



*School Transportation and Safety Study*

# **Highlands Elementary School**

**District of North Vancouver and North  
Vancouver School District 44**





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Vancouver School District 44**

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# Executive Summary

The District of North Vancouver (DNV) and North Vancouver School District 44 (NVSD44) led a school transportation and safety study (study) for Highlands Elementary School, 3150 Colwood Drive. This report discusses existing conditions, issues, and mitigation for Highlands Elementary and is intended for NVSD44 and Highlands representatives for their review and input. A summary of recommendations is included in the table below.

| Term       | Recommendation  | Responsibility          |
|------------|---|-------------------------|
| On-going   | <ul style="list-style-type: none"> <li>• More walking and cycling incentive programs and resources</li> </ul>   | Highlands ES, PAC Group |
|            | <ul style="list-style-type: none"> <li>• Continued active parking management at school front</li> </ul>   | DNV                     |
|            | <ul style="list-style-type: none"> <li>• Work with residents to maintain clear sight distance by addressing overgrown vegetation</li> </ul>   | DNV                     |
|            | <ul style="list-style-type: none"> <li>• Reinforcement of legal use of school drop off/pick up sites</li> </ul>   | RCMP                    |
| Short Term | <ul style="list-style-type: none"> <li>• Expansion of School Zone designation and signage</li> </ul>  | NVSD44                  |
|            | <ul style="list-style-type: none"> <li>• Improved crossing at Ridgewood and Ayr</li> </ul>  | DNV                     |
| Long Term  | <ul style="list-style-type: none"> <li>• Queens Road corridor study</li> <li>• Highland Boulevard / Colwood Drive – Build-out at northeast corner, expand Colwood Drive sidewalk, new crossing at west approach</li> <li>• West Queens Road at Colwood Drive and Woodbine Drive – Short-term speed reduction and pedestrian priority</li> <li>• Future sidewalk on north side of Ridgewood Avenue and connection to Ayr Street stairs</li> <li>• Belmont Avenue to Fairmont Park – further feasibility and cost investigation into direct park access via stairs</li> </ul> | DNV                     |

This report is the result of extensive comments and feedback from the District of North Vancouver and comments from the school's PAC. Recommendations have been identified, refined, and prioritized which are cost-effective and reflect each school's safety priorities – as supported by both the data and stakeholders.

# 1 Introduction

## 1.1 About the Study

The School Transportation and Safety study for Highlands Elementary School (Highlands) was commissioned as a partnership between the District of North Vancouver (DNV) and the North Vancouver School District 44 (NVSD44) to improve transportation safety around schools.

This study focuses on feasible and cost-effective mitigation that DNV, NVSD44 and the school is capable of implementing in the short and long term. It is not simply a wish list, but rather an attainable plan to improve safety of the school-area environment.

## 1.2 Background

The objectives and focus of this school report closely align with DNV's transportation policies and Official Community Plan (OCP). All of these background policies strongly support increasing the proportion of trips made by walking, cycling, and transit. Increasing safety and the share of school trips made by foot and bicycle is therefore the basis of all the proposed recommendations.

This report aligns with and supports higher-level policy and site-specific report documentation:

- District of North Vancouver Official Community Plan (OCP, 2011)
- District of North Vancouver Transportation Plan (2012) – outlines background conditions for growth and associated transportation infrastructure to support.
- North Vancouver Bicycle Master Plan (2012) – identifies several routes fronting schools as future on-street bicycle facilities
- District of North Vancouver Pedestrian Master Plan (2009, Opus) – identifies walking and sidewalk priority scores for locations relevant to school report areas
- Parks and Open Space Strategic Plan (2012)
- Safe Routes to Schools reports (2010 and 2011)
- Edgemont Village Traffic and Parking Technical Report (2014, Urban Systems)
- Capilano Main No. 9 – Phase 2 Traffic Management Study (2015, MMM Group)
- Safe Routes Advocates report (from 2013 delegation to Council – from parents group)
- North Vancouver school travel survey (2013, NVSD44, DNV and City of North Vancouver)

## 1.3 Methodology

This process proceeded as follows:

1. School stakeholders meeting and school investigations – June 2015
2. Submission of Draft 1 report to DNV – July 2015
3. DNV review of Draft 1 and confirmation of changes for Draft 2 – July-September 2015
4. Submission of Draft 2 to DNV– September 2015

5. School stakeholder meeting to review recommendations– December 2015
6. Draft 2 report review by school stakeholders – December 2015-January 2016
7. Submission of Final Report – 2016

The investigations at Highlands included:

- Close liaison with DNV, NVSD44, and school representatives (administration and parents);
- Walkabouts around the school with school and DNV stakeholders to discuss and identify specific safety issues and areas of concern;
- Follow up site visits to perform traffic counts at key intersections and discuss specific areas of concern with stakeholders;
- Observation of student drop-off and parking survey at drop-off and pick-up times;
- Analysis of ICBC crash data and school catchment data to identify crash trends; and
- Record of transportation issues.

## **2 Existing Situation and Problem Description**

### **2.1 About Highlands Elementary School**

#### **2.1.1 Population**

Highlands has a population of approximately 430 students, based on 2013 – 2014 totals. Highlands has an incorporated music program from kindergarten to grade 7. There is an unaffiliated day care centre just east of the school building. Figure 1 shows the catchment area for Highlands.

#### **2.1.2 Transportation Network**

Highlands is located in a suburban residential community. The surrounding neighbourhood is predominantly residential but is also near the Edgemont Village commercial district and several hundred metres from the new Delbrook Community Recreation Centre, scheduled for completion in 2016. The local transportation network is typical of many areas within the DNV, with some sidewalks, varying street widths and some encroachment of vegetation.



**Figure 1: Highlands Elementary School Location and Catchment Area (in green)**

#### **2.1.2.1 Access Points**

The school's main entrance on Colwood Drive is located approximately 120m from Highland Boulevard, a minor north-south arterial; and West Queens Road, a major east-west arterial.

The accesses to school property are located:

- On Fairmont Road, north of the Fairmont Road and Thorncliffe Drive intersection, east of school;
- On Fairmont Road, west of Fairmont Road and Thorncliffe Drive intersection, south of the school; and
- At Colwood Drive and Fairmont Road intersection, south west corner of school property.

### 2.1.2.2 Road Hierarchy

Highlands is located on Colwood Drive, a collector road. Highlands’ property is also bordered by Fairmont Road, a local road designation. Other roads in the immediate vicinity and catchment area of Highlands are shown in Figure 2 and include Highland Boulevard and West Queens Road, two nearby arterials.

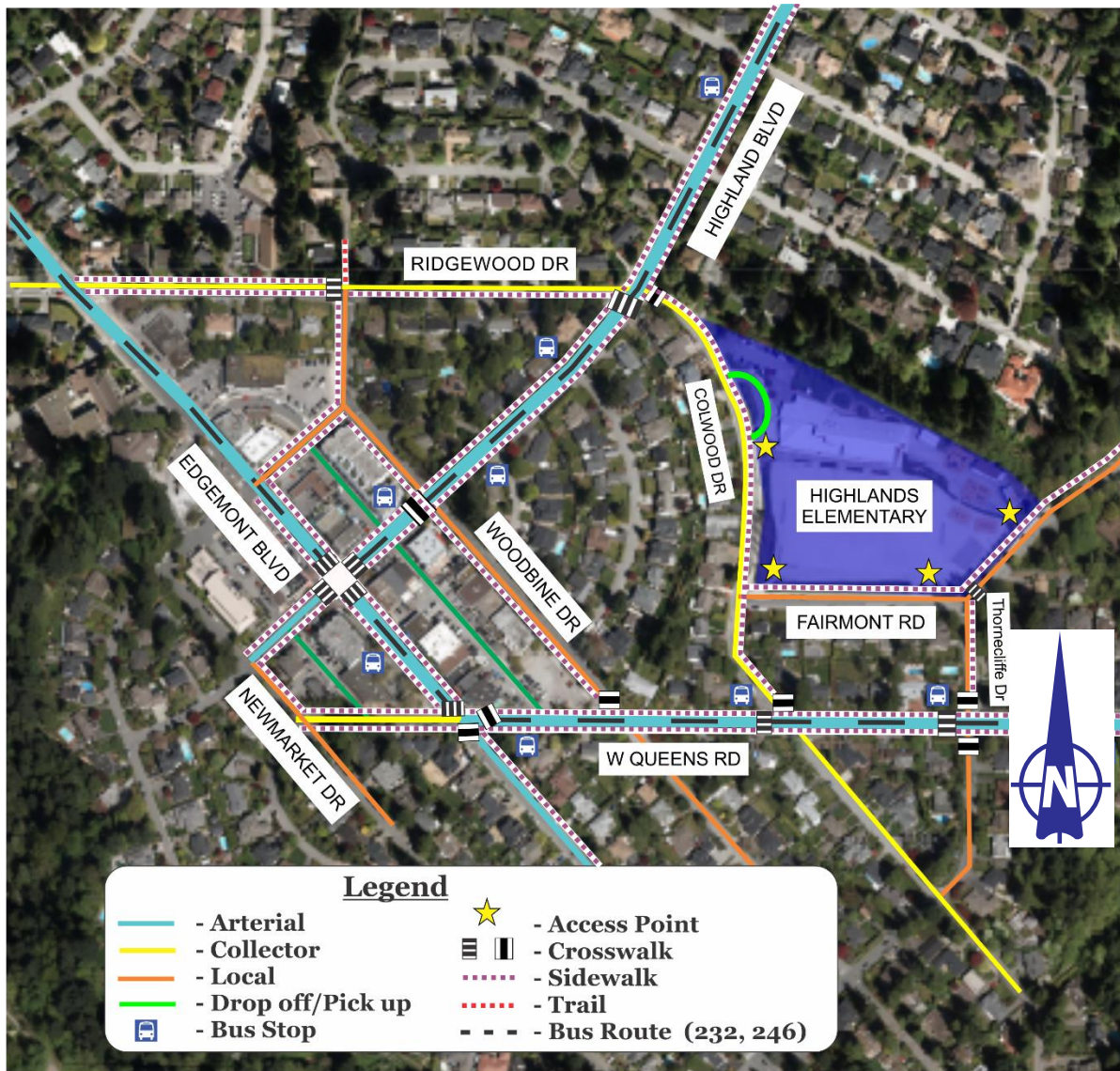


Figure 2: Highlands Elementary School - Existing Situation

### 2.1.3 Modes of Travel

A survey provided to parents was conducted by the DNV and NVSD44 in 2013. Of 114 responses from Highlands’ parents, 194 students’ travel behaviours were represented (45% of students). The survey found that 40% of survey respondents drove their children to school, the remaining 60% either cycled or walked to/from school. Parents note safety and/or distance from school as the main reasons they drive their children to school.



### **2.1.3.1 Transit**

There are two bus routes within Highlands' catchment. The bus routes that run through the catchment area are illustrated in Figure 2 and are as follows:

- Route 246 – travels along a long route from Lonsdale Quay up to Capilano Heights Region via Westview Drive and to Vancouver via Capilano Road and Lionsgate Bridge and reverse back from Vancouver to Lonsdale Quay. Eastbound direction is called either Highland or Lonsdale Quay and westbound direction is called one of the following; Highland, Marine and Capilano, Marine and Garden or Vancouver; and,
- Route 232 – travels eastbound and westbound on West Queens Road.

### **2.1.3.2 Cycling Facilities and Routes**

There are three large uncovered bicycle racks (space for 30 bicycles) located at the main entrance of Highlands, adjacent to the staff parking lot. During the June site visits, these racks were approximately  $\frac{3}{4}$  full. The DNV's Bicycle Master Plan shows both Highland Boulevard and West Queens Road as future bicycle routes. The nearby Mosquito Creek trail is uphill-only between Montroyal Boulevard and Del Rio Drive and bi-directional south of West Queens Road.

### **2.1.3.3 Pedestrian Facilities and Routes**

All streets surrounding the school have sidewalks. There are sidewalks on the east side of Colwood Drive in front of the school main entrance, north and south of the school property. Sidewalks are also located on the north side of Fairmont Road, along the school property, from Colwood Drive to the east beyond the property boundary. There is a large curb bulge with benches at the southwest corner of the school property, at the corner of Colwood Drive and Fairmont Road.

The available pedestrian routes are more inclusive on arterials and collectors, with some sidewalks provided on local streets (see Figure 2). The area shown in the figure contains approximately 9,900m of total roadway – or 19,800m of sidewalk demand area. With 5,600m of actual sidewalk, this provides roughly 28% of local area coverage. The crossing located on Queens Road West at Thorncliffe Road, Opus observed some motorists speeding and not yielding to wait for pedestrians.

