



# City of Whitehorse 2nd Avenue Corridor Traffic Study

Prepared for City of Whitehorse  
Prepared by Stantec Architecture Ltd

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202 - 107 Main Street, Whitehorse, YT Y1A 2A7

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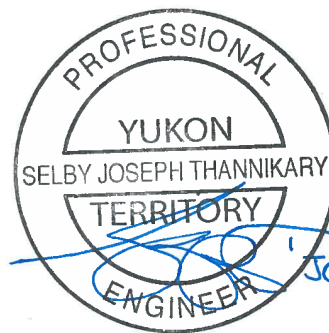
## 2ND AVENUE CORRIDOR STUDY

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## 2ND AVENUE CORRIDOR STUDY

### Introduction

## 1.0 INTRODUCTION

The City of Whitehorse is currently experiencing significant evolution due to potential development projects within the downtown core. The recent completion of the Downtown Plan, Transit Master Plan, and the Bicycle Master Plan supports planning for growth in the area and identifies locations for infrastructure improvement. The 2<sup>nd</sup> Avenue Corridor Study is a desktop review based on data provided by the City of Whitehorse and our knowledge and review of plans in the area. The intent of this study is to explore opportunities for improvements to increase safety and efficiency for all users while considering the evolving context of the corridor.

### 1.1 BACKGROUND

Action #4 of the City of Whitehorse Downtown Plan, completed in 2018, identified the need for a corridor study along 2<sup>nd</sup> Avenue to explore opportunities to increase safety, efficiency, and create a complete street for all modes while maintaining north-south vehicle capacity through the core area of the City. The Downtown Plan identified a few key improvement ideas to be explored as part of the 2<sup>nd</sup> Avenue Corridor Study including:

- increasing space dedicated to pedestrians and people with special mobility requirements along the corridor and crossing 2<sup>nd</sup> Avenue;
- improved lighting, safety, and design features at key intersections along the corridor; and
- exploring reconfigurations of existing 2<sup>nd</sup> Avenue right-of-way, potentially narrowing travel lanes.

In addition, the Downtown Plan developed a vision and guiding principles to be applied to future initiatives and policies within the downtown core. Some of the relevant policies to this study are summarized as follows:

- “Adopt a “pedestrian first” planning approach that prioritizes pedestrians but actively supports all transportation modes. Focus these efforts on the highest priority pedestrian-oriented areas of Downtown, including the riverfront and the commercial core centered on Main Street.” *City of Whitehorse Downtown Plan June 2018, pg. 21*
- “Provide safe, easy, and enjoyable connections between all Downtown areas and surrounding neighbourhoods and employment areas.” *City of Whitehorse Downtown Plan June 2018, pg. 21*

The City of Whitehorse has also identified future projects along the corridor that may shift the nature of 2<sup>nd</sup> Avenue from primarily accommodating vehicle traffic to accommodating higher transit, pedestrian, and cycling demand. The City of Whitehorse also expressed concerns regarding pedestrian crossing safety and vehicle speeds along the corridor.



## 2ND AVENUE CORRIDOR STUDY

### Introduction

## 1.2 STUDY AREA

2<sup>nd</sup> Avenue is a major roadway through Downtown Whitehorse, providing connectivity to the south across the Yukon River (as Lewes Boulevard) and to the north as it connects to Two Mile Hill Road and Quartz Road. Through the Downtown, 2<sup>nd</sup> Avenue functions as a 4-lane, undivided urban roadway with closely-spaced intersections and direct access to various businesses and land uses. The study area includes 2<sup>nd</sup> Avenue within the downtown area of the City of Whitehorse between Robert Service Way in the south to Ogilvie Street in the north. **Figure 1** illustrates the study area within the downtown area of the City of Whitehorse.

## 1.3 METHODOLOGY

The 2<sup>nd</sup> Avenue corridor study is a desktop study reviewing the existing conditions along 2<sup>nd</sup> Avenue through Downtown Whitehorse to identify preliminary recommendations for transportation changes to the street to better serve all users, improve safety outcomes and address any identified operational challenges. The purpose of this study focused on opportunities and constraints with preliminary recommendations identified to service future more detailed analysis.

The project team reviewed the existing cross sections, adjacent land uses, intersection capacity, collision data, travel speeds, and parking management plan along the corridor. This data was used to identify locations where there was the most need for safety and operational improvements and to begin to identify the types of improvements needed to meet the specific needs of the corridor

In addition to the technical review of the corridor, the project team reviewed current and ongoing projects completed by the City which may impact the use of 2<sup>nd</sup> Avenue including:

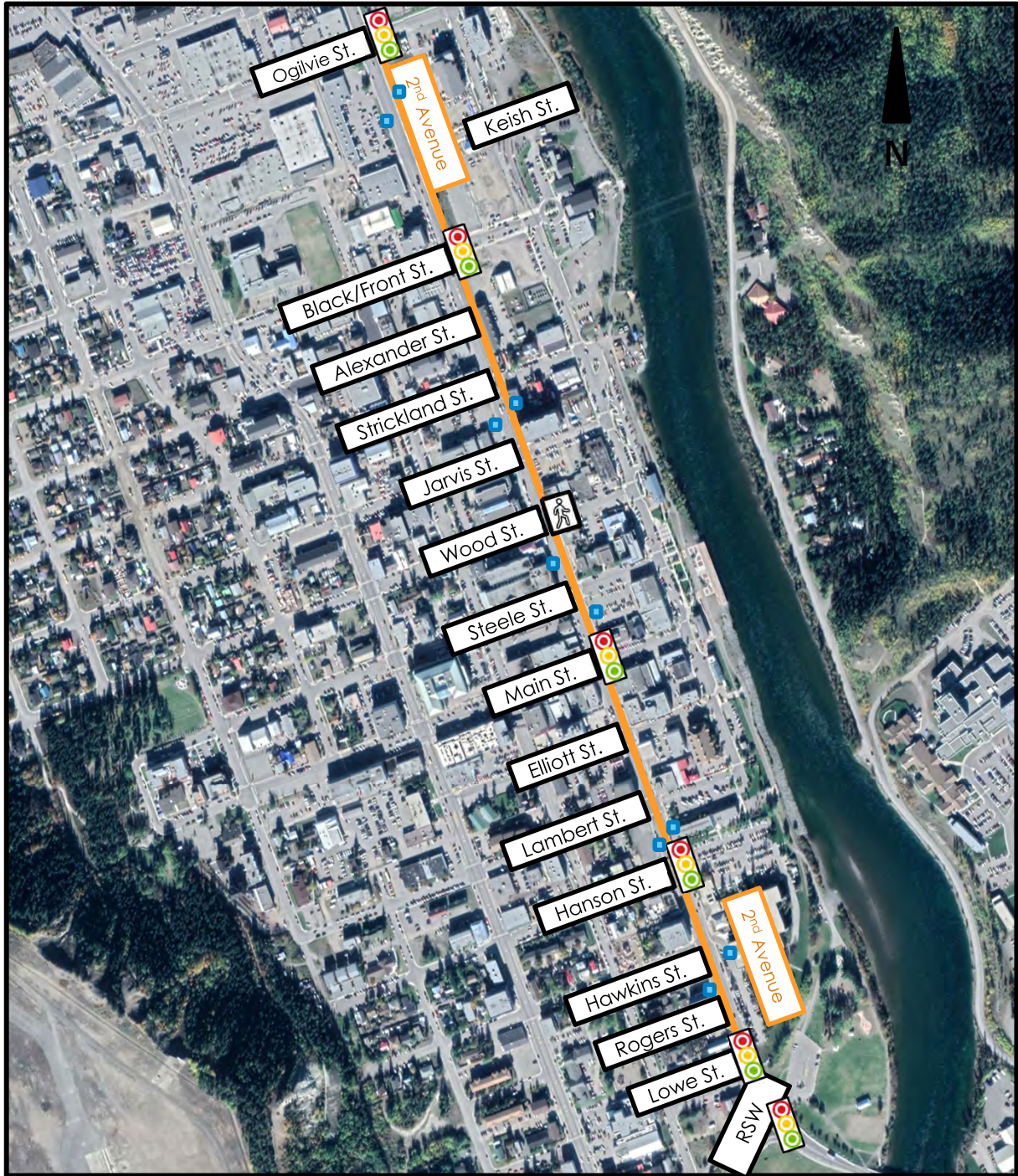
- City Hall Expansion;
- Veterans' Square development;
- Transit Master Plan; and
- Bicycle Master Plan.

Following the review of the existing and known future conditions, the project team identified the opportunities and constraints guiding future redevelopment or adjustment of 2<sup>nd</sup> Avenue as well as some tools and cross-sections that may help to achieve desired outcomes along the corridor.

Finally, the potential cross-sections were evaluated to determine the impacts and opportunities of the proposed changes, and some preliminary recommendations were identified. It is anticipated that this study will be the catalyst for Conceptual Design of the corridor.







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**Legend**



Signalized Intersection



Pedestrian Flasher



Transit Stop

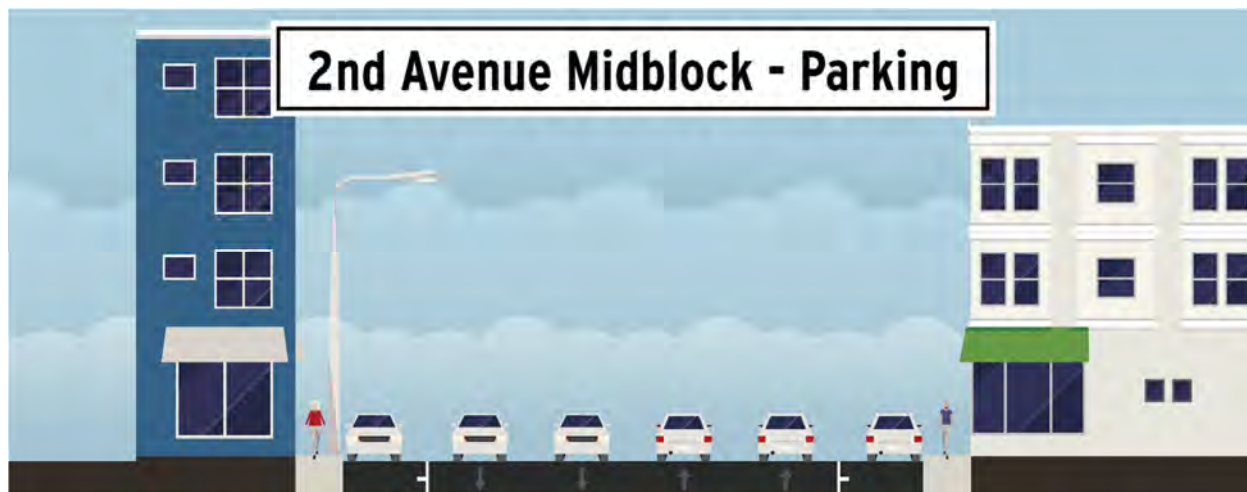
City of Whitehorse  
 2nd Avenue Corridor Study

Figure No.  
**1**

Title  
**Study Area & Traffic Control**

## 2.0 EXISTING CONDITIONS

2<sup>nd</sup> Avenue is currently developed within an approximate 24 metre right-of-way as a four-lane undivided arterial roadway running north-south within a grid network of streets in the downtown area of the City of Whitehorse. Additional parking lanes to accommodate on-street parking are generally provided along both sides of 2<sup>nd</sup> Avenue between Lowe Street and Black Street. South of Lowe Street and north of Black Street, parking is not permitted along 2<sup>nd</sup> Avenue. Monowalk sidewalks are currently provided along both sides of 2<sup>nd</sup> Avenue and curb extensions are constructed at most intersections where parking is provided along 2<sup>nd</sup> Avenue. **Figures 2, 3, and 4** illustrate the existing 2<sup>nd</sup> Avenue cross sections within the study area including midblock with on-street parking, midblock without on-street parking, and at intersections respectively. The posted speed limit along 2<sup>nd</sup> Avenue is 50 km/h.



**Figure 2: 2nd Avenue Midblock with Parking Cross Section**

As shown on Figure 2, the pedestrian realm and street furnishing zone (street lighting, traffic signs, parking meters, etc.) is generally narrow and most of the road right-of-way is paved for vehicle use. Based on a review of Google street view, there are some areas along 2<sup>nd</sup> Avenue that are perceived to have less than 1.5 metres walking space due to street lighting and sign placement within the sidewalk.



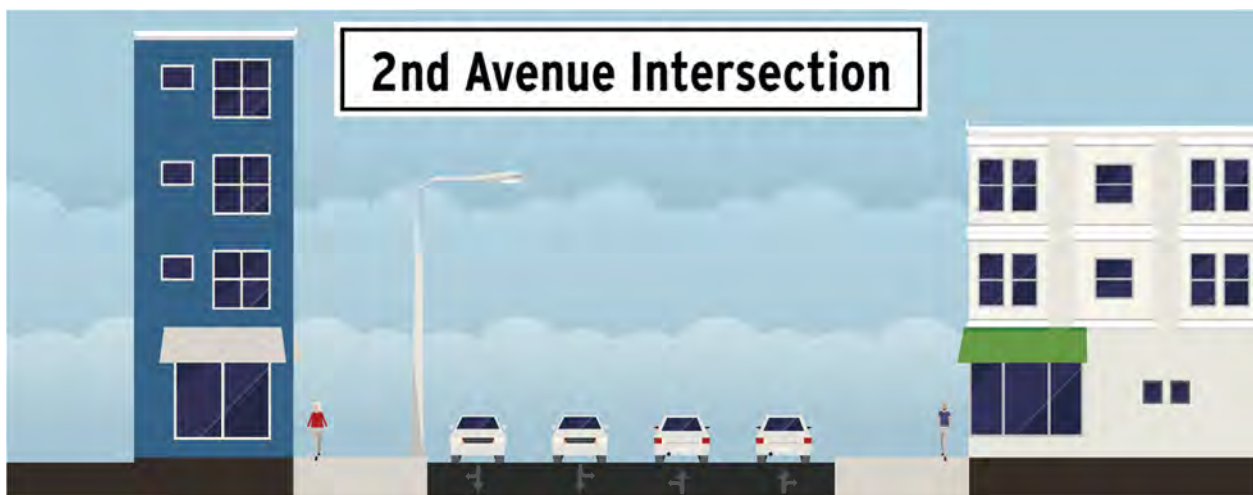
## 2ND AVENUE CORRIDOR STUDY

### Existing Conditions



**Figure 3: 2<sup>nd</sup> Avenue Midblock no Parking Cross Section**

As shown in Figure 3, areas along 2<sup>nd</sup> Avenue without on-street parking typically have larger areas for street furniture; therefore, the pedestrian realm is generally less obstructed.



**Figure 4: 2<sup>nd</sup> Avenue Intersection Cross Section**

As shown in Figure 4, curb extensions are constructed at intersections along 2<sup>nd</sup> Avenue in the vicinity of on-street parking areas.

In addition, the existing traffic control along 2<sup>nd</sup> Avenue is illustrated on Figure 1. The Ogilvie Street/2<sup>nd</sup> Avenue, Black Street/2<sup>nd</sup> Avenue, Main Street/2<sup>nd</sup> Avenue, Hanson Street/2<sup>nd</sup> Avenue, Lowe Street/2<sup>nd</sup> Avenue, and Robert Service Way/2<sup>nd</sup> Avenue intersections are currently signalized and a pedestrian flasher is currently on the north approach of the Wood Street/2<sup>nd</sup> Avenue intersection. There are left turn bays at Black Street in both directions.



## 2ND AVENUE CORRIDOR STUDY

### Existing Conditions

Zebra crosswalk markings are provided on the majority of crossing points along 2<sup>nd</sup> Avenue with the exception of Keish Street, Alexander Street, Hawkins Street, and Rogers Street where there are no crosswalks of any type provided across 2<sup>nd</sup> Avenue. However, there is no pedestrian crossing signage indicating to vehicle drivers that a pedestrian may be crossing at the crossing points along the corridor. Pedestrians are still using these locations. Section 5.2 discusses the Pedestrian Crossing Control Guide, which can be used to identify where additional pedestrian infrastructure may be warranted

In addition to the noted intersections, there are some direct accesses to businesses and alleys along 2<sup>nd</sup> Ave. When reviewing the impact of accesses and alleys on the corridor considerations should include: sidewalk grade, traffic volumes, sight lines, and width of access. In many cases, it is unavoidable to have direct access via sidewalks and alleys but any redevelopment along 2<sup>nd</sup> Avenue should avoid any grade differential for pedestrians along the sidewalk, no oversized accesses and consideration of pedestrian visibility.

