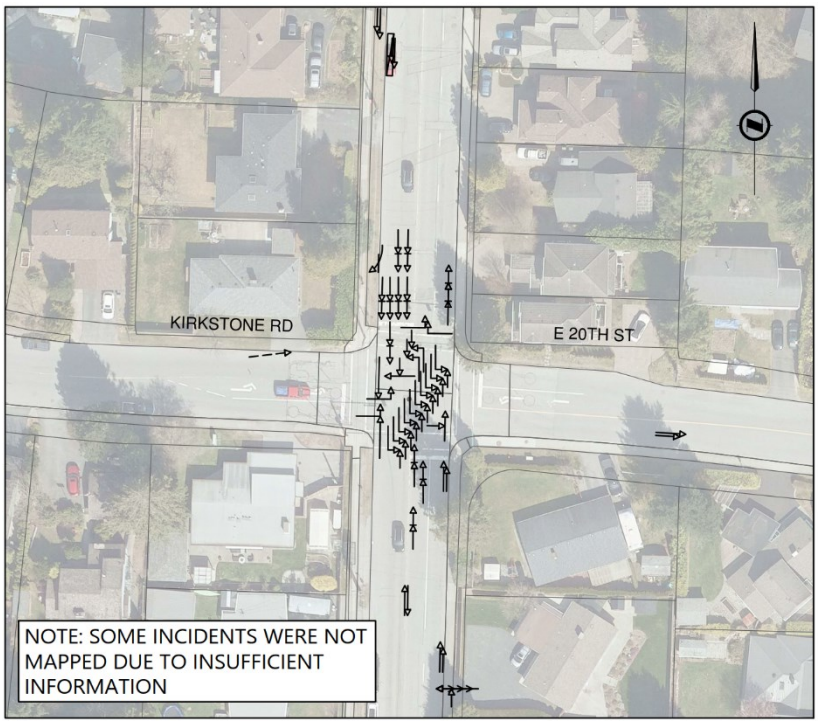


Figure 5. Collision Diagram at Mountain Highway and Kirkstone Road / E 20th Street Intersection

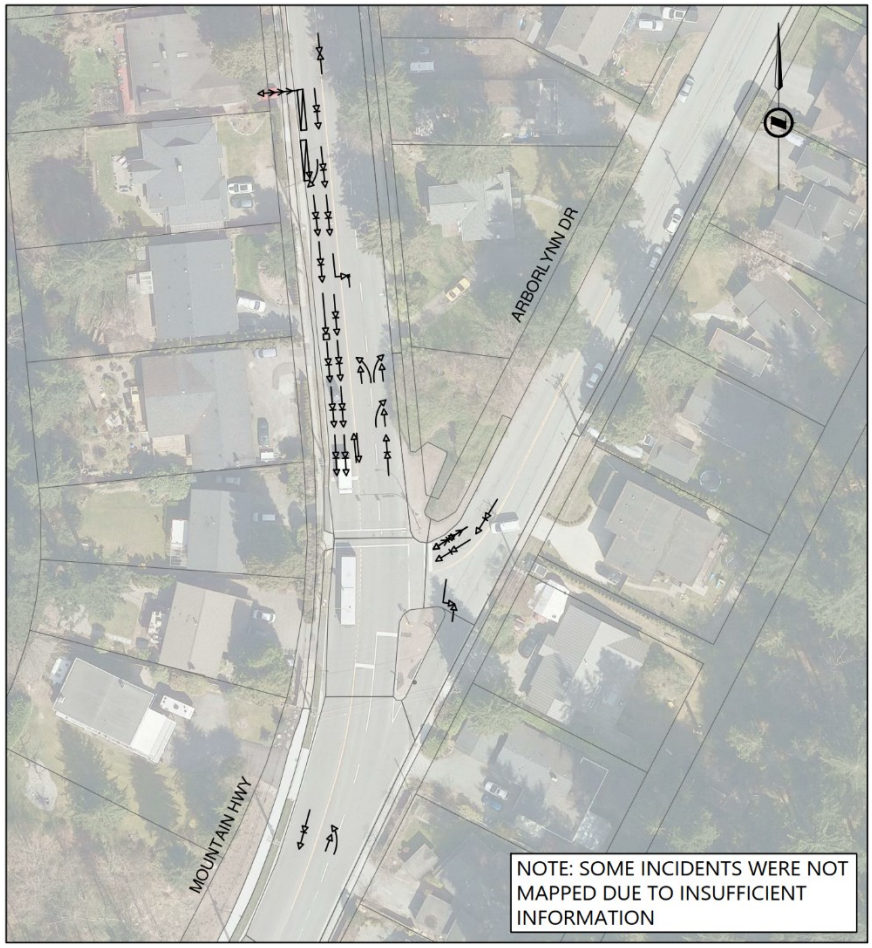


Figure 6. Collision Diagram at Mountain Highway and Arborlynn Drive Intersection