The crossing at Colwood Drive and West Queens Road is a Special Crosswalk with overhead flashing amber lights and signs to alert motorists that a pedestrian is crossing at this location; however, Opus observed during the site visit that motorists sometimes do not yield to the pedestrians.

## **2.1.4 School Transportation Facilities and Layout**

### **2.1.4.1 Drop-off / Pick-Up**

Most drop off and pick up activity is along the east/north side of Colwood Drive, but the school also has a 1-way, recessed drop-off lane off Colwood Drive at the school's main entrance. It is accessed via left or right turn at the south entrance and left or right-turn exit via its north approach. The school closes this area off during PM dismissal times to deter the problems associated with the long-term and double-parking that was common before the closure.

### 2.1.4.2 Traffic Control

There is one signalized intersection within the immediate vicinity and two overhead flashing light crossings. The signalized intersection is at the Queens Road West and Edgemont Road intersection and the overhead flashing light crossings are at (1) crossing West Queens Road, west of Colwood Drive and (2) crossing Highland Boulevard, north of Belmont Avenue. All-way stop controlled intersections include: Highland Boulevard at Ridgewood Drive and Colwood Drive, Woodbine Drive at Highlands Boulevard and Edgemont Boulevard at Ridgewood Drive. The remaining intersections are two-way stop controlled where the minor road is stop controlled and the main/major road has the right of way.

### 2.1.5 Collision History

ICBC data shows a relatively small number of crashes reported within several blocks of the school between 2008 and 2013 as shown in Table 1. None of these reported crashes included pedestrians or cyclists as shown in Table 1. Further crash data for the larger area is in Appendix A; the greatest number of these were reported at major intersections along West Queens Road and Edgemont Boulevard.

**Table 1: Collision volume around school (ICBC) 2008-2013**

| Intersection   | # Crashes | Pedestrian Crashes (Yes/No) |
|--|-----------|-----------------------------|
| West Queens Road and Del Rio Drive                   | 16        | N                           |
| Ridgewood Drive / Highland Boulevard / Colwood Drive | 15        | N                           |
| West Queens Road and Colwood Drive                   | 15        | N                           |
| Sunset Boulevard / Paisley Road / Ridgewood Drive    | 14        | N                           |
| West Queens Road and Woodbine Drive                  | 12        | N                           |
| Woodbine Drive and Highland Boulevard                | 11        | N                           |

### 2.1.6 Existing Transportation Demand Management Programs

Highlands has implemented a seasonal (Fall and Spring) ‘Walk or Wheel’ (WOW) program to encourage cycling or walking to school. The WOW program encourages parents and students to walk or cycle to school one day a week in the Fall and Spring seasons. There are prizes and a competition to encourage walking, biking or “driving to five”. Driving to five is where parents drive to locations that are a five minute walk to the school. Drive to five is being promoted through parent newsletters and student information.

The parents’ group is active in the North Shore Safe Routes Advocates (SRA) group, an independent advocate group of parents who work for safer streets for children and pedestrians. Working with SRA, the school was recently chosen as a recipient location for a grant from the DNV to hire HASTE BC to implement their WOW Program. This involves a scan-pass for students that electronically tallies walking and biking ‘points’ for each team across the school. The data can be cross-referenced with addresses to determine where walkers, bikers and “drive to fivers” live.

Highlands is also a TravelSmart School, which provides parents, teachers, students, and staff with trip information to help make smarter choices about their travel habits.

## 2.2 Observed Conditions and Issues

On Monday June 1<sup>st</sup>, 2015 DNV led a walkabout with Highlands’ Principal, two Highlands’ PAC members, and two DNV representatives. NVSD44 staff were also invited. The walkabout started inside the school for initial background discussion, strategy session, and marking out the walkabout route. Following this initial meeting, Opus revisited the school on June 10<sup>th</sup>, 2015 to collect quantitative and qualitative data relating to school area conditions at arrival and dismissal times.

Observed findings from both sets of site visits were:


- Wide local streets;
- Non-compliant usage of school drop off zone; and,
- Higher traffic volumes on arterial streets with pedestrians crossing wider arterial roadways.

### 2.2.1 Network Observations

#### 2.2.1.1 Vegetation Encroachment

Vegetation and planted landscaping may grow into the public right of way and may obscure visibility of signage and reduce effective sidewalk width. Table 2 illustrates issues discussed.


**Table 2: Issues – Sight Obstructions**

| Issue   | Picture  |
|---|--|
| <p>Vegetation obstructing sightlines, sidewalks, signage visibility, etc.</p> |  |

**2.2.1.2 Pedestrian Facilities (Connectivity, Treatments, etc.)**

There is good sidewalk coverage along school-area roadways noted in the previous section. Crossings in the network may be challenging to cross on busier streets. Additionally, there are some faded pavement markings. Table 3 highlights some of the specific locations.

**Table 3: Issues - Pedestrian Facilities**

| Issue  | Picture  |
|--|--|
| <p>Faded pavement markings at Aye Avenue and Ridgewood Drive crosswalk.</p>  |    |
| <p>Crossing Queens Road West at Colwood Drive; while the crossing has overhead flashing lights, motorists were observed to sometimes not comply with the warning flashers.</p> |   |
| <p>Crossing Queens Road West at Thorncliffe Road. Pedestrian crossing is signed and is a zebra crosswalk; however, motorists sometimes do not yield to pedestrians.</p>        |  |

## 2.2.2 Signage and Markings

### 2.2.2.1 Signage

The majority of signage in the vicinity of the school was either related to parking restrictions near intersections or stop signs at minor approaches to Highland Boulevard, Queens Road West, Ridgewood Drive and Edgemont Boulevard. Most of Colwood Drive on the east side is signed 'No Parking 8AM-4PM School Days' and is intended for short-term drop off and pick up (vehicle stopping) only. The road is 8m wide and 'No Stopping' or 'No Parking' signs are posted along the west side.

More varied parking restriction signage is located along Highland Boulevard and Queens Road West, in accordance with their designations as bus routes. A complete signage and markings inventory of the school vicinity is shown with their respective condition notes in Appendix B.

Overall, the condition of signage was fair-to-good and signs were appropriately placed to convey their accompanying restrictions. Some observations include:

- Some signs obscured by vegetation;
- To reinforce no parking zones, 'No Parking' signage could be added at some intersections where routine parking was observed; and
- 'School Zone Crossing' signage could replace 'Pedestrian Crossing' signage as per the appropriate guidelines. School crossing signage is intended to make drivers aware that a school is close by and to use extra caution. Pedestrian crossing signage is intended to let drivers know to yield or stop for pedestrians.

### 2.2.2.2 Markings

Road markings were inconsistently applied throughout the study area. More information about road markings can be found in Appendix B.

The most significant findings with regards to pavement markings are:

- Some stop signs without stop lines; and
- Many painted stop lines are located within 1.0m of intersecting curb plane and do not provide setback for pedestrian desire paths where these exist (for locations without sidewalks).

### 2.2.3 Arrival and Dismissal Traffic Conditions

On June 10<sup>th</sup>, 2015 Opus survey staff were positioned at two intersections in the Highlands catchment area – Highland Boulevard at Colwood Drive/Ridgewood Drive and Queens Road West at Colwood Drive; to observe traffic conditions, verify volumes and to observe driver behaviour. Turning movement counts for vehicles, buses, bicycles, and pedestrians were recorded in those locations at arrival and dismissal times.

The weather was sunny and approximately 20 degrees Celsius during the AM and 24 degrees Celsius for PM dismissal. One surveyor was positioned at the front of the school at the Colwood Drive main entrance to observe traffic conditions, drop-off/pickup behaviours and perform a parking occupancy survey.

General arrival is between 08:30 and 08:50 for first bell at 08:50. Dismissal is at 14:50. Survey and observing staff were out recording from 08:15 to 09:15 and again from 14:15 to 15:15.

The design of the school's main entrance reduces potential for pedestrian-vehicle conflict. Sidewalks onto the property are directed around the north and south approaches of the recessed parking bay and students accessing the school from the passenger side of a parked car or the sidewalk on the east side of Colwood Drive do not need to cross a travel or parking lane.

The sidewalk on the east side of Colwood Drive is approximately 1.6m wide and could be wider to accommodate the peak pedestrian demand generated by the school. During both arrival and dismissal periods, platoons of up to 20 pedestrians were observed coming to and from the intersection of Highland Boulevard and Colwood Drive. Many walked in the east lane of Colwood Drive, which is a single-approach lane to the east leg of the intersection, and is approximately 5.5m wide.

Speeding was not verified with radar, but was a commonly-perceived problem in the study area – as based from the 2013 parents' report and verbally at the June 1st walk through. No obvious or perceived instances of speeding were recorded during the June 1st or June 4th site visits. Traffic volumes and summaries are provided in the next section.

### 2.2.3.1 Traffic Patterns and Volumes

This section describes each intersection and the volumes for the following intersection movements:

- EBL/EBT/EBR = Eastbound Left Turn/Through/Right Turn;
- WBL/WBT/WBR = Westbound Left Turn/Through/Right Turn;
- NBL/NBT/NBR = Northbound Left Turn/Through/Right Turn; and
- SBL/SBT/SBR = Southbound Left Turn/Through/Right Turn.

#### Highland Boulevard at Colwood Drive/Ridgewood Drive

The Highland Boulevard at Colwood Drive/Ridgewood Drive intersection is a skewed intersection with four legs and is stop controlled in all directions. Left, through and right movements are accommodated for all legs. This intersection experienced higher volumes of vehicles, pedestrians, and cyclists during the hours surrounding arrival and dismissal times. The following tables provide a summary of the number of vehicles, pedestrians and cyclists counted, respectively, in 15 minute intervals.

**Table 4 : Highland Boulevard at Colwood Drive/Ridgewood Drive – Vehicles**

| Time         | Movement   |           |           |           |           |           |          |            |          |           |            |            | Whole Intersection |
|--------------|------------|-----------|-----------|-----------|-----------|-----------|----------|------------|----------|-----------|------------|------------|--------------------|
|              | EBL        | EBT       | EBR       | WBL       | WBT       | WBR       | NBL      | NBT        | NBR      | SBL       | SBT        | SBR        |                    |
| 8:15         | 27         | 13        | 3         | 3         | 11        | 14        | 3        | 35         |          | 29        | 56         | 60         | 254                |
| 8:30         | 34         | 28        | 2         | 15        | 20        | 22        |          | 35         | 2        | 24        | 58         | 61         | 301                |
| 8:45         | 13         | 8         | 3         | 16        | 15        | 21        | 1        | 13         | 1        | 23        | 47         | 42         | 203                |
| 9:00         | 30         | 4         |           | 4         | 10        | 18        |          | 25         | 1        | 18        | 36         | 63         | 209                |
| <b>Total</b> | <b>104</b> | <b>53</b> | <b>8</b>  | <b>38</b> | <b>56</b> | <b>75</b> | <b>4</b> | <b>108</b> | <b>4</b> | <b>94</b> | <b>197</b> | <b>226</b> | <b>967</b>         |
| 14:30        | 35         | 7         | 4         | 2         | 2         | 14        |          | 40         | 1        | 23        | 29         | 28         | 185                |
| 14:45        | 60         | 14        | 1         | 1         | 3         | 17        | 1        | 40         | 3        | 24        | 28         | 31         | 223                |
| 15:00        | 33         | 13        | 3         | 17        | 20        | 20        | 1        | 35         | 3        | 18        | 44         | 32         | 239                |
| 15:15        | 48         | 9         | 3         | 4         | 10        | 22        |          | 39         | 2        | 20        | 51         | 33         | 241                |
| <b>Total</b> | <b>176</b> | <b>43</b> | <b>11</b> | <b>24</b> | <b>35</b> | <b>73</b> | <b>2</b> | <b>154</b> | <b>9</b> | <b>85</b> | <b>152</b> | <b>124</b> | <b>888</b>         |