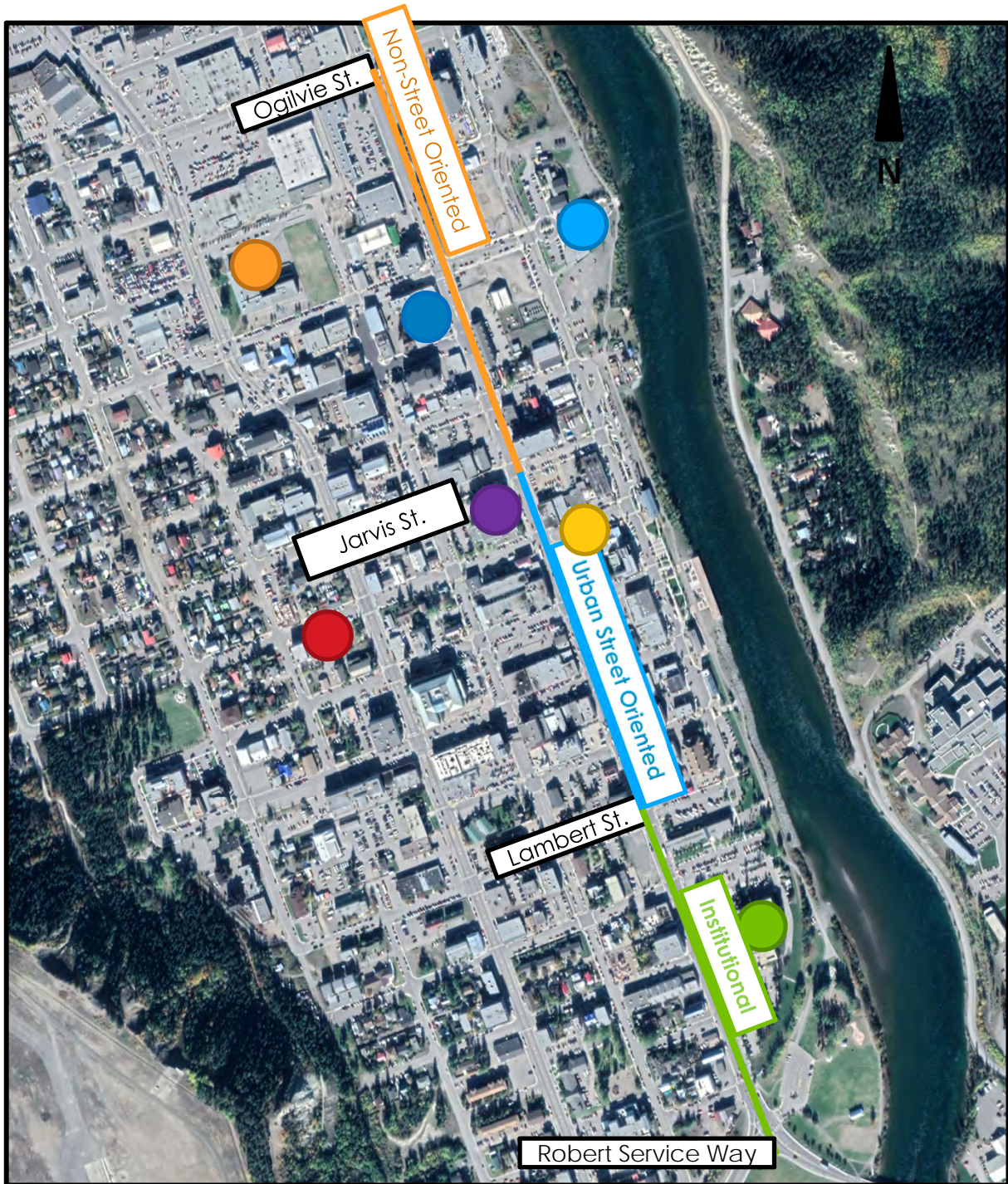
## 2.1 ADJACENT CONTEXTS

Figure 5 identifies three character areas along 2<sup>nd</sup> Avenue including the following:

- **Institutional** – Land uses along 2<sup>nd</sup> Avenue between Robert Service Way and Lambert Street generally fall under institutional uses including Rotary Park, the Public Library, the Government of Yukon Administrative Building, and the Yukon Visitor Information Center.
- **Urban Street Oriented** – Land uses and businesses along 2<sup>nd</sup> Avenue between Lambert Street and Jarvis Street are generally street-oriented. Whitehorse City Hall and the Fire Hall are located within this zone. The City of Whitehorse Downtown Plan identifies the area along 2<sup>nd</sup> Avenue between Lambert Street and Jarvis Street as the Downtown Commercial Core.
- **Non-Street Oriented** – Land uses along 2<sup>nd</sup> Avenue between Jarvis Street and Ogilvie Street are non-street oriented and generally include big-box type businesses with parking lots fronting onto 2<sup>nd</sup> Avenue.

In addition to the character areas identified along 2<sup>nd</sup> Avenue, facilities of note are identified on Figure 5 including Whitehorse Elementary School, Wood Street Centre, City Hall, Kwanlin Dun Cultural Centre, Yukon Law Courts, Main Street as the primary shopping area, Shipyards Park, and the Public Library. While not all these facilities are located directly on 2<sup>nd</sup> Avenue, they may represent areas with high pedestrian activity or vulnerable users that may contribute to the pedestrian demand along and crossing 2<sup>nd</sup> Avenue.





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**Legend**

- Whitehorse Elementary School
- Wood Street Centre
- City Hall
- Kwanlin Dün Cultural Centre
- Gov. of Yukon Admin Building & Library
- Yukon Lawcourts (Courtthouse)
- NorthLight Innovation

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Figure No.  
**5**

Title  
**Adjacent Land Use**

## 2ND AVENUE CORRIDOR STUDY

Existing Conditions

### 2.2 TRAFFIC COUNTS

The City of Whitehorse supplied recent intersection turning movement counts information between 2015 and 2018 for the following intersections:

- Robert Service Way & 2<sup>nd</sup> Avenue (2017);
- Lowe Street & 2<sup>nd</sup> Avenue (2018);
- Hanson Street & 2<sup>nd</sup> Avenue (2015);
- Lambert Street & 2<sup>nd</sup> Avenue (2015);
- Main Street & 2<sup>nd</sup> Avenue (2018);
- Steele Street & 2<sup>nd</sup> Avenue (2017);
- Wood Street & 2<sup>nd</sup> Avenue (2018);
- Strickland Street & 2<sup>nd</sup> Avenue (2018); and
- Ogilvie Street & 2<sup>nd</sup> Avenue (2018).

Daily volume information was provided at three locations along 2<sup>nd</sup> Avenue. The daily counts were completed in May 2018 north of Main Street and in November 2018 at the Ogilvie Street/2<sup>nd</sup> Avenue intersection. **Table 1** summarizes the two-way daily volumes measured along 2<sup>nd</sup> Avenue.

**Table 1: 2<sup>nd</sup> Avenue Two-way Daily Volumes (approx. between 2015 and 2018)**

Segment	Two-Way Daily Volume
North of Ogilvie Street	18,000
South of Ogilvie Street	19,000
North of Main Street	20,000

While it varies across the corridor, a sample of 24 hour volumes is shown in **Figure 6** to illustrate how volumes vary across the day. This figure is based on April 2019 counts at 2<sup>nd</sup> Avenue and Shipyards Crosswalk.



## 2ND AVENUE CORRIDOR STUDY

### Existing Conditions

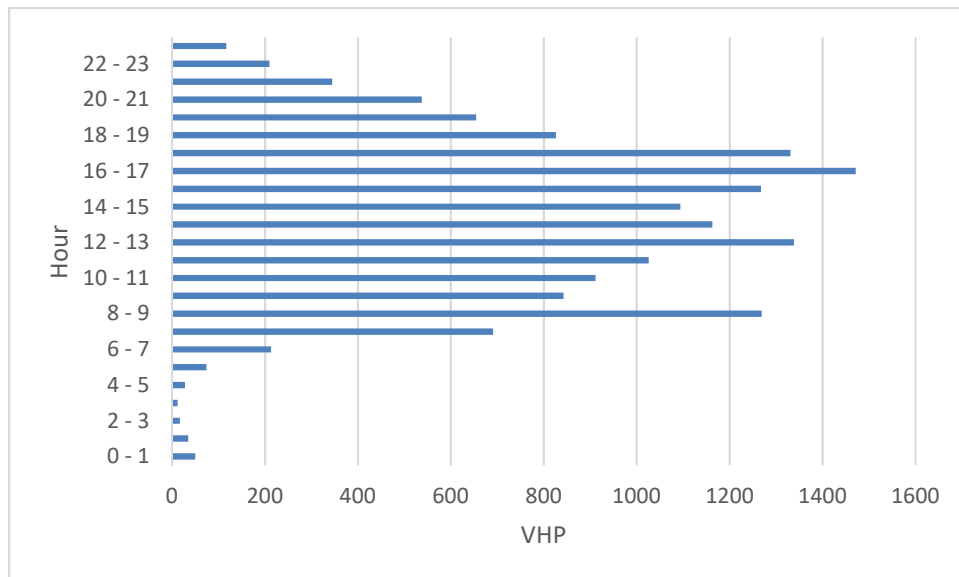


Figure 6 24 Hour Count Data

### 2.2.1 Pedestrian and Bicycle Activity

Based on the information provided by the City of Whitehorse, pedestrian volumes were not collected at the Hanson Street/2<sup>nd</sup> Avenue and Lambert Street/2<sup>nd</sup> Avenue intersections and bicycle volumes were not collected at the Hanson Street/2<sup>nd</sup> Avenue, Lambert Street/2<sup>nd</sup> Avenue, and Steele Street/2<sup>nd</sup> Avenue intersections.

**Table 2** summarizes the highest measured hourly pedestrian and bicycle volume along the 2<sup>nd</sup> Avenue corridor and the associated peak hours where information was available. As shown in Table 2, the Main Street/2<sup>nd</sup> Avenue intersection showed the highest pedestrian activity along the corridor with 634 pedestrians measured on all approaches from 12:15 to 1:15 PM. In addition to Main Street, pedestrian activity along 2<sup>nd</sup> Avenue at Steele Street, Wood Street, and Strickland Street also showed high pedestrian activity. The hourly bicycle volumes shown include bicycles on-road and measured within crosswalks.



## 2ND AVENUE CORRIDOR STUDY

Existing Conditions

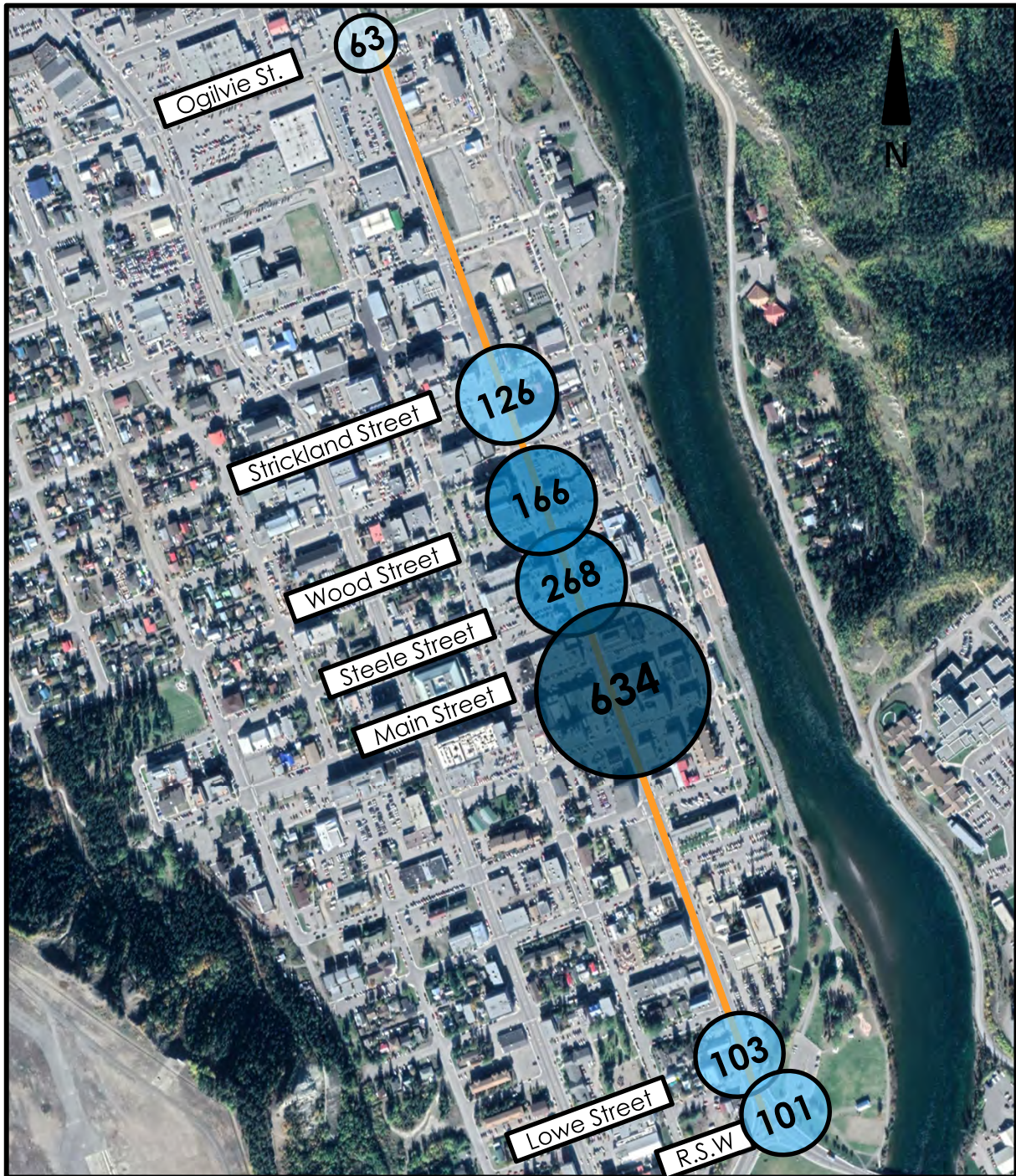
**Table 2: Highest Measured Hourly Pedestrian and Bicycle Volume**

2nd Avenue Intersection	Pedestrians		Bicycles	
	Peak Hourly Volume	Peak Hour	Peak Hourly Volume	Peak Hour
Robert Service Way	101	4:30 - 5:30 PM	-	
Lowe Street	103	11:45 AM - 12:45 PM	23	8:00 AM - 9:00 AM
Hanson Street	-		-	
Lambert Street	-		-	
Main Street	634	12:15 - 1:15 PM	5	7:45 AM - 8:45 AM 1:00 PM - 2:00 PM 4:30 PM - 5:30 PM
Steele Street	268	12:00 PM - 1:00 PM	12	2:30 PM - 3:30 PM
Wood Street	166	12:30 - 1:30 PM	6	12:15 PM - 1:15 PM
Strickland Street	126	11:45 AM - 12:45 PM	15	4:00 PM - 5:00 PM
Oglivie Street	63	1:00 - 2:00 PM & 4:00 - 5:00 PM	5	10:15 AM - 11:15 AM

It is noted that the Steele Street/2<sup>nd</sup> Avenue intersection turning movement count completed in May 2016 identified that the intersection was difficult to navigate for pedestrians travelling eastbound and westbound. **Figure 7** identifies the highest measured hourly pedestrian and bicycle volumes throughout the course of the count period for each intersection along 2<sup>nd</sup> Avenue.







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Legend

**101** Highest Measured Hourly  
 Pedestrian volume

City of Whitehorse  
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Figure No.  
**7**

Title  
**Pedestrian Activity**

## 2.3 COLLISION DATA

### 2.3.1 Pedestrian and Bicycle Collisions

The City of Whitehorse provided pedestrian and bicycle collision data along 2<sup>nd</sup> Avenue. In total, seven pedestrian collisions and three bicycle collisions were recorded within the study area along or near 2<sup>nd</sup> Avenue between 2012 and 2017. **Table 3** summarizes the locations of the pedestrian and bicycle incidents and the corresponding collision type.

**Table 3: Pedestrian and Bicycle Collisions (2012-2017)**

Location	Collisions		
	Pedestrian	Bicycle	Type
Ogilvie Street & 2nd Avenue	1		Head On
Keish Street & 2nd Avenue	1		Right Turn
Black Street & 2nd Avenue		2	Left Turn
Strickland Street & 2nd Avenue	1		Head On
Steele Street & 2nd Avenue	1		Unknown
Main Street & 2nd Avenue	2		Left Turn & Other
Main Street near 2nd Avenue	1		Other
Low Street & 2nd Avenue		1	Side swipe
<b>Total</b>	<b>7</b>	<b>3</b>	

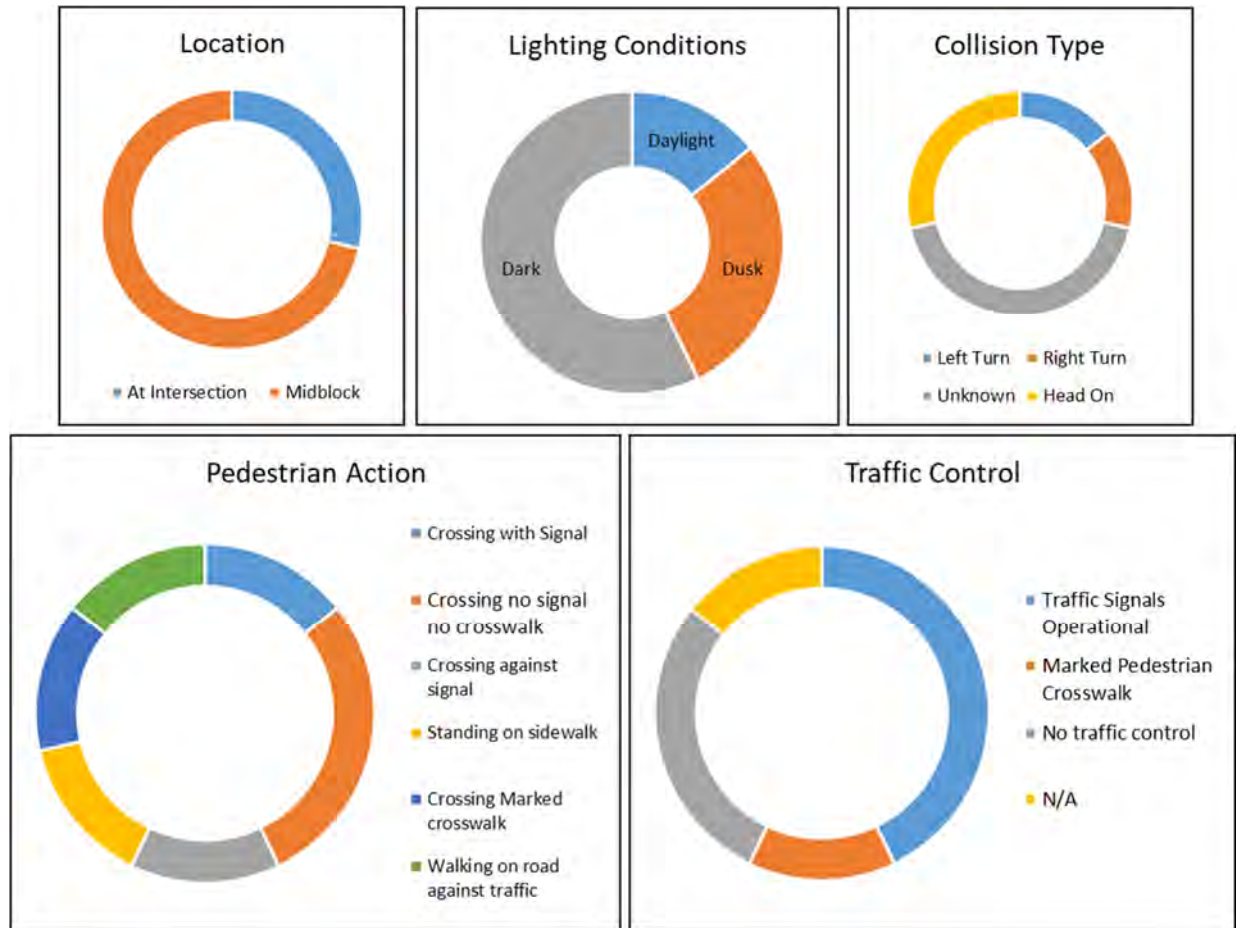
**Figure 8** illustrates the details of the pedestrian collisions along or near 2<sup>nd</sup> Avenue between 2012-2017. All three bicycle collisions recorded along 2<sup>nd</sup> Avenue occurred during daylight, with clear weather and dry road surface conditions. The data indicates:

- Almost ¾ of pedestrian collisions occurred at intersections;
- The majority of collisions occurred in dark or dusk lighting;
- Pedestrian action does not appear to be strongly correlated with collision cause; and
- More than half of collisions occurred at signals or within a marked crossing.



