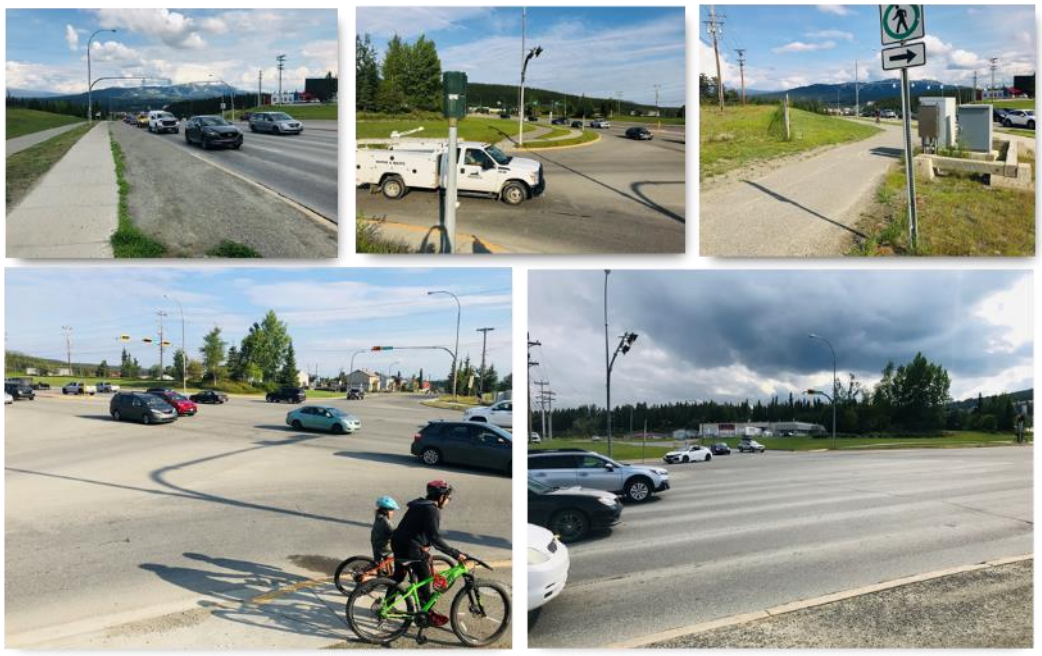
Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

REPORT

City of Whitehorse

Range Road and Two Mile Hill Road Intersection Study Conceptual Design Report



DECEMBER 2020

ASSOCIATED ENGINEERING

QUALITY MANAGEMENT SIGN-OFF

Signature.....

Date.....

TABLE OF CONTENTS

1 INTRODUCTION

Associated Engineering (AE) was retained by the City of Whitehorse to conduct a safety and operational study for the intersection of Range Road and Two Mile Hill Road, Whitehorse, Yukon. The intersection is identified as the main access between downtown and the northwest side of the City. Alaska Highway is the main access to the City and it intersects with Two Mile Hill Road 200 m west of Range Road.

1.1 Objectives and Scope

The study evaluates the intersection from a multi-modal perspective, where the movements of pedestrians, cyclists and transit are examined, along with vehicular traffic performance.
A site visit was conducted on June 25, 2019, by the AE study technical team: Monique Beaudry and Haytham Sadeq, to better understand the site constraints, safety concerns and operational issues. A kick-off meeting was conducted on June 26, 2019, with representatives from the City of Whitehorse engineering services, transit, and fire departments. A summary of the meeting notes is available in **Appendix A**.

This conceptual design report includes current and future conditions assessment at the intersection. The assessment identifies the problem definition statement and proposes a set of guiding principles to guide the improvement options. This report also documents the development of improvement options, and the qualitative Multiple-Account Evaluation (MAE) used to recommend the preferred option.

1.2 Background Documents

The following background documents were reviewed as part of this study:

- Existing historical counts at the intersection of Two Mile Hill Road / Range Road and Alaska Highway
- City Wide Transportation Study (UMA, 2004)
- City of Whitehorse Range Road Building - Traffic Analysis Memorandum (Associated Engineering, 2015)
- Whistle Bend Transportation Network Impact Study (AECOM, 2009)
- Whitehorse Transportation Demand Management Plan (Boulevard, 2014)
- Safety and Traffic Assessment of Potential Design Scenarios for the Closure of Range Road at Alaska Highway Whitehorse, (De Leur Consulting, May 2018)
- City of Whitehorse 2010 Official Community Plan (Reprinted 2013)
- City of Whitehorse Bicycle Network Plan (2018)
- City of Whitehorse Transit Master Plan (Stantec, 2018)
- Alaska Highway at Two Mile Hill Road and Hamilton Boulevard Collision Data (2004-2013)[1]

[1] Although we received the collision data on Two Mile Hill Road and Hamilton Boulevard (2004-2013), this data lacked the detail needed for assessment. The most recent collision data (2010 to 2016) from the Safety and Traffic Assessment of Potential Design Scenarios for the Closure of Range Road at Alaska Highway Whitehorse, (De Leur Consulting, May 2018) was used instead of this data.

2 EXISTING CONDITIONS

This section provides a description of the study intersection including the study area, pedestrian and cyclist facilities, transit network, and truck accommodation.

2.1 Intersection Area and Configuration

The location of the study intersection is shown in Figure 2-1. Two Mile Hill Road is an arterial road that provides a connection between Alaska Highway and Whitehorse's City Centre. Range Road is a collector road that connects between Alaska Highway and Whistle Bend Way.

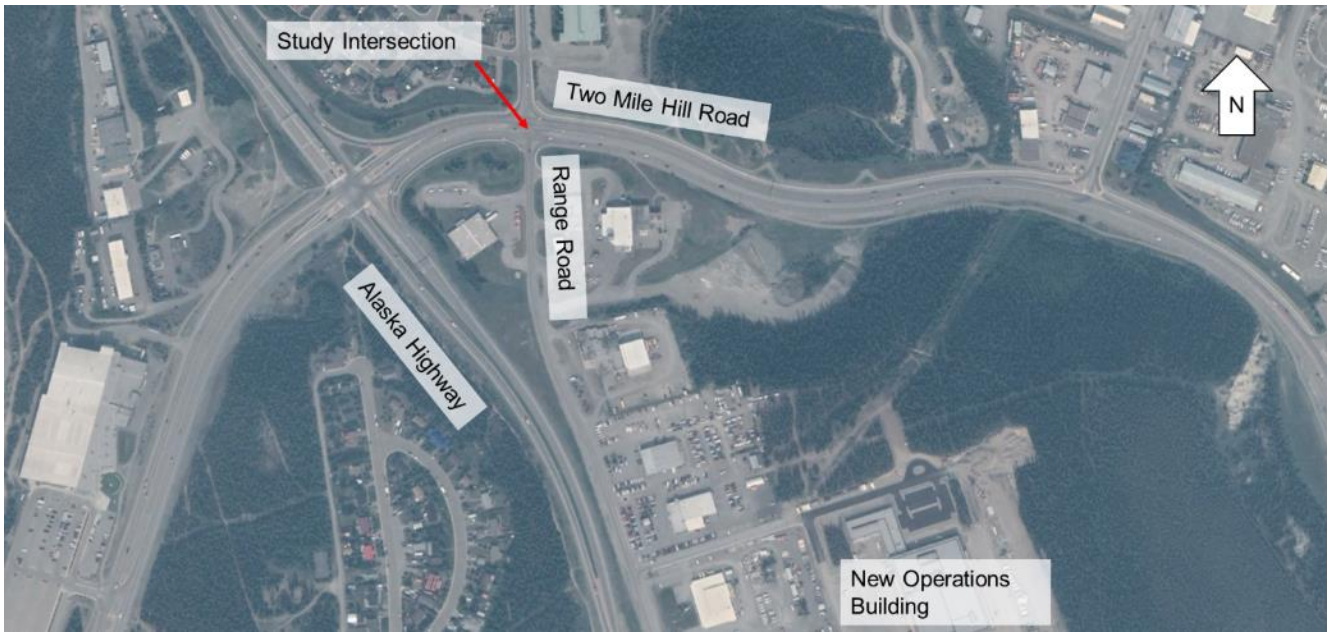


Figure 2-1
The Location of the Range Road and Two Mile Hill Road Intersection

The existing intersection configuration is shown in Figure 2-2. Two Mile Hill Road west approach has one through lane, one shared through/right lane, and one left turn lane with a permitted/protected phase. Two Mile Hill Road east approach has two through lanes, one shared through/right lane, and one left turn lane with a permitted phase. Range Road (at each north and south approaches) has one right turn lane, and one shared through/left-turn lane with a permitted phase.

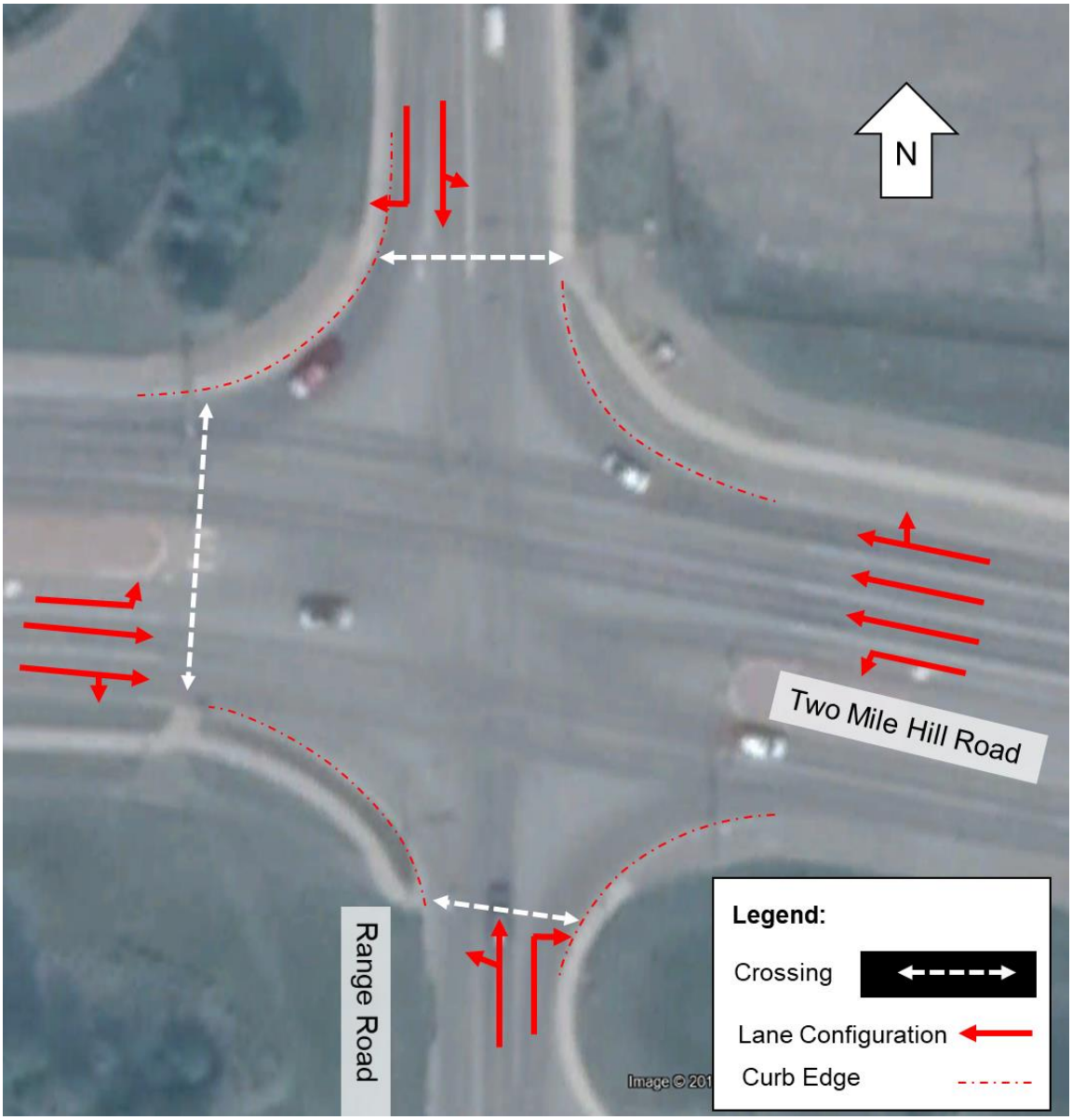


Figure 2-2
Intersection Configuration

The land-use plan extracted from the Official Community Plan (2010)[2] at the intersection area is shown in Figure 2-3. The northeast quadrant and the south areas of the intersection have public service and mixed-use industrial/ commercial areas. The northwest and further northern areas are mostly urban residential areas, with a mixed-use residential/commercial area.

[2] City of White 2010 Official Community Plan (Reprinted 2013).

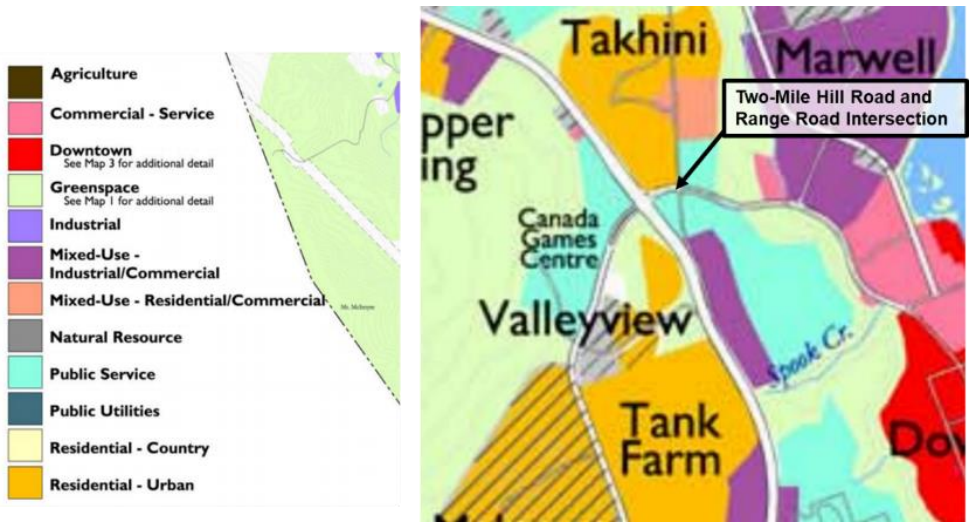


Figure 2-3
Land Use Plan at the Intersection Area

2.2 Pedestrians and Cyclists Facilities

The Whitehorse Bicycle Network Plan (BNP) identifies that currently Range Road and Two Mile Hill Road are part of the Commuter cycling routes. Range Road has an on-street bicycle route to the east. Two Mile Hill Road has off-street shared pedestrian/bike pathways on both sides of the roadway. Figure 2-4 shows the existing pedestrians and cyclists' facilities in the intersection area.

The City of Whitehorse provided information about pedestrians and cyclists' facilities during the winter months. The pedestrian sidewalks on Two Mile Hill Road are not maintained during winter months, and the bike pathways become shared pedestrian/bike pathways. The existing shared pedestrian/bike pathway on the south side of Two Mile Hill Road (from Range Road toward downtown) is not maintained. This may result in a higher risk for pedestrians and cyclists during winter months where pedestrians and cyclists would need to the cross Two Mile Hill Road at the intersection to reach their pathways.

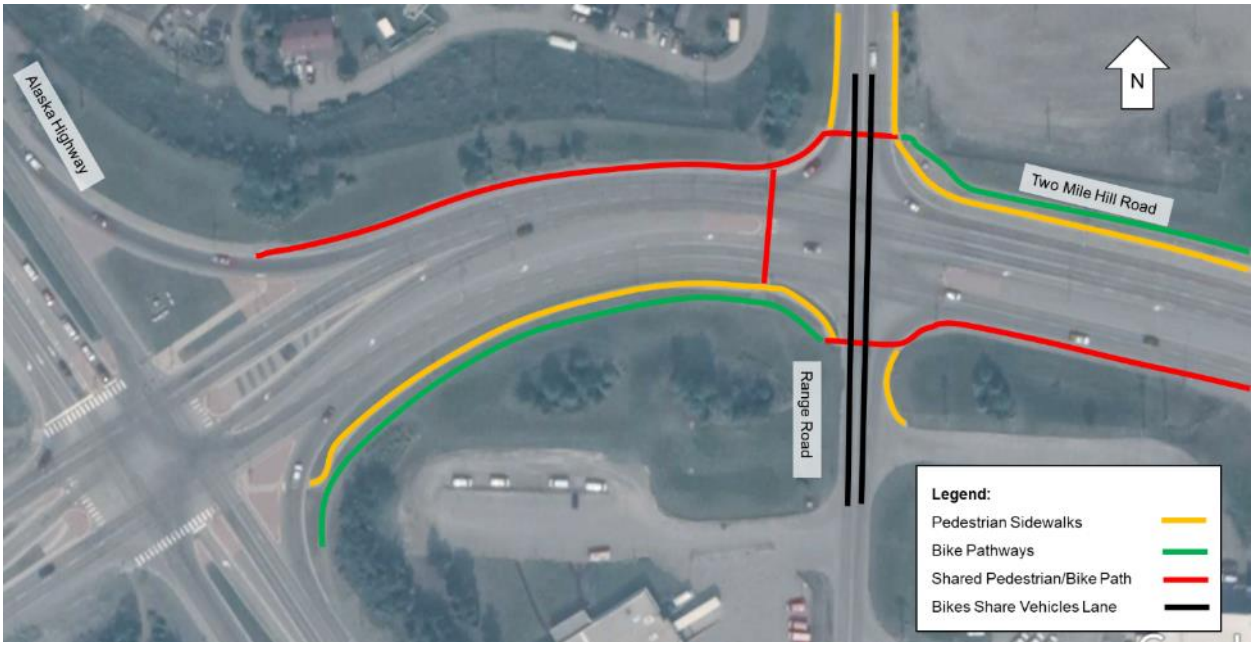


Figure 2-4
Existing Pedestrians and Cyclists Facilities at the Intersection Area

Figure 2-5 shows an extract from the City of Whitehorse Bicycle Network Plan (BNP - 2018) for the proposed bike network at the intersection area. Both Range Road and Two Mile Hill Road are proposed to be part of the All Ages and Abilities (AAA) bike network. The existing shared pedestrian/bike pathways provide AAA access along Two Mile Hill. The BNP plan includes proposed separated bicycle facilities along Range Road.

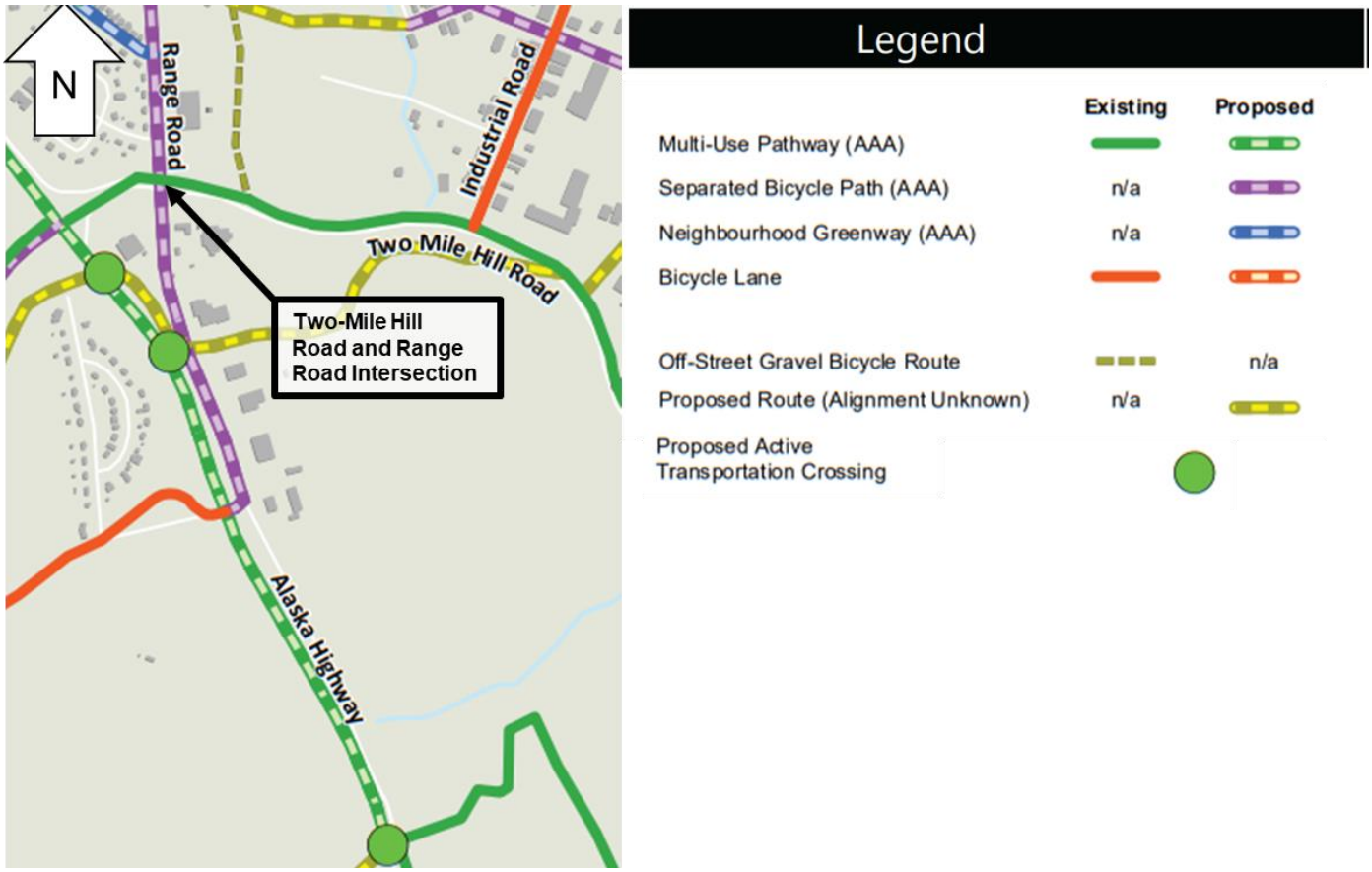


Figure 2-5
Proposed Bike Network in the Intersection Area

2.3 Transit Network

Transit bus stops in the intersection vicinity are shown in Figure 2-6. Four bus routes cross through the intersection (R2, R3, R4, and R5). There are two bus stops close to the study intersection: one serves R3 and the other serves R5 and R6. During the kick-off meeting, it was mentioned that the frequency of buses is expected to increase in 2020.