**Table 5: Highland Boulevard at Colwood Drive/Ridgewood Drive - Pedestrians**

| Time         | Movement |           |          |           |           |           |          |          |          |           |          |          | Whole Intersection |
|--------------|----------|-----------|----------|-----------|-----------|-----------|----------|----------|----------|-----------|----------|----------|--------------------|
|              | EBL      | EBT       | EBR      | WBL       | WBT       | WBR       | NBL      | NBT      | NBR      | SBL       | SBT      | SBR      |                    |
| 8:15         |          | 16        | 1        |           |           |           |          |          |          | 4         |          |          | 21                 |
| 8:30         |          | 32        |          | 1         | 2         |           |          |          | 2        | 58        | 3        |          | 98                 |
| 8:45         |          | 6         |          | 1         | 11        | 5         | 5        |          | 3        | 12        | 1        | 1        | 45                 |
| 9:00         | 1        | 3         | 2        | 1         |           | 3         | 2        | 2        |          | 4         | 5        |          | 23                 |
| <b>Total</b> | <b>1</b> | <b>57</b> | <b>3</b> | <b>3</b>  | <b>13</b> | <b>8</b>  | <b>7</b> | <b>2</b> | <b>5</b> | <b>78</b> | <b>9</b> | <b>1</b> | <b>187</b>         |
| 14:30        |          |           |          | 1         |           |           |          | 1        |          | 2         |          | 1        | 5                  |
| 14:45        |          | 14        | 2        |           |           |           |          | 5        | 5        | 24        | 1        |          | 51                 |
| 15:00        |          | 7         |          | 23        | 7         | 43        |          |          |          |           |          |          | 80                 |
| 15:15        | 2        |           |          | 2         | 6         | 31        |          | 2        | 1        | 3         |          |          | 47                 |
| <b>Total</b> | <b>2</b> | <b>21</b> | <b>2</b> | <b>26</b> | <b>13</b> | <b>74</b> | <b>0</b> | <b>8</b> | <b>6</b> | <b>29</b> | <b>1</b> | <b>1</b> | <b>183</b>         |

**Table 6: Highland Boulevard at Colwood Drive/Ridgewood Drive - Cyclists**

| Time         | Movement |          |          |          |          |          |          |          |          |          |          |          | Whole Intersection |
|--------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|
|              | EBL      | EBT      | EBR      | WBL      | WBT      | WBR      | NBL      | NBT      | NBR      | SBL      | SBT      | SBR      |                    |
| 8:15         | 1        | 1        |          |          | 1        |          |          |          |          | 2        |          |          | 5                  |
| 8:30         |          | 4        |          |          |          |          |          |          | 1        | 6        | 2        |          | 13                 |
| 8:45         |          |          |          |          |          |          |          |          |          |          |          | 1        | 1                  |
| 9:00         | 1        | 2        |          |          |          |          |          |          |          |          |          | 2        | 5                  |
| <b>Total</b> | <b>2</b> | <b>7</b> | <b>0</b> | <b>0</b> | <b>1</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>1</b> | <b>8</b> | <b>2</b> | <b>3</b> | <b>24</b>          |
| 14:30        |          |          |          |          |          |          |          |          |          |          |          | 1        | 1                  |
| 14:45        |          |          |          |          |          |          |          |          |          | 1        |          | 1        | 2                  |
| 15:00        |          | 2        |          | 7        |          | 6        |          |          |          |          |          |          | 15                 |
| 15:15        | 2        |          |          |          |          | 1        |          |          |          |          | 1        | 1        | 5                  |
| <b>Total</b> | <b>2</b> | <b>2</b> | <b>0</b> | <b>7</b> | <b>0</b> | <b>7</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>1</b> | <b>1</b> | <b>3</b> | <b>23</b>          |

### Queens Road West at Colwood Drive

The Queens Road West at Colwood Drive intersection is a skewed four-legged intersection that is two way stop controlled for traffic on Colwood Drive. Left, through and right movements are accommodated for all legs. The intersection experienced higher volumes of vehicles, pedestrians, and cyclists during the hours surrounding arrival and dismissal times. The following tables provide a summary of the number of vehicles, pedestrians and cyclists counted, respectively, in 15 minute intervals.

Table 7 : Queens Road West at Colwood Drive - Vehicles

| Time         | Movement  |            |          |          |            |           |          |          |          |           |          |           | Whole Intersection |
|--------------|-----------|------------|----------|----------|------------|-----------|----------|----------|----------|-----------|----------|-----------|--------------------|
|              | EBL       | EBT        | EBR      | WBL      | WBT        | WBR       | NBL      | NBT      | NBR      | SBL       | SBT      | SBR       |                    |
| 8:15         | 1         | 81         | 1        | 1        | 106        | 15        | 2        | 1        |          | 21        |          | 6         | 235                |
| 8:30         | 10        | 90         | 1        | 3        | 98         | 20        | 3        |          | 1        | 19        |          | 7         | 252                |
| 8:45         | 8         | 108        | 3        |          | 138        | 23        | 2        | 1        |          | 28        |          | 13        | 324                |
| 9:00         | 3         | 85         |          |          | 104        | 19        |          |          |          | 23        |          | 6         | 240                |
| <b>Total</b> | <b>22</b> | <b>364</b> | <b>5</b> | <b>4</b> | <b>446</b> | <b>77</b> | <b>7</b> | <b>2</b> | <b>1</b> | <b>91</b> | <b>0</b> | <b>32</b> | <b>1051</b>        |
| 14:30        | 7         | 91         | 1        |          | 69         | 18        |          | 1        | 2        | 23        |          | 4         | 216                |
| 14:45        | 3         | 124        | 1        |          | 103        | 24        |          | 1        |          | 19        |          | 3         | 278                |
| 15:00        | 4         | 120        | 1        | 3        | 119        | 15        |          |          |          | 27        |          | 3         | 292                |
| 15:15        | 2         | 125        |          | 1        | 141        | 18        |          |          | 3        | 26        |          | 5         | 321                |
| <b>Total</b> | <b>16</b> | <b>460</b> | <b>3</b> | <b>4</b> | <b>432</b> | <b>75</b> | <b>0</b> | <b>2</b> | <b>5</b> | <b>95</b> | <b>0</b> | <b>15</b> | <b>1107</b>        |

Table 8 : Queens Road West at Colwood Drive - Pedestrians

| Time         | Movement  |          |          |          |           |          |          |           |          |          |          |           | Whole Intersection |
|--------------|-----------|----------|----------|----------|-----------|----------|----------|-----------|----------|----------|----------|-----------|--------------------|
|              | EBL       | EBT      | EBR      | WBL      | WBT       | WBR      | NBL      | NBT       | NBR      | SBL      | SBT      | SBR       |                    |
| 8:15         | 5         | 4        | 2        |          | 1         | 2        |          | 3         |          |          |          |           | 17                 |
| 8:30         | 13        |          |          |          | 9         |          |          | 13        |          |          |          |           | 35                 |
| 8:45         | 6         | 2        |          |          | 2         |          |          | 3         |          | 2        | 2        | 7         | 24                 |
| 9:00         |           | 1        |          |          | 4         |          | 2        |           |          |          | 2        | 2         | 11                 |
| <b>Total</b> | <b>24</b> | <b>7</b> | <b>2</b> | <b>0</b> | <b>16</b> | <b>2</b> | <b>2</b> | <b>19</b> | <b>0</b> | <b>2</b> | <b>4</b> | <b>9</b>  | <b>87</b>          |
| 14:30        | 1         | 2        |          |          |           |          |          | 3         |          |          |          | 1         | 7                  |
| 14:45        | 8         |          |          |          | 4         | 2        |          | 4         |          |          |          | 1         | 19                 |
| 15:00        |           | 1        |          |          | 1         |          |          | 1         |          | 1        | 2        | 25        | 31                 |
| 15:15        |           | 2        |          |          |           |          |          |           |          |          | 5        | 13        | 20                 |
| <b>Total</b> | <b>9</b>  | <b>5</b> | <b>0</b> | <b>0</b> | <b>5</b>  | <b>2</b> | <b>0</b> | <b>8</b>  | <b>0</b> | <b>1</b> | <b>7</b> | <b>40</b> | <b>77</b>          |

Table 9 : Queens Road West at Colwood Drive - Cyclists

| Time         | Movement |          |          |          |           |          |          |          |          |          |          |          | Whole Intersection |
|--------------|----------|----------|----------|----------|-----------|----------|----------|----------|----------|----------|----------|----------|--------------------|
|              | EBL      | EBT      | EBR      | WBL      | WBT       | WBR      | NBL      | NBT      | NBR      | SBL      | SBT      | SBR      |                    |
| 8:15         |          |          |          |          | 6         |          |          |          |          |          |          | 1        | 7                  |
| 8:30         | 1        |          |          |          | 12        | 1        |          |          |          |          |          |          | 14                 |
| 8:45         |          |          |          |          | 3         | 1        |          |          |          |          |          | 1        | 5                  |
| 9:00         |          | 3        | 1        |          |           |          | 1        |          |          |          |          |          | 5                  |
| <b>Total</b> | <b>1</b> | <b>3</b> | <b>1</b> | <b>0</b> | <b>21</b> | <b>2</b> | <b>1</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>2</b> | <b>31</b>          |
| 14:30        |          |          |          |          | 3         |          |          |          |          |          |          |          | 3                  |
| 14:45        |          | 3        |          |          | 1         |          |          |          |          |          | 2        | 1        | 7                  |
| 15:00        |          | 2        | 1        |          | 1         |          |          |          |          | 6        |          |          | 10                 |
| 15:15        |          |          |          |          |           |          |          |          |          |          |          |          | 0                  |
| <b>Total</b> | <b>0</b> | <b>5</b> | <b>1</b> | <b>0</b> | <b>5</b>  | <b>0</b> | <b>0</b> | <b>0</b> | <b>0</b> | <b>6</b> | <b>2</b> | <b>1</b> | <b>20</b>          |

## 2.2.4 Drop-Off/Pick-Up Observations

On Thursday, June 10<sup>th</sup>, 2015 Opus went to Highlands to perform a parking occupancy survey and to observe drop-off and pick-up behaviours. On the whole, arrival and dismissal times saw different parking and driving behaviour from parents; mostly involving non-compliant/parked vehicles along much of the drop off zone for short-term parking. Weather conditions were sunny with temperatures between 22 and 24 degrees Celsius.



### 2.2.4.1 Drop-Off/Arrival

Parents started parking to drop off their children by 8:15 am. By 8:35 am all parking available on the east side of Colwood Drive, north of Fairmont Road, was taken by parents parked to drop off students at the school. Many of these parents remained for longer than 20 minutes. The east side of Colwood Drive from Fairmont Road to just south of the access to teacher’s parking lot is a ‘No Parking’ zone, thus, parents parking for more 20+ minutes is not permitted in the drop-off/pickup zone.

Highlands has a layby for drop-off in the morning period (Figure 3). The layby is off of Colwood Drive at the main entrance to the school.



**Figure 3: School drop off / layby area (markings installed Summer/Fall 2015)**

Opus personnel observed the layby functioning well, although there were two instances of vehicles attempting to enter the layby backing up traffic onto the roadway. Opus acknowledges that the presence of personnel in high visibility vests may have contributed to a quicker turn around in the layby. At the second bell, 8:50 am, the layby was still full with vehicles. In the morning drop-off hour, Opus observed 114 parked vehicles in total, illegally and/or legally. Table 10 shows the parking occupancy during the morning drop-off period.

**Table 10: Parking Occupancy - Morning Drop-Off**

| Zone<br>Time | Drop off Bay |           | East Side Colwood - Drop-off/ Pick-Up |            |                     |
|--------------|--------------|-----------|---------------------------------------|------------|---------------------|
|              | Left In      | Right In  | New                                   | Carry Over | Total Per Increment |
| 8:15         | 11           | 4         | 7                                     | 0          | 22                  |
| 8:30         | 23           | 11        | 16                                    | 6          | 56                  |
| 8:45         | 17           | 13        | 6                                     | 16         | 52                  |
| 9:00         | 1            | 2         | 3                                     | 8          | 14                  |
| <b>Total</b> | <b>52</b>    | <b>30</b> | <b>32</b>                             |            |                     |

The AM drop-off parking durations were, on average, shorter than PM dismissal durations. The entire east side of Colwood Drive was occupied with parked cars by 08:40 and turnover was consistent after the first bell. One vehicle was observed parked at the 'No Stopping' or 'No Parking' zone to the north of the staff parking lot and no vehicles were observed parked or stopped for any amount of time on the west side of Colwood Drive.

The recessed drop off lane saw the fastest and most consistent vehicle turnover, with average stopping times ranging from 1-5 minutes as opposed to 5-10 minutes along Colwood Drive (before first bell). The majority accessed the bay via a left turn (coming from Highland Boulevard) and exited via right turn.

#### 2.2.4.2 Pick-Up/Dismissal

During the pickup period in the afternoon, Highlands closes the layby to eliminate double row parking in the layby and prevent conflicts. Gates are used to close the layby. By 2:30 pm vehicles are parked along the east side of Colwood Drive in the drop-off/pickup zone. By 2:45 pm, all parking available south of the layby exit is full. The dismissal bell rings at 3:00 pm, after which double parking/pickup at the school entrance is observed.

During the dismissal period, queue lengths of 6 – 10 vehicles are observed along Colwood Drive. The main period where students are observed departing school is between 3:03 and 3:10 pm and by 3:15 pm most, if not all, students have departed. Table 11 shows the parking occupancy during the afternoon pick-up period.