## 2ND AVENUE CORRIDOR STUDY

### Existing Conditions



**Figure 8: 2<sup>nd</sup> Avenue Pedestrian Collisions (2012-2017)**

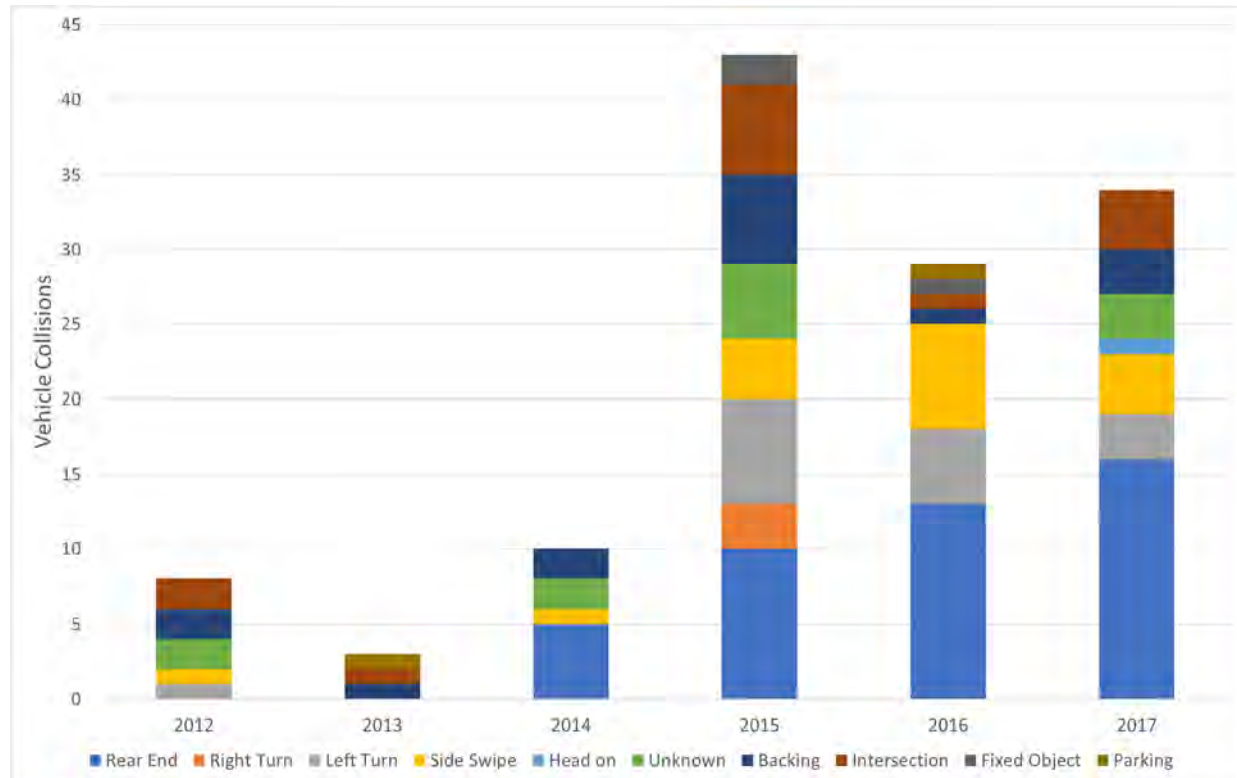
### 2.3.2 Vehicle Collisions

The City of Whitehorse provided vehicle collision data recorded at 16 intersections within the study area along 2<sup>nd</sup> Avenue between 2012 and 2017. **Figure 9** illustrates the types and magnitude of vehicle collisions recorded along 2<sup>nd</sup> Avenue between 2012 and 2017. As shown, the amount of collisions along 2<sup>nd</sup> Avenue has generally increased between 2012 and 2017. Collisions peaked in 2015 with 43 collisions recorded. 35% of collisions recorded were categorized as rear-ends while left turn and general intersection collisions accounted for approximately 24% of all types of collisions along 2<sup>nd</sup> Avenue.



## 2ND AVENUE CORRIDOR STUDY

### Existing Conditions



**Figure 9: Vehicle Collisions along 2<sup>nd</sup> Avenue per year (2012-2017)**

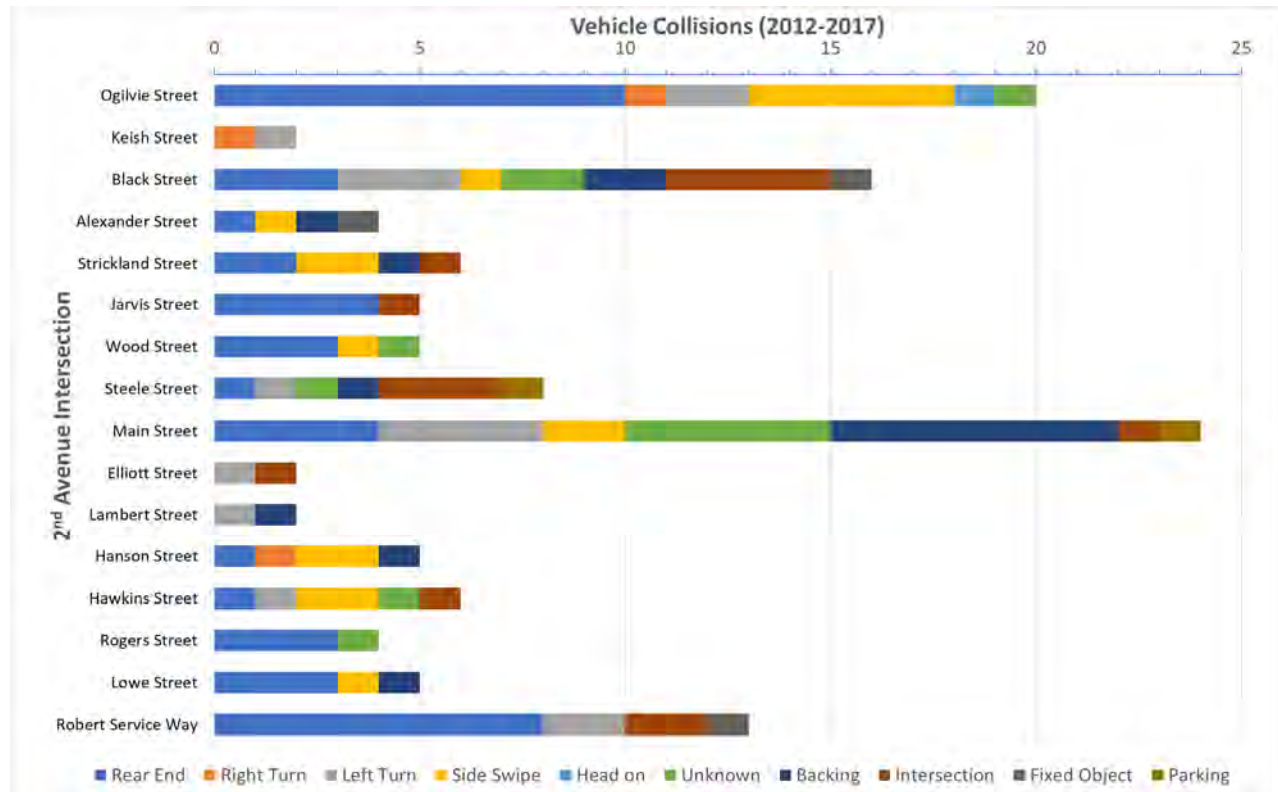
As shown in **Figure 9**, vehicle collisions reported along 2<sup>nd</sup> Avenue increased between 2014 and 2015. It is unclear whether the increase in vehicle collisions reported was due to a change in the built environment along 2<sup>nd</sup> Avenue or due to a change in reporting methods. Further discussions with City of Whitehorse will be required to determine the cause of the increase in collisions reported.



## 2ND AVENUE CORRIDOR STUDY

### Existing Conditions

**Figure 10** illustrates the number of vehicle collisions recorded between 2012-2017 at each intersection along 2<sup>nd</sup> Avenue. As shown, 24 collisions were recorded at the Main Street/2<sup>nd</sup> Avenue intersection, accounting for approximately 20% of total collisions recorded along the corridor between 2012 and 2017.



**Figure 10: Collisions by 2<sup>nd</sup> Avenue Intersection (2012-2017)**

While the magnitude and type of collisions were recorded and provided as part of the collision data along 2<sup>nd</sup> Avenue, there was no detailed description provided for each pedestrian, cyclist, and vehicle collision to allow comment on potential contributing factors along 2<sup>nd</sup> Avenue. The collision data was generally taken into consideration; however, as this study is a desktop review, the recommendations developed are based on speculation of issues causing collisions. Completion of further studies (i.e. conflict studies) are recommended to understand and confirm any issues contributing to collisions along 2<sup>nd</sup> Avenue.

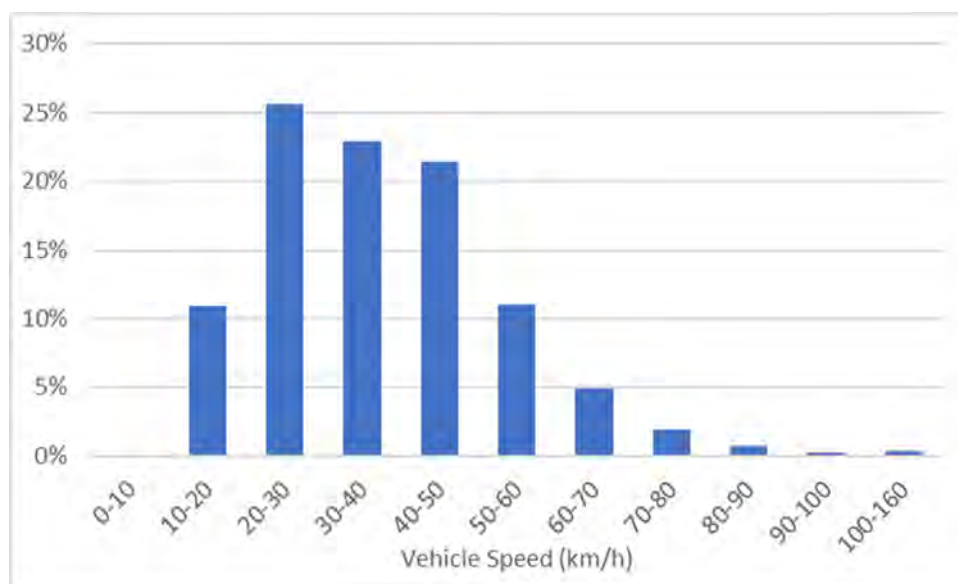


## 2ND AVENUE CORRIDOR STUDY

Existing Conditions

### 2.4 SPEED DATA

The City of Whitehorse Downtown Plan public engagement identified that the public viewed traffic speeds along 2<sup>nd</sup> Avenue as being a major safety concern. The City provided speed study data collected along 2<sup>nd</sup> Avenue between Main Street and Steele Street over a 24-hour period in May 2016. The posted speed along 2<sup>nd</sup> Avenue is 50 km/h. As shown in **Figure 11**, 11.0% of vehicles observed during the survey period were measured at speeds between 50 km/h and 60 km/h while 11.2% were observed travelling at speeds greater than 60 km/h. The 85<sup>th</sup> percentile speed was measured at 52.9 km/h while the 95<sup>th</sup> percentile speed was measured at 65.5 km/h.



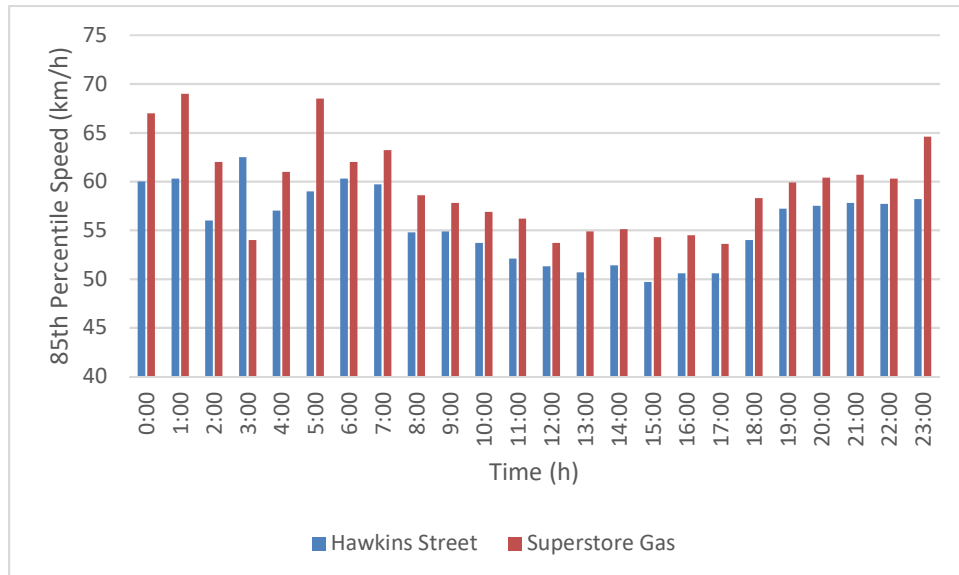
**Figure 11: 2<sup>nd</sup> Avenue Speed Study Results**

Additional speed studies were completed in April 2019, one at the south end of 2<sup>nd</sup> Ave (Hawkins Street) and one at the north end (Superstore Gas). At the Hawkins Street the 85<sup>th</sup> percentile speed was 55 km/h. Further north on 2<sup>nd</sup> Ave, the 85<sup>th</sup> percentile speed is higher, around 58 km/h. The studies also show a distinct increase in speeding between 6 pm and 7 am, as shown in **Figure 12**.



## 2ND AVENUE CORRIDOR STUDY

### Existing Conditions



**Figure 12 Time of Day Speed Data (2019)**

Though not a detailed speed study, this data indicates that speeding is more a concern as land uses become more disperse at the north end of 2<sup>nd</sup> Avenue, and outside of peak hour. Data like this may indicate that as traffic volumes decrease, there is less friction on street slowing drivers, and drivers exceed the posted speed limits as they feel comfortable going faster based on the design.

## 2.5 DOWNTOWN PARKING MANAGEMENT PLAN UPDATE

The City of Whitehorse was completed by Stantec and endorsed by the City of Whitehorse Council in July of 2019. A high-level review of the existing parking demands along the 2<sup>nd</sup> Avenue corridor was completed. Based on the review, parking demands along 2<sup>nd</sup> Avenue are generally low throughout the day. The highest parking demand was observed between Steele Street and Elliott Street.



## 2ND AVENUE CORRIDOR STUDY

Future 2nd Avenue Projects

### 3.0 FUTURE 2<sup>ND</sup> AVENUE PROJECTS

The City of Whitehorse identified a number of future potential projects along 2<sup>nd</sup> Avenue and within the downtown area that may impact transit, pedestrian, and cycling demand along 2<sup>nd</sup> Avenue.

#### 3.1 CITY HALL EXPANSION

The City Hall expansion project will consist of expanding the existing City Hall building located on the northeast corner of the Steele Street/2<sup>nd</sup> Avenue intersection. The project includes relocating the fire hall and constructing a new building north of City Hall, as well as including public accessible washroom facilities available for longer periods of the day than the City Hall operating hours. The City Hall expansion has not yet received funding to proceed.

The City Hall expansion will result in more people working in the area and therefore potentially higher pedestrian and cycling trips to and from City Hall within the downtown area.

#### 3.2 VETERAN'S SQUARE

Based on available site plans, the Veteran's Square project proposes to close Steele Street to vehicle traffic between 2<sup>nd</sup> Avenue and the lane west of Front Street and relocate Veteran's Square from its existing location along 2<sup>nd</sup> Avenue adjacent to City Hall to the closed portion of Steele Street. The closure of Steele Street in this area was also identified as a temporary measure within the City of Whitehorse Downtown Plan, with the potential of it being permanent. It is anticipated that reallocating this portion of Steele Street for exclusive pedestrian and cycling use could increase the demand for people to access the site within the downtown area; therefore, potentially increasing transit, pedestrian, and cycling activity. The Veteran's Square project has not been confirmed and is awaiting funding and approval.

#### 3.3 TRANSIT MASTER PLAN

The City of Whitehorse Transit Master Plan was completed by Stantec in April 2018 and identified limited transit infrastructure within the downtown core and recommended reducing the number of transit routes going into downtown from six to two routes (Riverdale Route and Copper Ridge Route) to better respond to how people move around the City.

The City of Whitehorse is currently investigating the feasibility to develop a transit kiosk on the southeast corner of the Steele Street/2<sup>nd</sup> Avenue intersection, south of the existing City Hall building. While no funding has been allocated to this project, the Transit Kiosk is anticipated to increase transit, pedestrian, and cycling demand in the area if developed since this infrastructure would facilitate and encourage multimodal travel options.