Bus route R2 uses Two Mile Hill Road and stops at Hamilton Boulevard around 800 m west of Range Road (next to the Canada Games Centre). Passengers destined to Range Road south and north of Two Mile Hill Road have a longer distance to walk due to the lack of proximate bus stops through R2. Figure 2-7 shows the existing transit routes at the intersection vicinity.

Bus routes R2, R3, and R6 currently operate with 60 minutes frequency in the peak hour. Bus route R5 operates every 30 minutes in the peak hour only.

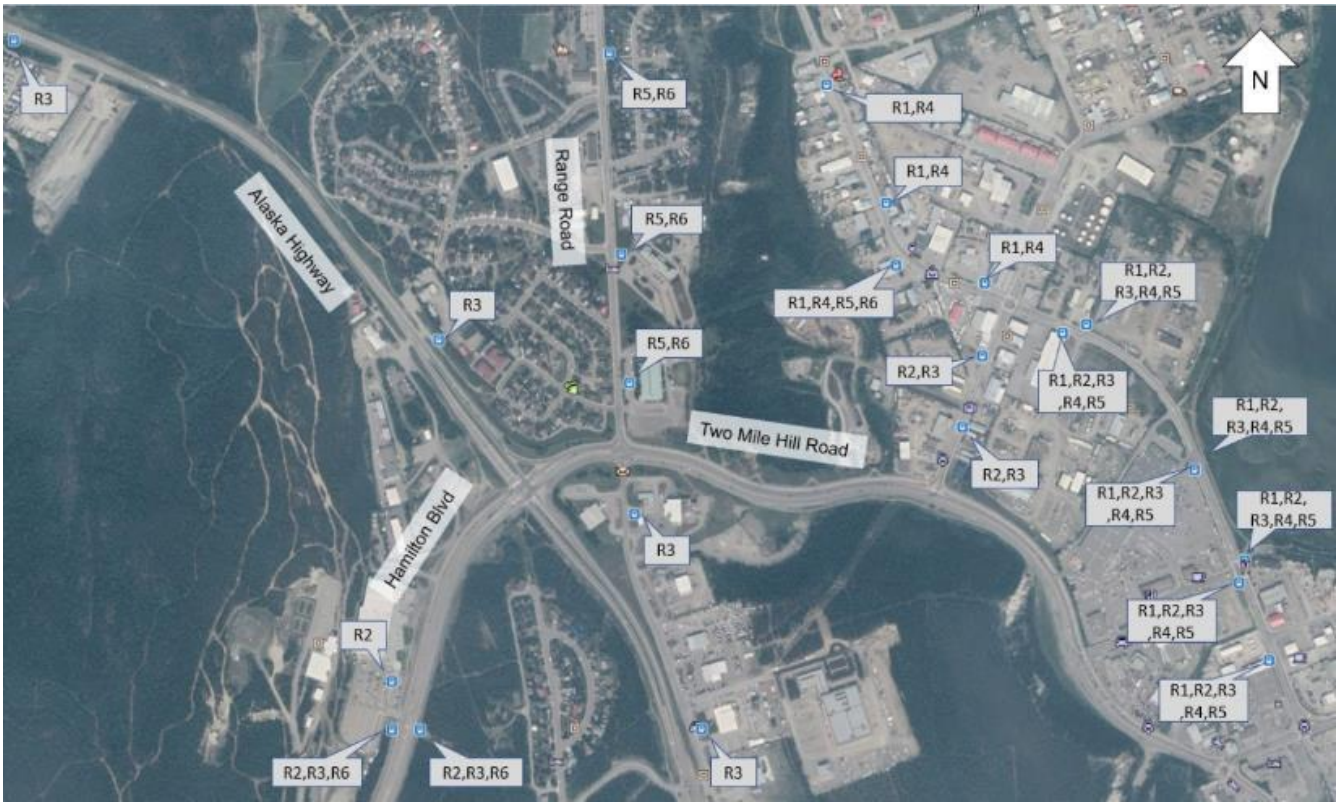


Figure 2-6
Transit Bus Stops in the Intersection Vicinity

Figure 2-7
Current Transit Routes in the Intersection Vicinity

The City of Whitehorse Transit Master Plan (Stantec, 2018) includes the proposed changes to the transit network, as shown in Figure 2-8. The number of routes is expected to decrease from four routes (Route no. 2, Route no. 3,

Route no. 5 and Route no. 6) to three routes (Route no. 1, no. 2 and no. 3). Route no. 1 and Route no. 2 are planned to operate with 30 minutes frequency in peak hour. Route no. 3 is planned to operate with 60 minutes frequency during peak hour. Route no. 2 will not have a bus stop close to the intersection of Range Road and Two Mile Hill Road. New transit routes are planned in both directions of Range Road. There are no bus stops at the southbound direction of Range Road which would be needed when the new transit routes run on both directions.

Figure 2-8
Proposed Transit Routes in the Intersection Vicinity (Transit Master Plan, Stantec, 2018)

The growth rate applied in the traffic analysis captures the future transit frequency increase. However, the transit ridership is expected to increase as the service gets improved which will impact the modal share and the overall intersection performance. Coordination with Transit is needed to capture their future needs at the vicinity of the intersection when developing improvement options. For example, the proposed transit changes are likely to increase pedestrian volumes travelling northbound and southbound (on Range Road). The lack of the crosswalk on the east approach of the intersection causes inconvenience for pedestrians especially since the nearby transit stops are on the northeast and southeast corners. Further improvements may include transit signal priority and relocations of bus stops to support the proposed routes. This is expected to potentially increase the transit ridership and reduce auto vehicles use resulting in an overall positive impact on the intersection operation.

2.4 Fire Trucks

The intersection pre-emption system for fire trucks uses sound for activation. This system may have technical issues as sound can deflect off nearby structures. The signal design in further project stages will be coordinated with the Fire Department to ensure the functional pre-emption for fire trucks and other first responders vehicles using the intersection.

2.5 Truck Routes

Two Mile Hill Road is an arterial road that is frequently used by trucks and commercial vehicles. Range Road is a collector road that also is used by trucks to serve the commercial and industrial areas north and south of Two Mile Hill Road. The existing curb radii at the intersection corners ranges between 20 to 30 meters which were probably designed to accommodate truck movements. A trade-off between accommodating trucks at the intersections and pedestrians/cyclists' movements is key at this intersection. However, the truck movements at the intersection can be accommodated based on the number and width of exit receiving lanes. The current intersection configuration has two or more exit lanes for all approaches except for the south approach which has one exit lane. Further considerations to accommodate truck movements safely with the other vulnerable road users will be addressed when developing the improvement options.

3 ROAD SAFETY ANALYSIS

This section summarizes the road safety review using historical collision data and the site visit safety observations. The intersection geometrics, lane marking, and signs are also reviewed. The safe system approach is adopted in conducting the safety review, which focuses on providing safe speeds, safe vehicles, safe people and safe roads. The safe system approach examines road safety conditions considering the following principles[3]:

1. People do make mistakes and collisions can occur.
2. The human body has limited ability in surviving collisions. Impacts with vehicles at a speed greater than 30 km/h significantly increase the injury and fatality risk.
3. The responsibility of collisions is shared among all system designers and users. All parts of the road system need to collaborate to protect the people.

3.1 Historical Collisions

Based on the previous road safety assessment[4], during the 7 years from 2010 to 2016 (inclusive) a total of 36 collisions were reported at the Range Road and Two Mile Hill Road intersection. The number of Property Damage Only (PDO) collisions were 27 collisions (75%), where the remaining 9 collisions (25%) were injury collisions. No fatal collisions were reported.

The Collision Severity Index (CSI) is a measure to estimate the severity level of the historical collisions. The CSI value of the intersection is 3.25 (lower than the average CSI 4.9 for intersections in Yukon[5]) indicating that the severity of collisions is generally low, as 75% of collisions were PDO and 25% were injury collisions.

Intersection collision rates are a measure to estimate the frequency of collisions per the intersection exposure, which is measured in million entering vehicles (MEV). This rate is used to normalize the safety performance among intersections with different traffic volumes. The collision rate for this intersection is 0.44 Coll./MEV, which is less than the average collision rate of 0.63 Coll./MEV identified in a previous safety study[6].

[3] Toward Zero Foundation
[4] "Safety and Traffic Assessment of Potential Design Scenarios for the Closure of Range Road at Alaska Highway Whitehorse", De Leur Consulting, Government of Yukon (May 2018)
[5] In-Service Road Safety Review: Existing Conditions, Alaska Highway (Highway 1) Corridor Near the City of Whitehorse, prepared for Transportation Engineering Branch, Department of Highways and Public Works, Government of Yukon, prepared by de Leur Consulting Ltd, October 30, 2011.
[6] See footnote 5.

During the 7 years, 41% of collisions at the intersection were categorized as “rear-end” collisions while 25% of collisions were categorized as “intersection” collisions, and 22% of collisions were “left turn” collisions. 17% of collisions were unspecific/other types, while the right turn and sideswipe collision types represent 3% each. Proportions of rear-end and left-turn and intersection collisions are generally higher than similar intersections[7].

50% of collisions at the intersection occurred in dry road surface conditions while 28% of collisions occurred during snowing, 14% of collisions occurred in ice road conditions, 5% on unknown conditions and 3% on wet conditions. 72% of collisions occurred in daylight hours.

3.2 Vehicular-Related Observations

Several vehicular-related safety observations were identified during the site visit, which included the following:

1. The north and south approaches (Range Road) have a permitted signal phasing for the left-turning vehicles. The permitted left turn generates a higher risk for vehicles while waiting for a gap. Left turning vehicles sometimes fail to interpret the opposing traffic movement where they either move through or turn right. If the northbound vehicle is turning right to the eastbound curb lane, southbound left-turn vehicles can still turn left to the inside lane at the eastbound exit. However, northbound traffic sometimes uses both lanes to go through which results in confusing the southbound left-turning traffic, leading to a potential conflict with the opposing traffic. Figure 3-1 shows the potential conflict.

[7] Compared with British Columbia average collision proportions.

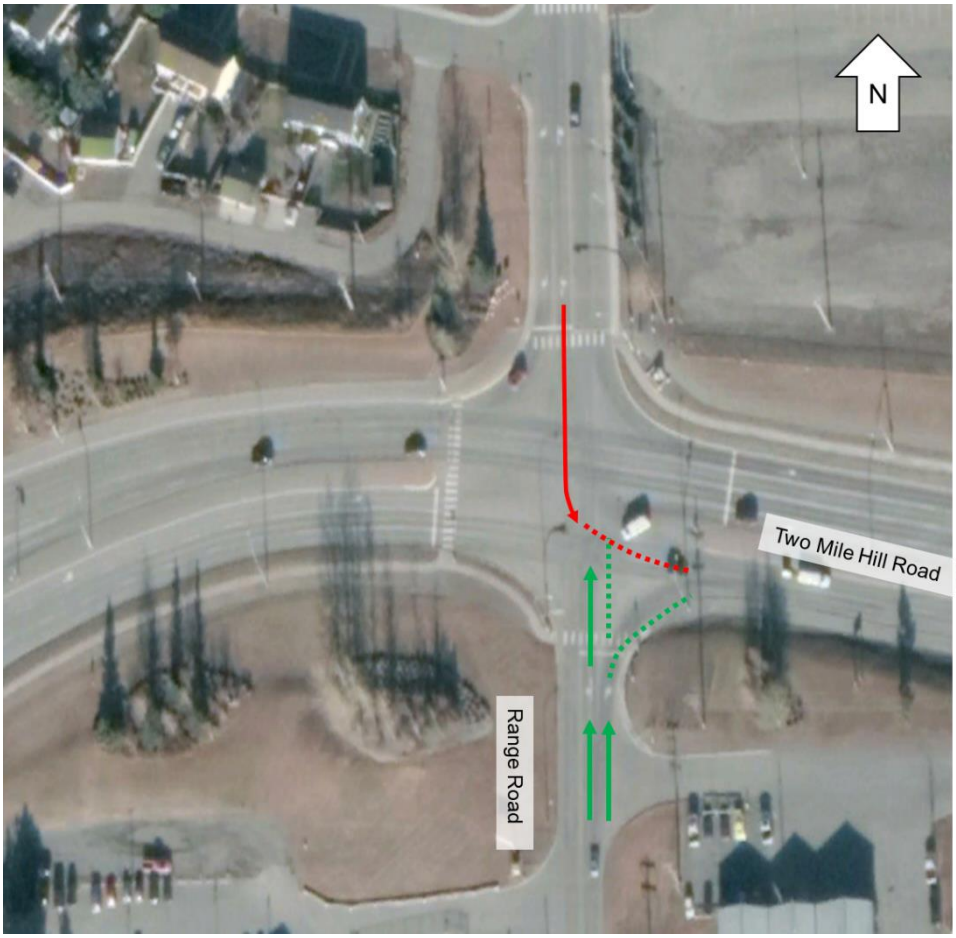


Figure 3-1
Potential Conflict between Northbound and Southbound Left-Turning Traffic[8]

2. As shown in Figure 3-2, Some of the Range Road southbound left-turn vehicles tend to use the outer lane rather than the inner lane at Two Mile Hill Road eastbound, resulting in potential conflicts with the opposing right-turn traffic. Several factors are contributing to this including the lack of left-turn dotted lane line markings and the size of the intersection.

[8] The satellite image used on this figure is from Google Earth imagery date Sept 19, 2018 where pavement lane markings were still visible to ensure the lane configuration of the intersection.

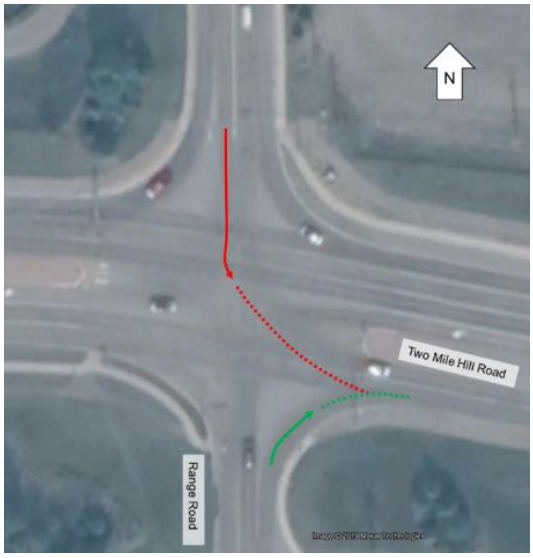


Figure 3-2
Conflicts due to Confusion of the Designated Lane

3. As shown in Figure 3-3, the corner radii at all intersection approaches are large, allowing vehicles to turn right with higher speeds than anticipated, resulting in a higher risk of conflicts with crossing pedestrians and cyclists. The risk is higher for the north approach (Range Road) and the west approach (Two Mile Hill Road) due to obstruction of the traffic controllers and signal poles. The pedestrian and cyclist crossing is after the corner and not visible at the start of the turn. The combination of high-speed turn plus a crossing in an unexpected place with poor visibility increases the collision risk at these locations. As the stop lines are faded at the intersection, right-turning vehicles may not stop before turning resulting in a higher risk of conflicts with pedestrians and cyclists.

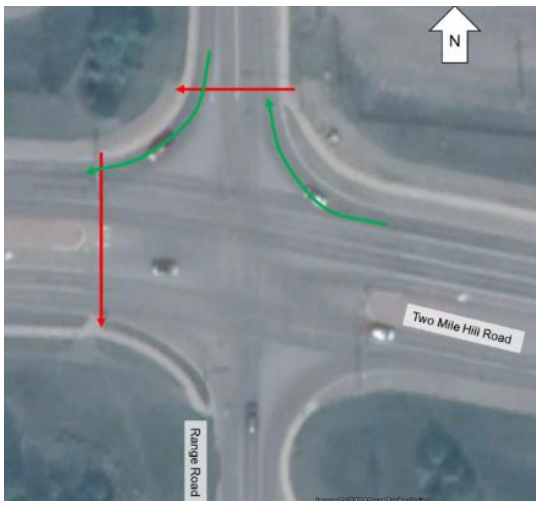


Figure 3-3
Conflicts due to Large Turning Radius and Visibility Obstruction

4. The westbound right-turn traffic has a poorly-marked short merging lane and tends to use the inner lane, rather than the outer lane creating a conflict with the eastbound left-turning traffic as shown in Figure 3-4. Additionally, the permissive left turn from the Two Mile Hill Road eastbound onto Range Road northbound causes a conflict point between left-turn vehicles and pedestrians and cyclists crossing between the northwest and the northeast corners of the intersections. Vehicle drivers are focused on finding a gap in the westbound traffic cresting the hill.

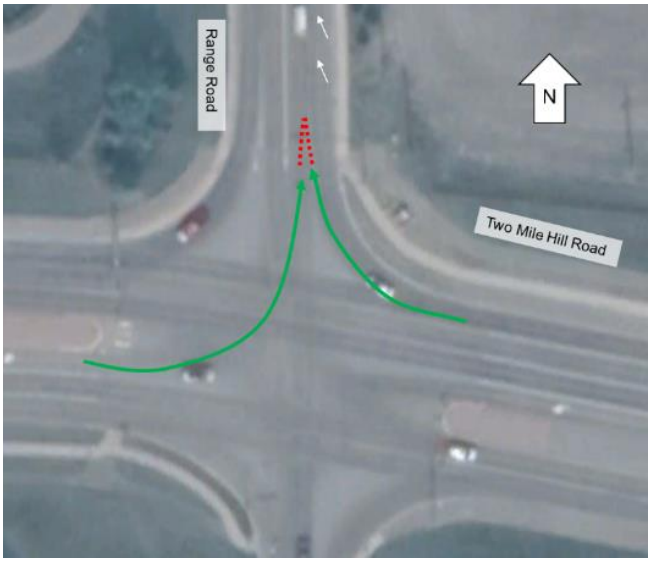


Figure 3-4
Conflicts Due to Short Merging Lane and Faded Lane Marking

5. The westbound through curb lane at Two Mile Hill Road, west of the intersection of Range Road and Two Mile Hill Road, turns into a right turn lane only to Alaska Highway as shown in Figure 3-5. Some of the westbound through traffic at the Two Mile Hill Road uses the middle lane rather than the curb lane to overpass the curb lane queue to reach Alaska Highway northbound. In 2019 PM peak hour volumes, there are around 2113 vehicle/hr at the Two Mile Hill Road westbound direction, where 909 vehicle /hr (43%) are turning right to Alaska Highway northbound, 909 vehicle/hr (43%) are going through at Two Mile Hill Road, and 295 vehicle/hr (14%) are turning left toward Alaska Highway southbound. This results in sideswipe conflicts at Two Mile Hill Road for the westbound traffic as observed on the site visit during the PM peak hour.

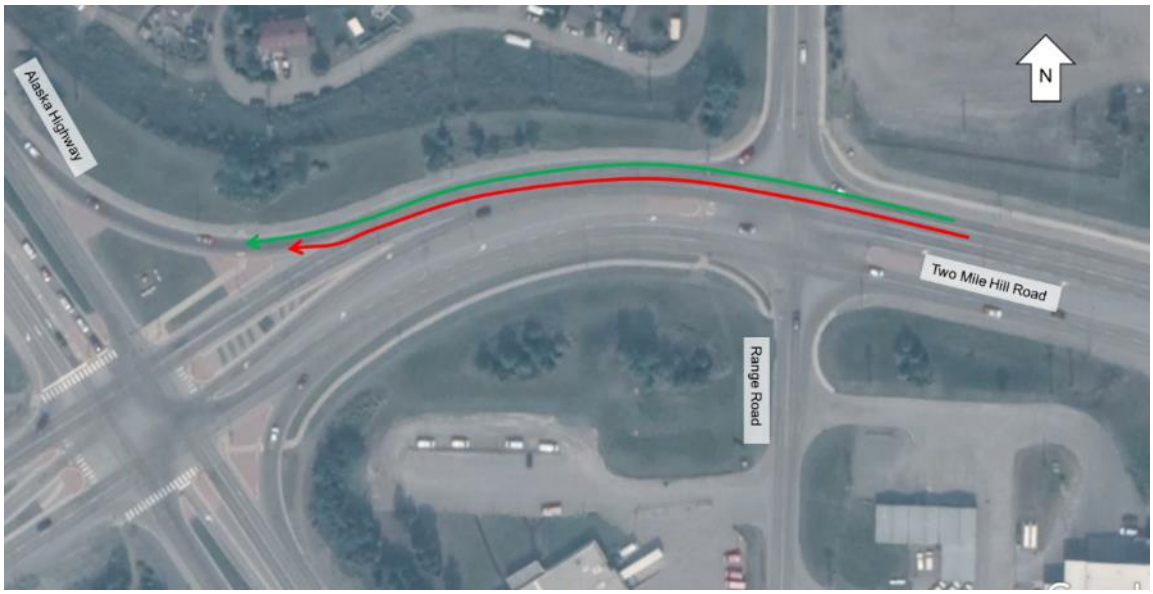


Figure 3-5
Observed Sideswipe Conflicts between the Two Intersections

6. The east approach (Two Mile Hill Road Road) of the intersection is at an uphill. When snowing, less friction may result in vehicles losing control while approaching the intersection, which may be the reason for high rear-end collisions at the intersection. This aligns with the historical collisions (section 2.2.1) where snow and icy road conditions represent 28% and 14% of total collisions, respectively (combined are 42% of total collisions). Anecdotal information[9] suggests that the yellow time at Two Mile Hill Road approaches are relatively long potentially contributing to the high rear-end collisions as some vehicles tend to slow down and stop at the beginning of the yellow time, and some vehicles would want to keep going through, expecting that they can still cross during the yellow time. Further investigations may be needed to address this concern when developing improvements for the intersection.