**Table 11: Parking Occupancy – Afternoon Pick-Up**

| Zone         | Layby     |          | East Side Colwood - Drop-off/ Pick-Up |            |                     |
|--------------|-----------|----------|---------------------------------------|------------|---------------------|
|              | Left In   | Right In | New                                   | Carry Over | Total Per Increment |
| 2:30         | Closed    |          | 20                                    |            | 20                  |
| 2:45         |           |          | 7                                     | 20         | 27                  |
| 3:00         |           |          | 9                                     | 25         | 34                  |
| 3:15         |           |          | 4                                     | 7          | 11                  |
| <b>Total</b> | <b>NA</b> |          | <b>40</b>                             |            |                     |

Vehicles parked prior to the PM dismissal were observed to be in non-compliance with the posted signage; averaging over 20 minutes along the east side of Colwood Drive. During the PM, three vehicles were parked in the 'No Stopping' or 'No Parking' zone north of the staff parking lot, but no vehicles were observed parked or stopping for any time along the west side of Colwood. Opus observed that prior to the closure of the recessed bay, parents routinely double-parked in the bay. This resulted in gridlock when one vehicle blocked another's egress or ingress. On the observed afternoon, the drop off zone along Colwood Drive was heavily utilized by students and parents congregating prior to and after dismissal.

### 2.3 Issues Identified by Safe Routes Advocates

On January 20, 2014 the Safe Routes Advocates (SRAs), a parent's advocacy group in the Handsworth catchment of schools, spoke to DNV's Council and gave a Safe Routes Recommendations report. The report highlighted general areas of concern and school specific safety issues. The summary in Table 12 identifies concerns raised by SRA on Highland Boulevard, at the Highland Boulevard / Colwood Drive intersection, and across West Queens Road.

**Table 12: SRA Identified Concerns - Highlands Elementary School**

| Concern  | SRA Suggested Mitigation Measure   | Opus Review   |
|--|--|---|
| Crossing on Queens Road West at Colwood Drive. Non-compliance with the yellow flashing lights.                                 | Install a pedestrian light – flashing green light that turns red for pedestrians crossing.   | Increasing visibility of pedestrians can be done with temporary or permanent buildouts; see Section 3.2.2                               |
| Speeding perception on Queens Road West.   | Implement a reduced speed zone (30 km/hr) a few blocks east and west of Colwood Drive.   | Short term: see mitigation response above and Section 3.2.2; long term: see Section 3.1.6   |
| Crossing at Thorncliffe Road on Queens Road West.  | Install zebra crosswalk and mark it a school crossing as it is an active route for students and other pedestrians.   | Zebra crosswalk installed since SRA's 2013 report   |
| Vegetation obstruction of pedestrians wishing to cross Ridgewood Drive at the Ayr Avenue crossing and faded pavement markings. | Repaint pavement markings and cut back foliage in advance of the crossing on the north side of Ridgewood Drive to ensure pedestrians crossing north to south are properly visible.   | Site-specific vegetation trimmed in 2015 + future consideration of north side sidewalk (ranked high priority in Pedestrian Master Plan) |
| Driver awareness of school zone on Colwood Drive.  | Ensure signage is visible and not obstructed by foliage. Install 'proper' school zone signage on Colwood Drive and Fairmont Road.<br>Draw attention to speed change using yellow flashing lights on signage or other notification techniques such as radar/speed notification signage. | Vegetation trimmed around signage in 2015.<br>Upgraded signage installed since the SRA's report   |

Opus reviewed this report prior to conducting the initial site walk-through and data collection. Opus' follow-up investigation corroborated some of these concerns as noted in Table 12, but also noted:

- The sidewalk on Colwood Drive near the Highland Boulevard intersection could be wider to accommodate pedestrians; and
- Highlands' closure of the drop-off lane during the PM peak was beneficial for safe operations during the dismissal period.

### 3 Mitigation Options and Recommendations

This section summarizes the improvement options to respond to the high level gaps identified in the previous section. All options are feasible and are accompanied by high-level cost estimates. Short term projects can be implemented quickly whereas long term projects require more substantial planning. Priority projects were identified by the PAC and the school, and are indicated with an asterisk.

**Table 13: Recommend Improvements**

| Location   | Infrastructure Cost Estimate | Suggested Mitigation  | Short / Long Term            | Who?   |
|--|------------------------------|---|------------------------------|--|
| Highlands Elementary*  | N/A                          | Expand School Travel Demand and Mode Shift Programs - Section 3.1.1   | Short Term                   | Highlands ES<br>NVSD44<br>North Shore<br>SRA |
| Highlands Elementary*  | N/A                          | Improved traffic management around school – Section 3.1.2   | Short Term                   | Highlands ES<br>PAC Group<br>RCMP            |
| Around Highlands Elementary*                                 | \$1,000                      | Expand School Zone - Section 3.1.3  | Short Term                   | DNV  |
| DNV*   | N/A                          | Work with residents to maintain clear sight distance by addressing overgrown vegetation – Section 3.1.4           | Short Term                   | DNV  |
| Ridgewood Drive / Ayr Ave Intersection                       | \$10,000                     | Additional lighting and cutting back vegetation   | Short Term                   | DNV  |
| Study Area*  | \$8,000                      | Signage and marking upgrades - Section 3.1.5  | Short Term                   | DNV  |
| West Queens Road between Thorncliffe Road and Colwood Drive* | Up to \$15,000               | Short term upgrades - Section 3.1.6   | Both Short & Long Term items | DNV  |
| Colwood Drive / Highland Boulevard intersection              | \$52,000                     | Intersection upgrades - Section 3.2.1   | Long Term                    | DNV  |
| West Queens Road from Edgemont Village to Lonsdale Road      | \$50-150,000                 | Corridor study to determine long-term needs and multi-modal connectivity and access – Section 3.2.2               | Short / Long Term            | DNV  |
| Belmont Avenue and Ridgewood Drive                           | \$300K-\$1M                  | Alternative school accesses (new stairs to Fairmont Park and new sidewalk from Ayr Street stairs) – Section 3.2.3 | Long Term                    | DNV  |

|                                      |                   |   |           |     |
|--------------------------------------|-------------------|---|-----------|-----|
| Ridgewood Drive                      | \$29,000          | Sidewalk (north side) between Ayr Avenue and Highland Boulevard - Section 3.2.3.1 | Long term | DNV |
| Sum of Short Term and Priority Items | \$19,000 - 34,000 |   |           |     |

### 3.1 Short Term Improvements

All of these projects are relatively low cost either to the DNV or NVSD44 and can be provided in the short term. DNV-related recommendations are eligible under the Capital or Operations budget, with some potential for reimbursement via school-related transportation grants.

#### 3.1.1 Expand School Travel Demand and Mode Shift Programs – Priority

**Responsibility of:** Highland ES, NVSD44, School Administration, PAC

As noted in the previous section, Highlands and PAC have collaborated on incentive programs to encourage and reward active travel modes to school. This resulted in a marked increase in students cycling to school during May and June. This and similar programs could be encouraged and expanded through the following means.

##### 3.1.1.1 Include more Traffic Safety into Curriculum

According to the 2013 school travel survey, traffic safety was listed as a significant contributor to parents' decisions to drive their children to school. The school can broaden its efforts to expand traffic safety into the background curriculum at the school.

ICBC offers age-appropriate teaching resources for traffic safety free of charge through its *RoadSense Kids* and *SMART Board RoadSense Kids* activities. These materials can be supplemented with individual ICBC and RCMP speakers to demonstrate appropriate behaviour at intersection and when near road traffic. Individual lessons and strategies can assist both children and parents with gaining confidence for walking or cycling to school in all weather conditions.

This can extend to modal choice curriculum for staff and faculty through TransLink's *Travel Smart* program, an informational site to assist schools with making smarter choices about their travel habits.

##### 3.1.1.2 Drive to Five Program

Drive to Five is an initiative that aims to map out where students travel to and from the school and then designate safe locations along those routes at roughly a 5 minute walk to or from the school. This provides pick up and drop off away from the front school entrance at arrival and dismissal times. Providing trustworthy and monitored pick up and drop off could eliminate a number of vehicle trips from the front school entrance at arrival and dismissal times. If the school is interested to start a Drive to Five program, it is recommended that Highlands undertake a study which includes neighbourhood consultation to determine feasible locations amenable to neighbours which are large enough for vehicle parking and turning movements. Communicating and working with the residents near the proposed locations would be important for the school to do as well.

### 3.1.1.3 Walking School Bus

A Walking School Bus is a group of children walking together under the supervision of one or more adults following a prescribed route and schedule. This is an idea for schools to consider to offer a safe, dependable, and healthy way for children to get to school versus being driven in a car. It can be informally planned when two or three families take turns walking or cycling with their children to school or it might be a more formally developed and organized program with specific stops, specific participants and volunteer Walking School Bus leaders.

Walking School Buses can contribute to reducing vehicle trips to schools, contribute to at least a modicum-recommended daily exercise regime for children, and improve parental involvement in school affairs. This type of program is recommended for younger elementary school students and daycare-attending children as well. This program could be implemented on a volunteer schedule for the school or day care with a number of suitable routes mapped out as required by participants' addresses.

### 3.1.2 Improved Traffic Management at School – Priority

**Responsibility of:** NVSD44, School Administration, PAC

Sustained efforts to manage or control traffic movements in and around school at arrival and dismissal times will reduce risk and the potential for pedestrian/vehicle conflicts.

The existing 'No Parking 8AM-4PM School Days' regulatory signage on Colwood Drive is routinely ignored – especially at dismissal times. The signage and regulation exists partially to ensure adequate turnover and availability of drop off space for parents. DNV Bylaws does periodic enforcement and bylaw enforcement is recommended to continue.

The options for enforcement and reinforcement range from school communication reminders, to active parent volunteer monitoring of parking behaviour, to ticketing by RCMP.

North Vancouver *Speed Watch* is another resource that the school or parents can request to come to a location to monitor vehicle speeds. It is a program operated by the RCMP, volunteers and ICBC.

### 3.1.3 Expand School Zone – Priority

**Responsibility of:** DNV

The BC Ministry of Transportation and Infrastructure (MoTI) supplement to Transportation Association of Canada (TAC) recommends that school zones not be less than 100m from the property of a school, where warranted. TAC's *School and Playground Areas and Zones: Guidelines for Application and Implementation* (2006) references the Geometric Design Guide for Canadian Roads (1999) to note that the actual distance of a school zone should be the safest Sight Stopping Distance (SSD) from the school's property line based on the road's terrain, topography, and design speed. For the flat surface on Highland Boulevard, SSD is 60m-65m (see Table 1.2.5.3, *Geometric Design Guide to Canadian Roads*).

Based on the minimum length and SSD guidelines for school zones, the existing school zone, with all accompanying signage and regulatory authority, should be extended to:

- Fairmont Road – north of Fairmont Park– school zone signage posted at a cost of approximately \$175 for each sign installation

### 3.1.4 Vegetation Maintenance – Priority

**Responsibility of:** DNV

Maintaining sight distance is an important element on streets and at intersections. Landscape vegetation may impede sight distance when it is not properly maintained. In addition, maintaining vegetation is also important so that it does not obscure signage or reduce the effective width of sidewalks.

Case-by-case vegetation trimming inquiries can be made to the general DNV engineering email or phone line.

### 3.1.5 Signage and Markings Enhancements – Priority

**Responsibility of:** DNV

#### 3.1.5.1 Install New Crosswalks and Crossing Markings

New crosswalks could be installed at locations with existing stop control, sidewalks, demonstrated pedestrian demand, and along demonstrated pedestrian desire paths as per TAC and BC MoTI guidelines. New school crosswalks are proposed for the south and north legs of cross roads intersecting Queens Road West, as these crossings bring pedestrians directly to the block on which the school and school entrance is located. Recommended improvements are listed below for the following locations:

- Highland Boulevard at Colwood Drive/Ridgewood Drive
  - South leg, improve visibility of zebra crosswalk
  - East leg, improve visibility of crossing and change to zebra crosswalk
- Ridgewood Drive at Ayr Avenue – west leg, repaint crosswalk, cut back vegetation and install additional lighting

#### 3.1.5.2 Standardize Signage as per TAC

This primarily concerns parking regulations and school zone-related signage.

- School zone-related signage – install ‘School Cross Ahead’ signs (sign number WC-16R/L) signs and ‘School Crosswalk’ signs (sign number RA-3R/L) signs on the north side of Queens Road West toward the approach of the Thorncliffe Road school crossing.