### 3.4 BICYCLE NETWORK PLAN

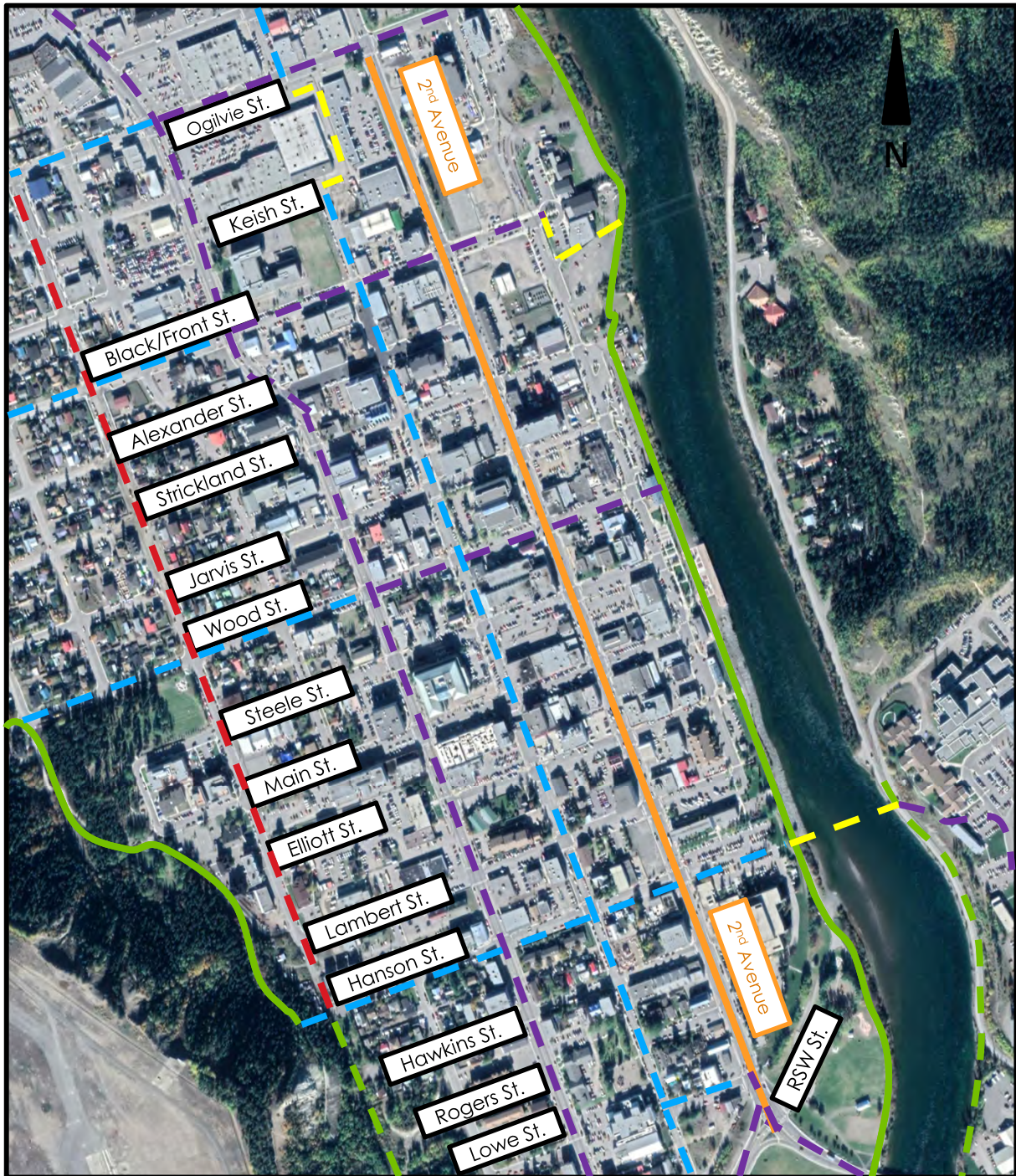
The City of Whitehorse Bicycle Network Plan was completed in 2018 and identified recommended cycling infrastructure within the downtown area along and crossing 2<sup>nd</sup> Avenue, but 2nd Ave is not a focus for bike infrastructure.

The Bicycle Network Plan recommends two types of facilities to be implemented on or near 2<sup>nd</sup> Avenue:

- **Separated Bicycle Paths** – Bicycle facilities physically separated from vehicle travel lanes are identified along Ogilvie Street, Black Street, Wood Street, 2<sup>nd</sup> Avenue south of Lowe Street, and Robert Service Way
- **Neighbourhood Greenways** – Shared on-street bicycle routes on low volume and low speed streets are identified along Hansen Street, 3<sup>rd</sup> Avenue, and Lowe Street.

**Figure 13** illustrates the recommended bicycle network in the vicinity of 2<sup>nd</sup> Avenue. In addition, the Bicycle Network Plan recommended short-term bicycle network priority projects including consideration for intersection improvements along 2<sup>nd</sup> Avenue at Ogilvie Street, Black Street, Wood Street, Hansen Street, and Lowe Street.





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**Legend**

- Existing Multi-Use Pathway (AAA)
- - - Proposed Multi-Use Pathway (AAA)
- - - Proposed Separated Bicycle Path (AAA)
- - - Proposed Neighbourhood Greenway
- - - Proposed Bicycle Lane
- - - Proposed Route (Alignment Unknown)
- Study Area – 2<sup>nd</sup> Avenue

City of Whitehorse  
 2<sup>nd</sup> Avenue Corridor Study

Figure No.  
 13

Title  
**Bicycle Network Plan**

## 4.0 CORRIDOR OPPORTUNITIES AND CONSTRAINTS

### 4.1 OPPORTUNITIES

The 2<sup>nd</sup> Avenue corridor is a relatively wide roadway running through a major portion of the downtown area of Whitehorse. The majority of 2<sup>nd</sup> Avenue is bordered by urban street-oriented land uses, civic and institutional land uses, and is located less than 200m from the Yukon River. The mix of land uses and amenities already developed in the vicinity of 2<sup>nd</sup> Avenue presents an opportunity for placemaking and connect people through the downtown area to and along 2<sup>nd</sup> Avenue.

2<sup>nd</sup> Avenue currently has approximately 24 metres of space reserved within the downtown core potentially able to accommodate the needs of multiple types of users travelling to 2<sup>nd</sup> Avenue and through the area without impacting existing building locations. Underutilized use of space could be reallocated to users such as pedestrians and cyclists who are currently underrepresented by the existing 2<sup>nd</sup> Avenue configuration; therefore, likely improving the pedestrian/cyclist experience and increasing safety while encouraging active modes activity within the downtown area.

In addition, the grid roadway network established within the downtown area provides excellent pedestrian and cycling connectivity opportunities as well as creates a robust vehicle network with multiple routing options through the area. Vehicles destined or originating within the downtown area have many options for accessing 2<sup>nd</sup> Avenue and the cross-streets. Where capacity constraints or high delays are projected for one or multiple movements at one intersection location, there is likely another intersection with capacity in the vicinity that drivers may choose to use instead without significantly disrupting their trip route. Grid networks allows for flexibility in choosing particular intersections along the corridor to provide vehicle capacity, while others may prioritize pedestrian and cyclist crossing.

### 4.2 CONSTRAINTS

The largest constraint in the study area is likely the traffic volumes along 2<sup>nd</sup> Avenue traveling through the downtown core. Daily volumes are in the order of 20,000 vehicles per day along 2<sup>nd</sup> Avenue, which demonstrates the reliance of vehicle traffic on the 2<sup>nd</sup> Avenue corridor within the overall City of Whitehorse roadway network. In our experience, accommodating existing and potential traffic growth along the corridor without shifting traffic to another roadway could require very deliberate and strong policy and leadership. However, the reduction in vehicle capacity along the corridor is the best way to encourage positive outcomes for other modes, improve safety while crossing 2<sup>nd</sup> Avenue and the pedestrian experience along 2<sup>nd</sup> Avenue.



## 5.0 IMPROVEMENT TOOLS & POTENTIAL CROSS SECTIONS

The following section highlights industry practice tools, possible spot improvement locations, and potential cross section options developed for the 2<sup>nd</sup> Avenue corridor.

### 5.1 TRAFFIC SIGNAL WARRANTS

The Transportation Association of Canada's (TAC) Traffic Signal Warrant was reviewed for the unsignalized intersections along the corridor where pedestrian data was available. TAC Traffic Signal Warrants were completed at the Strickland Street/2<sup>nd</sup> Avenue, Wood Street/2<sup>nd</sup> Avenue, and Steele Street/2<sup>nd</sup> Avenue intersections under existing traffic and pedestrian volumes and assumed existing roadway geometry. None of the intersections warranted traffic signals under this analysis due to low side street volume; however, signalization may be justified for other reasons such as intersection delay or safety concerns.

### 5.2 PEDESTRIAN CROSSING CONTROL GUIDE

TAC's Pedestrian Crossing Control Guide (2018) was reviewed to determine the potential pedestrian crossing controls at unsignalized intersections along 2<sup>nd</sup> Avenue. Based on a review of the guide, pedestrian crossing treatments are warranted if the following conditions are met:

- Signalization is not warranted;
- Daily traffic volumes greater or equal to 1,500 vehicles per day;
- Average hourly pedestrian volumes greater or equal to 15 Equivalent Adult Units (EAU); and
- The intersection is not in close proximity to another traffic control device; however, this is dependent on roadway characteristics and jurisdiction. In addition, if the intersection is near another traffic control device, but the intersection is located on pedestrian desire lines, pedestrian crossing treatments may still be warranted.

Daily traffic volumes along 2<sup>nd</sup> Avenue are in the order of 20,000 vehicles per day, greatly exceeding the 1,500 vehicles per day threshold. Average hourly pedestrian volumes crossing 2<sup>nd</sup> Avenue at Wood Street/, Strickland Street, and Steele Street are greater than 15 EAUs.

A pedestrian flasher is currently installed at the Wood Street/2<sup>nd</sup> Avenue intersection and the Steele Street/2<sup>nd</sup> Avenue intersection, less than 100 metres from other traffic control devices. However, Steele Street is currently located on pedestrian desire lines and pedestrian crossing demand along Steele Street is anticipated to increase when the future potential City Hall expansion, Veteran's Square relocation, and transit kiosk are developed. Based on the above discussion, a pedestrian crossing control may still be warranted in this location.



## 2ND AVENUE CORRIDOR STUDY

### Improvement Tools & Potential Cross Sections

Based on *Table 1: Decision Support Tool* of the Pedestrian Crossing Control Guide, for roadways carrying over 15,000 vehicle per day with a posted speed limit of 50km/h, the following preferred crossing treatments are recommended:

- Rectangular Rapid Flashing Beacons (RRFB) – where pedestrians are crossing 1 to 2 lanes total or 2 lanes per direction with a raised pedestrian refuge;
- Overhead flashing beacon systems (special crosswalks) – where pedestrians are crossing 3 lanes total or 3 lanes per direction with a raised pedestrian refuge; and
- Traffic Signal System – where pedestrians are crossing 2 to 3 lanes per direction without a raised pedestrian refuge.

Recommended, desirable, and optional components of each of the preferred crossing treatments in context of 2<sup>nd</sup> Avenue are summarized in **Table 4** based on *Table 4: RRFB Components*, *Table 5: Special Crosswalk Components*, and *Table 6: Pedestrian Signal Components* of the Pedestrian Crossing Control Guide.



**Table 4: Pedestrian Crossing Control Guide Treatment Components**

	RRFB	Special Crosswalks	Traffic Signal Systems
<b>Recommended Components</b>	<ul style="list-style-type: none"> <li>• RRFB and side-mounted signs; mounted back to back on both sides of an undivided roadway or one on the right side and one on the median for a roadway with a pedestrian refuge.</li> <li>• Zebra Crosswalk marking</li> <li>• Pedestrian pushbutton with sign at each crossing beginning</li> <li>• Advanced warning sign where visibility is limited</li> <li>• Stopping prohibition near the crosswalk</li> </ul>	<ul style="list-style-type: none"> <li>• Internally illuminated overhead mounted signs with alternative amber flashing beacons and down lighting mounted so that a driver faces two signs on each approach.</li> <li>• Side-mounted signs mounted so that a driver faces two signs on each approach.</li> <li>• Pedestrian pushbutton with sign at each crossing beginning</li> <li>• Zebra Crosswalk marking</li> <li>• Advanced warning sign</li> <li>• Stopping prohibitions near the crosswalk</li> </ul>	<ul style="list-style-type: none"> <li>• Twin parallel line crosswalk markings</li> <li>• Stop lines</li> <li>• Primary signal heads</li> <li>• Secondary signal heads</li> <li>• Pedestrian pushbutton at each crossing beginning</li> <li>• Stop sign on cross street</li> </ul>
<b>Desirable Components</b>	<ul style="list-style-type: none"> <li>• Advance yield to Pedestrians Line on multiple lane approaches</li> <li>• Yield Here to Pedestrians Sign on multiple lane approaches</li> <li>• Raised refuge island for road cross sections with more than two lanes and two-directional traffic</li> <li>• Greater stopping prohibitions near the crosswalk</li> <li>• Active indicator on pushbutton to confirm to pedestrians the RRFB is in operation.</li> </ul>	<ul style="list-style-type: none"> <li>• Advance Yield to Pedestrians Line on multiple lane approaches</li> <li>• Yield Here to Pedestrians Sign on multiple lane approaches</li> <li>• Raised refuge island for road cross sections with more than two lanes and two-directional traffic</li> <li>• Greater stopping prohibitions near the crosswalk</li> <li>• Active indicator on pushbutton to notify pedestrians the overhead flasher is in operation.</li> <li>• Additional side-mounted flashing amber ball beacons</li> </ul>	<ul style="list-style-type: none"> <li>• Raised refuge island for road cross sections with more than two lanes and two-directional traffic</li> <li>• Accessible pedestrian signals</li> <li>• Pedestrian countdown signals with Pedestrian Countdown Signal information sign</li> </ul>
<b>Optional Components</b>	<ul style="list-style-type: none"> <li>• Crossing guards</li> <li>• Offset crosswalk arrangement for crossings with raised refuge island</li> <li>• Curb extensions for road cross sections with full-time on-street parking</li> <li>• Curb corner radius reduction</li> <li>• Raised crosswalk</li> <li>• Additional overhead mounted signs on both sides of the road</li> </ul>	<ul style="list-style-type: none"> <li>• Crossing guards</li> <li>• Offset crosswalk arrangement for crossings with raised refuge island</li> <li>• Curb extensions for road cross sections with full-time on-street parking</li> <li>• Curb corner radius reduction</li> <li>• Raised crosswalk</li> </ul>	<ul style="list-style-type: none"> <li>• Zebra crosswalk markings</li> <li>• Curb corner radius reduction</li> <li>• Curb extensions for road cross sections with full-time on-street parking</li> </ul>



### 5.3 TOOLS & POTENTIAL SPOT IMPROVEMENTS

Tables 5, 6, and 7 summarize a few industry practice tools that could be applied to locations along the 2<sup>nd</sup> Avenue corridor in order to mitigate three issues identified based on discussions with the City of Whitehorse, including: difficulty for pedestrians and cyclists crossing 2<sup>nd</sup> Avenue, unsafe turning across or onto 2<sup>nd</sup> Avenue by vehicle, and vehicle speeds along 2<sup>nd</sup> Avenue. Table 5 lists options for mitigating difficulty for pedestrians and cyclists crossing 2<sup>nd</sup> Avenue, Table 5 lists options for mitigating unsafe turning across or onto 2<sup>nd</sup> Avenue by vehicle, and Table 6 lists options for mitigating vehicle speeds along 2<sup>nd</sup> Avenue. Possible spot improvement locations along 2<sup>nd</sup> Avenue were also identified in each table. The spot improvements locations may change depending on which cross sectional changes to the corridor are recommended and ultimately chosen by the City of Whitehorse.

**Table 5: Difficulty for Pedestrians/Cyclists Crossing 2<sup>nd</sup> Avenue - Tools**

Treatment	Intent	Possible Locations	Notes
<b>Median Refuge Island</b>	Provides a refuge in the middle of the crossing movement, allowing for people on foot and bike to cross one direction of travel at a time	<ul style="list-style-type: none"> <li>Consider constructing a median throughout 2<sup>nd</sup> Avenue corridor or at intersections where pedestrians cross more than 2 lanes</li> </ul>	Providing a median refuge island on a 4-lane cross section could reduce the need for a traffic signal to a overhead flasher as a pedestrian crossing treatment
<b>Side-mounted Crosswalk Signage</b>	Provides signage to communicate to vehicle drivers that a person walking or biking may be crossing the street	<ul style="list-style-type: none"> <li>Consider at all existing crosswalk locations</li> </ul>	
<b>Overhead-mounted Crosswalk signage</b>	Provides signage to communicate to vehicle drivers that a person walking or biking may be crossing the street	<ul style="list-style-type: none"> <li>Consider installing over-head mounted signage in addition to side-mounted signage where pedestrian crossing control treatments are warranted</li> </ul>	
<b>Pedestrian Crossing (RRFB or similar)</b>	Provides a warning communication to vehicle drivers that a person walking or biking is crossing the street	<ul style="list-style-type: none"> <li>Consider at the following intersections:                             <ul style="list-style-type: none"> <li>Strickland Street/2<sup>nd</sup> Avenue</li> <li>Steele Street/2<sup>nd</sup> Avenue</li> </ul> </li> </ul>	
<b>Lighting</b>	Additional lighting along the corridor and at intersections improves pedestrian and cyclists visibility to vehicle drivers	<ul style="list-style-type: none"> <li>Consider providing additional lighting at intersections along the corridor</li> </ul>	



## 2ND AVENUE CORRIDOR STUDY

### Improvement Tools & Potential Cross Sections

**Table 5 cont'd: Difficulty for Pedestrians/Cyclists Crossing 2<sup>nd</sup> Avenue - Tools**

Treatment	Intent	Possible Locations	Notes
<b>Half Signals</b>	Provides an indication to drivers to stop so that people walking or biking can cross the street	<ul style="list-style-type: none"> <li>Consider at Steele Street/2<sup>nd</sup> Avenue</li> </ul>	May impact vehicle operations along 2 <sup>nd</sup> Avenue with a traffic signal at Main Street and a pedestrian flasher at Wood Street
<b>Curb Extensions</b>	Narrows the crossing distance required to cross the street on foot, perception of narrowing the street also results in drivers travelling slower, provides better visibility to drivers of people intending to cross the street on foot or bike	<ul style="list-style-type: none"> <li>Maintain existing curb extensions where possible.</li> <li>Consider adding curb extensions across:                             <ul style="list-style-type: none"> <li>Hanson Street</li> <li>Hawkins Street</li> <li>Rogers Street</li> <li>Low Street</li> </ul> </li> </ul>	
<b>Table Top Intersections or Raised Crosswalks</b>	Vertical deflection to reinforce the desired operating speed of drivers travelling along the street because driving faster than intended would be uncomfortable to the driver		May not be viable due to transit operations on the street or winter maintenance
<b>Pedestrian Scramble</b>	A single phase for pedestrians to cross simultaneous. In high pedestrian activity areas this reduces the delay to people crossing the street	<ul style="list-style-type: none"> <li>Consider at Main Street/2<sup>nd</sup> Avenue intersection</li> </ul>	Appropriate signal timing and high pedestrian activity is crucial for this to be viable
<b>Cyclist Crossing Markings</b>	Indicates the intended path of cyclists for both cyclists and vehicle drivers	<ul style="list-style-type: none"> <li>Consider at the following intersections where bicycle infrastructure is proposed crossing 2<sup>nd</sup> Avenue:                             <ul style="list-style-type: none"> <li>Ogilvie Street/2<sup>nd</sup> Avenue</li> <li>Black Street/2<sup>nd</sup> Avenue</li> <li>Wood Street/2<sup>nd</sup> Avenue</li> <li>Hanson Street/2<sup>nd</sup> Avenue</li> <li>Low Street/2<sup>nd</sup> Avenue</li> </ul> </li> </ul>	
<b>Leading or Lagging Pedestrian Interval</b>	Provide short separation in time between people crossing the street on foot and drivers making left or right turns at signalized intersections to reduce conflicts	<ul style="list-style-type: none"> <li>Consider at Main Street/2<sup>nd</sup> Avenue</li> </ul>	
<b>Countdown Timer</b>	Provide information to, primarily, pedestrians on the remaining time for the crossing movement. Can be beneficial to drivers as well.	<ul style="list-style-type: none"> <li>Consider implementing countdown timers at all signalized intersections; particularly at:                             <ul style="list-style-type: none"> <li>Main Street/2<sup>nd</sup> Avenue</li> </ul> </li> </ul>	May be used by vehicles to jump the signal and lead to aggressive driving behaviour.