   Another anecdotal observation[10] is that there can be significant queuing in the right lane during the peak hour. This results in a speed differential between the right lane and other lanes with the right lane having frequent start and stops with the tendency to accelerate up the hill.

7. Crosswalks lane markings at the intersection are faded and this results in vehicles blocking the crossing area without noticing, as shown in Figure 3-6. This results in cyclists and pedestrians going around stopped vehicles, increasing their risk exposure. A “Stop Here” sign is available only for Range Road southbound traffic to guide drivers to the stop line location when it is faded or covered by snow. However, the sign is placed slightly away from the road lanes, making it less visible for drivers as shown in Figure 3-7.

[9] As provided by Sabine Schweiger, City of Whitehorse and as per the team discussion with the local RCMP in Whitehorse.
[10] As provided by Michael Abbott, City of Whitehorse.

Figure 3-6
Crosswalk Lane Marking Faded and Blocked by Vehicles

Figure 3-7
The "Stop Here" Sign for Range Road Southbound Traffic

8. The utility covers do not match the pavement surface level as shown in Figure 3-8 and may impact vehicles and cyclists.

Figure 3-8
Pavement Level around the Utility Cover

9. There is no lane marking arrows at all intersection approaches, which may result in drivers' confusion and inappropriate lane use, leading to potential conflicts.

10. The lane designation signs at Two Mile Hill Road westbound direction are old and damaged as shown in Figure 3-9. The signs may not be visible and clear for drivers, resulting in potential confusion and conflicts. The two sign davits are also not well aligned together. These signs have significant benefits when lane markings are faded or covered by snow and, therefore, they need to be visible and well maintained.

Figure 3-9
Lane Designation Signs at Two Mile Hill Road Westbound

11. When Range Road northbound traffic is trying to turn right on-red toward eastbound Two Mile Hill Road, the sightlines are poor to easily find gaps causing potential conflicts. Drivers waiting to turn right on red are usually focused solely on the gaps at the westbound traffic, and may not pay attention to cyclists and pedestrians crossing from the right (from the southeast corner to the southwest corner as shown in). Similarly, the southbound traffic trying to turn right on-red towards westbound Two Mile Hill Road have poor sightlines. This causes vehicles to creep forward and conflict with the pedestrian crossing with the driver's attention focused on vehicles approaching Two Mile Hill Road. The crossings of the multi-use paths at this location are bi-directional, potentially increasing the risk for pedestrians and cyclists.

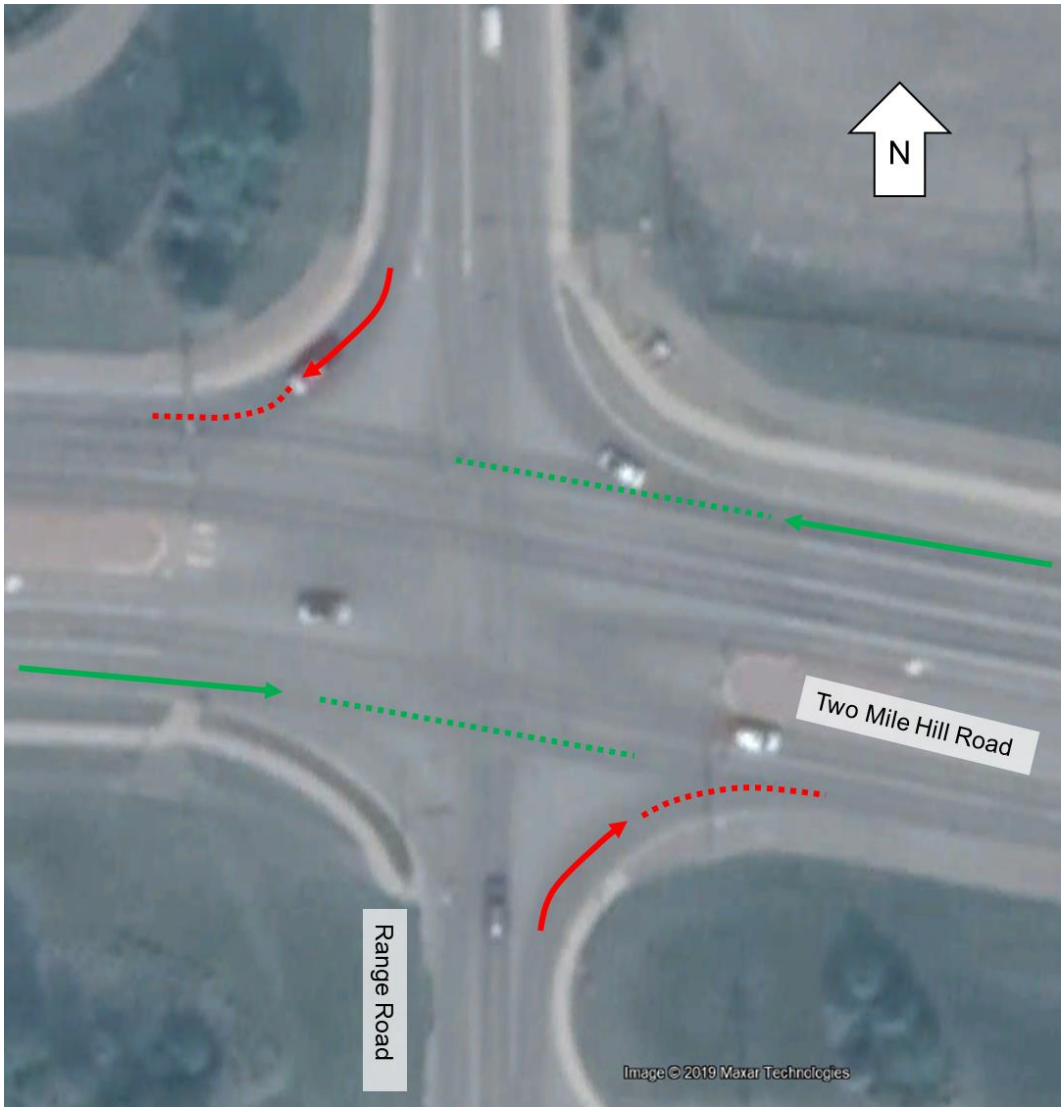


Figure 3-10
Conflicts between Northbound Right Turning Vehicles on-Red with Eastbound Through Vehicles

3.3 Pedestrian-Related Observations

Pedestrians were observed at the intersection during the site visit. Figure 3-11 shows the location of the existing crosswalks and pushbuttons. Several pedestrian-related issues are identified:

1. The pedestrian push-buttons for crossing the north and west approaches are placed on the same pole close to the west approach pedestrian crosswalk. Pedestrians would have to push the button and walk back to the crosswalk which is less convenient as it is a detour from their desire path. Additionally, there is insufficient time to push the button then get in position to cross before the walk light turns on.
2. The pedestrian waiting area at the southeast corner of the intersection is narrow and is currently used by cyclists to connect the shared pathway. This poses a safety hazard to pedestrians waiting at the intersection.

3. Pedestrians at the northside pedestrian path of Two Mile Hill Road who are destined to the southeast side of the intersection (fire hall, and mixed commercial/industrial area) would need to use three crosswalks in north, west and south approaches rather than one crosswalk. This is due to the lack of a crosswalk at the east approach of the intersection. This increases inconvenience, travel time, and exposure to risk for pedestrians. This aligns with the PLOS for the intersection estimated in Section 2.1.2.
4. Pedestrians pushbuttons at all approaches seem to not fully utilize the green phase. It seems that pedestrians would need to push the pedestrian crossing button before the start of the green phase in their direction to activate the pedestrian walk signal. Otherwise, the walk signal is not activated despite that the remaining green time for vehicles may be enough for crossing the roads. This may lead to a longer delay for pedestrians and cyclists or potentially unsafe crossing at the red time.
5. Pedestrian crosswalk lane markings are faded.
6. The intersection is large, making it difficult for less agile pedestrians to cross, due to the lengthy exposure to traffic.

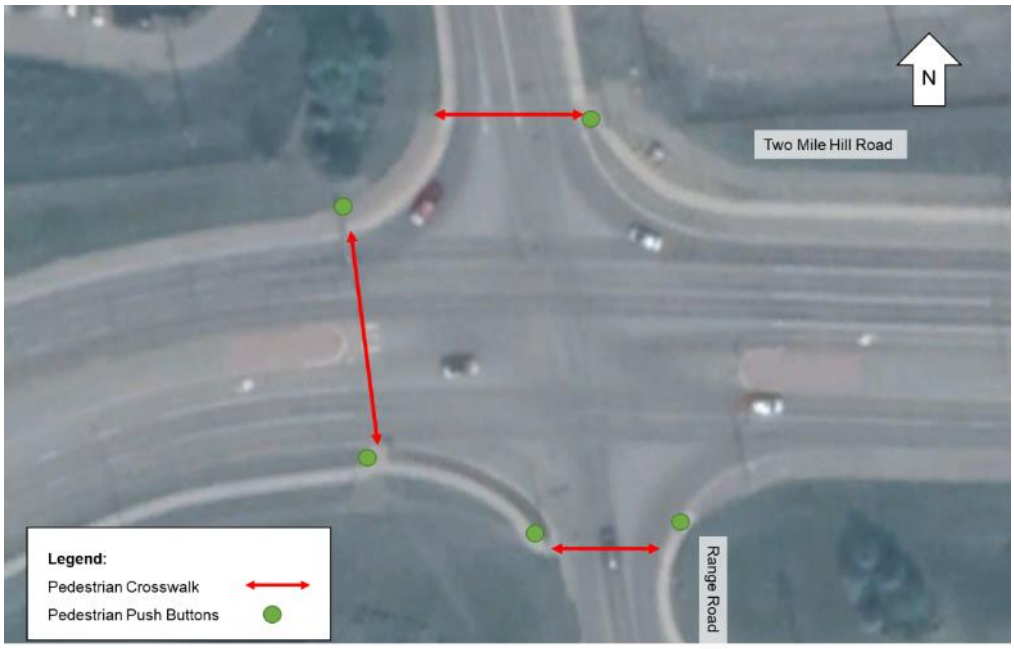


Figure 3-11
Location of Pedestrians Crosswalks and Push-buttons

7. The City of Whitehorse received several complaints about the paved path on the east side of Range Road between Alaska Highway and Two Mile Hill Road. The current path is paved at the same level as the roadway with no buffer or curb. This exposes higher risks and consequences for vehicle-pedestrian conflicts at Range Road. This path is expected to have higher pedestrian volumes with the operation of the new City of Whitehorse Operations Building.

3.4 Cyclist-Related Observations

Many cyclists were observed at the intersection during the site visit. The following several cyclist-related issues are identified at the intersection area:

1. Cyclists share the crosswalks with pedestrians at the north, west and south approaches. Although this is safer than sharing lanes with vehicles, it still poses inconveniences for pedestrians using the crosswalks and increases the risk of cyclists-pedestrian conflicts. The curb waiting areas are not large enough to accommodate pedestrians and cyclists and they are not visible to motorists.
2. Cyclists travelling westbound share the crosswalk and the pathways with pedestrians west of Range Road. Cyclists travelling eastbound share the crosswalk and the pathway with pedestrians east of Range Road. The shared pedestrian and cyclist pathways seem to be less than 3 m wide, which may not accommodate both road users conveniently.
3. Cyclists travelling southbound and northbound were usually sharing the lanes with vehicles as shown in Figure 3-12. This has a high-risk exposure for cyclists and results in potential vehicle-cyclist conflicts. The north-south distance at the intersection area is long and requires a longer for cyclists to cross the intersection.

Figure 3-12
Cyclists Traveling Northbound and Southbound with Vehicles

4. Although cyclists are prohibited to use the Two Mile Hill Road lanes as shown in the current commuter plans, there is no clear guide at the intersection site that advises cyclists on this prohibition and guides them to move to the pathways. Cyclists travelling southbound to eastbound and northbound to westbound may use vehicle lanes (with the permitted left-turn phase) or use crosswalks to cross with pedestrians. Turning with the permitted left-turn phase has a high risk for cyclists due to the speed differential between cyclists and vehicles.
5. The mix of cyclists and vehicles may also result in longer delays to the opposing left-turning traffic.
6. Cyclists travelling westbound to southbound, who are destined to the southeast side of the intersection, have to use three crosswalks at north, west and south approaches rather than one crosswalk due to the lack of a crosswalk at the east approach of the intersection. This increases inconvenience and exposure to risk. The study team observed a conflict on-site between a southbound left turning vehicle and a cyclist using the west approach to cross. This may be happening due to the lack of the crosswalk and a crossing phase for cyclists along their desire lines. The conflict location is shown in Figure 3-13.

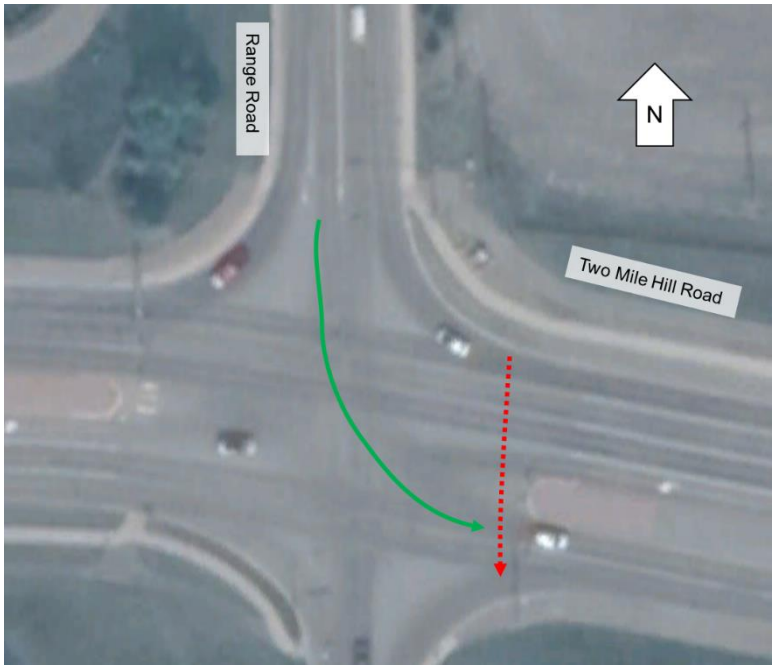


Figure 3-13
A Conflict between a Cyclist and a Southbound Left-turning Vehicle

7. Cyclists' use of the pedestrian push-buttons may result in blocking a longer green time that is not needed, as cyclists typically cross the street with higher speed than pedestrians.
8. The intersection is large, requiring cyclists to be exposed to traffic for a longer duration than desirable.
9. Vehicles making a right turn at north and south approaches (Range Road) are not warned of potential cyclists using the pedestrian crosswalk travelling against the traffic. Cyclists travel faster than pedestrians and drivers may not pay attention as they are more focused on finding a gap in the traffic to complete the right turn.

4 MULTI-MODAL LEVEL OF SERVICE ANALYSIS

This section includes a multi-modal traffic and safety assessment for pedestrians, cyclists, transit, and vehicular traffic at the intersection of Range Road and Two Mile Hill Road. The Multi-Modal Level of Service Analysis (MMLOS) analysis is based on the City of Ottawa Guidelines[11] which use quantitative performance measures for all travel modes. For this study, the guidelines are used to estimate the Pedestrian Level of Service (PLOS), Bicycle Level of Service (BLOS), and Transit Level of Service (TLOS) for the existing and target performance. However, for the Automobile Level of Service (ALOS), the guidelines are only used to identify the ALOS targets, but performance results were quantified for the intersection using Synchro traffic analysis software.

4.1 Vehicular Traffic Analysis

4.1.1 Analysis Criteria

The performance of an intersection depends on several factors including:

- **Degree of Saturation** – measured in terms of a ratio of demand flow rate (v) to maximum capacity (c); intersections with V/C ratios = 1.0 are at capacity.
- **Level of Service** – a measure of the average delay per vehicle during a 15-minute analysis period. Level of services (LOS) ranges from A (minimal delay) to F (unacceptable delay). The average delays are measured for the intersection and per each movement in seconds per vehicle.
- **Queue Length** – a measure of the 95th percentile of queuing length during peak hour is compared with storage length capacity.

Auto Level of Service (LOS) "D" is considered the minimum desirable LOS for the overall signalized intersection and each vehicle movement. This is typically used under AM and PM peak hour traffic conditions. Volume over Capacity (V/C) ratio of 0.85 or less is the desirable V/C a for the intersection and each vehicle movement. Table 4-1 summarizes the estimation of LOS for signalized intersections based on the average delay according to the Highway Capacity Manual.

Table 4-1
Signalized Intersections – Auto Level of Service Characteristics for the Average Delay

Level of Service	Average Delay (seconds/vehicle)	Characteristics
A	< 10	Free flow; low volumes and high speeds; most drivers can select their speed.
B	> 10 and < 20	Stable flow; speed restricted slightly by traffic.
C	> 20 and < 35	Stable flow; speed controlled by traffic.
D	> 35 and < 55	Approaching unstable flow; low speed. (Minimum Desirable Target)
E	> 55 and < 80	Unstable flow; low, varying speeds, volumes at or near capacity.
F	> 80	Forced flow; low speed; volume above capacity.

[11] Multi-Modal Level of Service Guidelines, IBI Group, City of Ottawa, September 2015.

The following assumptions were made for the traffic operational analysis:

- The 85th percentile speed on all roadways in the study area was assumed to be equal to the speed limit.
- Truck volumes percentages at the study intersection are based on the historical traffic counts with a minimum of 2% for each movement.
- Ideal saturated flow = 1,900 vehicles per hour.
- Peak hour factors at the intersection are based on the historical traffic counts.
- The length of the average passenger vehicle is 7.6 m and the length of the heavy vehicle is 23.0 m.

4.1.2 Traffic Performance (2019)

The existing traffic volumes for 2019 are estimated based on the previous study by AE (2015). The volumes are factored up to 2019 based on the annual compound growth rate of 2%[12]. The trip generation expected for the new Operations Building of the City of Whitehorse is added to the AM and PM peak hour volumes for 2019, as the new building is expected to be operational by the end of 2019. The turning movement volumes estimated for the intersection is shown in Figure 4-1.

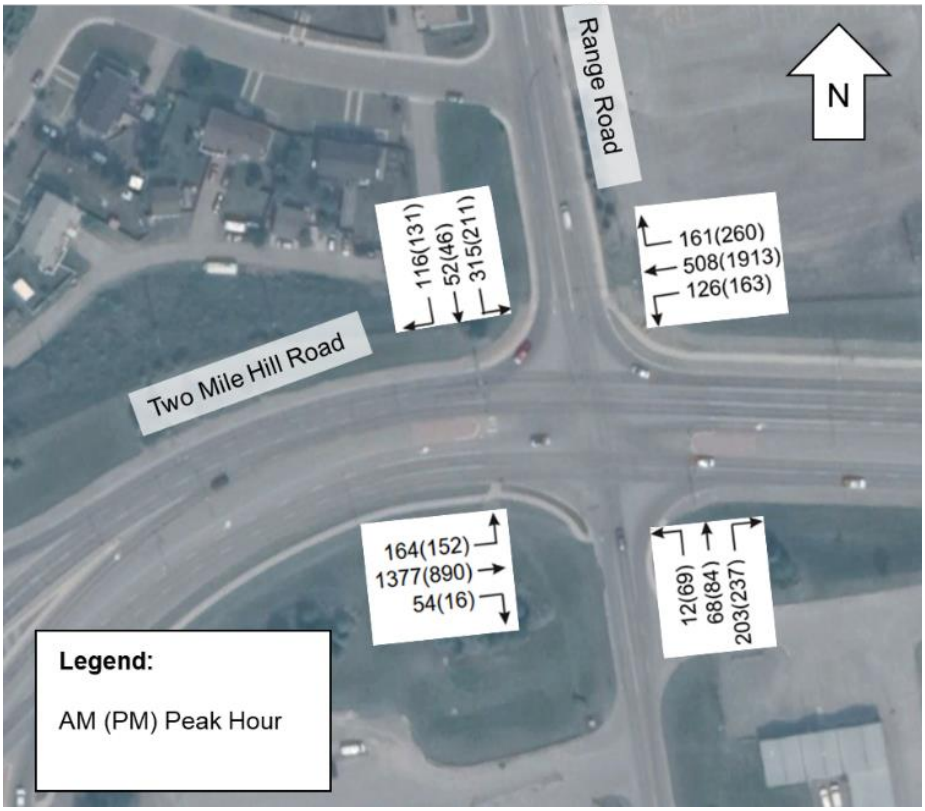


Figure 4-1
Turning Movement Volumes – 2019

[12] The annual growth rate of 2% is consistent with the City of Whitehorse, Transportation Demand Management Plan (March 2014).

Table 4-2 shows the intersection operations using the 2019 turning movement volumes. The analysis shows that the overall intersection ALOS is D which meets the minimum desirable target, but some movements are experiencing ALOS "E" or less, which does not meet the minimum desirable target. The southbound through movement has LOS "F" for AM and PM peak hours. The eastbound left-turn movement has LOS "F" for the PM peak hour. The westbound left turn movement has LOS "F" at the AM peak.

The queue length developed for the southbound through-movement reaches around 120 m in both AM and PM peak hours. The queue length for the northbound through-movement reaches around 120 m at the PM peak hour. The eastbound left-turn lane storage (150 m) is sufficient for the left turn queue (around 60 m in PM peak). The westbound left turn lane storage (around 80 m) is sufficient for the left turn queue (around 70 m in PM peak), but the through-movement queue (222 m) may block the left-turn lane.