### 3.1.6 West Queens Road (short term): between Thorncliffe Road and Colwood Drive – Priority

**Responsibility of:** DNV

The presence of the two crosswalks on West Queens Road can be enhanced by reducing travel lane widths at the location of the two crossings (Thorncliffe Road and Colwood Drive). This can be done in the short term by:

- Channelizing moving lanes in each direction to 3.5m through striping, temporary bollards, or a combination of these; or

- Creating temporary ‘build outs’ at both north and south approaches of both crosswalks with temporary plastic bollards (e.g. at Del Rio Drive at West Queens Road crosswalk).

In this case, using the plastic posts has successfully been used at other sites within DNV and is a reasonable, low-cost, easy-to-implement approach to enhance the visual presence of the crosswalk.

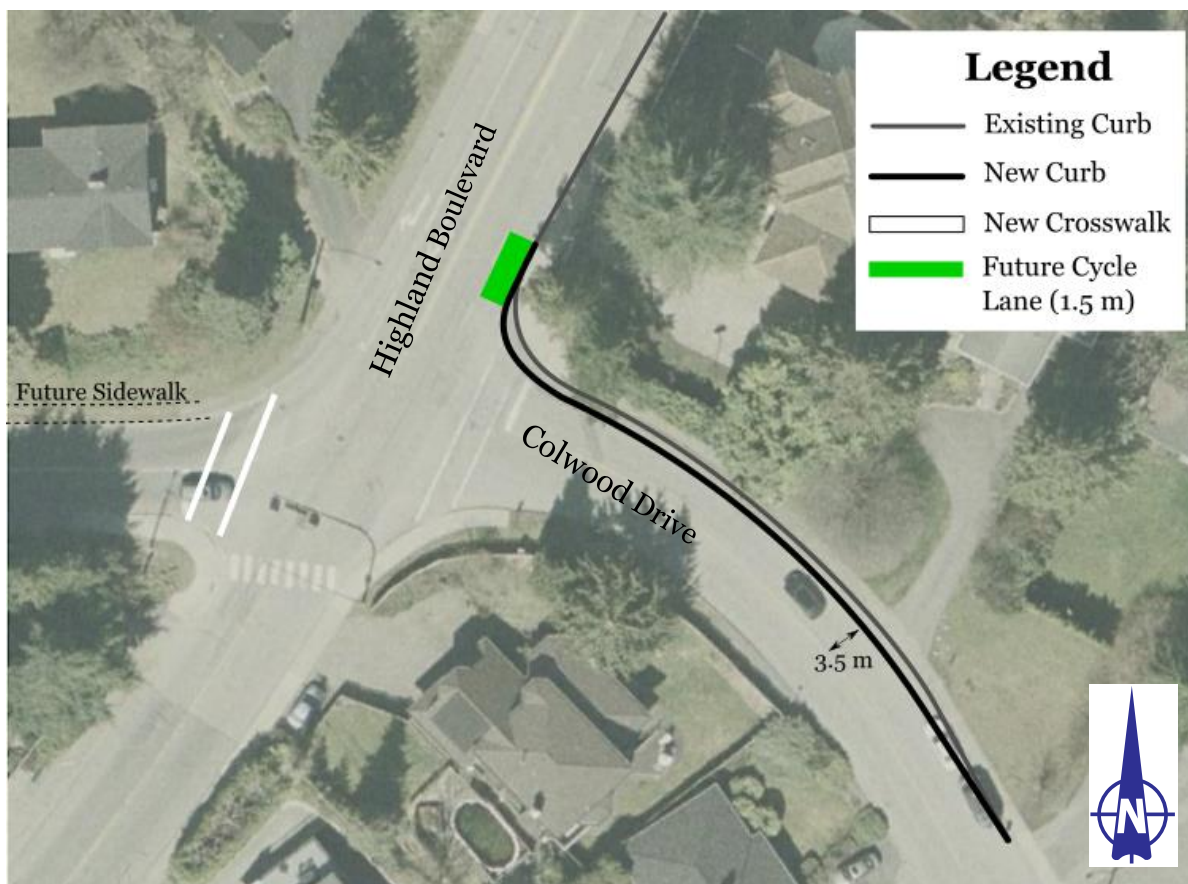
### 3.2 Long Term Improvements

These proposals respond to conditions identified at specific locations. See Appendix D for cost estimate sources and notes.

#### 3.2.1 Highland Boulevard at Colwood Drive

**Responsibility of:** DNV

As shown in Figure 4, the proposal includes an additional marked crosswalk.



**Figure 4: Highland Boulevard at Colwood Drive – High-Level Proposal**

A crosswalk on the north leg of the intersection was considered. However, southbound pedestrians on Highland Boulevard are encouraged to cross at the safer crossing at the Belmont Avenue crosswalk (1 block north) since it has existing pedestrian crossing infrastructure (overhead flashing amber lights).



The proposal also recommends widening the east side of the Colwood Drive sidewalk to approximately 3.0m (from 1.5m) where many pedestrians travelling on the existing sidewalk would benefit from a wider sidewalk. The sidewalk widening could be taken from the exiting east approach lane, which will be reduced from 5.0m-5.5m wide to 3.5m. This proposal does not require new or relocated drainage or utilities and its high-level estimate is shown in Table 14. The northeast corner on Highland Boulevard should retain sufficient space for a future bicycle lane in the northbound direction and a travel lane.

**Table 14: High-level costs for Highland Boulevard and Colwood Drive treatments**

| Highland and Colwood               |             |      |     |                     |
|------------------------------------|-------------|------|-----|---------------------|
| Long Term Improvements             | Cost        | Unit | Qty | Price               |
| School Crossing and Signage (each) | \$ 800.00   | each | 1   | \$ 800.00           |
| Concrete curbs (m)                 | \$ 150.00   | m    | 90  | \$ 13,500.00        |
| Concrete sidewalk (m)              | \$ 250.00   | m    | 75  | \$ 18,750.00        |
| Curb Let Downs                     | \$ 1,200.00 | each | 3   | \$ 3,600.00         |
| Contingency/Risk/Design            | 40%         |      |     | \$ 14,700.00        |
| <b>TOTAL</b>                       |             |      |     | <b>\$ 51,350.00</b> |

### 3.2.2 West Queens Road (long term): Corridor Study

#### Responsibility of: DNV

West Queens Road is an east-west arterial street between Capilano Road/Edgemont Village in the west and Lonsdale Road and Lynn Valley to the east. As demonstrated in this report, it serves a number of uses and multi-modal operations. In addition to its function as a vehicular arterial and transit route, it is identified as a future cycle route. Issues to consider in a corridor study include:

- How to better define the road space on West Queens Road; and,
- Research the perceived speeding on Queens Road West and the observed (not counted or quantified) motorists not stopping at crosswalks.

Retro-fitting the existing alignment to encourage slower vehicle speeds and provide amenities for transit, cycling, and pedestrians creates trade-offs, such as on-street parking. It is recommended that DNV undertake a study to assess the future function of the corridor and identify specific upgrades. This study should include, but does not need to be limited to:

- Speed assessment and driver compliance of crosswalk priority;
- Preventative crash analysis;
- Safety review of current alignment;
- Parking survey;
- Transit infrastructure survey;
- Stakeholder engagement;
- Development and assessment of alternative corridor designs; and
- Targeted improvement to transit infrastructure and active modes.

This corridor study could cost in the range of \$50,000 to \$150,000 depending on how many of the above-mentioned elements are included.

### 3.2.3 Alternative Accesses to School

#### Responsibility of: DNV

The school and parents' group both requested this study to include the potential for providing extra points of access to and from the school. The study team's findings identified two potential locations that, if developed, could provide more pedestrian connections.

#### 3.2.3.1 Ayr Avenue to Ridgewood Drive

From Ayr Avenue to the school, there is a sidewalk on the south side of Ridgewood Drive, but not the north side. Building a sidewalk on the north side of Ridgewood Drive in this block is in the Pedestrian Master Plan as a high priority sidewalk. This location and path is shown in Figure 5.



**Figure 5: Ayr Avenue to Ridgewood Drive connection (DNV Geoweb)**

Ridgewood Drive is relatively narrow here (7m-8m across) but visibility of pedestrians at the north approach was impacted due to vegetation, particularly on the east for westbound vehicles. School stakeholders noted vehicles sometimes did not yield to pedestrians in the crosswalk. Since visibility problems were identified, DNV has trimmed the vegetation at Ayr Avenue and Ridgewood Drive to improve visibility around the crosswalk.

The Pedestrian Master Plan identifies a sidewalk on Ridgewood Drive as a priority. At the same \$80/m<sup>2</sup> referenced in Appendix C of this report, this sidewalk would cost approximately \$29,000, excluding contingency, vegetation removal, and property-related discussions.

### 3.2.3.2 Fairmont Park Connection

This option had been provided for discussion purposes only. An access directly from the top, eastern end of Belmont Avenue through to Fairmont Park (Figure 6) was identified by school stakeholders as a potential new pedestrian connection.



**Figure 6: Belmont Avenue to Fairmont Park connection (DNV Geoweb)**

There is a 12m drop from the top of Belmont Avenue to the level of the park. At present, there is a very rough path leading to the east end of the avenue, where access is currently blocked by a fence. It is too steep to be commonly used even as an informal trail. There are similar stair connections to provide other connections throughout area; notably at Ayr Avenue and from Crescentview Drive to Murdo Frazer Park.

It is difficult to determine a very high-level price, as most elements pertaining to that cost are not confirmed. The geotechnical, soil and slip stability, structural (bridge over creek), environmental, and geometric elements need to first be confirmed. It would be an expensive connection through Fairmont Park and to Fairmont Road in the range of \$300K - \$1M with investigation, design, construction, and contingency.

## 4 Conclusions

This report recommends a combination of programming and infrastructure upgrades to improve safety around the school in a manner consistent with the availability of DNV resources. School and PAC representatives have further reviewed the draft list of proposals and indicated which they view as a priority for quick implementation.

**Table 15: Short-Term and Priority Projects for Implementation**

| <b>Proposal</b>  | <b>Partners</b>                           |
|--|---|
| Greater uptake of school-supported programs (Section 3.1.1)  | Highlands ES<br>NVSD44<br>North Shore SRA |
| Traffic management around school to promote quicker turnover, illegal and obstructive parking (Section 3.1.2)          | Highlands ES<br>PAC Group<br>RCMP         |
| School Zone expansion upgrade (Section 3.1.3)  | DNV                                       |
| Sightline and vegetation management (Section 3.1.4)  | DNV                                       |
| Improved crossing at Ridgewood Drive and Ayr Avenue (Section 3.1.5)  | DNV                                       |
| Signage and marking upgrades (Section 3.1.5)   | DNV                                       |
| Short term recommendations for West Queens Road through Colwood Drive and Woodbine Drive intersections (Section 3.2.2) | DNV                                       |

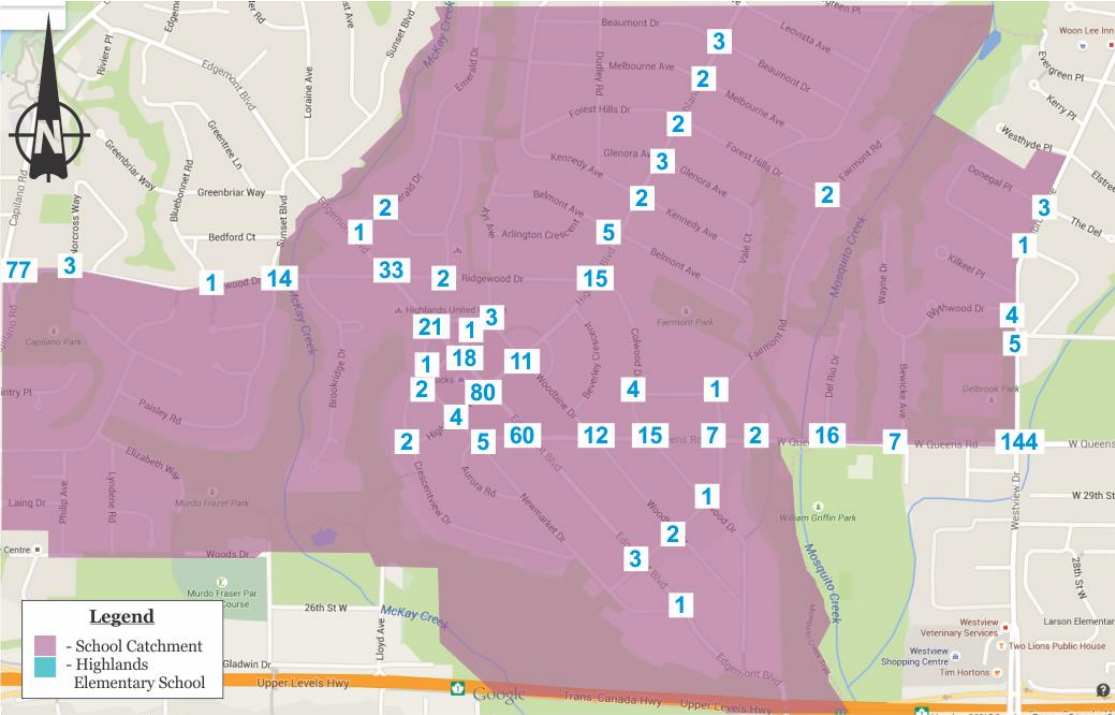
# **APPENDIX A**

## **Crash Report Memo**



**Highlands Elementary School Study**

ICBC provided crash data in the immediate vicinity of Highlands. In the 6 years of data reviewed, the local or collector roads had few crashes averaging 0 – 0.8 per year. The major/minor arterial roads (Capilano Road, Highland Boulevard and West Queens Road) average 1 – 24 collisions per year. The figure below illustrates the total collisions by intersection from 2008 to 2013. Where there are no numerical values, there are no crashes between the years 2008 and 2013.