## 2ND AVENUE CORRIDOR STUDY

### Improvement Tools & Potential Cross Sections

**Table 6: Unsafe Turning Across or Onto 2<sup>nd</sup> Avenue by Vehicle - Tools**

Treatment	Intent	Possible Locations	Notes
<b>Restrict turning vehicles (Signs and Enforcement)</b>	Restrict turning movements (permanently or by time of day) by using signs at intersections that have poor safety performance due to issues like sight distance, speed transitions, high driver workload. Enforcement of turn restrictions may be required depending on compliance, which may not be sustainable.		May increase traffic on parallel or alternate routes
<b>Restrict turning vehicles (median closures or forced turns)</b>	Restriction of turning movements by using physical barriers like medians or forced turn geometry at intersections that have poor safety performance due to issues like sight distance, speed transitions, high driver workload.		May increase traffic on parallel or alternate routes
<b>Change intersection controls (i.e. change to signals or four-way stop control or roundabout)</b>	Provide more intersection control through stop signs or signals to ensure that vehicle movements can be made safely because interactions with other vehicles and people are controlled		Implementing a control that is a higher measure than warranted can create a safety concern if it doesn't align with driver expectations



## 2ND AVENUE CORRIDOR STUDY

### Improvement Tools & Potential Cross Sections

**Table 7: Vehicle Speeds along 2<sup>nd</sup> Avenue - Tools**

Treatment	Intent	Possible Locations	Notes
<b>Narrower lanes</b>	Tends to make drivers travel slower through an area. This effect can be negated, however, if there are multiple travel lanes or high volumes of heavy vehicles.	<ul style="list-style-type: none"> <li>Consider along entire 2<sup>nd</sup> Avenue corridor</li> </ul>	Lane widths can be reduced to 3.5m for a transit route curbside lane and 3.4 m for a transit route lane.
<b>Provide median for narrowing effect</b>	Creates a narrower feel to the roadway for drivers, which results in slower speeds by introducing a physical object down the center of the street	<ul style="list-style-type: none"> <li>Consider along entire 2<sup>nd</sup> Avenue corridor</li> </ul>	Need to consider fire truck access.
<b>Edge/Boulevard/ Sidewalk treatment to make street feel less 'open'</b>	Creates a narrower feel to the roadway for drivers, which results in slower speeds by expanding the edge space along the travelled way	<ul style="list-style-type: none"> <li>Consider along entire 2<sup>nd</sup> Avenue corridor particularly segments without on-street parking</li> </ul>	
<b>Increase friction on street so operating speed matches design or intended speed (intersection treatments)</b>	Collection of intersection controls along the street may have the effect of slowing vehicles since one consistent speed may not be possible	<ul style="list-style-type: none"> <li>Consider when determining locations for pedestrian half signals</li> </ul>	
<b>Vertical deflection</b>	Vertical deflection to reinforce the desired operating speed of drivers travelling along the street because driving faster than intended would be uncomfortable to the driver		May not be viable due to transit operations and emergency vehicles on the street or winter maintenance
<b>Off-peak parking lanes</b>	Narrows roadway during off-peak periods but accommodates vehicle demand where required	<ul style="list-style-type: none"> <li>Consider along segments of 2nd Avenue where parking is desired</li> </ul>	This treatment does not allow for construction of curb extensions at intersections as the lanes are required for vehicle travel during peak periods



## 5.4 POTENTIAL CORRIDOR CROSS SECTIONS

In order to illustrate and later evaluate the potential configuration options along 2<sup>nd</sup> Avenue, potential cross sections were developed separately for three roadway segments: Jarvis Street to Lowe Street, Ogilvie Street to Jarvis Street, and Lowe Street to Robert Service Way.

### 5.4.1 Jarvis Street to Lowe Street

Four cross sections were developed for the segment of 2<sup>nd</sup> Avenue between Jarvis Street and Lowe Street. Illustrated in **Figure 14**, **Option A** represents the existing midblock condition along 2<sup>nd</sup> Avenue including four travel lanes, parking on both sides, and minimal pedestrian accommodation.

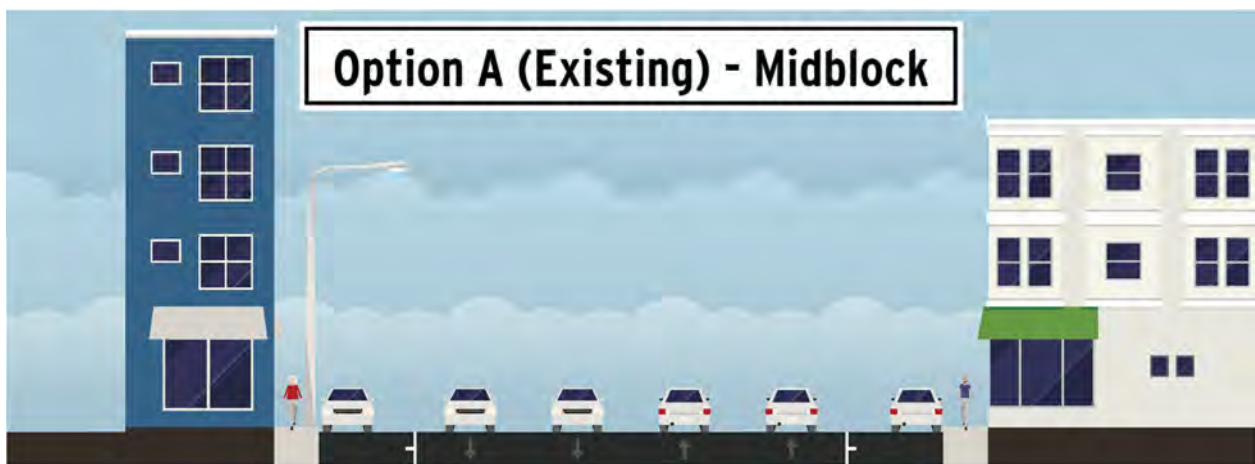


Figure 14: Option A – Existing Midblock Cross Section

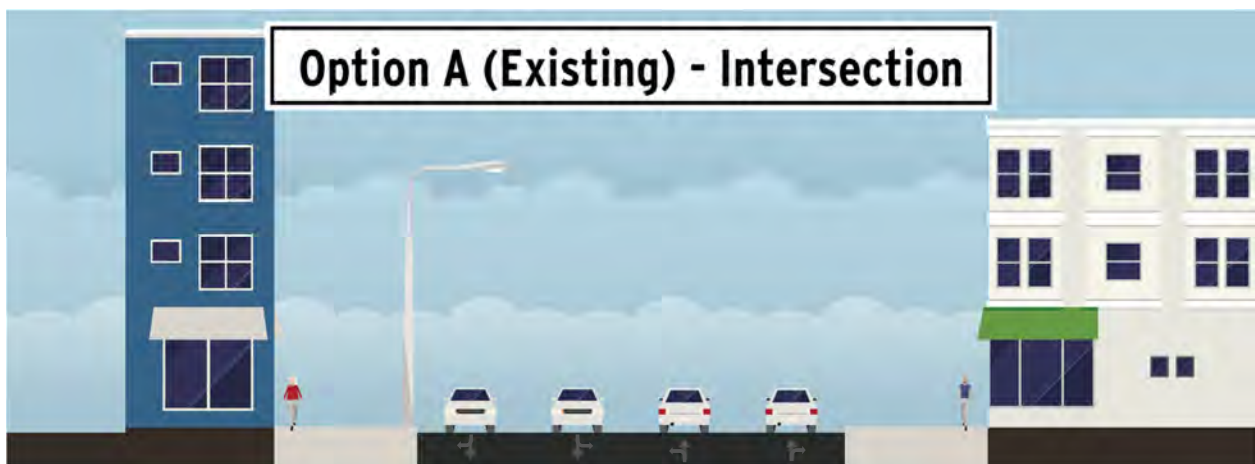


Figure 15: Option A – Existing Intersection Cross Section

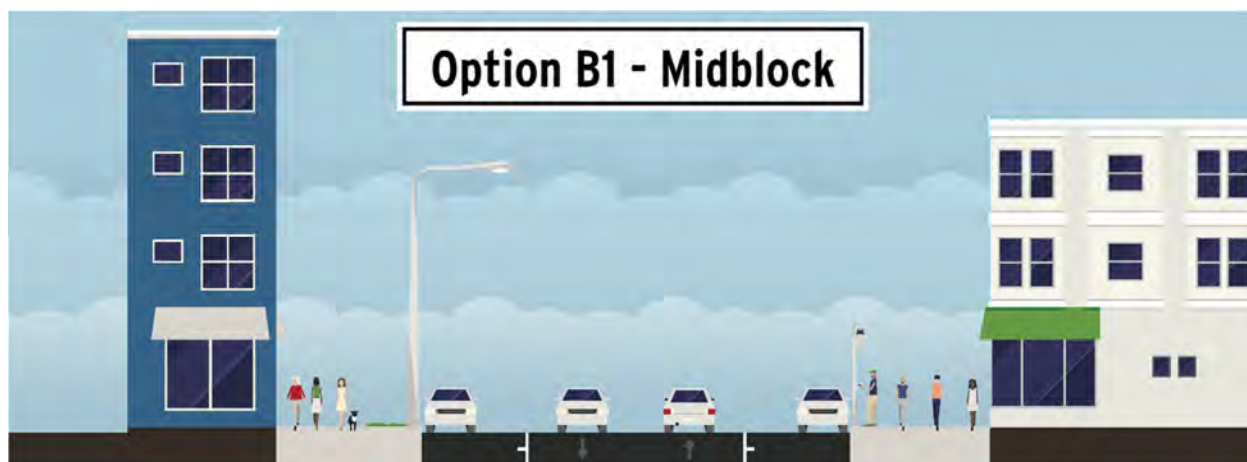


## 2ND AVENUE CORRIDOR STUDY

### Improvement Tools & Potential Cross Sections

**Figure 15** illustrates the curb extensions currently constructed at intersections along 2<sup>nd</sup> Avenue throughout this segment. *Option A* was included to compare the existing condition to potential alternatives during the evaluation portion of the study.

**Option B1**, illustrated in **Figure 16**, represents a four-lane cross-section with the curb lanes accommodating parking during off-peak periods. *Option B1* eliminates the existing parking lanes and balances on-street parking supply during off-peak periods with providing additional vehicle capacity during peak periods. Curb extensions are not included at intersections with *Option B1* due to providing four travel lanes through the intersection during peak periods. There is potential for the curb lane to operate as a dedicated transit lane during peak periods. As shown, the pedestrian realm is greater than *Option A* in *Option B1*.



**Figure 16: Option B1 – Off-peak Parking Midblock**



## 2ND AVENUE CORRIDOR STUDY

### Improvement Tools & Potential Cross Sections

**Option B2**, illustrated in **Figure 17**, features two travel lanes and two permanent parking lanes with curb extensions constructed at intersections along the corridor (**Figure 18**). Since parking lanes are narrower than travel lanes, **Option B2** reallocates additional ROW to the pedestrian realm as compared to **Option B1**. Curb extensions could also be constructed at transit stops under **Option B2**.

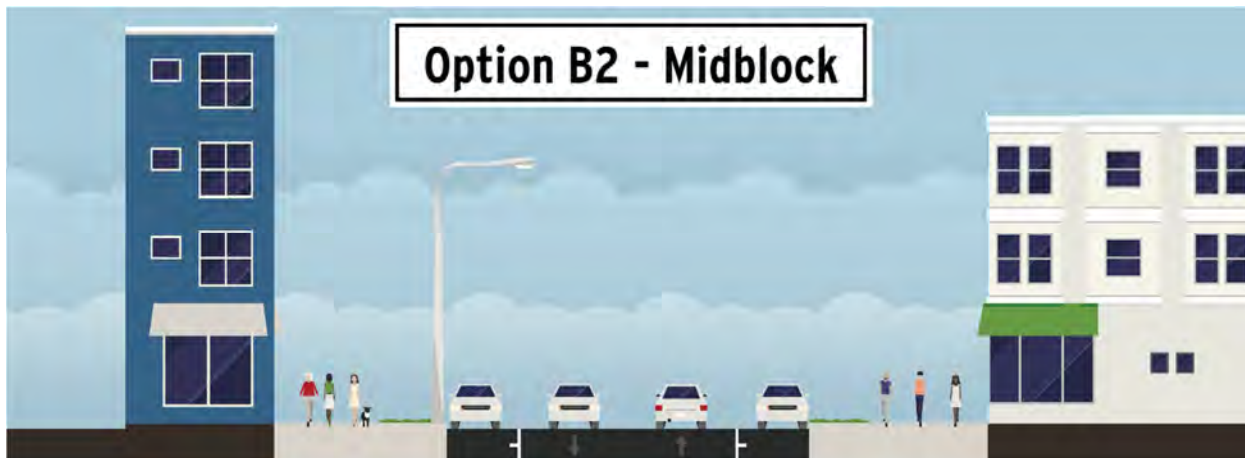


Figure 17: Option B2 – Two Travel Lanes + Parking Midblock

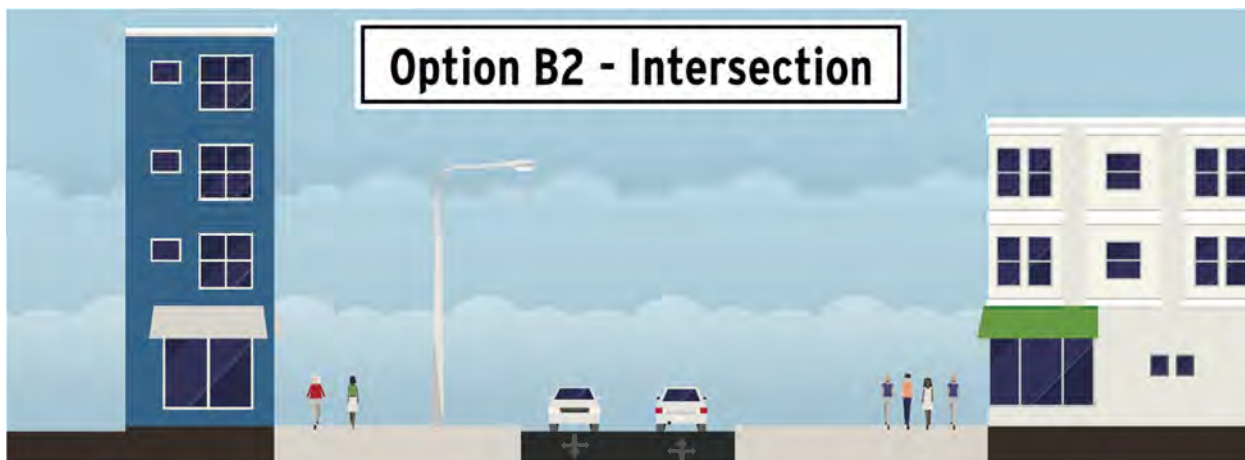


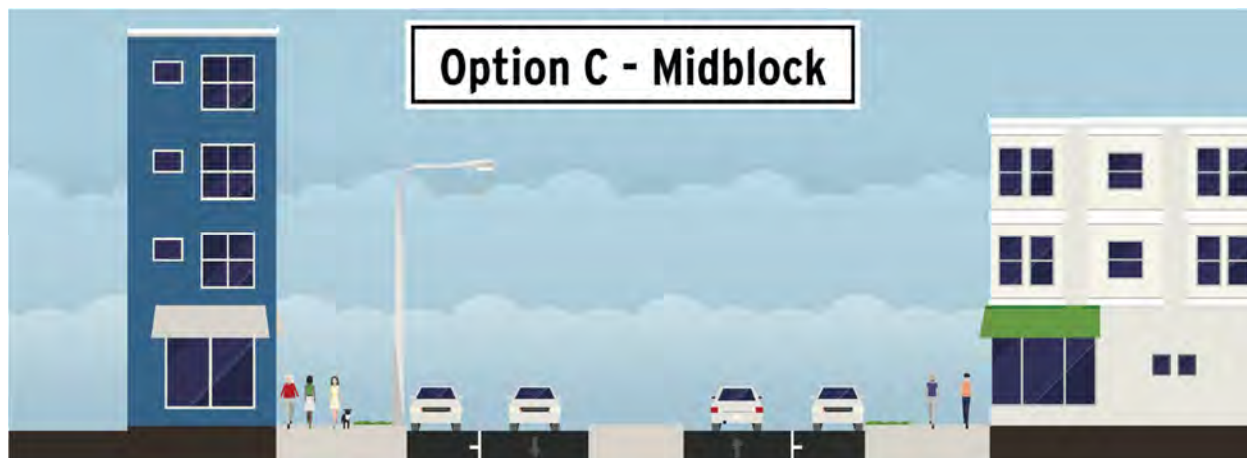
Figure 18: Option B2 – Curb Extensions at Intersections



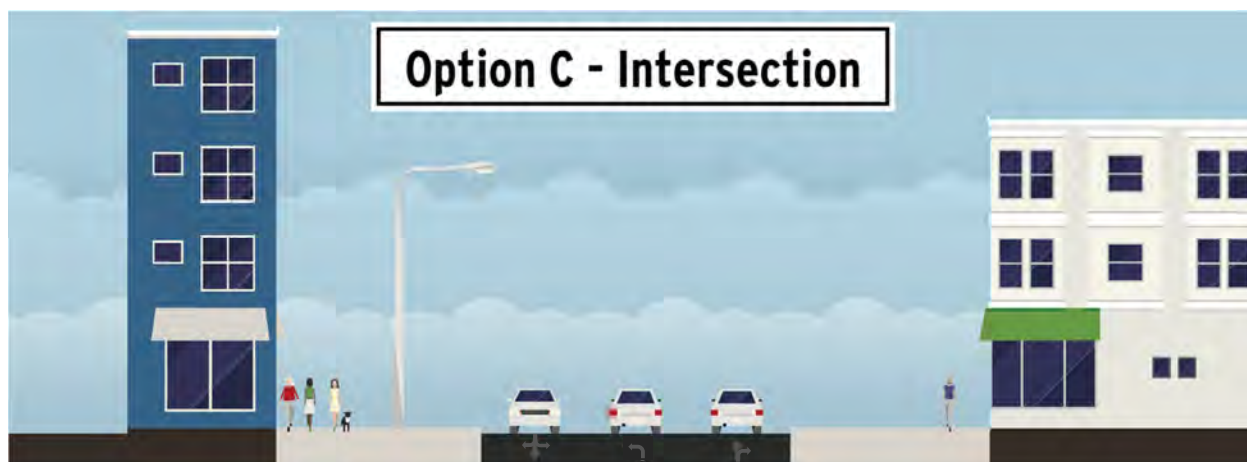
## 2ND AVENUE CORRIDOR STUDY

### Improvement Tools & Potential Cross Sections

**Option C**, illustrated in **Figure 19**, features two travel lanes, two permanent parking lanes with curb extensions at intersections, and a centre median with the ability to provide left turn capacity at intersections where required (**Figure 20**). Similar to *Option B2*, curb extensions could also be constructed at transit stops along the corridor.