The V/C ratio is higher than 0.85 for the southbound through-movement, eastbound left turn and through-movements, and eastbound left and through-movements.

Table 4-2
Intersection Auto Performance Results - 2019

Overall Intersection	Peak Time	Performance	North Approach (Southbound)			South Approach (Northbound)			West Approach (Eastbound)			East Approach (Westbound)		
			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
LOS = D Delay = 43.8sec	AM	Volume (vph)	315	52	116	12	68	203	164	1377	54	126	508	161
		Delay (sec)	-	106.4	4.2	-	21.3	-	19.9	30.0	-	281.8	16.5	-
		Queue (m)	-	120.8	9.8	-	55.5	-	26.0	159.8	-	61.6	34.1	-
		V/C	-	1.11	0.19	-	0.49	-	0.56	0.92	-	1.46	0.39	-
		Movement LOS	-	F	A	-	C	-	B	C	-	F	B	-
		Approach Delay (sec)	81.9			21.3			29			58.6		
		Approach LOS	F			C			C			E		
LOS = D Delay = 48.1sec	PM	Volume (vph)	211	46	131	69	84	237	152	890	16	163	1913	260
		Delay (sec)	-	106.5	12.7	-	41.1	-	173.1	16.8	-	50.1	48.7	-
		Queue (m)	-	116.1	22.9	-	121.4	-	56.4	82.9	-	70.6	222.0	-
		V/C	-	1.05	0.23	-	0.82	-	1.23	0.51	-	0.78	1.00	-
		Movement LOS	-	F	B	-	D	-	F	B	-	D	D	-
		Approach Delay (sec)	74.9			41.1			39.2			48.8		
		Approach LOS	E			D			D			D		

*Note: Values in yellow indicate results below acceptable criteria.

4.1.3 Future Traffic Performance (2029)

The future traffic volumes for the 10-year planning horizon (2029) are estimated based on the previous study by AE (2015). The volumes are factored up to 2029, based on the annual compound growth rate of 2%[13]. The trip generation expected for the new Operations Building is also added to the AM and PM peak hour volumes. The future turning movement volumes estimated for the intersection are shown in Figure 4-2.

During the kick-off meeting, it was mentioned that the frequency of buses is expected to increase in 2020. The changes to the bus routes and frequency are described in section 2.5. However, these changes will likely not impact the intersection performance. The growth factor used in the forecasting is assumed to capture the overall volume increase at the intersection.

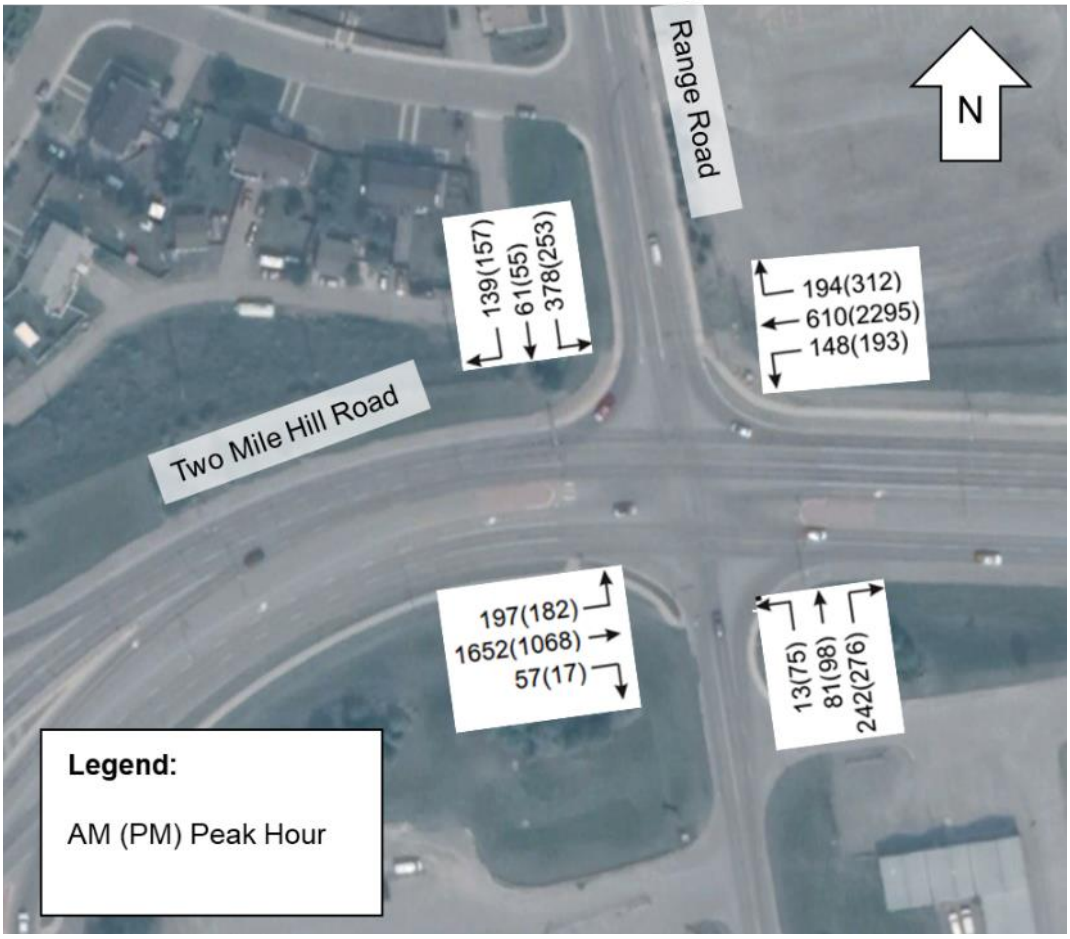


Figure 4-2
Forecasted Turning Movement Volumes – 2029

[13] The annual growth rate of 2% is also consistent with the City of Whitehorse, Transportation Demand Management Plan (March 2014).

Table 4-3 shows the intersection operations using the forecasted 2029 turning movement volumes. The analysis shows that the overall intersection LOS is "F", which does not meet the minimum desirable target. The southbound through-movement has LOS "F" for AM and PM peak hours. The northbound through, eastbound left-turn and westbound through-movements have LOS "F" for the PM peak hour. The eastbound through-movement has LOS "E" for the AM peak hour. The westbound left-turn movement has LOS "F" at the AM and PM peak hours. The westbound through-movement has LOS "F" for the PM peak hour.

The queue length developed for the southbound through-movement reaches around 190 m in both AM and PM peak hours. The queue length for the northbound through movement reaches around 220 m at the PM peak hour. The eastbound left-turn lane storage (150 m) is sufficient for the left turn queue (around 105 m in PM peak). The westbound left turn lane storage (around 80 m) is insufficient for the left turn queue (around 132 m in PM peak).

The V/C ratio is higher than 0.85 for the southbound through-movement, eastbound left turn and through-movements, and eastbound left and through-movements.

Table 4-3
Intersection Performance Results - 2029

Overall Intersection	Peak Time	Performance	North Approach (Southbound)			South Approach (Northbound)			West Approach (Eastbound)			East Approach (Westbound)		
			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
LOS = F Delay = 87.6sec	AM	Volume (vph)	378	61	139	13	81	242	197	1652	57	148	610	194
		Delay (sec)	-	257.4	4.0	-	24.3	-	37.9	76.1	-	385.7	17.8	-
		Queue (m)	-	155.6	10.7	-	69.1	-	42.8	213.3	-	59.6	42.3	-
		V/C	-	1.48	0.22	-	0.58	-	0.79	1.1	-	1.71	0.47	-
		Movement LOS	-	F	A	-	C	-	D	E	-	F	B	-
		Approach Delay (sec)	196.4			24.3			72.1			75		
		Approach LOS	F			C			E			E		
LOS = F Delay = 116.9sec	PM	Volume (vph)	253	55	157	78	98	276	182	1068	17	193	2295	312
		Delay (sec)	-	204.5	8.7	-	101.4	-	154.4	25.1	-	209.3	144.4	-
		Queue (m)	-	189.5	21.9	-	218.2	-	104.7	140.1	-	131.5	404.2	-
		V/C	-	1.31	0.25	-	1.07	-	1.16	0.60	-	1.30	1.23	-
		Movement LOS	-	F	A	-	F	-	F	C	-	F	F	-
		Approach Delay (sec)	138.3			101.4			43.7			148.9		
		Approach LOS	F			F			D			F		

*Note: Values in yellow indicate results below acceptable criteria.

4.1.4 Summary of Vehicular Traffic Performance

The intersection overall LOS is D in 2019, with three movements experiencing LOS F in both AM and PM peak hours. With the potential growth in the 10-year horizon, delays are expected to significantly increase resulting in overall LOS of F for both peak hours. However, the average delay in 2029 is less than 2 minutes per vehicle. Considering that this may be one of the busiest intersections in the City of Whitehorse, such delays may be inevitable. This traffic performance evaluation would need to be read in conjunction with the other transportation modes' performance (cyclists, pedestrians, transit) to ensure a multi-modal perspective in the evaluation and options development.

4.2 Pedestrian Level of Service

PLOS is estimated using two methods: Pedestrian Exposure to Traffic at Signalized Intersection (PETSI) and the pedestrian crossing delay using HCM methodology. The method that results in a worse condition would govern the intersection PLOS.

The PETSI score is calculated by the summation of the score points related to the intersection geometry as shown in Table 4-4. The PLOS criteria based on the PETSI score threshold are shown in Table 4-6. The design features identified in the PETSI score include the following:

1. Crossing Distance and Conditions
2. Signal Phasing and Timing Features
3. Corner Radius
4. Crosswalk Treatment

Table 4-4
PETSI Scoring Tables (Exhibit 5 – Ottawa MMLOS guidelines, 2015)

5.1 Crossing Distance & Conditions		
Total travel lanes crossed	No median	With Median (>2.4m)
2	120	120
3	105	105
4	88	90
5	72	75
6	55	60
7	39	45
8	23	30
9	6	15
10	-10	0
Island Refuge	**Points**	
No	-4	
Yes	0	

5.2 Signal Phasing & Timing Features	
Left turn conflict ("Left_turns")	**Points**
Permissive	-8
Protected/permissive	-8
Protected	0
No left turn/prohibited	0
Right turn conflict ("Right_turns")	**Points**
Permissive or yield control	-5
Protected/permissive	-5
Protected	0
No right turn	0
Right turns on red ("RTOR")	**Points**
RTOR allowed	-3
RTOR prohibited at certain time(s)	-2
RTOR prohibited	0
Leading ped interval? ("LPI")	**Points**
No	-2
Yes	0

5.3 Corner Radius	
Corner radius	**Points**
Greater than 25m	-9
> 15m to 25m	-8
> 10m to 15m	-6
> 5m to 10m	-5
> 3m to 5m	-4
Less than/equal to 3m	-3
No right turn	0
Right turn channel with receiving	-3
Right turn "smart channel"	2

5.4 Crosswalk Treatment	
Crosswalk treatment ("Crosswalk")	**Points**
Standard transverse markings	-7
Textured/coloured pavement	-4
Zebra stripe hi-vis markings	-4
Raised crosswalk	0

Table 4-5
PETSI Evaluation Table (Exhibit 6 – Ottawa MMLOS guidelines, 2015)

Pedestrian Exposure to Traffic LOS	
Points threshold	**LOS**
≥90	A
≥75	B
≥60	C
≥45	D
≥30	E
<30	F

Each corner of the intersection is designated as shown in Figure 4-3.

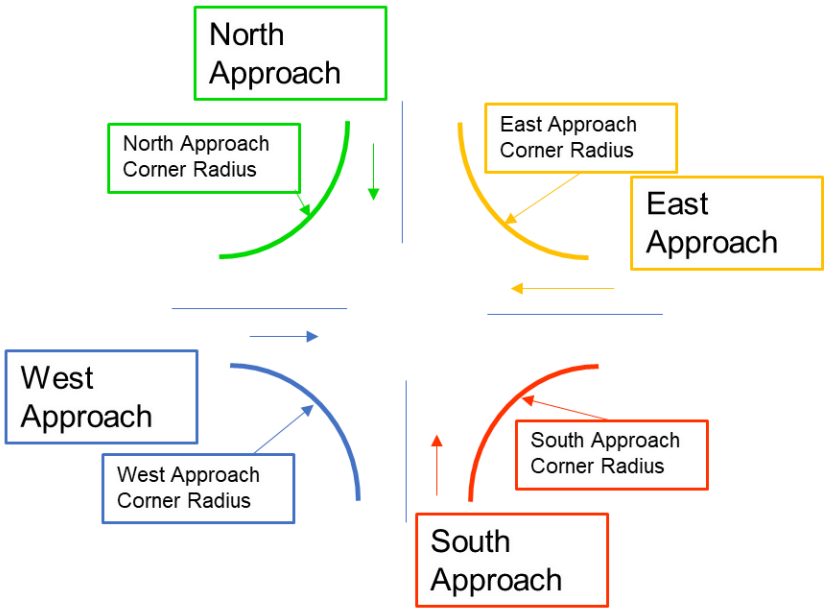


Figure 4-3
Corner Radius Designation for the intersection

The estimation of PLOS for each approach at the intersection based on the PETSI estimation is shown in Table 4-6.

Table 4-6
PLOS Based on the PETSI Estimation for the Intersection Approaches

Feature	North	South	West	East
Crossing Distance	4 lanes no median no island refuge (84 points)	3 lanes no median no island refuge (101 points)	6 lanes a median and no island refuge (56 points)	N/A
Signal Phasing	Permissive, right-turn conflicts, RTOR, and no LPI (-18 points)	Permissive, right-turn conflicts, RTOR, and no LPI (-18 points)	Permissive, right-turn conflicts, RTOR, and no LPI (-18 points)	N/A
Corner Radius	20 m (-8 points)	20 m (-8 points)	30 m (-9 points)	N/A
Crosswalk Treatment	Standard transverse markings (-7 points)	Standard transverse markings (-7 points)	Standard transverse markings (-7 points)	N/A
Total PETSI Score	51	68	22	N/A
PLOS based on PETSI	D	C	F	F

The pedestrian crossing delay and corresponding PLOS is estimated using criteria shown in Table 4-7. Table 4-8 shows the estimation of the average pedestrian delay.

Table 4-7
PLOS Intersection Evaluation (Exhibit 7 – Pedestrian Crossing Delay - Ottawa MMLOS Guidelines, 2015)

Average Pedestrian Crossing Delay Component	
$\text{Delay} = 0.5 \times \frac{(\text{Cycle Length} - \text{Pedestrian Effective Walk Time})^2}{\text{Cycle Length}}$	
< 10 s per intersection leg	LOS A
≥10 to 20 sec	LOS B
>20 to 30 sec	LOS C
>30 to 40 sec	LOS D
>40 to 60 sec	LOS E
> 60 sec	LOS F

Table 4-8
PLOS Based on the Estimation of Average Pedestrian Delays

Measure	North Approach	South Approach	West Approach	East Approach
Lanes	4	3	6	N/A
Distance	14.4	10.8	24	N/A
Walk time (sec)	12	9	20	N/A
Average Pedestrian Delay	29	32	23	N/A
PLOS based on Delay	C	D	C	F

The critical PLOS from both Table 4-6 and Table 4-8 governs the approach PLOS. The PETSI score and PLOS for each approach at the study intersections are shown in Table 4-9.

Table 4-9
PLOS Performance

Measure	North Approach	South Approach	West Approach	East Approach	Critical PLOS
PETSI Score / LOS	51 / D	68 / C	22 / F	N/A (F)	22 / F
Pedestrian Delay / LOS	29 / C	32 / D	23 / C	83 / F	F
Governing PLOS	**D**	**D**	**F**	**F**	**F**

4.3 Bicycle Level of Service

BLOS for signalized intersections is based on the cyclists' facility, road geometry, speed and number of lane crosses for cyclists making a left turn. The criteria for identifying the BLOS for the west and east approaches are shown in Table 4-10. The criteria for identifying the BLOS for the south and north approaches are shown in Table 4-11. The left turn configurations are shown in Table 4-12.

The BLOS is defined using two features:

1. The presence of the right turn lane and the turning speed of motorists.
2. The cyclists left turn maneuvers at the intersection and the operating speed of motorists.

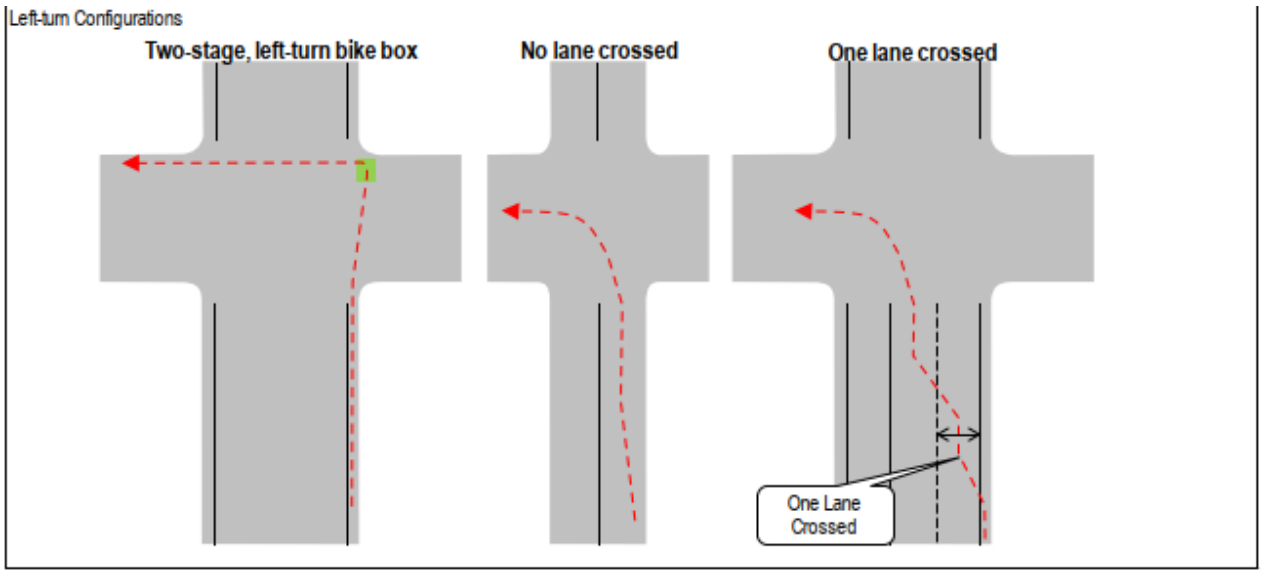
Table 4-10
BLOS Intersection Evaluation for West and East Approaches (Exhibit 12 – Bike Lanes - Ottawa MMLOS guidelines, 2015)

Bike Lanes or higher order facility on a Signalized Intersection Approach		
Right-turn Lane and Turning Speed of Motorists	No impact on LTS (as long as cycling facility remains to the right of any turn lane - otherwise see pocket bike lanes below)	
Cyclist Making a Left-turn and Operating Speed of Motorists (refer to figure)	Two-stage, left-turn bike box; ≤ 50 km/h	A
	No lane crossed, ≤ 50 km/h	B
	1 lane crossed, ≤ 40 km/h	B
	No lane crossed, ≥ 60 km/h	C
	1 lane crossed, 50 km/h	C
	2 or more lanes crossed, ≤ 40 km/h	D
	1 lane crossed, ≥ 60 km/h	E
	2 or more lanes crossed, ≥ 50 km/h	F
	All other single left-turn lane configurations	F
	Dual left-turn lanes (shared or exclusive)	F

Table 4-11
BLOS Intersection Evaluation for North and South Approaches (Exhibit 12 – Mixed Traffic - Ottawa MMLOS guidelines, 2015)

Mixed Traffic on a Signalized Intersection Approach		
Right-turn Lane and Turning Speed of Motorists	Right-turn lane 25 to 50 m long, turning speed ≤ 25 km/h (based on curb radii and angle of intersection)	D
	Right-turn lane 25 to 50 m long, turning speed > 25 km/h (based on curb radii and angle of intersection)	E
	Right-turn lane longer than 50 m	F
	Dual right-turn lanes (shared or exclusive)	F
Cyclist Making a Left-turn and Operating Speed of Motorists (refer to figure)	Two-stage, left-turn bike box; ≤ 50 km/h	A
	No lane crossed, ≤ 50 km/h	B
	1 lane crossed, ≤ 40 km/h	B
	No lane crossed, ≥ 60 km/h	D
	1 lane crossed, 50 km/h	D
	2 or more lanes crossed, ≤ 40 km/h	D
	1 lane crossed, ≥ 60 km/h	F
	2 or more lanes crossed, ≥ 50 km/h	F
	All other single left-turn lane configurations	F
	Dual left-turn lanes (shared or exclusive)	F

Table 4-12
Left Turn Configurations (Exhibit 12 – Mixed Traffic - Ottawa MMLOS guidelines, 2015)



The BLOS estimated for each approach based on the criteria is shown in Table 4-13.

Table 4-13
BLOS Performance

BLOS				
North Approach	South Approach	West Approach	East Approach	Critical BLOS
Right-turn lane 25 to 50 m long turning speed > 25 km/h (BLOS E)	Right-turn lane 25 to 50 m long turning speed > 25 km/h (BLOS E)	One lane crossed, speed 50 km/h (BLOS C)	One lane crossed, speed 50 km/h (BLOS C)	BLOS E

4.4 Transit Level of Service

The methodology to estimate TLOS for signalized intersections is primarily based on expected delays at each approach of the intersection along with the provision of Transit Signal Priorities (TSP). The evaluation criteria for TLOS is shown in Table 4-14.