**Figure A.1: Highlands - Crash Information by Intersection (2008 -2013)**

Overall, there were no identifiable trends to the vehicle crash data, aside from a number of rear-end collisions. Higher volumes of crashes were reported along arterials and a number of collisions with parked vehicles reported on smaller streets. Nine cyclist crashes were reported, with no clear trend or unifying factor. Three of the eight reported pedestrian crashes were vehicles striking pedestrians as they were crossing the West Queens Road crosswalks.

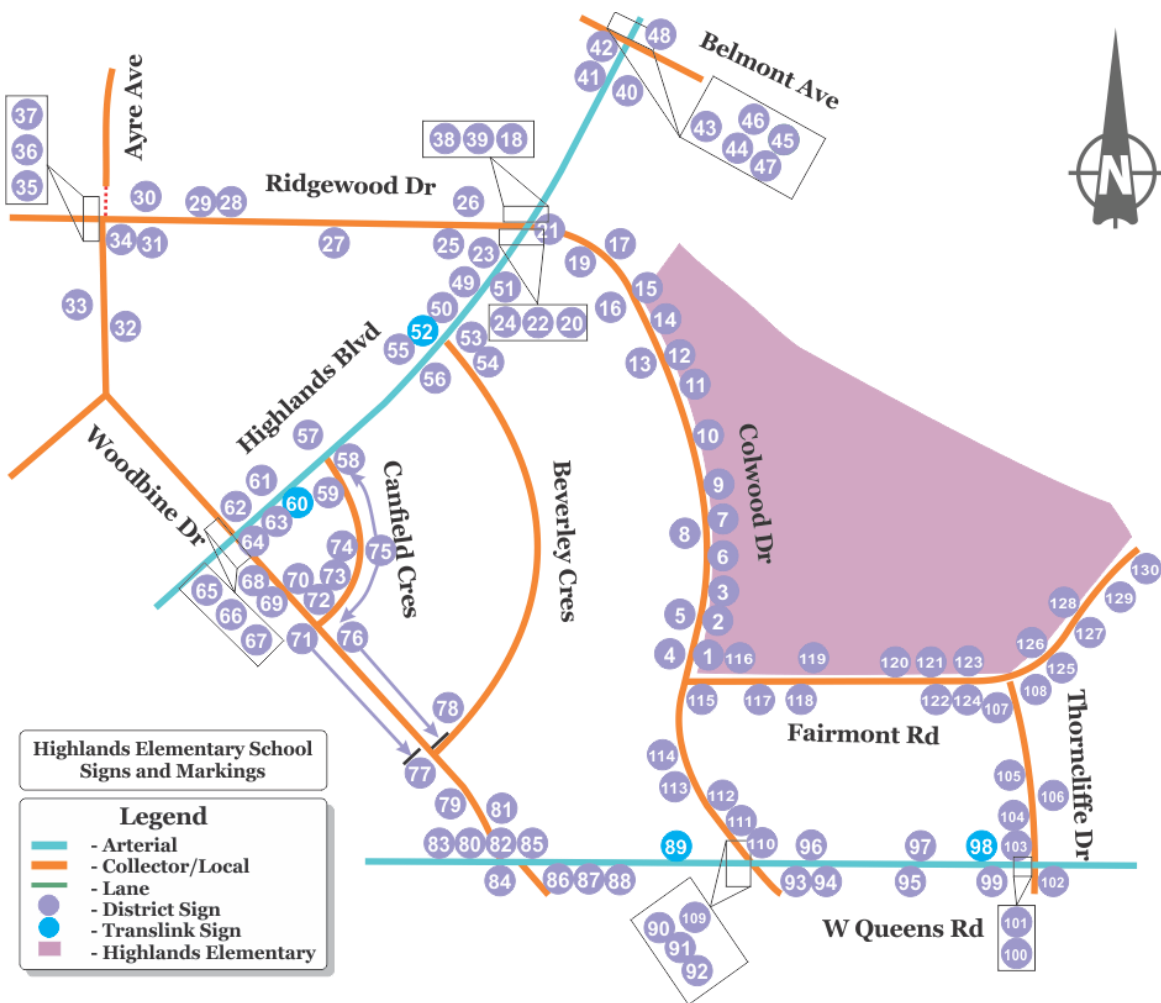
# **APPENDIX B**

## Signs and Markings Survey Notes



## Highlands Elementary School Study

A complete signage and markings inventory of the school vicinity is shown here with reference table of respective condition notes below.



**Figure B.1: Signs and Markings Inventory in School Vicinity**



Highlands Elementary School Study

| No. On Map | Sign/Pavement Marking Name                                       | TAC Sign Code   | BCMoTI Sign Code    | Condition        | Elaborate on Fair/Poor Condition | Location                                 |
|------------|--|-----------------|---------------------|------------------|----------------------------------|--|
| 1          | Object Marker  | WA-36R          | W-054-R             | Good             |                                  | North Corner - Colwood @ Fairmont        |
| 2          | No Parking on School Days/Drop off Pick Up Zone                  | RB-52 / ?       | P-008/?             | Good             |                                  | East Side of Colwood, North of Fairmont  |
| 3          | Speed Hump Sign  | WA-50           | W-108-2             | Good             |                                  | East Side of Colwood, North of Fairmont  |
| 4          | Warning Sign - Left Curve in Road and No Stopping                | WA-3L & RB-55   | W-001-L & P-058     | Good             |                                  | West Side of Colwood, North of Fairmont  |
| 5          | Speed Hump Sign  | WA-50           | W-108-2             | Good             |                                  | West Side of Colwood, North of Fairmont  |
| 6          | No Parking on School Days/Drop off Pick Up Zone                  | RB-52 / ?       | P-008/?             | Good             |                                  | East Side of Colwood, In Front of School |
| 7          | No Parking on School Days/Drop off Pick Up Zone                  | RB-52 / ?       | P-008/?             | Good             |                                  | East Side of Colwood, In Front of School |
| 8          | No Stopping  | RB-55           | P-058               | Fair             | Dirty/Damaged - still legible    | West Side of Colwood, In Front of School |
| 9          | No Parking on School Days/Drop off Pick Up Zone                  | RB-52 / ?       | P-008/?             | Good             |                                  | East Side of Colwood, In Front of School |
| 10         | No Parking on School Days/Drop off Pick Up Zone                  | RB-52 / ?       | P-008/?             | Good             |                                  | East Side of Colwood, In Front of School |
| 11         | No Parking on School Days/Drop off Pick Up Zone                  | RB-52 / ?       | P-008/?             | Good             |                                  | East Side of Colwood, In Front of School |
| 12         | Speed Hump Sign  | WA-50           | W-108-2             | Good             |                                  | East Side of Colwood, In Front of School |
| 13         | Speed Hump Sign & Mirror   | WA-50           | W-108-2             | Good             |                                  | West Side of Colwood, In Front of School |
| 14         | No Parking on School Days/Drop off Pick Up Zone                  | RB-52 / ?       | P-008/?             | Good             |                                  | East Side of Colwood, In Front of School |
| 15         | No Stopping to Corner  | RB-55           | P-058               | Fair             | Damaged - loose pole             | East Side of Colwood, North of School    |
| 16         | No Stopping to Corner  | RB-55           | P-058               | Fair to Poor     | Obstructed by Vegetation         | West Side of Colwood, North of School    |
| 17         | 30 km/hr Speed Sign  |                 | R-004               | Good             |                                  | West Side of Colwood, North of School    |
| 18         | Stop Sign/Stop Bar and 4 Way Supp. Sign                          | RA-1            | R-001/R-001-Tb      | Good/Good & Good |                                  | Highland @ Colwood - NW Corner           |
| 19         | School Signage and No Stopping                                   | NOT TAC & RB-55 | PS-001 & P-058      | Fair             | Dirty/Damaged - still legible    | Highland @ Colwood - SW Corner           |
| 20         | Stop Sign/Stop Bar and 4 Way Supp. Sign, Reflective tape on pole | RA-1            | R-001/R-001-Tb      | Good/Good & Fair | Stop Bar fading                  | Highland @ Colwood - SW Corner           |
| 21         | Crosswalk  | NA              | NA                  | Good             |                                  | Highland @ Colwood - West Leg            |
| 22         | Crosswalk  | NA              | NA                  | Fair             | Fading                           | Highland @ Colwood - South Leg           |
| 23         | Object Marker  | WA-36R          | W-054-R             | Good             |                                  | Highland @ Colwood - SE Corner           |
| 24         | Stop Sign/Stop Bar and 4 Way Supp. Sign                          | RA-1            | R-001/R-001-Tb      | Good/Good & Fair | Stop Bar fading                  | Highland @ Colwood - SE Corner           |
| 25         | No Parking   | RB-52           | P-008               | Poor             | Fading                           | Ridgewood - South Side                   |
| 26         | No Parking   | RB-52           | P-008               | Poor             | Fading                           | Ridgewood - North Side                   |
| 27         | No Parking   | RB-52           | P-008               | Poor             | Fading                           | Ridgewood - South Side                   |
| 28         | No Parking   | RB-52           | P-008               | Poor             | Fading                           | Ridgewood - North Side                   |
| 29         | Pedestrian Crossing Warning Sign                                 | WC-2R           | PS-002              | Good             |                                  | Ridgewood - North Side                   |
| 30         | No Stopping and No Parking Signs                                 | RB-55 & RB-52   | P-058 & P-008       | Poor             | Obstructed by Vegetation         | Ridgewood - North Side                   |
| 31         | No Parking   | RB-52           | P-008               | Good             |                                  | Ridgewood - South Side                   |
| 32         | 2 hr Parking   | RB-53           | P-021               | Fair             | Fading                           | Ayre - West Side                         |
| 33         | 2 hr Parking   | RB-53           | P-021               | Good             |                                  | Ayre - East Side                         |
| 34         | Stop Sign/Stop Bar and 4 Way Supp. Sign                          | RA-1            | R-001/R-001-Tb      | Good/Good & Fair | Stop Bar fading                  | Ayre @ Ridgewood - SE Corner             |
| 35         | Pedestrian Crossing Signs + Reflective Strip                     | RA-4R & RA-4L   | PS-003-R & PS-003-L | Good             |                                  | Ayre @ Ridgewood - SW Corner             |
| 36         | Crosswalk  | NA              | NA                  | Fair             | Fading                           | Ayre @ Ridgewood - West Leg              |
| 37         | Pedestrian Crossing Signs + Reflective Strip                     | RA-4R & RA-4L   | PS-003-R & PS-003-L | Good             |                                  | Ayre @ Ridgewood - NW "Corner"           |
| 38         | Stop Sign/Stop Bar and 4 Way Supp. Sign                          | RA-1            | R-001/R-001-Tb      | Good/Good & Fair | Stop Bar fading                  | Highland @ Colwood - NW Corner           |
| 39         | Stop Sign/Stop Bar and 4 Way Supp. Sign                          | RA-1            | R-001/R-001-Tb      | Good/Good & Fair | Stop Bar fading                  | Highland @ Colwood - NW Corner           |
| 40         | No Stopping/No Parking   | RB-55 / RB-52   | P-058 / P-008       | Fair             | Fading                           | Highland, North of Colwood - East Side   |
| 41         | Stop Ahead   | WB-1            | W-011               | Good             |                                  | Highland @ Belmont - SW Corner           |