**Figure 19: Option C – Two Travel Lanes + Parking + Centre Median Midblock**



**Figure 20: Option C – Curb Extensions + Left Turn Capacity at Intersections**

**Option D1**, illustrated in **Figure 21**, was prepared based on the City's successful dedicated transit lane pilot program. *Option D1* features two single occupant vehicle travel lanes, two full time dedicated transit lanes and parking both sides. As shown in Figure 19, the cross section is very similar to the existing cross section (*Option A*); however, there may be opportunities to reduce travel lane widths in order to provide increased pedestrian right of way in addition to what is currently provided. Similar to the existing configuration, curb extensions could be constructed at intersections along 2<sup>nd</sup> Avenue (**Figure 22**).



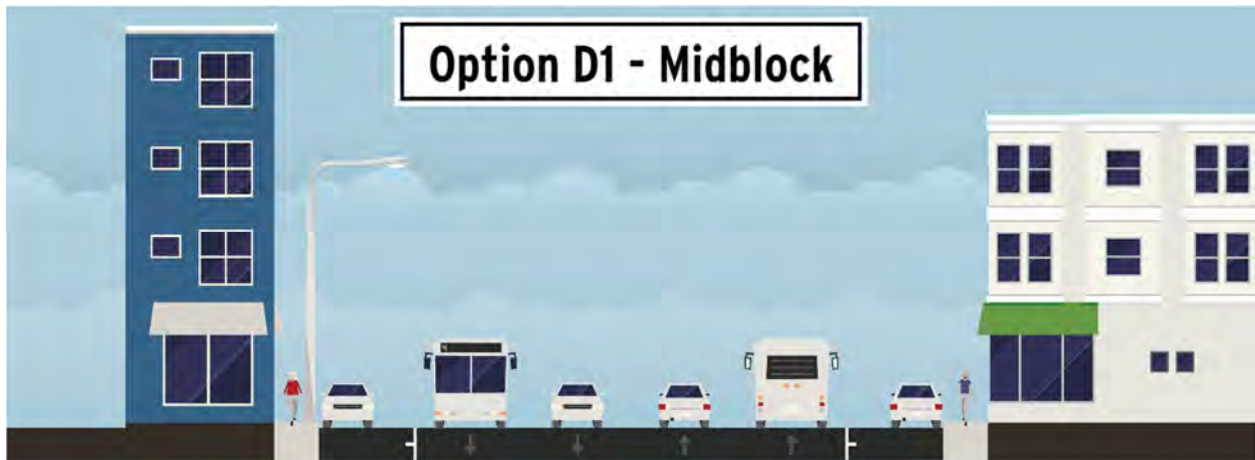


Figure 21: Option D1 – Dedicated Transit Lanes Midblock

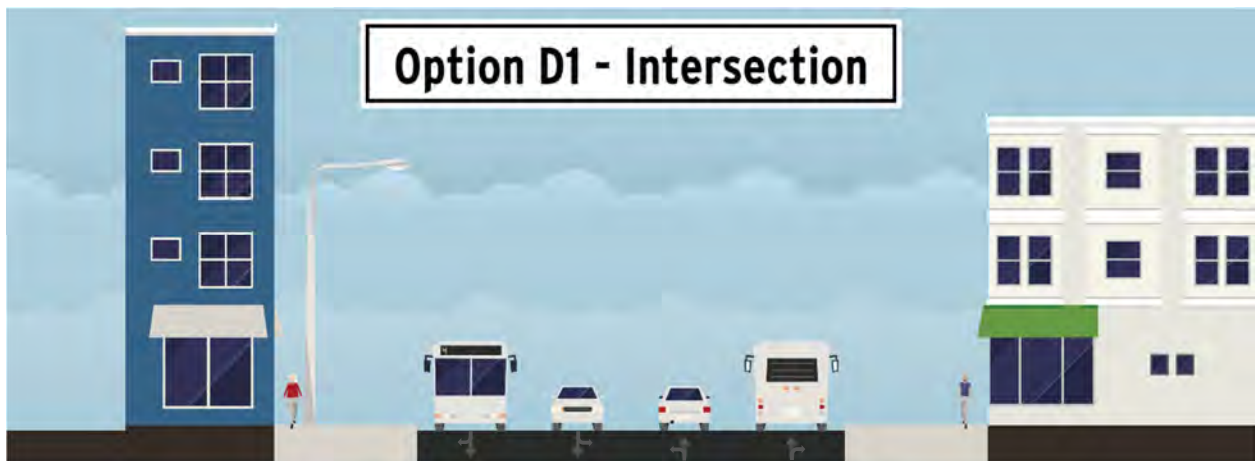


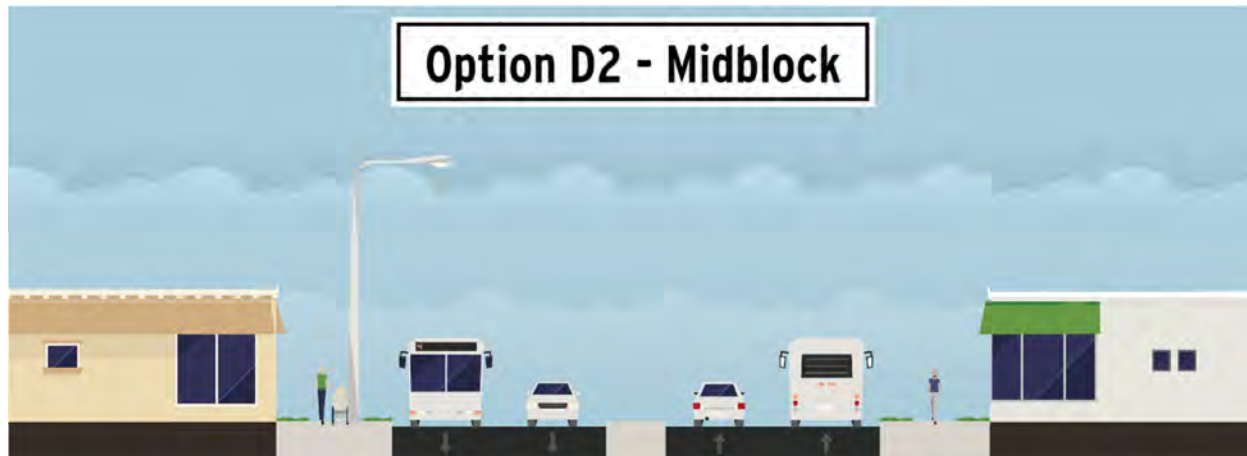
Figure 22: Option D1 – Curb Extensions at Intersections

#### 5.4.2 Ogilvie Street to Jarvis Street

2<sup>nd</sup> Avenue between Ogilvie Street and Jarvis Street currently includes four travel lanes and two parking lanes for the portion between Black Street and Jarvis Street. As previously mentioned, parking demand between Black Street and Jarvis Street is low and the land uses adjacent to 2<sup>nd</sup> Avenue in this area are non-street oriented with parking provided on site. Since the parking lanes are likely empty most of the time, this segment of 2<sup>nd</sup> Avenue would feel like a six-lane roadway, potentially resulting in the speed concerns noted by the City of Whitehorse.

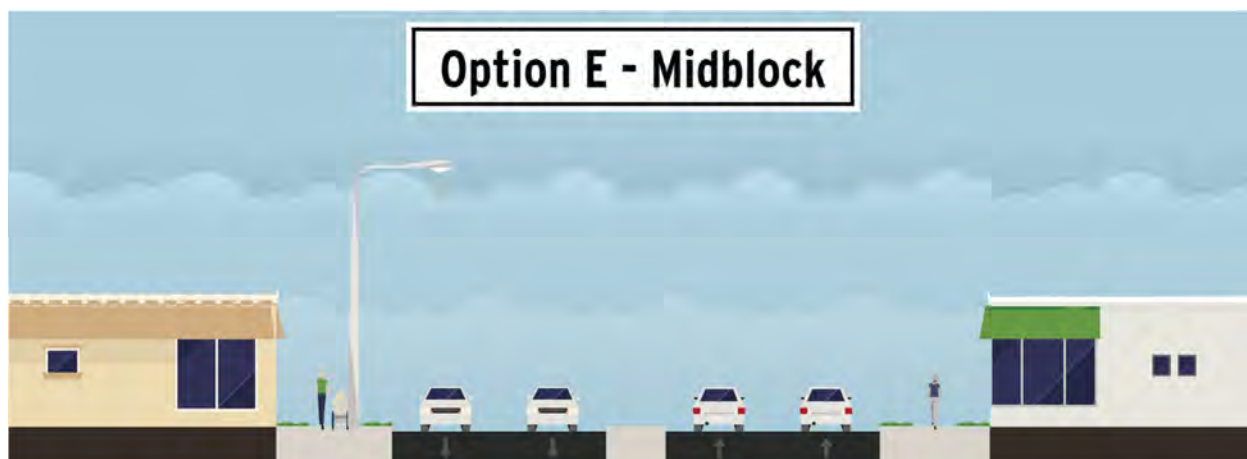
**Option D2**, illustrated in **Figure 23**, represents the continuation of *Option D1* through the Ogilvie Street to Jarvis Street section of 2<sup>nd</sup> Avenue. *Option D2* features two narrower single occupant vehicle travel lanes, dedicated transit lanes, a centre median, and the removal of parking from Jarvis Street to Black Street.





**Figure 23: Option D2 – Dedicated Transit Lanes + Centre Median Midblock**

*Option E*, as shown in **Figure 24**, represents a similar cross section to *Option D2* without dedicated transit lanes; however, maintaining four narrower travel lanes, a centre median, and the removal of parking from Jarvis Street to Black Street.



**Figure 24: Option E – Four Travel Lanes + Centre Median Midblock**

### 5.4.3 Low Street to Robert Service Way

2<sup>nd</sup> Avenue between Lowe Street and Robert Service Way is a short segment between the Lowe Street/2<sup>nd</sup> Avenue and the Robert Service Way/ 2<sup>nd</sup> Avenue intersections generally accommodating four travel lanes with additional left turn capacity at Lowe Street and Robert Service Way. Parking is not currently permitted along this segment of 2<sup>nd</sup> Avenue. In addition, a separated bicycle facility is proposed to be constructed along 2<sup>nd</sup> Avenue in this location. Therefore, a potential cross section other than the existing configuration for this portion of 2<sup>nd</sup> Avenue was not included other than the spot improvements identified in Section 5.3; however, dedicated transit lanes and the cross section shown in *Option D2* could be considered for this portion of 2<sup>nd</sup> Avenue.





## 6.0 EVALUATION

In order to evaluate the cross-section options introduced in Section 5.4 and understand the benefits and trade-offs between each option, an intersection capacity assessment was completed at key intersections along the corridor and an evaluation matrix was developed based on criteria outlined in this section.

### 6.1 INTERSECTION CAPACITY ASSESSMENT

#### 6.1.1 Assessment Intersections

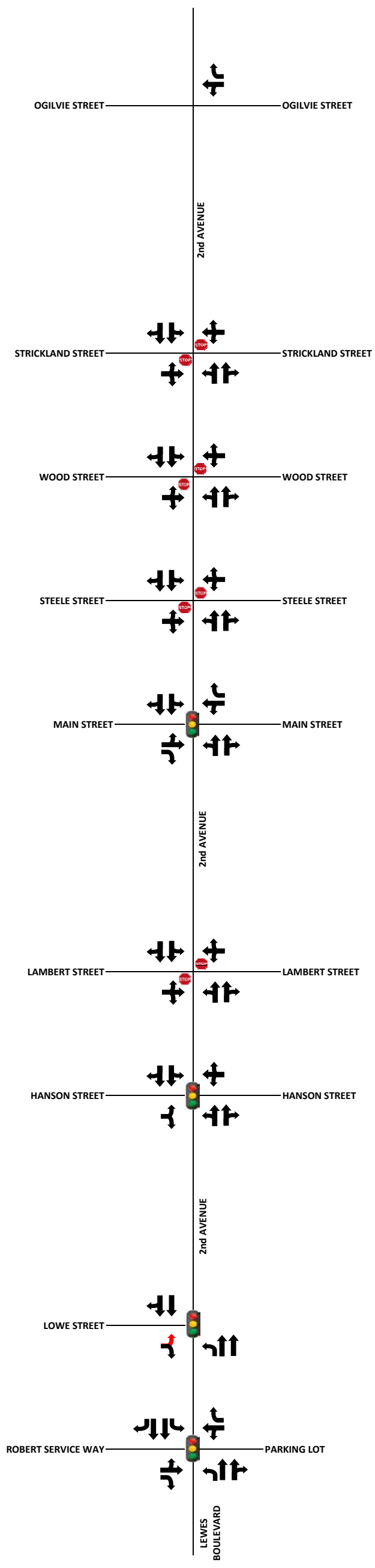
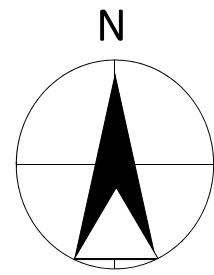
An intersection capacity assessment was completed at study area intersections along 2<sup>nd</sup> Avenue where existing traffic count information was available. The intersections analyzed include the following locations:

- Wood Street & 2nd Avenue
- Main Street & 2nd Avenue
- Ogilvie Street & 2nd Avenue
- Lowe Street & 2nd Avenue
- Strickland Street & 2nd Avenue
- Steele Street & 2nd Avenue
- Robert Service Way & 2nd Avenue
- Hanson Street & 2nd Avenue
- Lambert Street & 2nd Avenue

**Figure 25** illustrates the existing intersection geometry and traffic control measures for each study intersection. The City provided turning movement volumes (including pedestrian and cyclist data) for each of the study intersections, as well as signal timing information for signalized intersections. The operational analyses were focused on the AM peak hour and PM peak hour periods, defined as the four highest consecutive 15-minute intervals of volumes occurring from 7:00am to 9:00am and from 4:00pm to 6:00pm, respectively.




As the turning movement data spanned several years, the most recent data was utilized in the operational analysis. Older traffic volumes were increased by an annual traffic growth rate of 1% to reflect 2018 traffic volumes. The 1% traffic growth rate was calculated through a comparison of historic traffic volumes provided by the City. **Figure 26** illustrates the adjusted 2018 existing traffic volumes for the AM and PM peak hour periods.





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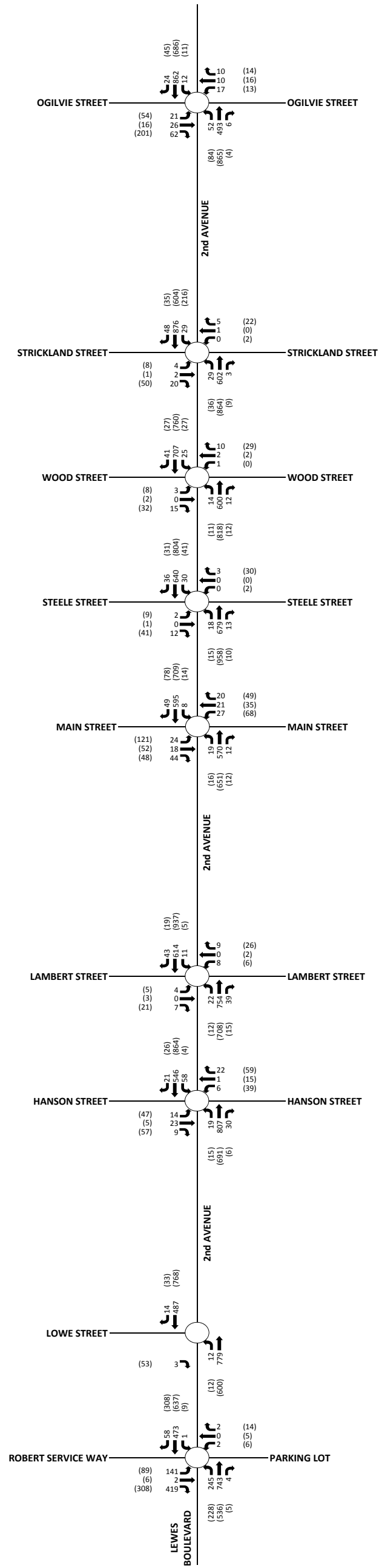
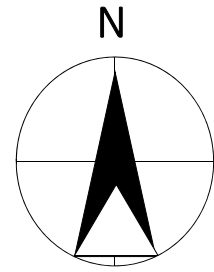
-  SIGNALIZED INTERSECTION
-  STOP CONTROL
-  NO TURN DURING PEAK HOUR

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EXISTING LANE CONFIGURATION

FIGURE 25



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**LEGEND**

### AM PEAK VOLUMES  
(###) PM PEAK VOLUMES

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ADJUSTED 2018 EXISTING AM & PM PEAK HOUR TRAFFIC VOLUMES

FIGURE 26

## 2ND AVENUE CORRIDOR STUDY

### Evaluation

#### 6.1.2 Future Developments

As previously identified and through discussions with the City, three future developments (compared to existing conditions) were noted within the study area to be considered as part of the traffic operations analysis. These developments are:

- Cenotaph (Veteran's Square) option that triggers the closure of Steele Street between 2<sup>nd</sup> Avenue and the lane west of Front Street. It should be noted that the closure of this portion of Steele Street was also identified as a temporary measure which may become permanent in the City's Downtown Plan.
- Expansion of City Hall for a new service building, to house staff from the existing Municipal Services Building that are not moving to the Operations Building.
- A proposed transit kiosk located on the east side of 2<sup>nd</sup> Avenue, south of Steele Street and north of the existing CIBC facility, which includes a small retail area. A portion of the parking lot would be removed as part of the kiosk.