Table 4-14
TLOS Signalized Intersection Evaluation Table (Exhibit 16 – Ottawa MMLOS guidelines, 2015)

Delay	Typical Location	LOS
0	Grade Separation	A
≤10 sec	High Level TSP	B
≤20 sec		C
≤30 sec		D
≤40 sec	TSP & long cycle length	E
>40 sec	No TSP & long cycle length	F

Note: Delay includes travel time from end of queue to entering the intersection

The TLOS estimated for each approach and the overall intersection is shown in Table 15. The critical delay in AM and PM peaks are considered in estimating the TLOS for each approach.

Table 4-15
TLOS Performance Based on Approach Delays

	TLOS				
	North Approach	South Approach	West Approach	East Approach	Critical TLOS
Critical Approach Delay from Table 4-2	81.9 sec (AM Peak)	41.1 sec (PM Peak)	39.2 sec (PM Peak)	58.6 sec (AM Peak)	-
BLOS	F	F	E	F	F

4.5 Summary of MMLOS Analysis

As shown in Table 4-16, the overall intersection has a PLOS of "F", BLOS of "E", TLOS of "F" and ALOS[14] of "D". PLOS, BLOS and TLOS are less than the minimum desirable MMLOS targets where the ALOS meets the minimum desirable target for the overall intersection. This aligns with the site observations and will form the basis for the problem definition statement and guiding principles for the next steps.

[14] Vehicular Auto Level of Service (ALOS) based on 2019 analysis.

Table 4-16
Summary of Multi-Modal Level of Service (MMLOS) Analysis

Measure	North Approach	South Approach	West Approach	East Approach	Overall Intersection	Minimum Desirable MMLOS Target[15]	Does Meet Desirable Target[16]?
PLOS	D	D	F	F	F	C	No
BLOS	E	E	C	C	E	D	No
TLOS	F	F	E	F	F	D	No
ALOS	F	D	D	E	D	D	Yes

5 SUMMARY OF ASSESSMENT FINDINGS

This study identifies current operational and road safety issues at the intersection of Range Road and Two Mile Hill Road. Several issues were identified and summarized as follows:

- The overall intersection vehicular performance in 2019 meets LOS and V/C criteria except for southbound through, eastbound through and left, and westbound through and left movements. Although the LOS is E or F for these movements, the overall intersection is at a LOS D. The left turn storage length at the east and west approaches are sufficient to accommodate the left-turn movements.
- With no changes in commuter behaviour and an increase in population, the overall intersection vehicular performance in 2029 may have LOS "E" or "F" and V/C ratios higher than 1. Southbound through, northbound through, eastbound through and left, and westbound through movements will have a LOS E and F. Left turn queues are accommodated in the available lane storage except for the westbound left-turn volumes.
- The intersection vehicle collisions are generally less frequent and less severe than the average rates. However, rear-end, left-turn and intersection collisions are generally over-represented at the intersection.
- During the site visit, several safety issues were identified which mainly include:
  - Conflicts between left-turning vehicles with the opposing right-turning vehicles.
  - Conflicts between southbound and northbound vehicles due to the permitted left-turn signal phasing.
  - Sideswipe conflicts between westbound traffic downstream of the intersection due to late lane change of the middle lane traffic toward Alaska Highway northbound.
  - Pedestrians and cyclists using the crosswalks are not visible enough for the right-turning vehicles. This occurs due to the corner obstructions and the ability of vehicles to turn right faster with the existing large turning radii.
  - Conflicts between cyclists and vehicles sharing northbound and southbound lanes.
  - Crosswalk and stop line-markings are all faded at the intersection, resulting in road user confusion and higher risk exposure of pedestrians and cyclists.
  - Directional signs are damaged and have low visibility. There is no arrow lane marking at all intersection approaches.
  - Visibility at darkness was not examined due to the full daylight hours in the summer season. Further review during winter days may be needed to capture any lighting and visibility issues.

[15] Minimum MMLOS targets are based on Ottawa Guidelines (Exhibit 22 – General Urban Area).
[16] Intersection level performance.

- Cyclists are not well accommodated at the intersection, especially for northbound and southbound movements where cyclists share lanes with vehicles. These cyclists typically perform left-turns across multiple lanes of traffic. Cyclists travelling eastbound and southbound share the crosswalks and some of the narrow pathway with pedestrians. This poses a higher risk and inconvenience for pedestrians in addition to delays for cyclists. None of the crossings enforce two-stage left-turns.
- Pedestrian crosswalks are faded at all approaches. The lack of a pedestrian crosswalk at the east approach results in a longer walking distance for pedestrians travelling from the Two Mile Hill Road north pathway to Range Road east side. This increases their exposure to risk in using three crosswalks, rather than one. The pushbutton is not located at the pedestrians' (nor cyclists) desire line for the north approach. The pushbuttons at the north and south approaches seem to not fully utilize the green phase resulting in longer delays for pedestrians.
- Bus routes R5 and R6 stop at 130 m north of the intersection at the east side of Range Road. Bus routes R2 and R3 stop at the Canada Games Centre, which is around 800 m west of the intersection. Current bus stops and routes do not fully support passengers' trips destined to the public service areas and mixed commercial/ industrial areas south of Range Road.
- The MMLOS analysis shows that the pedestrian, cyclists and transit level services do not meet desirable targets which align with the overall observations and assessment performed at the intersection

6 PROBLEM DEFINITION

The primary problem with this intersection is the existing safety and operational issues identified for pedestrians and cyclists' interactions with the vehicle's movements especially with the large size of the intersection.

7 GUIDING PRINCIPLES

The following guiding principles are proposed for the development of the improvement options:

- **Safety** - Address current pedestrian and cyclist safety issues along with vehicle-vehicle conflict areas.
- **Facilities -** Improve pedestrian and cyclist movements and crossing facilities and ensure that improvements are integrated with planned facilities at all approaches of the intersection.
- **Traffic -** Maintain or improve vehicle traffic performance.
- **Network** – Integrate the multi-modal Improvements with the surrounding network.
- **Transit** - Incorporate future transit plans to improve transit level of service.

8 OPTIONS DEVELOPMENT

Based on the problem definition statement for the study intersection, the improvement options focus on addressing pedestrians and cyclists' issues with integrating the intersection with current and future transit plans. The following sections include the descriptions for each of the conceptual design options. The conceptual design drawings are provided in Appendix C.

8.1 Option 1 – Pedestrian and Cyclists Improvements

Option 1 includes the following improvements:

- There is no change to the lane configurations except for changing the existing two exit lanes at the north approach to one exit lane and a bike lane.
- An additional pedestrian crossing is provided at the east approach of the intersection.
- The pedestrian crossing and cycle cross-ride facilities are separated and moved closer to the intersection. High contrast bike markings are proposed to emphasize potential vehicle-cycle conflict areas.
- The cyclist cross-ride facilities require cyclists to make two-stage left-turns, increasing the safety of the movements.
- Curb extensions are created to facilitate protected intersections for pedestrians and cyclists. The curb extensions are proposed to still accommodate turning buses and facility trucks. Detailed swept path analysis for design vehicles would be needed in the detailed design stage.
- The median island at Two Mile Hill Road is extended up to the proposed crosswalk.
- Crosswalks are realigned and kept separate from cycle cross-ride facilities. The cross-rides use high contrast road markings in areas of vehicle-cycle conflict.
- Provide a transit priority at the signal to reduce transit delay. This would only allow adjusting the signal timing when buses are waiting or approaching the intersection. A further review would be needed to ensure the compatibility of this technology with the existing buses at the City.
- Providing the path marking would help in guiding northbound and southbound left-turning traffic to the right path to reduce conflicts.
- Prohibit the Right-Turn-On-Red (RTOR) on the southbound approach to reduce conflicts between vehicles and pedestrians and cyclists.

8.2 Option 2 – Pedestrian and Cyclists Improvements with Split Phasing and Bus Queue Jump

Option 2 includes the following improvements:

- The existing two exit lanes at the north approach are changed to one exit lane and a bike lane.
- Each of the north and south approaches has a separate signal phase (Split phasing) where a separate green phase is allocated for each approach. This eliminates any conflicts between left-turning vehicles and pedestrians and eliminates conflicts between left-turning vehicles and the through traffic.
- An additional pedestrian crossing is provided at the east approach of the intersection.
- The pedestrian crossing and cycle cross-ride facilities are separated and moved closer to the intersection.
- The cross-ride facilities require cyclists to make two-stage left-turns, increasing the safety of the movements.
- The south approach split phasing is activated with the pedestrian crossing at the east approach and the cyclists' northbound crossing. The north approach split phasing is active with the pedestrian crossing at the east approach and cyclists southbound crossing.

- Due to the split phasing for the north and south approaches, an additional third eastbound through lane is added to accommodate the additional queues developed at the west approach.
- Crosswalks and cross-rides are separated to reduce conflict between cyclists and pedestrians. High contrast bike markings are proposed to emphasize potential vehicle-cycle conflict areas.
- An additional westbound bus queue jump / right-turn-only lane is proposed to reduce the transit delay at the intersection, and separate right-turn delay from through traffic. It reduces queues resulting from the split phasing.
- Provide a transit priority at the signal to better utilize the queue jump lane and reduce transit delay.
- Provide a new bus stop at the new queue jump lane to serve the proposed bus routes 1 and 2 in the Transit Master Plan (2018). The far-side bus stops are generally recommended rather than the near-side bus stops. However, in this intersection, most of the land use developments including the new Operations Building are located on the east side of Range Road south of Two Mile Hill Road. Therefore, the new bus stop is proposed at the near-side of Two Mile Hill Road to allow pedestrians to reach these developments with only one crossing (at the east approach) rather than two crossings if the bus stop were to be located at the far side. Additionally, this bus stop location can be used by all proposed bus routes at the transit master plan.
- This option improves the visibility for the northbound right-turn traffic while waiting for a gap at the eastbound traffic.
- Northbound through and left-turn traffic will have their phase. Southbound through and left-turn traffic will have their phase. This will allow the left-turning traffic to easily maneuver the left turn.
- Prohibit the RTOR on the southbound approach to reduce conflicts between vehicles and pedestrians and cyclists.
-

8.3 Option 3 – Pedestrians and Cyclists Improvements with Bus Queue Jump and Channelized Right Turn Lanes

Option 3 includes the following improvements:

- The existing two exit lanes at the north approach are changed to one exit lane and a bike lane.
- The northbound and southbound right-turn lanes are channelized with “pork-chop” islands.
- The median island at Two Mile Hill Road is extended up to the proposed crosswalk.
- An additional pedestrian crossing is provided at the east approach of the intersection.
- The pedestrian crossing and cycle cross-ride facilities are separated and moved closer to the intersection.
- The cyclist cross-ride facilities require cyclists to make two-stage left-turns, increasing the safety of the movements.
- The northbound and southbound bike lanes have an additional conflict zone due to the channelized right-turn lanes. High contrast bike markings are proposed to emphasize potential vehicle-cycle conflict areas.
- An additional right-turn / bus queue jump lane is proposed in the westbound direction to remove right-turn vehicle delays from the through traffic. The lane also provides an ability for a decrease in bus delay in the intersection.
- Provide a transit priority at the signal to better utilize the queue jump lane and reduce transit delay.
- Existing eastbound traffic lane configuration remains.

- This option improves the visibility for the northbound right-turn traffic while waiting for a gap at the eastbound traffic.

8.4 Generic Improvements with All Options

Generic improvements are recommended to be implemented with each option to improve the safety and operations of the intersections. The improvements are summarized in the following:

- Provide permanent arrows and lane markings at the intersection. Additional review is needed to ensure that the winter maintenance does not remove or impact the visibility of the lane marking.
- Provide additional arrow lane marking for westbound traffic at Two Mile Hill Road.
- Eliminate or relocate obstructions at the intersection quadrants to ensure the visibility of all road users.
- Replace the overhead lane designation signs with larger signs for both directions at Two Mile Hill Road to ensure its visibility and reflectivity.
- Provide pedestrian crossing push buttons adjacent to the start of the crossing point, which requires two push-buttons per corner.
- Provide cyclists push buttons either in a separate pole close to the first stopped cyclist location or at the other side of the pedestrian bush button poles.
- Provide permanent path marking at the intersections to guide motorists to the right path and reduce encroachments to other lanes.
- Provide “stop line” signs at all approaches to ensure motorists stop at the stop lines especially in the winter.
- Update the signal timing using the optimized cycle length and phasing for the intersection of Range Road and Two Mile Hill Road and the intersection of Alaska Highway and Two Mile Hill Road. Ensure that the signal timing at both intersections is coordinated.
- Provide on-street bike lane treatments for northbound and southbound cyclists along Range Road. The expectation is when an upgrade of Range Road occurs to create off-road AAA facilities for cyclists, the intersection could be adjusted to accommodate the separated treatment, or the separated treatment can ramp into the proposed northbound and southbound cycle cross-rides.

8.5 Long-Term Recommendations

Several improvements proposed at this intersection would work the best if larger network-wide improvements are proposed which include the following:

- It is recommended to extend the separated bike path and pedestrian sidewalk at the north side of Two Mile Hill Road to Alaska Highway and possibly along Hamilton Boulevard north side. This would eliminate the need for cyclists to cross at the intersection of Range Road and Two Mile Hill Road.
- Extending the proposed bike lanes at Range Road from the industrial land use (south) up to Mountain View Drive.

9 OPTIONS EVALUATIONS

9.1 Qualitative MAE Framework

A qualitative Multiple Accounts Evaluation (MAE) is conducted on the proposed improvement options to assist in the options evaluation process. The criteria include active transportation, transit, road safety, traffic operations, geometry,

winter operations, permits and approval process, environmental considerations, drainage, utilities, properties and businesses, and traffic management during construction. The results of the MAE are presented using “stoplight” indicators for each criterion (green for good, yellow for neutral or red for poor). The qualitative MAE framework that defines how each account is evaluated is available in **Appendix B**.

9.2 Qualitative MAE Assessment

The three improvement options identified for the intersection of Range Road and Two Mile Hill Road are assessed using the qualitative MAE shown in Table 9-1. This evaluation focuses on the different components of these options and does not include the generic improvements recommended at all options in the previous section.

Table 9-1
Qualitative Multiple Account Evaluation for the Proposed Options

Qualitative Criteria	Option 1 (Pedestrian and Cyclists Improvements)	Option 2 (Pedestrian and Cyclists Improvements, Split Phasing and WB Queue Jump)	Option 3 (Pedestrian and Cyclists Improvement, WB Queue Jump and Channelized Right Turns)
Active Transportation Identifies the impacts of each option on active transportation modes (mobility, conveniences, desire lines, delays, etc.)	• The pedestrians and cyclists' crossings align with the desire lines. • Provide shorter crossing distances compared to existing. • Provide separate bike cross-rides for all approaches.	• Pedestrian and cyclist crossings (at NB and SB) deviate from the desire lanes. • Pedestrian and cyclist crossings (at EB and WB) align with the desire lanes. • Provide a similar crossing distance of the existing configuration. • Provide separate bike cross-rides for all approaches.	• Provide the shortest crossing distances in all options. • The pedestrians and cyclists' crossings align with the desire lines. • Provide separate bike cross-rides for all approaches. • The right-turn channelized generally reduce pedestrian crossing distance and exposure. Upgrades for visually impaired people may be needed.
Transit Identifies the impact of each option on current and future transit accommodation.	• This option does not impact or improve transit operations.	• This option improves transit operations by reducing bus delays using the queue jump. • Includes a proposed bus stop at the north side of Two Mile Hill Road.	• This option improves transit operations by reducing bus delays using the queue jump. • Includes a proposed bus stop at the north side of Two Mile Hill Road.
		• The location of the bus stop is at the near-side of the intersection.	• The location of the bus stop is at the near-side of the intersection.
Road Safety Identifies the impacts of each option on road safety in terms of collision/conflict potential for vehicles, pedestrians and cyclists.	• Improve safety for vehicle-pedestrian/cyclist interactions. • Improves visibility of pedestrian and cyclists crossing.	• Improve safety for vehicle-pedestrian/cyclist interactions. • Split phasing eliminates conflicts with pedestrians crossing Two Mile Hill Road. • Eliminate vehicle conflicts between NB/SB left turn traffic and through traffic.	• Improve safety for vehicle-pedestrian/cyclist interactions. • Improves visibility of pedestrian and cyclists crossing. • Right-turn channelized turns to improve safety for vehicles and pedestrians/cyclists.
Traffic Operations Identifies the impacts of each option on the auto traffic operations at the intersections.	• This option does not impact auto traffic operation.	• Improve auto traffic operation due to the additional WB bus lane that can be separate right-turn traffic from the through movements. • Improve queue due to the additional EB lane.	• Improve auto traffic operation by providing the NB and SB channelized right-turn lanes.
Geometry Identifies constraints and general level of compliance of each option with geometric design guidelines.	• This option may require some deviations from geometric design guidelines.	• This option would likely comply with geometric design guidelines.	• This option would likely comply with geometric design guidelines.
Winter Operations Identifies constraints and general impact of each option with the winter and snow removal operations.	• This option will not impact winter and snow removal operations.	• This option will not impact winter and snow removal operations.	• This option may have minor impacts on the winter and snow removal operations.

Qualitative Criteria	Option 1 (Pedestrian and Cyclists Improvements)	Option 2 (Pedestrian and Cyclists Improvements, Split Phasing and WB Queue Jump)	Option 3 (Pedestrian and Cyclists Improvement, WB Queue Jump and Channelized Right Turns)
Permits and Approval Process Identifies the potential of the complexity and duration of the permits/approvals process required to construct each option.	• This option would likely have simple permits and approvals process with no anticipated complexities or delays.	• This option would likely have simple permits and approvals process with no anticipated complexities or delays.	• This option would likely have simple permits and approvals process with no anticipated complexities or delays.
Environmental Considerations Identifies the potential environmental impact of each option, including environmental permitting requirements under federal and provincial laws and regulations.	• This option would likely have no environmental impacts. • Environmental permitting is unlikely.	• This option would likely have no environmental impacts. • Environmental permitting is unlikely.	• This option would likely have no environmental impacts. • Environmental permitting is unlikely.
Drainage Identifies the potential impact of each option on the road drainage.	• This option requires minor changes to the existing road drainage.	• This option requires minor changes to the existing road drainage.	• This option requires major changes to the existing road drainage.
Utilities (Electrical, etc.) Identifies the potential impact of each option on existing utilities.	• This option does not require changes to existing utilities.	• This option requires minor changes to existing utilities.	• This option requires minor changes to existing utilities.
Properties and Business Identifies the potential impact of each option on adjacent properties, lands, and businesses. Property requirements, full or partial property and business acquisitions may be identified.	• This option would require partial property acquisition. • This option does not impact surrounding businesses or accesses.	• This option would require partial property acquisition. • This option does not impact surrounding businesses or accesses.	• This option does not impact surrounding properties, businesses or accesses.
Traffic Management During Construction Identifies the potential impacts of each option on traffic operations during construction.	• Construction of the option will likely not impact traffic operations (e.g. traffic flow, access to surrounding land uses, etc.). Minor traffic management is required.	• Construction of this option will likely have major impacts on traffic operations • Major traffic delays due to construction. • A significant level of traffic management is required.	• Construction of this option will likely have major impacts on traffic operations • Major traffic delays due to construction. • A significant level of traffic management is required.
Order of Magnitude Costs (Relative)*	• Low $2,918,000	• Medium $ 3,612,000	• Medium $ 3,655,000

* Cost Estimates are included in **Appendix D.**

9.3 Public Engagement

Public engagement was conducted using IAP2 concepts to help establish realistic objectives of the consultation process while managing expectations of the public. A virtual public consultation was conducted, that included an electronic survey hosted on SurveyMonkey, and a public webinar to present the improvement options.

The public engagement resulted in input from numerous drivers, cyclists, and pedestrians who use the intersection on a daily basis. It collected information about users' primary concerns:

- Vehicles drivers do not yield for pedestrians and it feels unsafe crossing the road.
- Vehicle drivers have difficulty or feel unsafe making left-turns at the intersection.
- There are unsuitable crossing facilities for pedestrians and cyclists.
- There is not enough enforcement of speed and traffic signals at the intersection.

Overall, 44% of respondents, who were primarily vehicle drivers or passengers preferred shorter delays at the intersection, and this comes with longer crossing times. 36% of respondents would prefer longer delays with separate crossings for cyclists and pedestrians. There was a preference for Option 2 as the best design option overall. Full details about the results of the public engagement is available in the Summary of Public Engagement Memo in **Appendix E**[17].

9.4 Recommendations

Based on the qualitative MAE assessment on the proposed three options and the input from the public engagement session, Option 2 is recommended to be advanced for further detailed design stages. It provides a balanced intersection configuration that provides separated crossing space for pedestrians and cyclists. It integrates well with surrounding facilities. While it does not decrease the crossing distance, it can utilize split signal phasing to increase safety for pedestrians and cyclists crossing Two Mile Hill. It also provides better transit operations through the queue jump and the proposed bus stop.

As the design progresses, ensuring signal timing with protected left turns for traffic travelling eastbound and westbound along Two Mile Hill is important to provide vehicles with an opportunity to turn without vehicle or pedestrians/cyclist conflicts. As well, the signal timing is recommended to be assessed in detailed design to ensure adequate crossing time for pedestrians with all ages and abilities can cross the intersection safely.

10 SUMMARY

This conceptual design report includes the current and future conditions assessment at the intersection of Range Road and Two Mile Hill Road. The assessment identified the problem definition statement and proposed a set of guiding principles to guide the development of improvement options at the intersection.

The improvement options focus on addressing pedestrians and cyclists' issues and integrate the intersection with current and future transit plans. Three options are proposed and a qualitative MAE is conducted to assist in identifying the recommended option. The qualitative MAE framework includes active transportation, transit, road safety, traffic

[17] Refer to Appendix E: Summary of Public Engagement, Range Road and Two Mile Hill Road Intersection Study, Associated Engineering, November 9, 2020

operations, geometry, winter operations, permits and approval process, environmental considerations, drainage, utilities, properties and businesses, and traffic management during construction.