Highlands Elementary School Study

| No. On Map | Sign/Pavement Marking Name              | TAC Sign Code  | BCMoTI Sign Code    | Condition        | Elaborate on Fair/Poor Condition               | Location                                    |
|------------|---|----------------|---------------------|------------------|--|---|
| 42         | Stop Sign                               | RA-1           | R-001               | Good             |  | Highland @ Belmont - SW Corner              |
| 43         | Pedestrian Crossing Signs               | RA-4R & RA-4L  | PS-003-R & PS-003-L | Fair             | Older - <b>not reflective?</b>                 | Highland @ Belmont - NW Corner              |
| 44         | Crosswalk                               | NA             | NA                  | Fair             | Fading   | Highland @ Belmont - North Leg              |
| 45         | No Parking                              | RB-52          | P-008               | Fair             | Dirty/Damaged - still legible                  | Highland @ Belmont - NE Corner              |
| 46         | Overhead Crossing Lights/Signage        | NA             | NA                  | Good             |  | Highland @ Belmont - North Leg              |
| 47         | Pedestrian Crossing Signs               | RA-4R & RA-4L  | PS-003-R & PS-003-L | Fair             | Older - <b>not reflective?</b>                 | Highland @ Belmont - NE Corner              |
| 48         | Stop Sign                               | RA-1           | R-001               | Good             |  | Highland @ Belmont - NE Corner              |
| 49         | No Parking                              | RB-52          | P-008               | Good             |  | Highland - West Side, South of Ridgewood    |
| 50         | No Parking                              | RB-52          | P-008               | Good             |  | Highland - West Side, South of Ridgewood    |
| 51         | No Stopping                             | RB-55          | P-058               | Fair             | Older - fading                                 | Highland - East Side, South of Ridgewood    |
| 52         | Bus Stop                                | NA             | NA                  | Good             |  | Highland - West Side, South of Ridgewood    |
| 53         | No Stopping                             | RB-55          | P-058               | Fair             | Older - fading                                 | Highland - East Side, South of Ridgewood    |
| 54         | Stop Sign/Stop Bar                      | RA-1           | R-001               | Good/Fair        | Stop Bar fading, Stop Sign and Bar not in line | Highland @ Beverley - NE Corner             |
| 55         | Unknown                                 | NA             | NA                  | Poor             | Obstructed by Vegetation                       | Highland @ Beverley - East Side of Highland |
| 56         | Stop Ahead                              | WB-1           | W-011               | Fair             | Obstructed by Vegetation                       | Highland @ Beverley - SW Corner             |
| 57         | Stop Ahead                              | WB-1           | W-011               | Good             |  | Highland @ Canfield - West Side Highland    |
| 58         | Stop Sign                               | RA-1           | R-001               | Good             |  | Highland @ Canfield - NE Corner             |
| 59         | No Stopping/Bus Stop Only               | RB-60          | NA                  | Good             | Slightly Obstructed by Vegetation              | Highland @ Canfield - SE Corner             |
| 60         | Bus Stop                                | NA             | NA                  | Good             |  | Highland @ Canfield - SE Corner             |
| 61         | No Parking                              | RB-52          | P-008               | Good             |  | Highland @ Woodbine - NW Corner             |
| 62         | Stop Sign/Stop Bar and 4 Way Supp. Sign | RA-1           | R-001/R-001-Tb      | Good/Good & Good | Stop Bar fading slightly                       | Highland @ Woodbine - NW Corner             |
| 63         | No Stopping/Bus Stop Only               | RB-60          | NA                  | Good             | Slightly Obstructed by Vegetation              | Highland @ Woodbine - NE Corner             |
| 64         | Stop Sign/Stop Bar and 4 Way Supp. Sign | RA-1           | R-001/R-001-Tb      | Good/Good & Good | Stop Bar fading slightly                       | Highland @ Woodbine - NE Corner             |
| 65         | Stop Sign/Stop Bar and 4 Way Supp. Sign | RA-1           | R-001/R-001-Tb      | Good/Good & Good |  | Highland @ Woodbine - SW Corner             |
| 66         | Crosswalk                               | NA             | NA                  | Fair             | Fading slightly                                | Highland @ Woodbine - South Leg             |
| 67         | Stop Sign/Stop Bar and 4 Way Supp. Sign | RA-1           | R-001/R-001-Tb      | Good/Good & Good |  | Highland @ Woodbine - SE Corner             |
| 68         | Parking - 30 mins Only                  | RB-53          | P-021               | Good             |  | Woodbine - SW Side                          |
| 69         | Parking - 30 mins Only                  | RB-53          | P-021               | Good             |  | Woodbine - SW Side                          |
| 70         | No Parking                              | RB-52          | P-008               | Fair             | Obstructed by Vegetation                       | Woodbine - NE Side                          |
| 71         | 2 hr Parking                            | RB-53          | P-021               | Good             |  | Woodbine - SW Side                          |
| 72         | No Parking and Stop Ahead               | RB-52 and WB-1 | P-008 and W-011     | Poor and Poor    | Damaged and worn/damaged                       | Woodbine - NE Side                          |
| 73         | Stop Sign                               | RA-1           | R-001               | Good             |  | Woodbine @ Canfield - NW Corner             |
| 74         | No Parking to Corner                    | RB-55          | P-058               | Fair             |  | Woodbine @ Canfield - NW Corner             |
| 75         | No Parking signs                        | RB-52          | P-008               | Fair             |  | Canfield - North Side                       |
| 76         | No Parking                              | RB-52          | P-008               | Poor             | Fading   | Woodbine - NE Side                          |
| 77         | No Stop / Handicap Spot                 | RB-71          | P-019               | Good             |  | Woodbine - SW Side                          |
| 78         | Stop Sign/Stop Bar                      | RA-1           | R-001               | Good             |  | Woodbine @ Beverley - NW Corner             |
| 79         | Stop Ahead                              | WB-1           | W-011               | Fair             | Old  | Woodbine - SW Side                          |

Highlands Elementary School Study

| No. On Map | Sign/Pavement Marking Name  | TAC Sign Code             | BCMoTI Sign Code                 | Condition        | Elaborate on Fair/Poor Condition | Location                                 |
|------------|---|---------------------------|----------------------------------|------------------|----------------------------------|--|
| 80         | Stop Sign/Stop Bar  | RA-1                      | R-001                            | Good             |                                  | Woodbine @ Queens - SW Corner            |
| 81         | No Parking to Corner  | RB-55                     | P-058                            | Fair             | Hidden by Vegetation             | Woodbine - NE Side                       |
| 82         | Crosswalk   | NA                        | NA                               | Good             |                                  | Woodbine @ Queens - West Leg             |
| 83         | No Stopping to Corner   | RB-55                     | P-058                            | Good             |                                  | Queens - North Side                      |
| 84         | No Stopping   | RB-55                     | P-058                            | Fair             | Fading slightly                  | Queens - South Side                      |
| 85         | Object Marker   | WA-36R                    | W-054-R                          | Good             |                                  | Woodbine @ Queens - NE Corner            |
| 86         | Stop Sign/Stop Bar  | RA-1                      | R-001                            | Good             |                                  | Woodbine @ Queens - SE Corner            |
| 87         | Pedestrian Crossing Warning Sign and No Passing Suppl. Tab                            | WC-2R / ?                 | PS-002/PS-006-Tb                 | Good             |                                  | Queens - South Side                      |
| 88         | No Stopping   | RB-55                     | P-058                            | Fair             | Fading slightly                  | Queens - South Side                      |
| 89         | Bus Stop  | NA                        | NA                               | Good             |                                  | Queens - North Side                      |
| 90         | No Stopping to Corner   | RB-55                     | P-058                            | Fair             | Fading slightly                  | Queens - North Side                      |
| 91         | Overhead Crossing Lights/Signage, Object Marker, Ped Crossing Signs (North and South) | NA, WA-36R, RA-4R & RA-4L | NA, W-054-R, PS-003-R & PS-003-L | Good, Good, Fair | Fading signs (ped crssing)       | Queens @ Colwood - West Leg              |
| 92         | No Stopping   | RB-55                     | P-058                            | Fair             | Fading slightly                  | Queens - South Side                      |
| 93         | Stop Sign/Stop Bar  | RA-1                      | R-001                            | Good             |                                  | Queens @ Colwood - SE Corner             |
| 94         | No Stopping to Corner   | RB-55                     | P-058                            | Good             |                                  | Queens @ Colwood - SW Corner             |
| 95         | Pedestrian Crossing Warning Sign  | WC-2R                     | PS-002                           | Good             |                                  | Queens - South Side                      |
| 96         | No Stopping to Corner   | RB-55                     | P-058                            | Good             |                                  | Queens @ Colwood - NW Corner             |
| 97         | Pedestrian Crossing Warning Sign  | WC-2R                     | PS-002                           | Good             |                                  | Queens - North Side                      |
| 98         | Bus Stop  | NA                        | NA                               | Good             |                                  | Queens - North Side                      |
| 99         | No Stopping to Corner   | RB-55                     | P-058                            | Good             |                                  | Queens - South Side                      |
| 100        | Pedestrian Crossing Signs (N&S) and Crosswalk   | RA-4R & RA-4L             | PS-003-R & PS-003-L              | Good/Fair        | Crosswalk Fading                 | Queens @ Thorncliffe - West Leg          |
| 101        | Crosswalk   | NA                        | NA                               | Good             |                                  | Queens @ Thorncliffe - South Leg         |
| 102        | Stop Sign/Stop Bar  | RA-1                      | R-001                            | Good             |                                  | Queens @ Thorncliffe - SE Corner         |
| 103        | Stop Sign/Stop Bar  | RA-1                      | R-001                            | Good             |                                  | Queens @ Thorncliffe - NW Corner         |
| 104        | No Parking on School Days   | RB-52                     | P-008                            | Fair             |                                  | Thorncliffe, North of Queens - West Side |
| 105        | No Parking on School Days   | RB-52                     | P-008                            | Fair             |                                  | Thorncliffe, North of Queens - West Side |
| 106        | School Signage and 30 km/hr Speed   | NOT TAC                   | PS-001 & R-004                   | Good             |                                  | Thorncliffe, North of Queens - East Side |
| 107        | No Parking on School Days   | RB-52                     | P-008                            | Fair             |                                  | Thorncliffe, North of Queens - West Side |
| 108        | Stop Sign/Stop Bar  | RA-1                      | R-001                            | Good/Fair        | Stop Bar Fading                  | Thorncliffe @ Fairmont - NE Corner       |
| 109        | Stop Sign/Stop Bar  | RA-1                      | R-001                            | Good             |                                  | Queens @ Colwood - NW Corner             |
| 110        | Do Not Black Intersection and Object Marker   | ? / WA-36R                | R-106 / W-054-R                  | Good/Fair        | Slightly Damaged                 | Queens @ Colwood - NE Corner             |
| 111        | School Signage and No Stopping  | NOT TAC & RB-55           | PS-001 & P-058                   | Fair/Fair        | Fading                           | Queens @ Colwood - NW Corner             |
| 112        | 30 km/hr Speed Sign   |                           | R-004                            | Good             |                                  | Queens @ Colwood - NW Corner             |
| 113        | Stop Ahead and Object Marker  | WB-1 / WA-36R             | W-011 / W-054-R                  | Good/Good        |                                  | Colwood, N of Queens - West Side         |
| 114        | No Stopping   | RB-55                     | P-058                            | Fair             | Faded                            | Colwood, N of Queens - West Side         |
| 115        | No Stopping   | RB-55                     | P-058                            | Fair             | Obstructed by Vegetation         | Colwood, N of Queens - East Side         |
| 116        | Stop Sign   | RA-1                      | R-001                            | Good             |                                  | Colwood @ Fairmont - NE Corner           |
| 117        | School Zone, No Stopping and Reduced Speed School Days                                | Not TAC/RB-57             | PS-001/PS-001-Ta/?               | Good             |                                  | Fairmont, E of Colwood - South Side      |
| 118        | No Stopping School Days   | RB-57                     | ?                                | Good             | Pole slanted                     | Fairmont, E of Colwood - South Side      |
| 119        | 2 hr Parking - School Days  | RB-53                     | P-021                            | Good             |                                  | Fairmont, E of Colwood - North Side      |

**Highlands Elementary School Study**

| No. On Map | Sign/Pavement Marking Name                             | TAC Sign Code | BCMoTI Sign Code | Condition | Elaborate on Fair/Poor Condition     | Location                            |
|------------|--|---------------|------------------|-----------|--------------------------------------|-------------------------------------|
| 120        | 2 hr Parking - School Days                             | RB-53         | P-021            | Good      |                                      | Fairmont, E of Colwood - North Side |
| 121        | 2 hr Parking - School Days                             | RB-53         | P-021            | Good      |                                      | Fairmont, E of Colwood - North Side |
| 122        | No Stopping - School Days                              | RB-57         | ?                | Poor      | Obstructed by Vegetation             | Fairmont, E of Colwood - South Side |
| 123        | No Stopping And 2 Hr Parking School Days               | RB-57 / RB-53 | ? / P-021        | Fair      | Vandalized                           | Fairmont, E of Colwood - North Side |
| 124        | No Stopping - School Days                              | RB-57         | ?                | Good      |                                      | Fairmont @ Thorncliffe - South Side |
| 125        | No Stopping 8:30 am - 9 pm                             | RB-57         | ?                | Good      |                                      | Fairmont - S/E Side                 |
| 126        | No Stopping  | RB-55         | P-058            | Fair      | Slanted Pole                         | Fairmont - N/W Side                 |
| 127        | Playground, reduced speed, No Stopping                 | RB-57         | ?                | Good      | Slightly Obstructed by Vegetation    | Fairmont - E Side                   |
| 128        | School Zone and Reduced Speed School Days              | Not TAC       | PS-001/PS-001-Ta | Fair      | Damaged and slanted                  | Fairmont - W Side                   |
| 129        | No Stopping 8:30 am - 9 pm                             | RB-57         | ?                | Fair      | Dirty/Damaged - still legible        | Fairmont - E Side                   |
| 130        | No Stopping 8:30 am - 9 pm and No Stopping School Days | RB-57         | ?                | Fair      | Slanted Pole and Slightly Obstructed | Fairmont - W Side                   |

# **APPENDIX C**

## **MMM Group Traffic Volume Survey Summary**



## MMM Group Study and Local Volumes

MMM Group Limited (MMM Group) produced a Traffic Management Strategy (TMS) for the Capilano Water Main Project for Metro Vancouver. In the report, traffic counts were provided for various intersections effected by the project.<sup>1</sup> Traffic counts were conducted in the AM and PM peaks at the intersection of Highland Boulevard at Ridgewood Drive/Colwood Drive. MMM Groups’ counts are shown below.