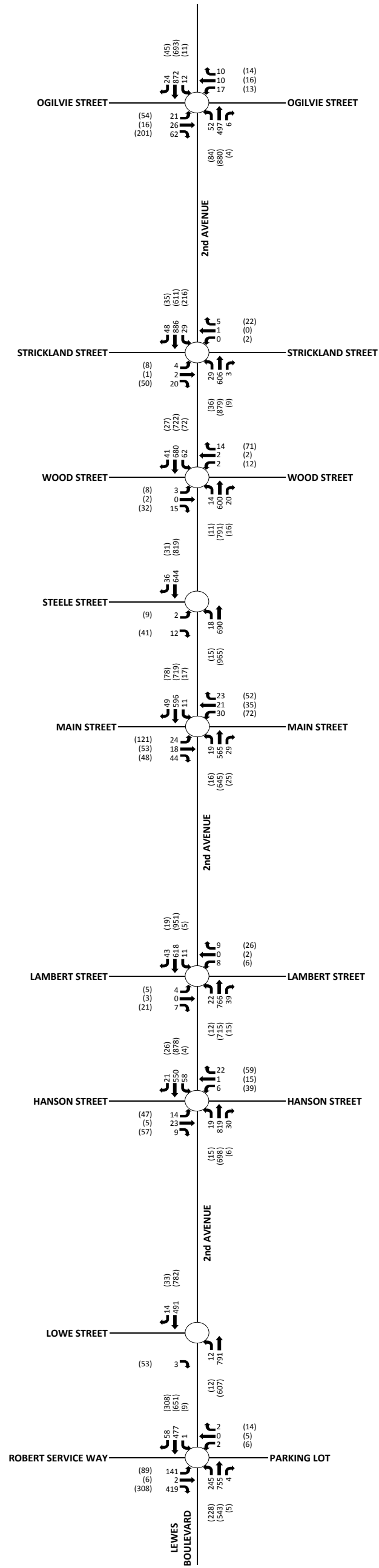
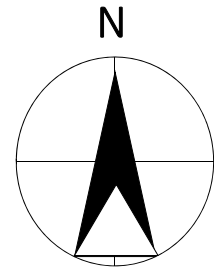
The trip generation potential for the City Hall expansion and transit kiosk was calculated based on the site plans provided and distributed on the roadway network based on existing traffic flow patterns. In addition, the closure of Steele Street east of 2<sup>nd</sup> Avenue is expected to alter some traffic flow patterns within the area. Therefore, the traffic utilizing this portion of Steele Street was re-distributed to surrounding intersections and assumed to follow the same traffic flow patterns.

The resulting Future Traffic Volumes, consisting of the Adjusted 2018 Existing Traffic Volumes as well as the transportation impacts associated with the future developments and roadway network changes, are illustrated in **Figure 27**.

#### 6.1.3 2<sup>nd</sup> Avenue Corridor Changes

The proposed changes to 2<sup>nd</sup> Avenue include a reduction in the number of travel lanes along 2<sup>nd</sup> Avenue (from two lanes in each direction to a single lane in each direction), as well as the construction of a center median along the corridor to provide pedestrian / cyclist refuge areas. Conceptual designs of the proposed corridor changes were illustrated previously in this report in Section 5.4.





### 6.1.4 Intersection Operations Evaluation Criteria

The intersection analysis for the analyzed intersections was undertaken using the Synchro 9 software package, which is based on the Highway Capacity Manual (HCM 2000).

For unsignalized intersections, the methodology considers the intersection geometry, the traffic volumes, the posted speed limit, and the type of intersection control. The average delay for each individual movement from the minor street, the major street left-turn movements and the overall intersection are calculated. An operation level of service (LOS) is then assigned based on the calculated average delay. For signalized intersections, the methodology considers the intersection geometry, the traffic volumes, the posted speed limit, the traffic signal phasing/timing plan as well as pedestrian volumes. The average delay for each lane group and the overall intersection are calculated. An operation LOS is then assigned based on the calculated average delay. The level of service criteria for both signalized and unsignalized intersections is described in **Table 8**.

**Table 8: Level of Service Criteria**

Level of Service	Average Control Delay (seconds per vehicle)		Comment
	Signalized Intersection	Unsignalized Intersection	
A	10.0 or less	10.0 or less	Very good operation
B	10.1 to 20.0	10.1 to 15.0	Good operation
C	20.1 to 35.0	15.1 to 25.0	Acceptable operation
D	35.1 to 55.0	25.1 to 35.0	Congestion
E	55.1 to 80.0	35.1 to 50.0	Significant congestion
F	More than 80.0	More than 50.0	Unacceptable operation
Breakdown	Very high	Very high	Conditions so poor that capacity calculations are meaningless

The volume-to-capacity (v/c) ratio was also considered. If the v/c ratio for a movement is greater than 1.00, then that movement has technically exceeded capacity.

### 6.1.5 Existing Conditions Analysis

The Adjusted 2018 Existing Traffic Volumes were analyzed using *Synchro*, Version 9.2, for both the AM and PM Peak Hour periods to understand current operating conditions and to create a baseline to compare with other scenarios. The results of this analysis are provided in **Appendix A (Table A-1)** and indicate the following:

2<sup>nd</sup> Avenue & Strickland Street: The eastbound approach during the PM Peak Hour currently operates with a LOS F, however the v/c ratio is less than 1.00, indicating the poor operations are a result of vehicle delay and not a capacity constraint.



## 2ND AVENUE CORRIDOR STUDY

### Evaluation

2<sup>nd</sup> Avenue & Steele Street: The eastbound approach during the PM Peak Hour currently operates with a LOS F, however the v/c ratio is less than 1.00, indicating the poor operations are a result of vehicle delay and not a capacity constraint.

All other study intersections, approaches and movements currently operate with an acceptable LOS and v/c ratios.

### 6.1.6 Future Conditions Analysis

The Future Traffic Volumes were also analyzed using *Synchro*, Version 9.2, for both the AM and PM Peak Hour periods to evaluate the anticipated operations with and without the proposed changes to 2<sup>nd</sup> Avenue. Three Future Conditions were evaluated as part of this operational analysis. **Scenario 1** consists of only the geometry changes associated with the Future Developments identified previously. The results of this analysis are provided in **Appendix A (Table A-2)** and indicate the following:

2<sup>nd</sup> Avenue & Strickland Street: The eastbound approach during the PM Peak Hour is expected to operate with a LOS F, however the v/c ratio is less than 1.00, indicating the poor operations are a result of vehicle delay and not a capacity constraint.

All other study intersections, approaches and movements currently operate with an acceptable LOS and v/c ratios.

**Scenario 2** consists of the geometry changes associated with the Future Developments identified previously as well as the proposed lane reduction and constructed median along 2<sup>nd</sup> Avenue. Scenario 2 maintains the full movements currently allowed along the corridor at each study intersection, with no further turn restrictions. The results of this analysis are provided in **Appendix A (Table A-3)** and indicate the following:

2<sup>nd</sup> Avenue & Strickland Street: The eastbound approach during the PM Peak Hour is expected to operate with a LOS F, with a v/c ratio of 1.70 during the PM Peak Hour indicating the movement is overcapacity. The eastbound approach during the AM Peak Hour and the westbound approach during the PM Peak Hour are also expected to operate with a LOS F, however v/c ratios for these movements during these periods are expected to remain less than 1.0.

2<sup>nd</sup> Avenue & Wood Street: The eastbound and westbound approaches during the PM Peak Hour is expected to operate with a LOS F, however the v/c ratios are less than 1.00, indicating the poor operations are a result of vehicle delay and not a capacity constraint.

2<sup>nd</sup> Avenue & Steele Street: The eastbound approach during the PM Peak Hour is expected to operate with a LOS F, however the v/c ratio is less than 1.00, indicating the poor operations are a result of vehicle delay and not a capacity constraint.

All other study intersections, approaches and movements currently operate with an acceptable LOS and v/c ratios.



## 2ND AVENUE CORRIDOR STUDY

### Evaluation

Based on the anticipated capacity issues of the 2<sup>nd</sup> Avenue & Strickland Street intersection, **Scenario 3** was developed that consists of a median extension through the intersection, resulting in the restriction of the westbound left-turn, eastbound left-turn and northbound left-turn, as well as the eastbound and westbound through movements. Therefore, AM and PM Peak Hour traffic volumes on the eastbound left, eastbound through, westbound left, westbound through, and northbound left were re-assigned to nearby intersections, and the 2<sup>nd</sup> Avenue & Strickland Street intersection was re-analyzed assuming the restriction of these movements. The results of this analysis are also included in Appendix A (Table A-3) and indicate the intersection will operate with an acceptable LOS and v/c ratios less than 1.0 with this modification in place.





## 6.2 EVALUATION CRITERIA

Four themes representing the policies developed within the Downtown Plan and the City of Whitehorse’s existing concerns with the 2<sup>nd</sup> Avenue corridor were selected to evaluate the potential cross section options outlined in Section 5.4. Descriptions of the four themes are:

- The theme of ‘**Safety**’ was identified by the City of Whitehorse and includes pedestrian and cyclist safety, vehicle safety, and managing vehicle speeds along the 2<sup>nd</sup> Avenue corridor.
- The theme of ‘**Policy**’ generally refers to the guiding policies adopted by the City of Whitehorse through the Downtown Plan.
- The theme of ‘**Level of Service**’ (LOS) relates to the capacity and delays a street user may experience while travelling along the 2<sup>nd</sup> Avenue corridor. Consideration of pedestrian, transit, and vehicle level of service generally assists with indicating street user priority.
- The theme of ‘**Cost & Constructability**’ is generally associated with the cost implications and ease of constructability associated with each cross-section options.

The criteria associated with each of these themes are identified with a short description and commentary. Additionally, each criterion also has a short description on potential risks that may be experienced should that criteria score low. **Table 9** summarizes the criteria associated with the theme ‘Safety’.

**Table 9: Safety Criteria**

Theme	Criteria	Description	Risk if option is scored low
Safety	<b>Pedestrian/Cyclist Safety</b>	Pedestrian and cyclist safety while crossing 2 <sup>nd</sup> Avenue.	Vehicle/pedestrian and vehicle/cyclist conflicts could occur more frequently, pedestrian/cyclist comfort may be compromised.
	<b>Vehicle Safety</b>	Vehicle safety along the corridor including minimizing vehicle conflicts.	Vehicle conflicts may occur more frequently.
	<b>Vehicle Speeds</b>	Mitigation high travel speeds along the corridor.	May result in more severe vehicle/pedestrian, vehicle/cyclist, and vehicle/vehicle conflicts, may compromised pedestrian/cyclist comfort.



## 2ND AVENUE CORRIDOR STUDY

### Evaluation

The criteria associated with the theme ‘Policy’ are shown in **Table 10** below.

**Table 10: Policy Criteria**

Theme	Criteria	Description	Risk if option is scored low
<b>Policy</b>	<b>Policy Adherence</b>	How well does the user priority of the option meet the goals outlined in the Downtown Plan?	The street concept may not align with other projects and priorities in the downtown area, resulting in incohesive design and development throughout downtown.
	<b>Public Realm</b>	How well does the space provided for each street user meet the goals outlined in the Downtown Plan?	The public realm may not match the rest of the downtown character and may compromise the success of the goals outlined in the Downtown Plan.

The criteria associated with the theme ‘Level of Service’ are outlined in **Table 11** below.

**Table 11: Level of Service Criteria**

Theme	Criteria	Description	Risk if option is scored low
<b>Level of Service</b>	<b>Pedestrian LOS</b>	How well are pedestrians accommodated along the corridor?	Pedestrian comfort and accessibility for mobility-challenged users may be compromised resulting in low pedestrian activity along the corridor.
	<b>Transit LOS</b>	How well is transit accommodated along the corridor? (ex. Transit stops lay-bys, transit stop curb extensions, dedicated transit lanes)	Transit ridership may be compromised.
	<b>Vehicle LOS</b>	Vehicle capacity is generally met, and delay is within acceptable targets.	Vehicle congestion and driver impatience may occur.

**Table 12** summarizes the criteria associated with the theme ‘Cost & Constructability’.

**Table 12: Cost & Constructability Criteria**

Theme	Criteria	Description	Risk if option is scored low
<b>Cost &amp; Constructability</b>		What is the extent and ease of construction required for each option?	High costs without adequate funding or complicated construction could delay any improvements along the corridor.



### 6.3 EVALUTION OF POTENTIAL CROSS SECTIONS

The evaluation of the five potential cross-sections was completed based on scoring each criterion on a qualitative scale of Low, Moderate, or High. This approach allows for a relative comparison between the five potential treatments and an understanding of trade-offs that may be required based on the chosen cross-section. As previously mentioned, Option A represents the existing condition along the majority of 2<sup>nd</sup> Avenue, *Options B1, B2, C, and D1* are associated with the 2<sup>nd</sup> Avenue segment between Jarvis Street and Lowe Street, and *Options D2 and E* represent potential roadway cross sections north of Jarvis Street to Ogilvie Street. **Figure 28** illustrates the cross sections that correspond to each roadway segment. **Table 13** summarizes the cross-section evaluation for options between Jarvis Street and Lowe Street.

**Table 13: Jarvis Street to Lowe Street Cross Section Option Evaluation**

Theme	Criteria	Option A	Option B1	Option B2	Option C	Option D1
Safety	Pedestrian/Cyclist Safety	Low	Moderate	High	High	Low
	Vehicle Safety	Low	Moderate	Moderate	High	Moderate
	Vehicle Speeds	High Speeds	Moderate Speeds	Moderate Speeds	Low Speeds	Moderate Speeds
Policy	Policy Adherence	Does not meet Policies	Moderately meets Policies	Meets Policies	Meets Policies	Moderately meets Policies
	Public Realm	Low	Moderate	High	High	Low
Level of Service	Pedestrian LOS	Low	Moderate	High	High	Low
	Transit LOS	Low	High (with dedicated transit lanes)	Moderate	Moderate	High
	Vehicle LOS	High	High	Low	Moderate	Moderate
Cost & Constructability		Low Cost	High Cost	High Cost	High Cost	Low Cost



**2ND AVENUE CORRIDOR STUDY**

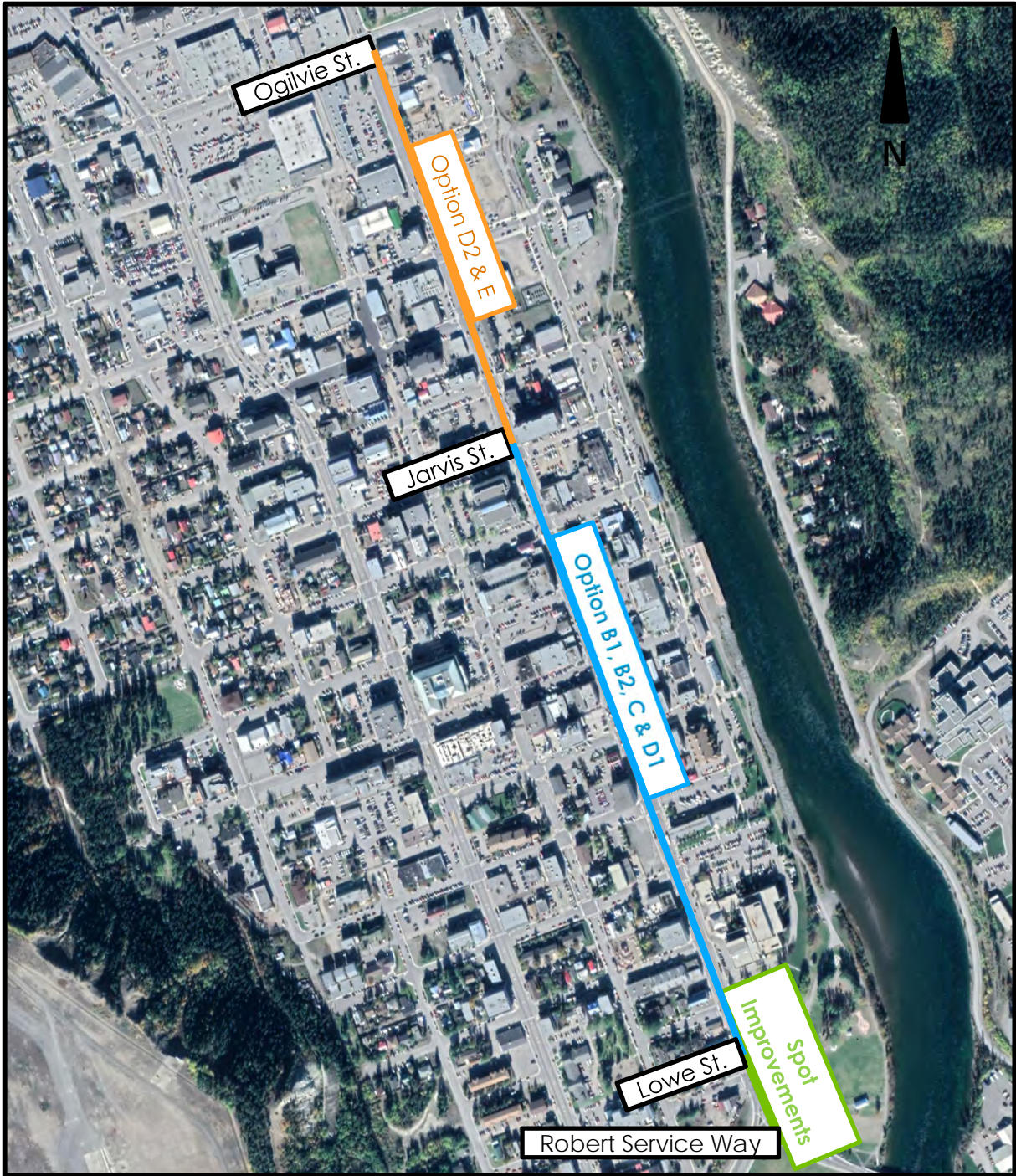
Evaluation

**Table 14** summarizes the cross-section evaluations for *Option D2* and *Option E* between Ogilvie Street and Jarvis Street.

**Table 14: Ogilvie Street to Jarvis Street Cross Section Option Evaluation**

Theme	Criteria	Option A	Option D2	Option E
Safety	Pedestrian/Cyclist Safety	Low	Moderate	Moderate
	Vehicle Safety	Low	High	Moderate
	Vehicle Speeds	High Speeds	Low Speeds	Moderate Speeds
Policy	Policy Adherence	Does not meet Policies	Moderately meets Policies	Does not meet Policies
	Public Realm	Low	High	Moderate
Level of Service	Pedestrian LOS	Low	High	Moderate
	Transit LOS	Low	High	Moderate
	Vehicle LOS	High	Low	High
Cost & Constructability		Low Cost	Moderate Cost	Moderate Cost





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City of Whitehorse  
 2nd Avenue Corridor Study

Figure No.  
**28**

Title  
**Potential Cross-Section  
 Options**

## 2ND AVENUE CORRIDOR STUDY

### Evaluation

As shown in Tables 13 and 14, **Option A** scores low under the 'Safety' and 'Policy' categories and scores low under the pedestrian and transit level of service. The cost of construction scores high for Option A as only spot improvements would be required to be constructed.

**Option B1** scores moderate or high under the 'Safety', 'Policy', and 'Level of Service' categories and scores low under the 'Cost & Constructability' as the existing curb would require relocation. Since curb extensions would not be possible with Option B1, pedestrian safety and level of service scores moderately due to a potential reduction of vehicle speeds and an increase in the pedestrian realm. Transit level of service could be scored high if the off-peak parking lanes were used as dedicated transit lanes during peak periods.

**Option B2** scores high under pedestrian/cyclist safety and high under the 'Policy' category as this option prioritizes pedestrians along the corridor translating to a lower vehicle level of service.