Based on the qualitative MAE assessment on the proposed three options and the public engagement that was conducted, Option 2 is recommended to be advanced for further detailed design stages. It provides a balanced intersection configuration that addresses existing pedestrians and cyclists' concerns and well integrates with the surrounding facilities. It also provides better transit operations through the queue jump and the proposed bus stop.

CLOSURE

This report was prepared for the City of Whitehorse and summarizes the problem definition for the intersection study of Range Road and Two Mile Hill Road in the City of Whitehorse, Yukon.

The services provided by Associated Engineering (B.C.) Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,
Associated Engineering (B.C.) Ltd.

Prepared by:

Amr Mohammed, P.Eng., M.A.Sc.
Transportation Engineer

Breanna Jackson, EIT
Transportation Planning Engineer

Haytham Sadeq, M.A.Sc., PMP, P.Eng.
Transportation Planning Engineer

Reviewed by:

Monique Beaudry, P.Eng., RPP, MCIP
Senior Transportation Planning Engineer

PROFESSIONAL ENGINEER
YUKON TERRITORY
STEVEN M. BARTSCH
11-Dec-2020

Steven Bartsch, P.Eng.
Project Manager

PERMIT TO PRACTICE
ASSOCIATED ENGINEERING (BC) LTD.
SIGNATURE
Date 11-Dec-2020
PERMIT NUMBER PP060
Association of Professional Engineers of Yukon

AM/HS/MB/SB/mc

APPENDIX A - KICK-OFF MEETING NOTES

Kick-Off Meeting Notes:

- The kick-off meeting was held on June 26, 2019, from 1:00 pm to 3:00 pm. The attendees include:
  - George Farrow (GF) - City of Whitehorse
  - Taylor Eshpeter (TE) - City of Whitehorse
  - Sabine Schweiger, Planning & Sustainability – City of Whitehorse
  - Steven Bartsch (SB) – Associated Engineering
  - Monique Beaudry (MB) - Associated Engineering
  - Haytham Sadeq (HS) - Associated Engineering
  - Chris Green, Fire Department – City of Whitehorse
  - Wayne Smyth, Fire Department – City of Whitehorse
  - Sherry Mallow, Transit – City of Whitehorse
  - Brian Crist, Yukon Government
  - Sandra MacDougall, Yukon Government
- The meeting was started by SB with an introduction for each person.
- Discussion about the incorporation of the data required for the study. Previous collision history will be provided to the study team.
- Traffic counts will be provided by the City for use in this study.
- The safety concerns found during the site visit were generally discussed by Monique and Haytham which are mainly related to pedestrian and cyclist accommodation within the intersection. Meeting participants indicated some of their personal observations of the intersection as well.
  - Pedestrians on the west side are hard to see.
  - Very long to make a left turn out then weaving to Alaska Highway.
  - Poor sightlines for EB lefts on Two Mile.
- The Fire department noted that they have city-wide traffic signal pre-emption devices but they are not working well at this intersection. They are exploring ways to address this including replacement with a more modern system. MB referred to the ITS specialist Keenan Kitasaka in AE who can help with this issue. HS confirmed that the traffic analysis will be based on the typical peak hour but considerations for the pre-emption requirements may be incorporated in further detailed design stages.
- The Fire Department often leaves to go out left then right then the opposite.
- Fire Department often attends accidents at this location and described it as a high-accident location.
- The design vehicle for fire is a 75’ ladder truck. They are moving towards a 100’ ladder truck but with a shorter turning radius.
- SM indicated an expected increase in the number of buses using this intersection because Range Road is becoming the primary route for all bus routes. A new hub on Hamilton Boulevard west of Alaska Highway on Range Road. New buses are expected in 2020 based on the transit master plan which provides information about the transit volumes. SM indicated a desire to have bus stops on every corner and a desire for transit priority signals. MB and HS confirmed that bus stops at and around the existing intersections will be examined and considered in the safety and operational review.
- Transit indicated that they are concerned that increased transit will increase the delay for EB lefts.

- SS referred to pedestrians and cyclists connectivity in the area. MB and HS confirmed that pedestrian and cyclists' desire routes will be assessed as part of this study.
- Yukon Government indicated they are building a new intersection at the west end of Range Road and Alaska Highway. It is far enough away from the existing intersection that it should have no impact on the existing intersection. They are planning to construct a double left turn for SB turns from Alaska Highway to Two Mile Hill Road in about five years. The reason is to accommodate forecast traffic increases related to Whistle Bend construction. The City has a study related to the double left turns.
- YG indicated there's a lot of pedestrian and bicycle traffic.
- GF showed us a previous design for the intersection and indicated that he would provide us with a copy of that design.
- The City indicated:
  - The bicycle networks plan for the intersection should be referenced to determine the design parameters.
  - A desire to have pedestrians crossing on all four sides of the intersection.
  - A goal to reduce the number of single-occupancy vehicles through the intersection.
- Due to the nature of the multi-modal identified at the intersection, it was agreed to prepare a problem definition memo that will examine current conditions, identify a problem statement and guiding principles before developing improvement options.

APPENDIX B - QUALITATIVE MULTIPLE-ACCOUNT EVALUATION FRAMEWORK

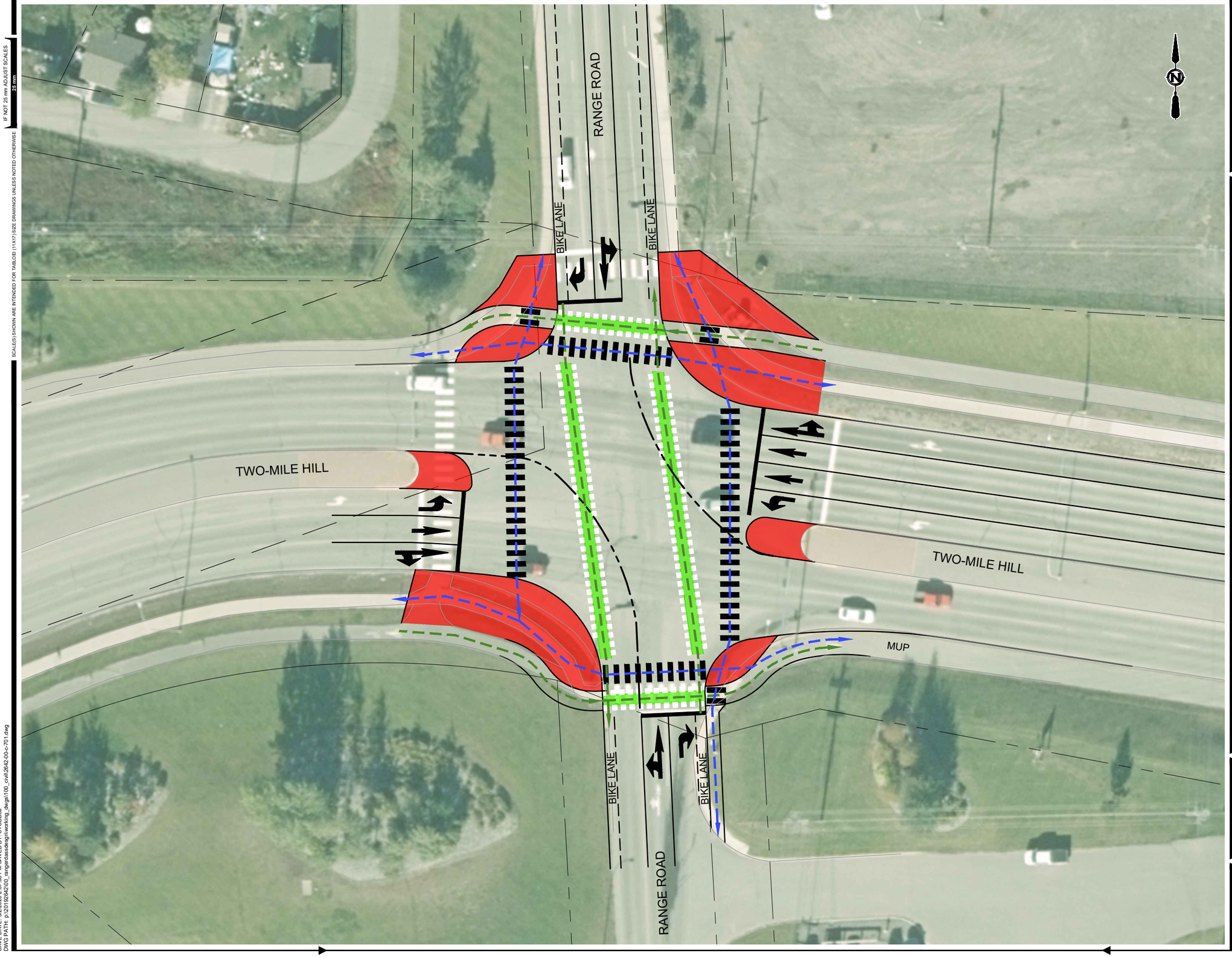
Qualitative Criteria	Description	Good	Neutral	Poor
Traffic Operations	This criterion identifies the impacts of each option on the auto traffic operations at the intersections.	• Improves traffic operations (e.g. potential to improve delay, LOS, reduce queues). • Improves traffic mobility.	• It does not impact traffic operations (e.g. no change in delay, LOS, queues). • It does not impact traffic mobility.	• Hinders traffic operations (e.g. potential to increase delay, queues and reduce the LOS). • It negatively impacts traffic mobility.
Active Transportation	This criterion identifies the impacts of each option on active transportation modes (mobility, conveniences, desire lines, delays, etc.)	• Improve cyclists and pedestrian movements (reduce delay, increase convenience, etc.)	• Does not impact cyclists and pedestrian movements (no change in delay, convenience, etc.)	• Hinder cyclists and pedestrian movements (increase delay, increase travelled distance, etc..)
Transit	This criterion identifies the impact of each option on current and future transit accommodation.	• Improve transit operations (reduce transit delays, etc.)	• Do not impact transit operations (maintain transit delays, etc.)	• Hinder transit operations (increase transit delays, etc.)
Road Safety	This criterion identifies the impacts of each option on road safety in terms of collision/conflict potential for vehicles, pedestrians and cyclists.	• Potential for major reductions of collisions for vehicles, pedestrians and cyclists.	• Potential for minor reductions of collisions for vehicles, pedestrians and cyclists.	• This option has no potential for collision reductions.
Geometry	This criterion identifies constraints and general level of compliance of each option with geometric design guidelines.	• No geometric constraints. • Meets geometric design guidelines.	• Minor geometric constraints. • Deviates from geometric design guidelines with justification, and a requirement for relatively minor variance(s).	• Significant geometric constraints. • Deviates from geometric design guidelines with a requirement for significant variance(s) that may not be justifiable.
Winter Operations	This criterion identifies constraints and the general impact of each option with the winter and snow removal operations.	• Does not impact the winter and snow removal operations	• Potential for a minor impact on the winter and snow removal operations	• Potential for a major impact on the winter and snow removal operations
Permits and Approval Process	This criterion identifies the complexity and duration of the permits/approvals process required to construct each option.	• The permits and approvals process is simple with no anticipated complexities or delays.	• The permits and approvals process presents a potential for relatively minor complexities, delays and costs.	• The permits and approval process has major complexities, and significant delays and/or costs.

Qualitative Criteria	Description	Good	Neutral	Poor
Environmental considerations	This criterion identifies the potential environmental impact of each option, including environmental permitting requirements under federal and provincial laws and regulations.	• The option has no environmental impact. • Environmental permitting is unlikely.	• The option has environmental impacts with a requirement for mitigations through minor environmental compensation. • Some permitting is required.	• The option has environmental impacts with a requirement for mitigations through significant environmental compensation. • Permitting process is expected to be lengthy.
Drainage	This criterion identifies the potential impact of each option on road drainage.	• The option does not require changes to the existing road drainage.	• The option requires minor changes to the existing road drainage.	• The option requires major changes to the existing road drainage.
Utilities	This criterion identifies the potential impact of each option on existing utilities.	• The option does not require changes to existing utilities.	• The option requires minor changes to existing utilities.	• The option requires major changes to existing utilities.
Properties and Businesses	This criterion identifies the potential impact of each option on adjacent properties, lands, and businesses. Property requirements, full or partial property and business acquisitions may be identified.	• The option does not impact adjacent properties or businesses. • No property takes required. • Option benefits local businesses and properties.	• The option has minor impacts on adjacent properties or businesses. • Minor property acquisitions required.	• The option has major impacts on adjacent properties or businesses. • Major property acquisitions required.
Traffic Management During Construction	This criterion identifies the impacts of each option on traffic operations during construction.	• Construction of the option will likely not impact traffic operations • Minor traffic management is required.	• Construction of the option will likely have minor impacts on traffic operations, • Minor traffic delays due to construction. • A moderate level of traffic management is required.	• Construction of the option will likely have major impacts on traffic operations • Major traffic delays due to construction. • A significant level of traffic management is required.
Order of Magnitude Cost	This criterion identifies the relative order of magnitude cost for each option in comparison to each other.	• This option may have the lowest cost.	• This may have a higher cost than the other options but still not the highest cost option.	• This option may have the highest cost.

APPENDIX C - CONCEPTUAL DESIGN DRAWINGS

IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



Associated Engineering

CANADA'S BEST MANAGED COMPANIES
Platinum member

LEGEND

- CYCLIST MOVEMENTS
- CYCLIST PUSH BUTTON
- PEDESTRIAN MOVEMENTS
- PEDESTRIAN PUSH BUTTON
- PEDESTRIAN/CYCLIST PUSH BUTTON ON ONE POLE
- CYCLIST SIGNAL HEAD
- PEDESTRIAN SIGNAL HEAD
- RAISED CURBS
- PATH MARKING
- PROPERTY LINES

THIS IS A SKETCH CONCEPT AND IS ISSUED FOR DISCUSSIONS ONLY. FURTHER SWEPT PATH ANALYSIS (SPA) FOR OTHER DESIGN VEHICLES WOULD BE PERFORMED IN FURTHER STAGES TO UPDATE GEOMETRIC.

OPTION 1

CITY OF WHITEHORSE

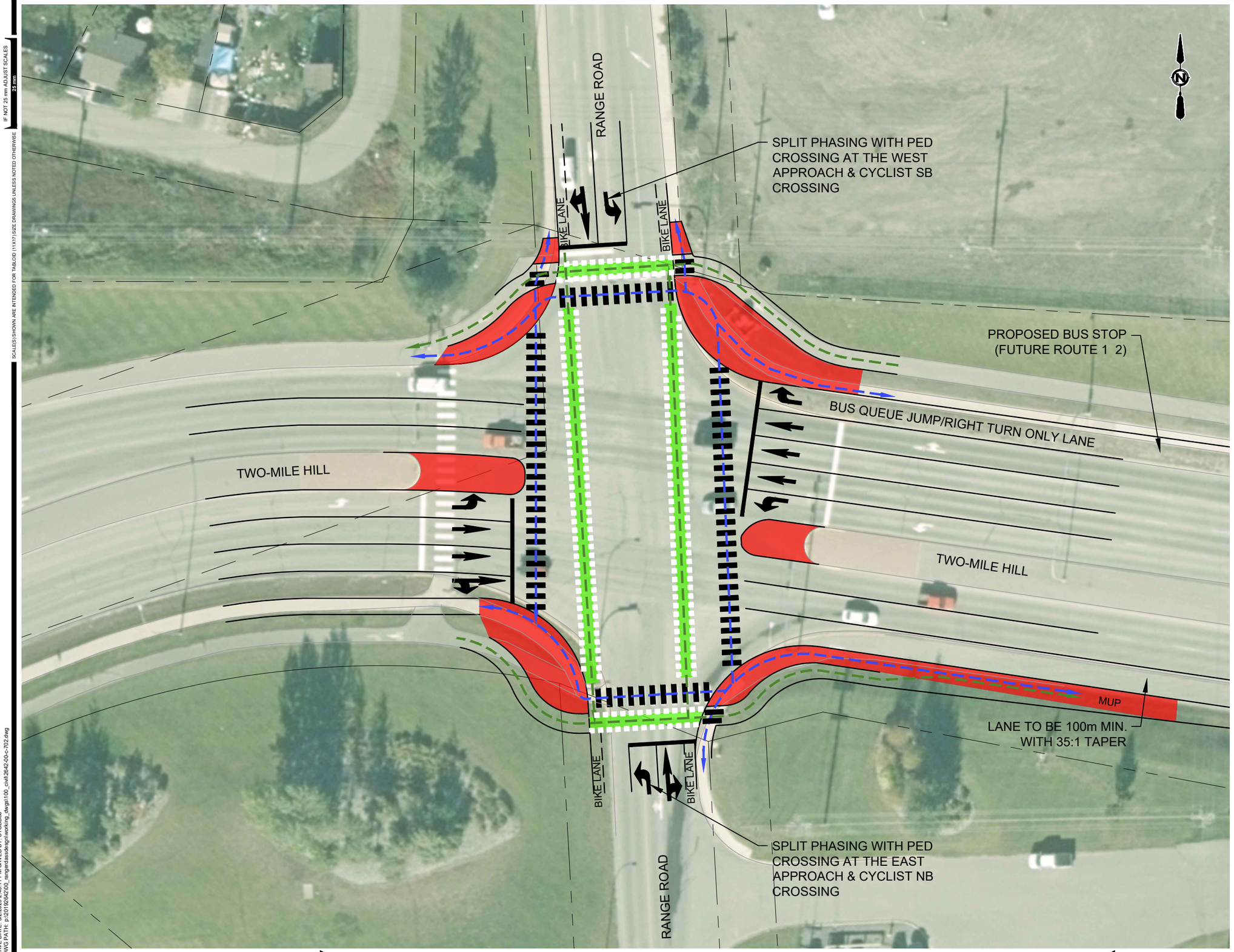
RANGE ROAD/TWO MILE HILL
INTERSECTION UPGRADES

AE PROJECT No.	2019-2642-00
SCALE	1:500
APPROVED	H. SADEQ
DATE	20200228
REV	0
DESCRIPTION	ISSUED FOR DISCUSSION

PLOT DATE: 3/2/2020 3:09:32 PM
SAVE DATE: 3/2/2020 2:37:38 PM SAVED BY: STOBBSJ
DWG PATH: p:\2019\2642\00_rangerdassdesign\working_dwgs\100_civil\2642-00-c-701.dwg

IF NOT 25 mm ADJUST SCALES
25 mm

SCALES SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND

- CYCLIST MOVEMENTS
- CYCLIST PUSH BUTTON
- PEDESTRIAN MOVEMENTS
- PEDESTRIAN PUSH BUTTON
- PEDESTRIAN/CYCLIST PUSH BUTTON ON ONE POLE
- CYCLIST SIGNAL HEAD
- PEDESTRIAN SIGNAL HEAD
- RAISED CURBS
- PATH MARKING
- PROPERTY LINES

THIS IS A SKETCH CONCEPT AND IS ISSUED FOR DISCUSSIONS ONLY. FURTHER SWEPT PATH ANALYSIS (SPA) FOR OTHER DESIGN VEHICLES WOULD BE PERFORMED IN FURTHER STAGES TO UPDATE GEOMETRIC.

OPTION 2

CITY OF WHITEHORSE

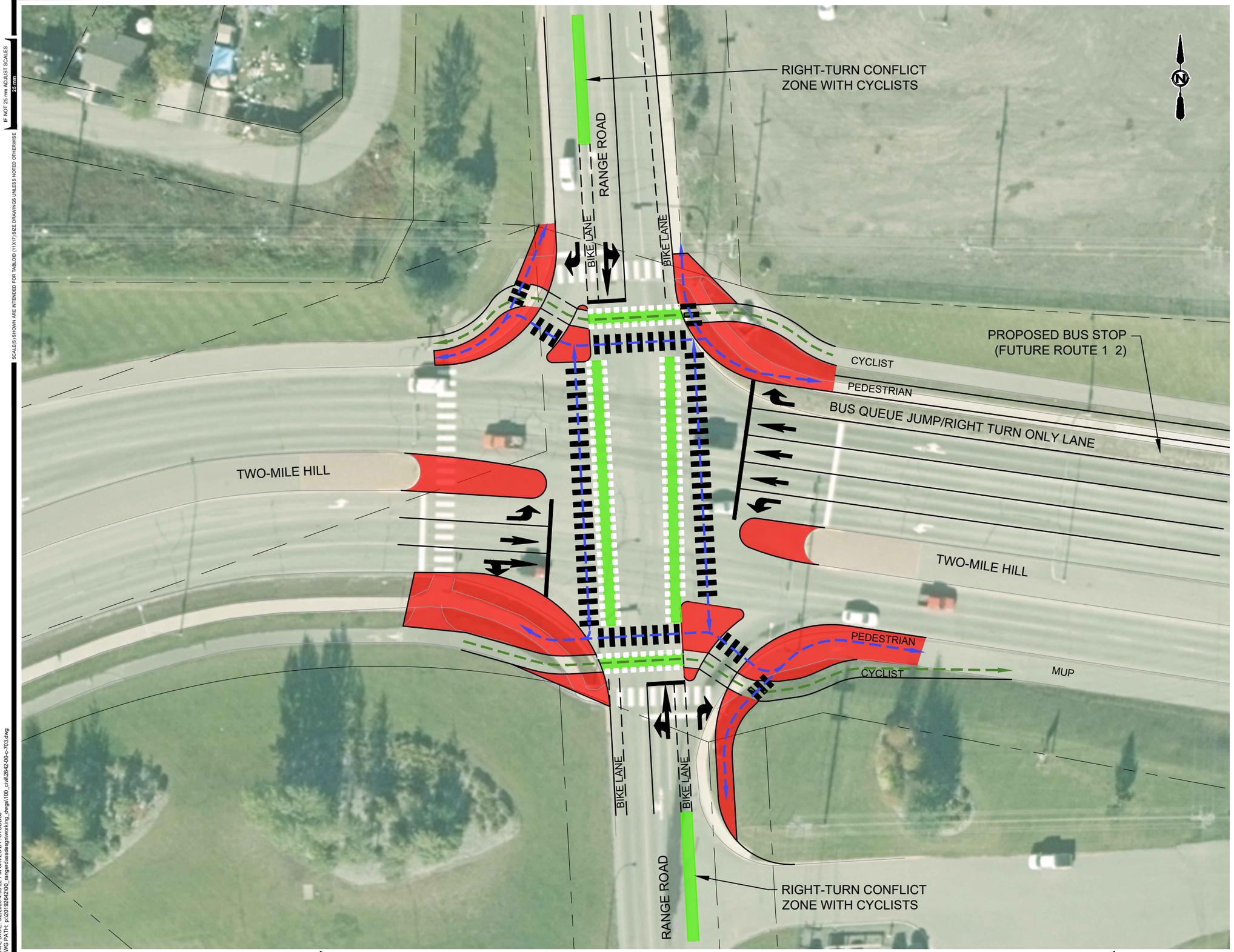
RANGE ROAD/TWO MILE HILL
INTERSECTION UPGRADES

AE PROJECT No.	2019-2642-00
SCALE	1:500
APPROVED	H. SADEQ
DATE	20200228
REV	0
DESCRIPTION	ISSUED FOR DISCUSSION

PLOT DATE: 3/2/2020 3:10:07 PM
SAVE DATE: 3/2/2020 2:45:11 PM SAVED BY: STOBBSJ
DWG PATH: p:\2019\2642\00_ringerdassdesign\workingdwgs\100_civil\2642-00-c-702.dwg

IF NOT 25 mm ADJUST SCALES
25 mm

SCALES SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



Associated Engineering

BEST MANAGED COMPANIES
Platinum member

LEGEND

- CYCLIST MOVEMENTS
- CYCLIST PUSH BUTTON
- PEDESTRIAN MOVEMENTS
- PEDESTRIAN PUSH BUTTON
- PEDESTRIAN/CYCLIST PUSH BUTTON ON ONE POLE
- CYCLIST SIGNAL HEAD
- PEDESTRIAN SIGNAL HEAD
- RAISED CURBS
- PATH MARKING
- PROPERTY LINES

THIS IS A SKETCH CONCEPT AND IS ISSUED FOR DISCUSSIONS ONLY. FURTHER SWEPT PATH ANALYSIS (SPA) FOR OTHER DESIGN VEHICLES WOULD BE PERFORMED IN FURTHER STAGES TO UPDATE GEOMETRIC.