### MMM Group Traffic Counts - Highland Boulevard at Montroyal Boulevard

| Time | Movement |     |     |     |     |     |     |     |     |     |     |     | Whole Intersection |
|------|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--------------------|
|      | EBL      | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |                    |
| AM   | 80       | 60  | 5   | 30  | 80  | 75  | 10  | 110 | 5   | 120 | 235 | 270 | 1080               |
| PM   | 195      | 15  | 5   | 5   | 15  | 140 | 5   | 250 | 10  | 100 | 135 | 115 | 990                |

\* MMM study was not done in school peak hours. MMM report is used for information only.

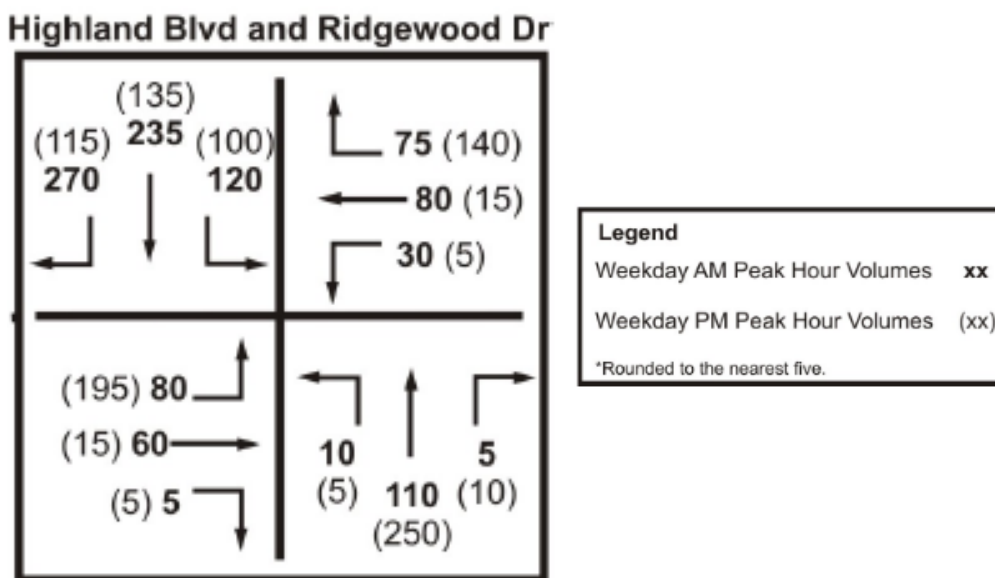


Figure D.2: Snapshot of Existing AM and PM volumes – 2015 MMM Group report

The report found approximately 1080 vehicles travelling through the Highland Boulevard/Ridgewood Drive intersection in the AM peak (report peak recorded between 7AM and 9AM). The report’s PM peak (between 4PM and 6PM) does not correspond to school dismissal time, but shows approximately 990 vehicles proceeding through the intersection. There are approximately 9 vehicles travelling through the intersection per minute.

Opus traffic counts for the morning period were for school arrival and dismissal times and did not strictly overlap with MMM’s commuting counts. Opus counted about 100 vehicles fewer than those taken by MMM Group for their TMS; similarly, the PM counts taken by Opus showed approximately 100 fewer vehicles lower than those taken by MMM Group in the PM period as well

<sup>1</sup> Traffic Management Strategy; Capilano Main No. 9 – Phase 2 (March 2015), MMM Group Ltd.

# **APPENDIX D**

## Concept-level Estimate Sources



## Assumptions

Landscaping and demolition costs are not included.

| Description of Work                   | Cost       | Unit           | Source  |
|---------------------------------------|------------|----------------|---|
| Temporary Curb Stops (m)              | \$25.00    | m              | <a href="https://www.trafficsafetystore.com/parking-blocks/recycled-rubber">https://www.trafficsafetystore.com/parking-blocks/recycled-rubber</a>                                       |
| Pavement Markings (Stop Bar)          | \$175.00   | each           | <a href="http://www.transportation.alberta.ca/Content/docType257/Production/UnitPriceList.pdf">http://www.transportation.alberta.ca/Content/docType257/Production/UnitPriceList.pdf</a> |
| Signs (each)                          | \$175.00   | each           | DNV   |
| School Crossing and Signage (each)    | \$800.00   | each           | Assume 15m crosswalks + 2 signs   |
| 1. Crosswalk                          | \$30.00    | m              | Fineline  |
| 2. Crosswalk Signage                  | \$175.00   | each           | DNV   |
| Concrete curbs (m)                    | \$150.00   | m              | <a href="http://www.transportation.alberta.ca/Content/docType257/Production/UnitPriceList.pdf">http://www.transportation.alberta.ca/Content/docType257/Production/UnitPriceList.pdf</a> |
| Concrete sidewalk (m)                 | \$250.00   | m              | DNV   |
| Curb Let Downs                        | \$1,200.00 | each           | Quote for other project   |
| Pavement Markings (Longitudinal)      | \$2.00     | m              | <a href="http://www.transportation.alberta.ca/Content/docType257/Production/UnitPriceList.pdf">http://www.transportation.alberta.ca/Content/docType257/Production/UnitPriceList.pdf</a> |
| Pavement Markings (Gore)              | \$1,000.00 | each           | <a href="http://www.transportation.alberta.ca/Content/docType257/Production/UnitPriceList.pdf">http://www.transportation.alberta.ca/Content/docType257/Production/UnitPriceList.pdf</a> |
| Pavement Markings (Median)            | \$13.00    | m              | Fineline  |
| Coloured Paint (Sidewalk/Bike Lane)   | \$125.00   | m <sup>2</sup> | Fineline  |
| Move Catchbasin                       | \$3,000.00 | each           | Opus File System  |
| Clear Vegetation (m <sup>2</sup> )    | \$80.00    | m <sup>2</sup> | Chesterfield proposal - cost to trim each tree - Assumed 1 m <sup>2</sup> = 1 tree  |
| Pavement Markings (arrows)            | \$200.00   | each           | Fineline  |
| Raised Crosswalk (asphalt)            | \$5,000.00 | each           | DNV   |
| Bollards                              | \$200.00   | each           | <a href="http://www.reliance-foundry.com/bollard/all-bollards">http://www.reliance-foundry.com/bollard/all-bollards</a>   |
| Gravel Sidewalk (m <sup>2</sup> )     | \$40.00    | m <sup>2</sup> | Duncan Paving Quote for installing sub base   |
| Stairs (m)                            |            | m              |   |
| Handrail                              | \$111.00   | m              | Quote from Simplified Building  |
| Relocate Existing Signs               | \$125.00   | each           | Assume approximately 70-75% of supply and install cost  |
| Improved Pedestrian Crossing Lighting | \$10,000   | Each           | BC MoTI Construction and Rehabilitation Cost Guide (2013)   |



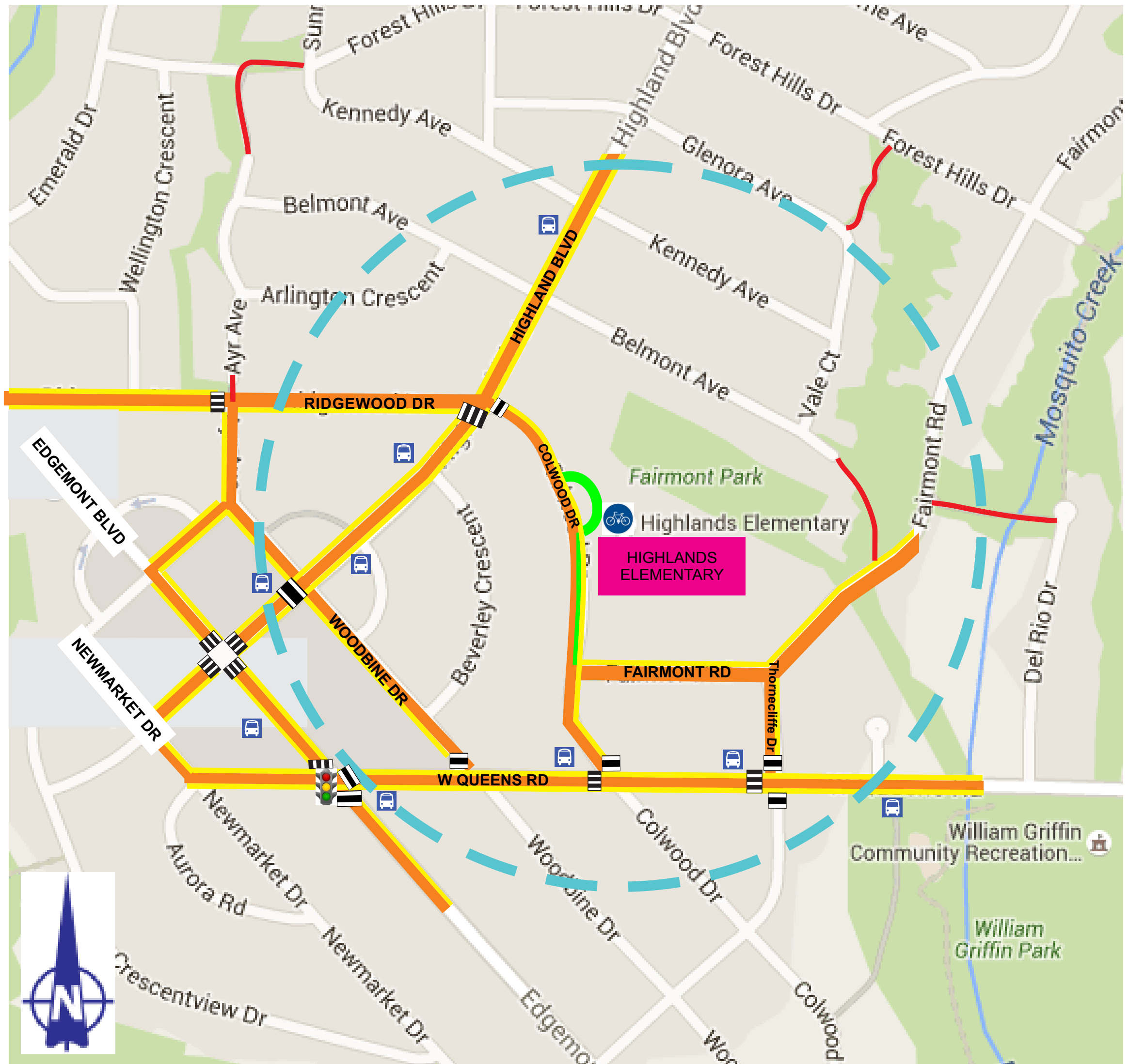
# **APPENDIX E**

## **Safe-Routes-to-School Map**














# Highlands Elementary School Safe Routes to School Map



## Legend - Canyon Heights Elementary School

- |  |  |  |
|--|--|--|
|  Best Walking Routes  |  Drop off/Pick up |  Sidewalk       |
|  5 Minute Walk Radius |  Bus Stop         |  Trail          |
|  Pedestrian Crosswalk |  Bicycle Parking  |  Traffic Signal |



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