**Option C** scored the highest of all the options and is the option with the greatest potential of lowering vehicle speeds. Curb extensions at intersections in combination with a centre median drastically reduces pedestrian crossing distances and conflict areas. Option C also has the potential to accommodate left turn capacity at intersections if needed. The cost to constructed Option C would likely be the highest due to relocating the existing curb, reconstructing the curb extensions, and constructing a median.

**Option D1** scores low on pedestrian level of service because there was no increase in pedestrian realm; however, the pedestrian environment could be improved if the travel lanes were narrowed to allocate additional right-of-way to the pedestrian realm which would result in higher construction costs. The dedicated transit lanes are highlight the increase transit level of service while generally meeting policies for the downtown area by encouraging travel by modes other than single occupant vehicles.

As shown in Table 14, **Option D2** generally scores well encouraging low vehicle speeds, high pedestrian and transit level of service. It is noted that vehicle level of service may be compromised at the Strickland/2<sup>nd</sup> Avenue intersection with the reduced single occupant vehicle geometry as mentioned in the intersection assessment in Section 6.1.6.

**Option E** generally scored moderately; however, scores low in 'policy adherence' and scores high in vehicle level of service.



## 2ND AVENUE CORRIDOR STUDY

### Recommendations & Conclusions

## 7.0 RECOMMENDATIONS & CONCLUSIONS

Based on the analysis completed in the previous section and a meeting with the City of Whitehorse in September 2019 to review the findings, the following cross sections are recommended for the two study areas:

- Option C between Jarvis Street to Lowe Street
- Option D2 between Ogilvie Street to Jarvis Street

For the section between Jarvis Street to Lowe Street, Option C performs the best with respect to Safety and meeting the goals that the City have identified within Policy. From a motor vehicle operations perspective, this performs at a moderate level, but the safety benefits of this option provides a significant rationale for making a change. Option D2 for the section between Ogilvie Street and Jarvis Street performs the best in the evaluation scheme compared to the other two options.

To progress the above recommendations, it is recommended that the City engage in developing a Conceptual Design of the street using the recommended cross sections for the mid-block and intersections. This design would be in plan view and allow for specific modifications and considerations to be identified and addressed along the entire corridor for each block face, before more detailed design is commenced.

Phasing of the implementation of the design could be started at Main Street and radiate in both the north and south directions from there. It is expected that adoption of new driving behaviours would occur if the new cross-section is implemented for approximately 2-3 blocks in both the north and south direction of Main Street, resulting in a 4-6 block Phase 1. The exact extents and rationale for phasing should be considered in the Concept Design and Detailed Design phase of the work plan, since the above is only based on conversations with the City and limited site observations.



# **APPENDIX A**

## **Intersection Assessment Results**



Table A-1 - City of Whitehorse - 2nd Avenue Corridor Traffic Study : Level of Service Summary for Existing 2018 Condition

Intersection	Intersection Control Device	Interval	Measure	Eastbound			Westbound			Northbound			Southbound			Overall Intersection LOS		
				Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right			
2nd Avenue & Ogilvie Street	Signalized	AM	Volumes (vph)	21	26	62	17	10	10	52	493	6	12	862	24	A		
			Level of Service	C			A			A			A					
			V/C Ratio By Movement	0.25			0.26			0.16			0.05				0.28	
		Queue Length (in metres)	12			8			8			1			17			
		Volumes (vph)	54	16	201	13	16	14	84	865	4	11	686	45	A			
		Level of Service	C			A			A			A						
V/C Ratio By Movement	0.36			0.52			0.14			0.06			0.50					
Queue Length (in metres)	16			14			8			2			35					
2nd Avenue & Strickland Street	Unsignalized	AM	Volumes (vph)	4	2	20	0	1	5	29	602	3	29	876	48	A		
			Level of Service	D			C			A			A					
			V/C Ratio By Movement	0.17			0.03			0.20			0.33					
		Queue Length (in metres)	5			1			1			1						
		Volumes (vph)	8	1	50	2	0	22	36	864	9	216	604	35	A			
		Level of Service	F			E			A			A						
V/C Ratio By Movement	0.54			0.18			0.28			0.36								
Queue Length (in metres)	20			5			1			13								
2nd Avenue & Wood Street	Unsignalized	AM	Volumes (vph)	3	0	15	1	2	10	14	600	12	25	707	41	A		
			Level of Service	C			C			A			A					
			V/C Ratio By Movement	0.06			0.05			0.21			0.26					
		Queue Length (in metres)	2			1			1			1						
		Volumes (vph)	8	2	32	0	2	29	11	818	12	27	760	27	A			
		Level of Service	D			C			A			A						
V/C Ratio By Movement	0.21			0.09			0.25			0.24								
Queue Length (in metres)	6			2			0			1								
2nd Avenue & Steele Street	Unsignalized	AM	Volumes (vph)	2	0	12	0	0	3	18	679	13	30	640	36	A		
			Level of Service	C			B			A			A					
			V/C Ratio By Movement	0.05			0.00			0.23			0.23					
		Queue Length (in metres)	1			0			1			1						
		Volumes (vph)	9	1	41	2	0	30	15	958	10	41	804	31	A			
		Level of Service	F			C			A			A						
V/C Ratio By Movement	0.43			0.14			0.30			0.27								
Queue Length (in metres)	14			4			1			2								
2nd Avenue & Main Street	Signalized	AM	Volumes (vph)	24	18	44	27	21	20	19	570	12	8	595	49	B		
			Level of Service	B			A			B			B					
			V/C Ratio By Movement	0.07			0.08			0.09			0.04				0.32	
		Queue Length (in metres)	11			6			12			4			41			
		Volumes (vph)	121	52	48	68	35	49	16	651	12	14	709	78	B			
		Level of Service	C			A			B			B						
V/C Ratio By Movement	0.38			0.09			0.22			0.09			0.42					
Queue Length (in metres)	36			8			22			7			45					
2nd Avenue & Lambert Street	Unsignalized	AM	Volumes (vph)	4	0	7	8	0	9	22	754	39	11	614	43	A		
			Level of Service	B			B			A			A					
			V/C Ratio By Movement	0.02			0.05			0.27			0.22					
		Queue Length (in metres)	1			1			1			0						
		Volumes (vph)	5	3	21	6	2	26	12	708	15	5	937	19	A			
		Level of Service	C			B			A			A						
V/C Ratio By Movement	0.08			0.08			0.23			0.30								
Queue Length (in metres)	2			2			0			0								
2nd Avenue & Hanson Street	Signalized	AM	Volumes (vph)	14	23	9	6	1	22	19	807	30	58	546	21	A		
			Level of Service	C			B			A			A					
			V/C Ratio By Movement	0.16			0.10			0.35			0.30					
		Queue Length (in metres)	13			7			32			23						
		Volumes (vph)	47	5	57	39	15	59	15	691	6	4	864	26	A			
		Level of Service	B			B			A			A						
V/C Ratio By Movement	0.37			0.36			0.31			0.38								
Queue Length (in metres)	19			20			25			33								
2nd Avenue & Lowe Street	Signalized	AM	Volumes (vph)			3				12	779			487	14	A		
			Level of Service			A				A	A			A				
			V/C Ratio By Movement			0.00				0.01	0.26			0.18				
		Queue Length (in metres)			0				1	19			33					
		Volumes (vph)			53				12	600			768	33	A			
		Level of Service			A				A	A			A					
V/C Ratio By Movement			0.07				0.01	0.19			0.27							
Queue Length (in metres)			0				1	13			#61.0							
2nd Avenue/Lewes Blvd & Robert Service Way/Parking Lot access	Signalized	AM	Volumes (vph)	141	2	419	2	0	2	245	743	4	1	473	58	B		
			Level of Service	D			A			C			A					
			V/C Ratio By Movement	0.48			0.63			0.01			0.00				0.39	
		Queue Length (in metres)	41			24			2			0			25			
		Volumes (vph)	89	6	308	6	5	14	228	536	5	9	637	308	C			
		Level of Service	C			A			C			A						
V/C Ratio By Movement	0.35			0.56			0.03			0.04			0.46					
Queue Length (in metres)	30			21			6			0			25					

Note: "m" indicates Upstream metering is in effect & "#" indicates the volume modeled at an approach exceeds capacity and the queue length could be much longer.

Table A-2 - City of Whitehorse - 2nd Avenue Corridor Traffic Study : Level of Service Summary for Future Scenaric

Intersection	Intersection Control Device	Interval	Measure	Eastbound			Westbound			Northbound			Southbound			Overall Intersection LOS															
				Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right																
2nd Avenue & Ogilvie Street	Signalized	AM	Volumes (vph)	21	26	62	17	10	10	52	497	6	12	872	24	A															
			Level of Service	C			A			A			A																		
			V/C Ratio By Movement	0.25			0.26			0.16			0.05				0.28			0.39											
			Queue Length (in metres)	12			8			8			1				18			30											
		PM	Volumes (vph)	54	16	201	13	16	14	84	880	4	11	693	45		A														
			Level of Service	C			A			C			A					A													
2rd Avenue & Strickland Street	Unsignalized	AM	Volumes (vph)	4	2	20	0	1	5	29	606	3	29	886	48	A															
			Level of Service	D			C			A			A																		
			V/C Ratio By Movement	0.17			0.03			0.20			0.33																		
			Queue Length (in metres)	5			1			1			1																		
		PM	Volumes (vph)	8	1	50	2	0	22	36	879	9	216	611	35	A															
			Level of Service	F			E			A			A																		
2nd Avenue & Wood Street	Unsignalized	AM	Volumes (vph)	3	0	15	2	2	14	14	600	12	62	680	41	A															
			Level of Service	C			C			A			A																		
			V/C Ratio By Movement	0.06			0.07			0.21			0.25																		
			Queue Length (in metres)	2			2			1			2																		
		PM	Volumes (vph)	8	2	32	12	2	71	11	791	16	72	722	27	A															
			Level of Service	D			D			A			A																		
2rd Avenue & Steele Street	Unsignalized	AM	Volumes (vph)	2		12				18	690			644	36	A															
			Level of Service	C						A			A																		
			V/C Ratio By Movement	0.04						0.30			0.28																		
			Queue Length (in metres)	1						1			0																		
		PM	Volumes (vph)	9		41				15	965			819	31	A															
			Level of Service	D						A			A																		
2rd Avenue & Main Street	Signalized	AM	Volumes (vph)	24	18	44	30	21	23	19	565	29	11	596	49	B															
			Level of Service	B			A			B			B																		
			V/C Ratio By Movement	0.07			0.08			0.09			0.04				0.33			0.35											
			Queue Length (in metres)	11			6			13			4				41			44											
		PM	Volumes (vph)	121	53	48	72	35	52	16	645	25	17	719	78	B															
			Level of Service	C			A			B			A				B														
2rd Avenue & Lambert Street	Unsignalized	AM	Volumes (vph)	4	0	7	8	0	9	22	766	39	11	618	43	A															
			Level of Service	B			C			A			A																		
			V/C Ratio By Movement	0.02			0.05			0.27			0.23																		
			Queue Length (in metres)	1			1			1			0																		
		PM	Volumes (vph)	5	3	21	6	2	26	12	715	15	5	951	19	A															
			Level of Service	C			B			A			A																		
2rd Avenue & Hanson Street	Signalized	AM	Volumes (vph)	14	23	9	6	1	22	19	819	30	58	550	21	A															
			Level of Service	C			B			A			A																		
			V/C Ratio By Movement	0.16			0.10			0.36			0.30																		
			Queue Length (in metres)	13			7			33			23																		
		PM	Volumes (vph)	47	5	57	39	15	59	15	698	6	4	878	26	A															
			Level of Service	B			B			A			A																		
2rd Avenue & Lowe Street	Signalized	AM	Volumes (vph)			3				12	791			491	14	A															
			Level of Service				A			A			A																		
			V/C Ratio By Movement				0.00						0.01				0.26			0.18											
			Queue Length (in metres)				0						1				19			34											
		PM	Volumes (vph)			53					12	607			782	33	A														
			Level of Service				A			A			A			A															
2rd Avenue/Lewes Blvd & Robert Service Way/Parking Lot access	Signalized	AM	Volumes (vph)	141	2	419	2	0	2	245	755	4	1	477	58	B															
			Level of Service	D			A			C			A				B														
			V/C Ratio By Movement	0.48			0.63			0.01			0.00				0.39			0.34			0.00			0.32			0.08		
			Queue Length (in metres)	41			24			2			0				25			37			1			40			4		
		PM	Volumes (vph)	89	6	308	6	5	14	228	543	5	9	651	308	C															
			Level of Service	C			A			C			A				A			B			E			C					
Queue Length (in metres)	30			21			6			0			25			28			4			60			43						

Note: "m" indicates Upstream metering is in effect & "#" indicates the volume modeled at an approach exceeds capacity and the queue length could be much longer.

Table A-3 - City of Whitehorse - 2nd Avenue Corridor Traffic Study : Level of Service Summary for Future Modified Scenario

Intersection	Intersection Control Device	Interval	Measure	Eastbound			Westbound			Northbound			Southbound			Overall Intersection LOS			
				Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right				
2nd Avenue & Ogilvie Street	Signalized	AM	Volumes (vph)	21	26	62	17	10	10	52	497	6	12	872	24	A			
			Level of Service	C			A			A			B						
			V/C Ratio By Movement	0.25			0.26			0.16			0.05				0.50		
			Queue Length (in metres)	12			8			8			1				50		
		PM	Volumes (vph)	54	16	201	13	16	14	84	880	4	11	693	45	B			
			Level of Service	C			A			C			A						
			V/C Ratio By Movement	0.36			0.52			0.14			0.06				0.90		
			Queue Length (in metres)	16			14			8			2				#165.8		
2nd Avenue & Strickland Street	Unsignalized	AM	Volumes (vph)	4	2	20	0	1	5	29	606	3	29	886	48	A			
			Level of Service	F			D			A			A						
			V/C Ratio By Movement	0.30			0.04			0.05			0.04						
			Queue Length (in metres)	9			1			1			1						
		PM	Volumes (vph)	8	1	50	2	0	22	36	879	9	216	611	35	D			
			Level of Service	F			F			A			B						
	V/C Ratio By Movement		1.70			0.51			0.05			0.42							
	Queue Length (in metres)		52			15			1			16							
	Unsignalized (RESTRICTED LEFT SCENARIO)	AM	Volumes (vph)			20			5		606	3	29	886	48	A			
			Level of Service			C			B		A		A	A					
			V/C Ratio By Movement			0.09			0.02		0.41		0.04	0.62					
			Queue Length (in metres)			2			0		0		1	0					
PM		Volumes (vph)			50			22		879	9	216	611	35	A				
		Level of Service			C			C		A		C	A						
2nd Avenue & Wood Street	Unsignalized	AM	Volumes (vph)	3	0	15	2	2	14	14	600	12	62	680	41	A			
			Level of Service	D			D			A			A						
			V/C Ratio By Movement	0.12			0.12			0.02			0.08						
			Queue Length (in metres)	3			3			1			2						
		PM	Volumes (vph)	8	2	32	12	2	71	11	791	16	72	722	27	B			
			Level of Service	F			F			A			A						
			V/C Ratio By Movement	0.76			0.91			0.01			0.11						
			Queue Length (in metres)	25			39			0			3						
2nd Avenue & Steele Street	Unsignalized	AM	Volumes (vph)	2		12				18	690			644	36	A			
			Level of Service	C						A			A						
			V/C Ratio By Movement	0.08						0.03			0.45						
			Queue Length (in metres)	2						1			0						
		PM	Volumes (vph)	9		41				15	965			819	31	A			
			Level of Service	F						A			A						
			V/C Ratio By Movement	0.78						0.03			0.53						
			Queue Length (in metres)	27						1			0						
2nd Avenue & Main Street	Signalized	AM	Volumes (vph)	24	18	44	30	21	23	19	565	29	11	596	49	B			
			Level of Service	B			A			B			B						
			V/C Ratio By Movement	0.08			0.09			0.10			0.04				0.59		
			Queue Length (in metres)	11			6			13			4				110		
		PM	Volumes (vph)	121	53	48	72	35	52	16	645	25	17	719	78	C			
			Level of Service	C			A			B			A						
			V/C Ratio By Movement	0.39			0.10			0.24			0.10				0.77		
			Queue Length (in metres)	37			8			23			7				126		
2nd Avenue & Lambert Street	Unsignalized	AM	Volumes (vph)	4	0	7	8	0	9	22	766	39	11	618	43	A			
			Level of Service	C			C			A			A						
			V/C Ratio By Movement	0.04			0.07			0.03			0.02						
			Queue Length (in metres)	1			2			1			0						
		PM	Volumes (vph)	5	3	21	6	2	26	12	715	15	5	951	19	A			
			Level of Service	D			C			A			A						
			V/C Ratio By Movement	0.17			0.15			0.02			0.01						
			Queue Length (in metres)	4						1			0						
2nd Avenue & Hanson Street	Signalized	AM	Volumes (vph)	14	23	9	6	1	22	19	819	30	58	550	21	A			
			Level of Service	C			B			A			A						
			V/C Ratio By Movement	0.16			0.10			0.65			0.53						
			Queue Length (in metres)	13			7			116			70						
		PM	Volumes (vph)	47	5	57	39	15	59	15	698	6	4	878	26	B			
			Level of Service	B			B			A			B						
			V/C Ratio By Movement	0.37			0.36			0.56			0.70						
			Queue Length (in metres)	19			20			73			116						
2nd Avenue & Lowe Street	Signalized	AM	Volumes (vph)			3				12	791			491	14	A			
			Level of Service			A				A	A		A	A					
			V/C Ratio By Movement			0.00				0.01	0.49			0.34					
			Queue Length (in metres)			0				1	62			#104.3					
		PM	Volumes (vph)			53				12	607			782	33	A			
			Level of Service			A				A	A			B					
			V/C Ratio By Movement			0.07				0.01	0.36			0.53					
			Queue Length (in metres)			0				1	35			#173.4					
2nd Avenue/Lewes Blvd & Robert Service Way/Parking Lot access	Signalized	AM	Volumes (vph)	141	2	419	2	0	2	245	755	4	1	477	58	C			
			Level of Service	D			A			A			B						
			V/C Ratio By Movement	0.48			0.64			0.01			0.00				0.47		
			Queue Length (in metres)	41			24			2			0				27		
		PM	Volumes (vph)	89	6	308	6	5	14	228	543	5	9	651	308	C			
			Level of Service	D			A			C			A				B		
			V/C Ratio By Movement	0.38			0.59			0.04			0.04				0.64		
			Queue Length (in metres)	37			25			7			0				47		

Note: "m" indicates Upstream metering is in effect & "W" indicates the volume modeled at an approach exceeds capacity and the queue length could be much longer.