OPTION 3

CITY OF WHITEHORSE

RANGE ROAD/TWO MILE HILL
INTERSECTION UPGRADES

AE PROJECT No.	2019-2642-00
SCALE	1:500
APPROVED	H. SADEQ
DATE	20200228
REV	0
DESCRIPTION	ISSUED FOR DISCUSSION

PLOT DATE: 3/2/2020 4:03:56 PM
SAVE DATE: 3/2/2020 4:03:22 PM SAVED BY: STOBBSJ
DWG PATH: p:\2019\2642\00_rangerdass\design\working_dwgs\100_civil\2642-00-c-703.dwg

APPENDIX D – COST ESTIMATES

Date	14-Oct-20
Project Title:	Intersection of Range Road and Two Mile Hill Road Road Class C Estimate
Cost Estimate Prepared by:	James Stobbs
Cost Estimate Reviewed by:	Laurel Richl, Haytham Sadeq

Description of Work	Option 1	Option 2	Option 3
General	$ 373,500	$ 423,500	$ 423,500
Demolition	$ 140,150	$ 176,950	$ 169,100
Roadworks	$ 790,575	$ 1,185,225	$ 1,237,625
Road Markings	$ 586,000	$ 631,000	$ 619,500
Storm System	$ 88,000	$ 88,000	$ 88,000
Provisional	$ 266,500	$ 274,000	$ 274,000
Construction Sub Total	$ 2,244,725	$ 2,778,675	$ 2,811,725
Construction Contingency (30%)	$ 673,418	$ 833,603	$ 843,518
Total	**$ 2,918,000**	**$ 3,612,000**	**$ 3,655,000**

Summary Notes:

This cost estimate is prepared as part of the conceptual design report for the intersection of Range Road and Two Mile Hill Road. The cost estimate was based on typical city of Whitehorse road reconstruction projects from the last 10 years, including projects like Black street, Ogilvie, alexander and Tlingit reconstruction projects. Additional assumptions are listed in the column next to the item. Costs were based on averages from the above mention projects as well as costs from Whistle Bend phases 3-6. Quantities were measured from ACAD files of the concept designs where available, volumes were estimated from an area measured in ACAD and average depth.

Range Road & Two Mile Hill Class C Estimate

Option 1

A		General					
	Description	Unit of Measure	Estimate Quantity	Unit Rate		Total	Notes
1	Mob/Demob	LS	1	$ 150,000.00	$	150,000.00	max 10% of project cost
2	Enviromental Compliance	LS	1	$ 7,500.00	$	7,500.00	
3	Traffic Control	LS	1	$ 150,000.00	$	150,000.00	
4	Construction Survey	LS	1	$ 50,000.00	$	50,000.00	
5	Utility Co-ordination	LS	1	$ 6,000.00	$	6,000.00	
6	Utilization of City Forces	LS	1	$ 10,000.00	$	10,000.00	
				Subtotal	$	373,500.00	
B		Demolition					
1	Cutting and Removal of Aphalt (range road/2 mile)	m2	3550	$ 12.00	$	42,600.00	
2	Cutting and Removal of Concrete curb (range road/2 mile)	L.M.	320	$ 50.00	$	16,000.00	
3	Cutting and Removal of Aphalt (multi use trail)	m2	340	$ 10.00	$	3,400.00	
4	Cutting and Removal of Concrete (sidewalks)	m2	220	$ 50.00	$	11,000.00	
5	Remove existing CBs & CBMHs	each	5	$ 3,750.00	$	18,750.00	
6	Remove Existing CB Leads	L.M.	92	$ 200.00	$	18,400.00	
7	Remove Existing Traffic Lights	LS	1	$ 30,000.00	$	30,000.00	
				Subtotal	$	140,150.00	
C		Roadworks					
1	Common Excavation to offsite Disposal	m3	6000	$ 30.00	$	180,000.00	assuming full subcut - 1.7m below existing grade
2	Subgrade Prep	m2	4500	$ 2.50	$	11,250.00	
3	100mm pit run Granular Sub-base 1.25m thick	m3	5625	$ 30.00	$	168,750.00	
4	50mm Crush Gravel - 200mm thick Sub-base	m2	4500	$ 12.00	$	54,000.00	
5	20mm Crush Gravel - 150mm thick base	m2	4500	$ 10.00	$	45,000.00	
6	Warm Mix Asphalt - 100mm Thick	m2	3275	$ 65.00	$	212,875.00	will include adjustment of all Manholes/Valves/appertanances
7	Warm Mix Asphalt - 50mm Thick (multiuse trail)	m2	300	$ 42.00	$	12,600.00	
8	Concrete Curb and Gutter - Barrier Curb	L.M.	350	$ 150.00	$	52,500.00	
9	Concrete Sidewalk	m2	360	$ 130.00	$	46,800.00	
10	Para-ramps	each	8	$ 850.00	$	6,800.00	
				Subtotal	$	790,575.00	
D		Road Markings					
1	Pedestrian Crosswalks	Each	6	$ 2,000.00	$	12,000.00	
2	Bicycle Symbols	Each	4	$ 500.00	$	2,000.00	
3	Bicycle Crosswalks	Each	4	$ 2,500.00	$	10,000.00	
4	600mm Stop Bars	L.M.	45	$ 500.00	$	22,500.00	
5	100mm Solid Yellow/White Lines	L.M.	240	$ 100.00	$	24,000.00	
6	100mm Dashed Yellow/White Lines	L.M.	100	$ 100.00	$	10,000.00	
7	Turn Bay Arrows	Each	11	$ 500.00	$	5,500.00	
8	Re-install Existing Traffic Lights and Sensors	LS	1	$ 500,000.00	$	500,000.00	
9	supply and install Signs	Each	20	$ 500.00	$	10,000.00	no solid count - just an assumption at this point
10	Supply and Install Sign posts	Each	10	$ 500.00	$	5,000.00	no solid count - just an assumption at this point
				Subtotal	$	586,000.00	
E		Storm System					
1	Supply and Install new CB or CBMH	each	8	$ 5,000.00	$	40,000.00	just an assumption based off of size of intersection and possible drainage catchment
2	Supply and Install new CB Lead	L.M.	160	$ 300.00	$	48,000.00	assuming 20m lead from each CB
				Subtotal	$	88,000.00	
F		Provisional Items					
1	Unsuitable Trench Material Replacement	m3	500	$ 35.00	$	17,500.00	
2	Common Excavation to onsite Reuse	m3	1500	$ 25.00	$	37,500.00	assuming 20% of subcut volume is reusable
3	Excavation of Boulders	each	10	$ 100.00	$	1,000.00	
4	Supply and Install Trench Bottom Geotextile	m2	1000	$ 5.00	$	5,000.00	
5	Common Ex to offsite Disposal	m3	1500	$ 30.00	$	45,000.00	
6	Granular Subbase (100mm Pit Run)	m3	1500	$ 32.00	$	48,000.00	
7	Warm Mix Asphalt - 100mm Thick	m2	500	$ 65.00	$	32,500.00	
8	Crossing of underground utitlites - electrical	each	10	$ 1,000.00	$	10,000.00	
9	Top Soil and Seed	m2	500	$ 10.00	$	5,000.00	
10	Concrete Boulevard infill	m2	500	$ 130.00	$	65,000.00	
				Subtotal	$	266,500.00	
				Subtotal	**$**	**2,244,725.00**	
				Contigency 30%)	$	673,417.50	
				Total	**$**	**2,918,000.00**	**rounded to nearest $1000**

Range Road & Two Mile Hill Class C Estimate

Option 2

	Description	Unit of Measure	Estimate Quantity	Unit Rate	Total	Notes
A	General					
1	Mob/Demob	LS	1	$ 200,000.00	$ 200,000.00	max 10% of project cost
2	Enviromental Compliance	LS	1	$ 7,500.00	$ 7,500.00	
3	Traffic Control	LS	1	$ 150,000.00	$ 150,000.00	
4	Construction Survey	LS	1	$ 50,000.00	$ 50,000.00	
5	Utility Co-ordination	LS	1	$ 6,000.00	$ 6,000.00	
6	Utilization of City Forces	LS	1	$ 10,000.00	$ 10,000.00	
				Subtotal	$ 423,500.00	
B	Demolition					
1	Cutting and Removal of Aphalt (range road/2 mile)	m2	4900	$ 12.00	$ 58,800.00	
2	Cutting and Removal of Concrete curb (range road/2 mile)	L.M.	560	$ 50.00	$ 28,000.00	
3	Cutting and Removal of Aphalt (multi use trail)	m2	600	$ 10.00	$ 6,000.00	
4	Cutting and Removal of Concrete (sidewalks)	m2	340	$ 50.00	$ 17,000.00	
5	Remove existing CBs & CBMHs	each	5	$ 3,750.00	$ 18,750.00	
6	Remove Existing CB Leads	L.M.	92	$ 200.00	$ 18,400.00	
7	Remove Existing Traffic Lights	LS	1	$ 30,000.00	$ 30,000.00	
				Subtotal	$ 176,950.00	
C	Roadworks					
1	Common Excavation to offsite Disposal	m3	7200	$ 30.00	$ 216,000.00	assuming full subcut - 1.7m below existing grade
2	Subgrade Prep	m2	7050	$ 2.50	$ 17,625.00	
3	100mm pit run Granular Sub-base 1.25m thick	m3	9000	$ 30.00	$ 270,000.00	
4	50mm Crush Gravel - 200mm thick Sub-base	m2	7050	$ 12.00	$ 84,600.00	
5	20mm Crush Gravel - 150mm thick base	m2	7050	$ 10.00	$ 70,500.00	
6	Warm Mix Asphalt - 100mm Thick	m2	5600	$ 65.00	$ 364,000.00	will include adjustment of all Manholes/Valves/appertanances
7	Warm Mix Asphalt - 50mm Thick (multiuse trail)	m2	450	$ 42.00	$ 18,900.00	
8	Concrete Curb and Gutter - Barrier Curb	L.M.	600	$ 150.00	$ 90,000.00	
9	Concrete Sidewalk	m2	360	$ 130.00	$ 46,800.00	
10	Para-ramps	each	8	$ 850.00	$ 6,800.00	
				Subtotal	$ 1,185,225.00	
D	Road Markings					
1	Pedestrian Crosswalks	Each	6	$ 2,000.00	$ 12,000.00	
2	Bicycle Symbols	Each	4	$ 500.00	$ 2,000.00	
3	Bicycle Crosswalks	Each	4	$ 2,500.00	$ 10,000.00	
4	600mm Stop Bars	L.M.	55	$ 500.00	$ 27,500.00	
5	100mm Solid Yellow/White Lines	L.M.	630	$ 100.00	$ 63,000.00	
6	100mm Dashed Yellow/White Lines	L.M.	100	$ 100.00	$ 10,000.00	
7	Turn Bay Arrows	Each	13	$ 500.00	$ 6,500.00	
8	Re-install Existing Traffic Lights and Sensors	LS	1	$ 500,000.00	$ 500,000.00	
9	supply and install Signs	Each	20	$ 500.00	$ 10,000.00	no solid count - just an assumption at this point
10	Supply and Install Sign posts	Each	10	$ 500.00	$ 5,000.00	no solid count - just an assumption at this point
				Subtotal	$ 631,000.00	
E	Storm System					
1	Supply and Install new CB or CBMH	each	8	$ 5,000.00	$ 40,000.00	just an assumption based off of size of intersection and possible drainage catchment
2	Supply and Install new CB Lead	L.M.	160	$ 300.00	$ 48,000.00	assuming 20m lead from each CB
				Subtotal	$ 88,000.00	
F	Provisional Items					
1	Unsuitable Trench Material Replacement	m3	500	$ 35.00	$ 17,500.00	
2	Common Excavation to onsite Reuse	m3	1800	$ 25.00	$ 45,000.00	assuming 20% of subcut volume is reusable
3	Excavation of Boulders	each	10	$ 100.00	$ 1,000.00	
4	Supply and Install Trench Bottom Geotextile	m2	1000	$ 5.00	$ 5,000.00	
5	Common Ex to offsite Disposal	m3	1500	$ 30.00	$ 45,000.00	
6	Granular Subbase (100mm Pit Run)	m3	1500	$ 32.00	$ 48,000.00	
7	Warm Mix Asphalt - 100mm Thick	m2	500	$ 65.00	$ 32,500.00	
8	Crossing of underground utitlites - electrical	each	10	$ 1,000.00	$ 10,000.00	
9	Top Soil and Seed	m2	500	$ 10.00	$ 5,000.00	
10	Concrete Boulevard infill	m2	500	$ 130.00	$ 65,000.00	
				Subtotal	$ 274,000.00	
				Subtotal	**$ 2,778,675.00**	
				Contigency 30%	$ 833,602.50	
				Total	**$ 3,612,000.00**	**rounded to nearest $1000**

Range Road & Two Mile Hill Class C Estimate

Option 3

A		General					
	Description	Unit of Measure	Estimate Quantity	Unit Rate		Total	Notes
1	Mob/Demob	LS	1	$ 200,000.00	$	200,000.00	max 10% of project cost
2	Enviromental Compliance	LS	1	$ 7,500.00	$	7,500.00	
3	Traffic Control	LS	1	$ 150,000.00	$	150,000.00	
4	Construction Survey	LS	1	$ 50,000.00	$	50,000.00	
5	Utility Co-ordination	LS	1	$ 6,000.00	$	6,000.00	
6	Utilization of City Forces	LS	1	$ 10,000.00	$	10,000.00	
				Subtotal	$	423,500.00	
B		Demolition					
1	Cutting and Removal of Aphalt (range road/2 mile)	m2	4600	$ 12.00	$	55,200.00	
2	Cutting and Removal of Concrete curb (range road/2 mile)	L.M.	475	$ 50.00	$	23,750.00	
3	Cutting and Removal of Aphalt (multi use trail)	m2	600	$ 10.00	$	6,000.00	
4	Cutting and Removal of Concrete (sidewalks)	m2	340	$ 50.00	$	17,000.00	
5	Remove existing CBs & CBMHs	each	5	$ 3,750.00	$	18,750.00	
6	Remove Existing CB Leads	L.M.	92	$ 200.00	$	18,400.00	
7	Remove Existing Traffic Lights	LS	1	$ 30,000.00	$	30,000.00	
				Subtotal	$	169,100.00	
C		Roadworks					
1	Common Excavation to offsite Disposal	m3	7200	$ 30.00	$	216,000.00	assuming full subcut - 1.7m below existing grade
2	Subgrade Prep	m2	7050	$ 2.50	$	17,625.00	
3	100mm pit run Granular Sub-base 1.25m thick	m3	9000	$ 30.00	$	270,000.00	
4	50mm Crush Gravel - 200mm thick Sub-base	m2	7050	$ 12.00	$	84,600.00	
5	20mm Crush Gravel - 150mm thick base	m2	7050	$ 10.00	$	70,500.00	
6	Warm Mix Asphalt - 100mm Thick	m2	5600	$ 65.00	$	364,000.00	will include adjustment of all Manholes/Valves/appertanances
7	Warm Mix Asphalt - 50mm Thick (multiuse trail)	m2	450	$ 42.00	$	18,900.00	
8	Concrete Curb and Gutter - Barrier Curb	L.M.	600	$ 150.00	$	90,000.00	
9	Concrete Sidewalk	m2	750	$ 130.00	$	97,500.00	
10	Para-ramps	each	10	$ 850.00	$	8,500.00	
				Subtotal	$	1,237,625.00	
D		Road Markings					
1	Pedestrian Crosswalks	Each	9	$ 2,000.00	$	18,000.00	
2	Bicycle Symbols	Each	4	$ 500.00	$	2,000.00	
3	Bicycle Crosswalks	Each	4	$ 2,500.00	$	10,000.00	
4	600mm Stop Bars	L.M.	45	$ 500.00	$	22,500.00	
5	100mm Solid Yellow/White Lines	L.M.	450	$ 100.00	$	45,000.00	
6	100mm Dashed Yellow/White Lines	L.M.	160	$ 100.00	$	16,000.00	
7	Turn Bay Arrows	Each	12	$ 500.00	$	6,000.00	
8	Re-install Existing Traffic Lights and Sensors	LS	1	$ 500,000.00	$	500,000.00	
9	supply and install Signs	Each	20	$ 500.00	$	10,000.00	no solid count - just an assumption at this point
10	Supply and Install Sign posts	Each	10	$ 500.00	$	5,000.00	no solid count - just an assumption at this point
				Subtotal	$	619,500.00	
E		Storm System					
1	Supply and Install new CB or CBMH	each	8	$ 5,000.00	$	40,000.00	just an assumption based off of size of intersection and possible drainage catchment
2	Supply and Install new CB Lead	L.M.	160	$ 300.00	$	48,000.00	assuming 20m lead from each CB
				Subtotal	$	88,000.00	
F		Provisional Items					
1	Unsuitable Trench Material Replacement	m3	500	$ 35.00	$	17,500.00	
2	Common Excavation to onsite Reuse	m3	1800	$ 25.00	$	45,000.00	assuming 20% of subcut volume is reusable
3	Excavation of Boulders	each	10	$ 100.00	$	1,000.00	
4	Supply and Install Trench Bottom Geotextile	m2	1000	$ 5.00	$	5,000.00	
5	Common Ex to offsite Disposal	m3	1500	$ 30.00	$	45,000.00	
6	Granular Subbase (100mm Pit Run)	m3	1500	$ 32.00	$	48,000.00	
7	Warm Mix Asphalt - 100mm Thick	m2	500	$ 65.00	$	32,500.00	
8	Crossing of underground utitlites - electrical	each	10	$ 1,000.00	$	10,000.00	
9	Top Soil and Seed	m2	500	$ 10.00	$	5,000.00	
10	Concrete Boulevard infill	m2	500	$ 130.00	$	65,000.00	
				Subtotal	$	274,000.00	
				Subtotal	**$**	**2,811,725.00**	
				Contigency 30%)	$	843,517.50	
				Total	**$**	**3,655,000.00**	**rounded to nearest $1000**

APPENDIX E – PUBLIC ENGAGEMENT SUMMARY

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

MEMO

Date:	December 4, 2020	**File:**	2019-2642
To:	City of Whitehorse: Taylor Eshpeter, P.Eng., & Stefan Baer, E.I.T.	**Page:**	Page 1 of 13
From:	Haytham Sadeq, P.Eng., PMP		
Project:	Range Road and Two Mile Hill Road Intersection Study		
Subject:	Summary of Public Engagement		

1 INTRODUCTION

The City of Whitehorse (The City) retained Associated Engineering (AE) to plan and deliver a public consultation process to capture the public feedback, preferences, concerns, and ideas about the three proposed improvement options at the intersection of Range Road and Two Mile Hill Road. The objective of the public engagement process is to identify the level of support for each of the alternative options and better understand the public expectations and needs at this intersection.

The public consultation process was conducted using the IAP2 concepts to help establish realistic objectives of the consultation process while managing the expectations of the public. The public inputs were gathered to help in the selection and development of the preferred conceptual design option. The City team participated as project sponsors and worked with AE during the overall process.

Due to the COVID-19 situation, we conducted a virtual public consultation that includes an electronic survey hosted on SurveyMonkey, and a public webinar to present the improvement options. We published the survey before the webinar and we encouraged the public to participate in the webinar before responding to the survey.

2 PUBLIC WEBINAR

The webinar was advertised through the City website and other public communication channels and interest groups. The webinar was held August 31, 2020 from 6:00 pm to 7:00 pm (PDT). A 30 minute presentation was presented using the GoToMeeting platform. The City started the presentation by welcoming the public, introducing the study team and communication channels. The AE team presented the technical content of the presentation and illustrated the overall study process and proposed improvements. The presentation included key information from the draft conceptual design report, including the study process, results, and proposed improvement options. The presentation was followed by a 30 minute question and answer session to respond to public comments, questions, and ideas.

A total of 93 individuals were registered for the webinar. The actual attendants was approximately 45, and the attendees decreased as the question period progressed. There were 71 questions raised during and after the webinar. The recorded webinar is publicly available at the City website below:
https://www.whitehorse.ca/twomilehill Following the review of the 71 questions raised during the webinar, most were questions regarding technical difficulties about accessing the webinar.
Noteworthy comments and questions:

- Vehicles occupy the crosswalks when waiting to turn right
- Vehicles do not yield to pedestrians when turning right
- Visibility concerns for westbound traffic along Two Mile Hill Road for the eastbound left-turn traffic while waiting for a gap

AE team and the City staff collaboratively answered some of the questions received during the 30 minute question and answer period. We then referred the public to use the electronic survey to provide more inputs and comments.

2.1 Other Webinar Comments

There were some comments brought up at the webinar that pertained to concerns outside the scope of this project area. They include the following:

- How would future developments along Range Road impact the parking demand and biking movements north of Two Mile Hill Road.
- Could there be a bike around or through the Takhini Arena Parking lot where cyclists travelling westbound to northbound can avoid the intersection of Range Road and Two Mile Hill Road.

3 ELECTRONIC SURVEY

We prepared an electronic survey to request inputs and feedback from the public about the study. The survey includes details about the project, simple figures and illustrations to show the study's key elements, an explanation of the decision-making process, and a link to the webinar. The survey includes questions about the existing intersection and how the improvement options address the existing concerns. The average time to complete the survey was eight minutes.

The survey was made available on August 24, 2020 and was kept open until September 14, 2020 (11:59 pm). The survey was open before the webinar to capture public comments and feedback before and after the webinar. The survey was adjusted later on to allow any respondent who may have answered before the webinar to recomplete the survey. Our results show that two respondents took advantage of this and submitted an additional response following the webinar.

The survey contained 11 multiple choice questions regarding the intersection as well as two additional questions for survey participants to leave short comments and their contact information. In total, 279 participants responded to the survey. Below are the summary results of the survey responses, and a summary of the SurveyMonkey questions and responses is included in Appendix A

Question 1: Please indicate if you attended the webinar prior to completing the survey?

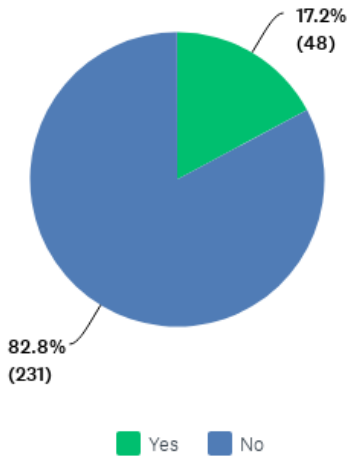


Figure 3-1 – Webinar Attendance

31 of the webinar attendees answered the survey. Survey participants were asked if they had attended the webinar prior to completing the survey and with a link to the recording of the webinar provided to participants within the question.

- Approximately 17% of participants attended the webinar.
- Approximately 82% did not attend the webinar.

Most of the webinar attendees were vehicle drivers or vehicle passengers, with their second most common mode of transportation being cycling.

Question 2: How frequently do you use the intersection of Range Road and Two Mile Hill Road?

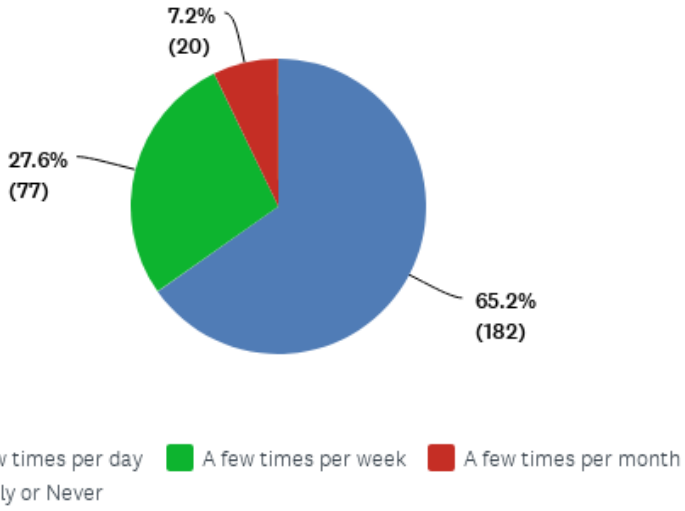
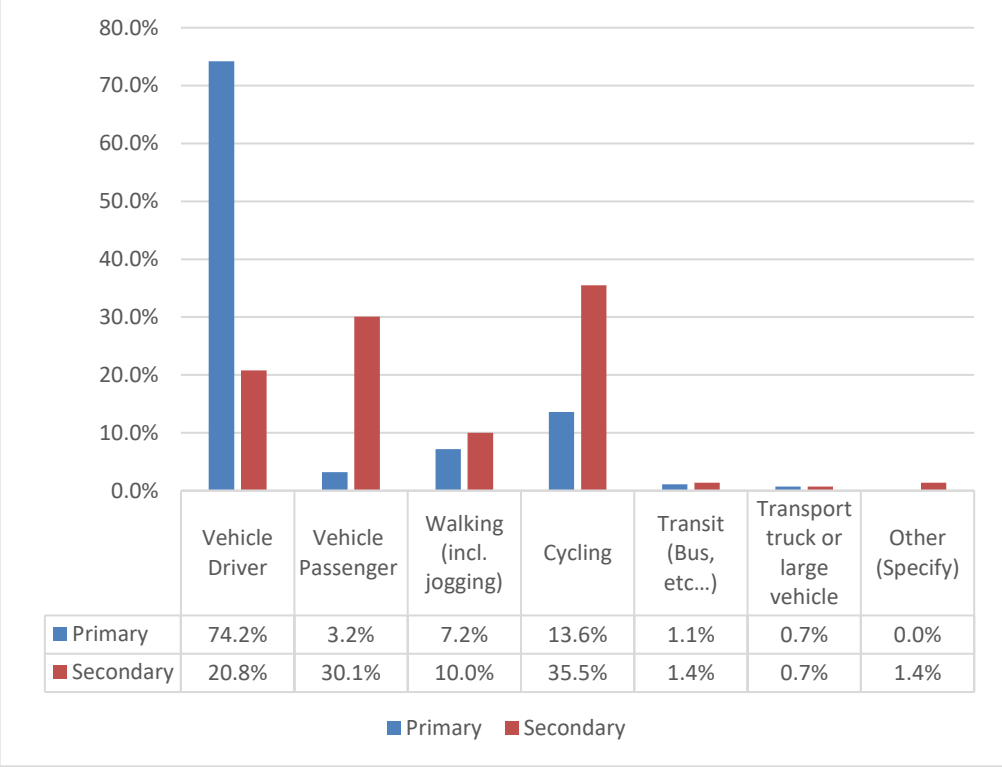


Figure 3-2 – Intersection Use Frequency

Approximately 65% of those surveyed indicated that they use the intersection a few times per day, 28% indicated they used it a few times per week, and 7% indicated that they used it a few times per month.

Question 3: What are your PRIMARY and SECONDARY modes of transportation when using this intersection?



	Vehicle Driver	Vehicle Passenger	Walking (incl. jogging)	Cycling	Transit (Bus, etc...)	Transport truck or large vehicle	Other (Specify)
Primary	74.2%	3.2%	7.2%	13.6%	1.1%	0.7%	0.0%
Secondary	20.8%	30.1%	10.0%	35.5%	1.4%	0.7%	1.4%

Figure 3-3 – Primary and Secondary Modes of Transportation

Respondents indicated that vehicles made up approximately 74% and 21% of primary and secondary modes of transportation, respectively.

- Vehicle Passengers were 3% primary and 30% of secondary modes of transportation.
- Walking made up 7% of primary and 10% of secondary modes of transportation.
- Cycling made up 14% primary and 36% secondary transportation modes.
- Transit and Transport Truck or Large Vehicle were approximately 1% each.

Question 4: Please indicate what your main observations and/or concerns are with this intersection as a pedestrian (Check all relevant boxes)

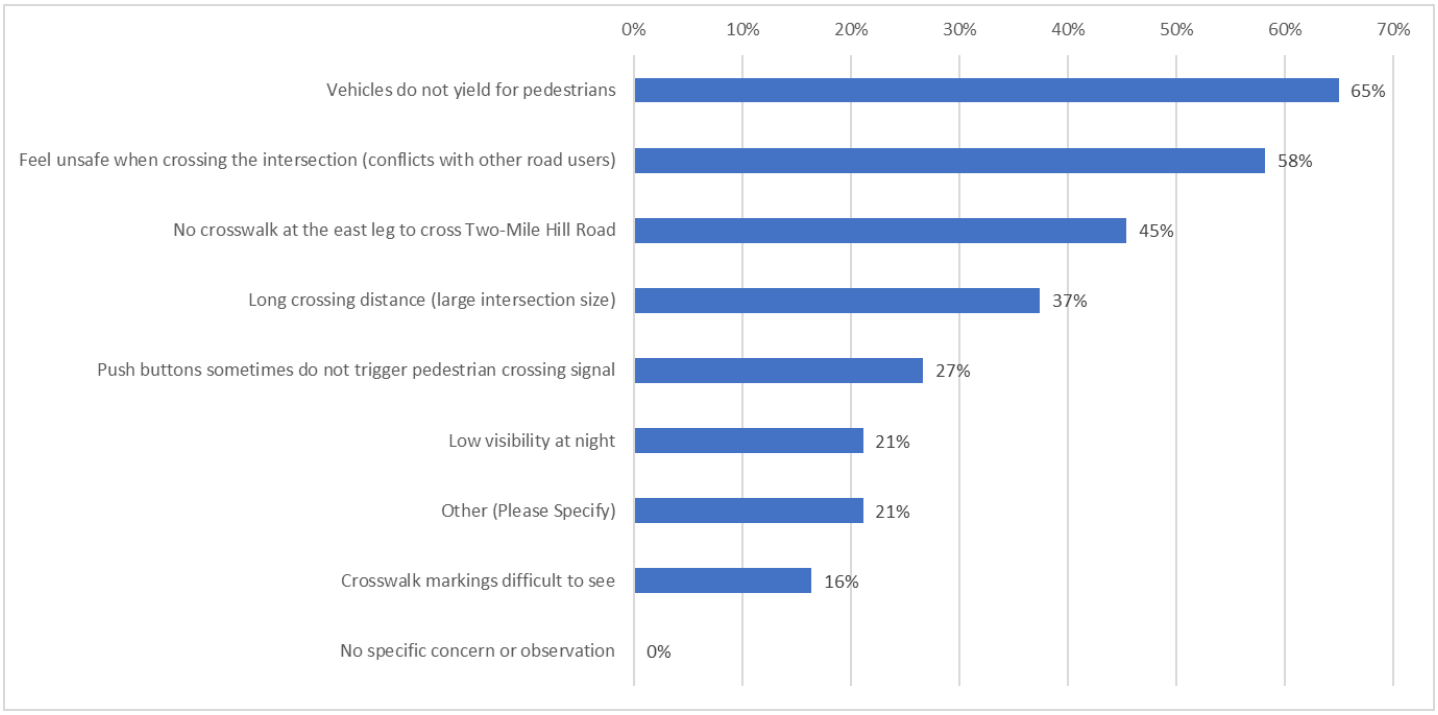


Figure 3-4 – Observations and Concerns - Pedestrians

The most common observation at the intersection was that vehicles do not yield to pedestrians. 65% of respondents found this to be the main concern. 58% of respondents felt unsafe to cross the intersection and 45% found the lack of crosswalk at the east leg a concern.

A total of 53 responses were provided as “Other”. These responses include the following themes:

- Excessive vehicle speeds
- Lack of enforcement of traffic rules
- Running of red and amber lights
- Vehicles not yielding to pedestrians
- Inadequate signal timing for pedestrians to cross the intersection
- Long crossing length
- Lack of sidewalk on Range Road to the post office (southwest quadrant of the intersection).

Question 5: Please indicate what your main observations and/or concerns are with this intersection as a cyclist (Check all relevant boxes)

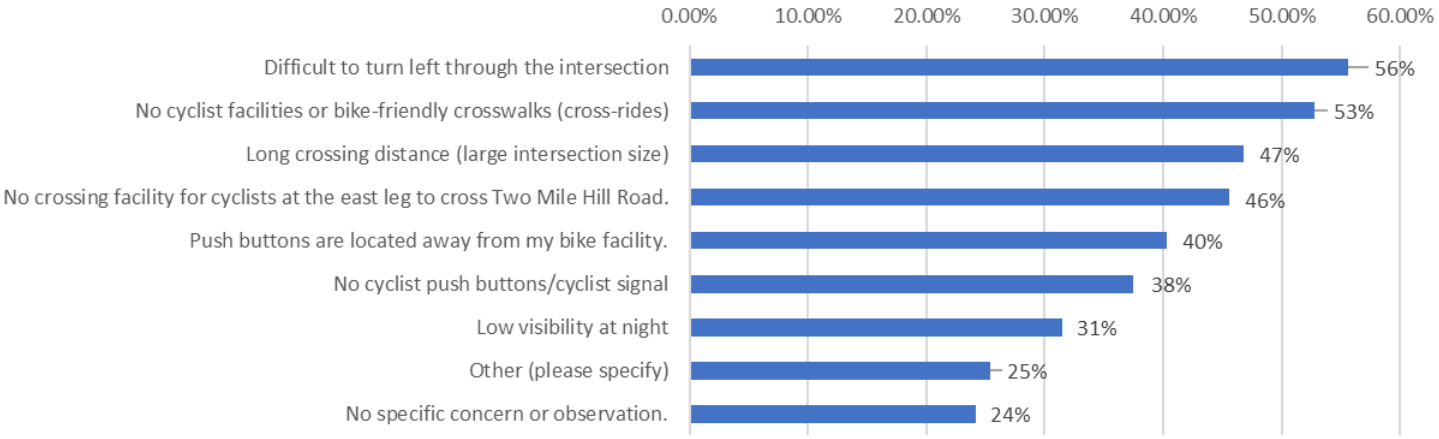


Figure 3-5 – Observations and Concerns - Cyclists

As cyclists, 56% of respondents indicated it was difficult to turn left through the intersection and53% found a concern with the lack of cycling or cycling-friendly facilities.

A total of 63 comments was provided and they include the following:

- Excessive speeds of cars
- Vehicles running red and amber lights
- Visibility issues that cause near misses between turning vehicles and cyclists
- Driver behaviour
- Accessibility issues
- Inadequate green times for cyclists
- Inadequate winter maintenance
- Long crossing length

Question 6: Please indicate what your main observations and/or concerns are with this intersection as a transit user (Check all relevant boxes)

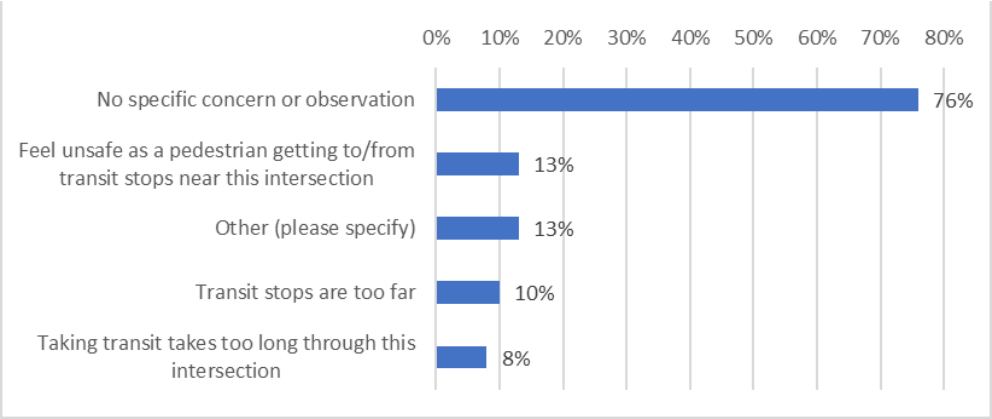


Figure 3-6 - Observations and Concerns – Transit User

76% of respondents had no specific concern or observation. Of the respondents that are transit users, the most common indication was that they felt unsafe accessing the transit stop,
An additional 30 comments were received with some concerns of transit users:

- High speeds of vehicles
- Size of the intersection is too large
- Lack of winter cycling amenities

Question 7: Please indicate what your main observations and/or concerns are with this intersection as a vehicle driver or vehicle passenger (Check all relevant boxes)

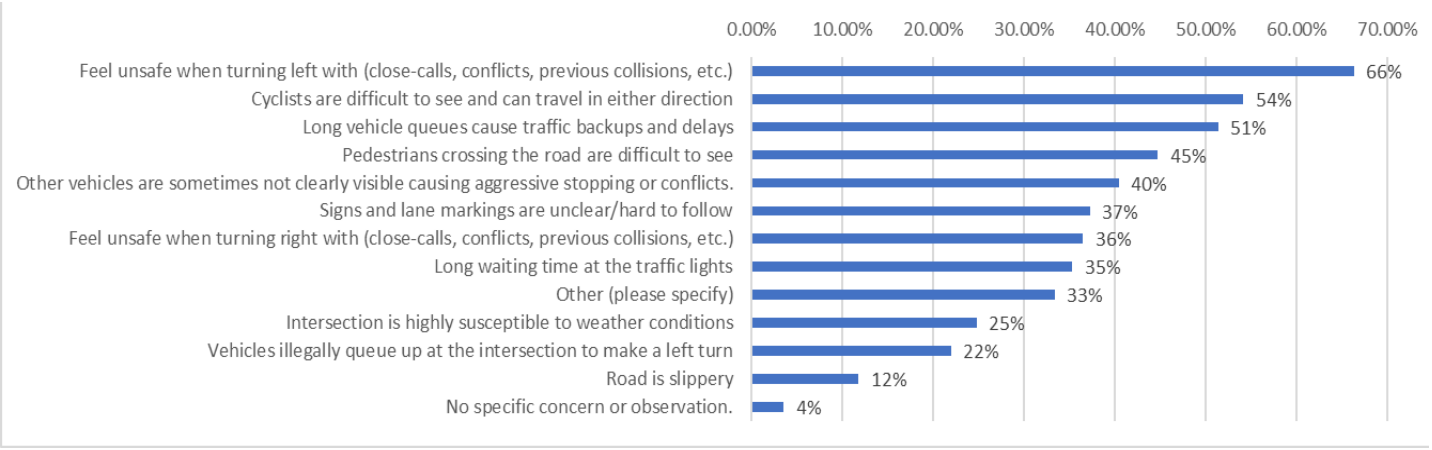


Figure 3-7 – Observations and Concerns – Vehicle Driver or Vehicle Passenger

As a vehicle driver or vehicle passenger, 66% of those surveyed felt unsafe making left turns and 54% indicated it was hard to see cyclists. 51% of respondents felt that vehicle delays and queues were long
85 "Other" comments were received and some of the problems identified were:

- Visibility
- Unclear lane markings
- Excessive speeds
- Running of amber and red lights
- Lack of a protected phase for the movement of westbound left turns from Two Mile Hill Road to southbound Range Road.

Question 8: Please indicate what your main observations and/or concerns are with this intersection as a truck driver or large vehicle driver (Check all relevant boxes)

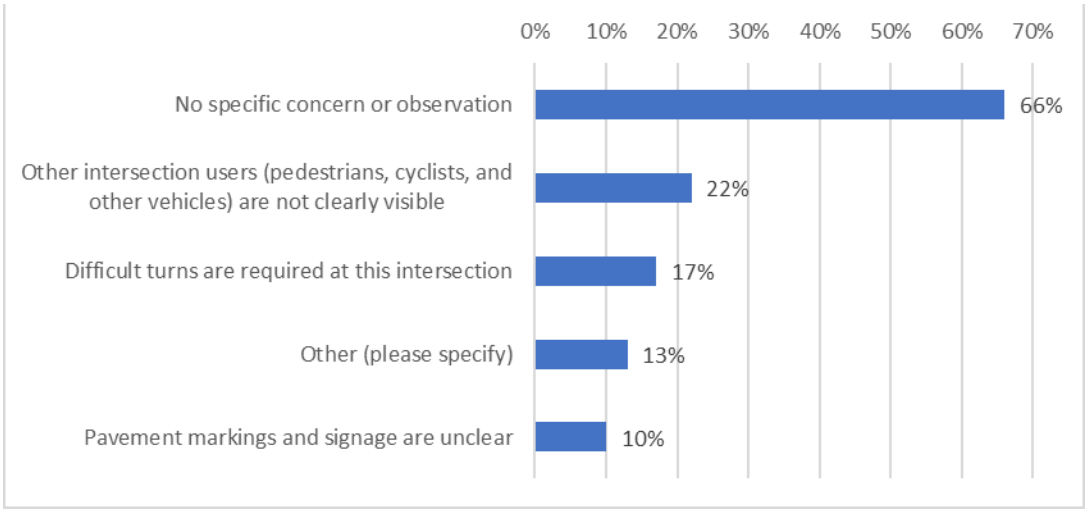


Figure 3-8 - Observations and Concerns – Truck Driver

For respondents that had concerns as a truck or large vehicle driver, 22% indicated that that visibility is a concern, and 17% indicated that there were difficult turns at the intersection.

An additional 29 comments were received regarding concerns with:

- High speeds
- Length of the crossing
- Running of amber and red lights
- Lack of a protected phase for the movement of westbound left turns from Two Mile Hill Road to southbound Range Road.

Question 9: What improvements would encourage you to walk, cycle or take transit more at this intersection? (Check all that apply)

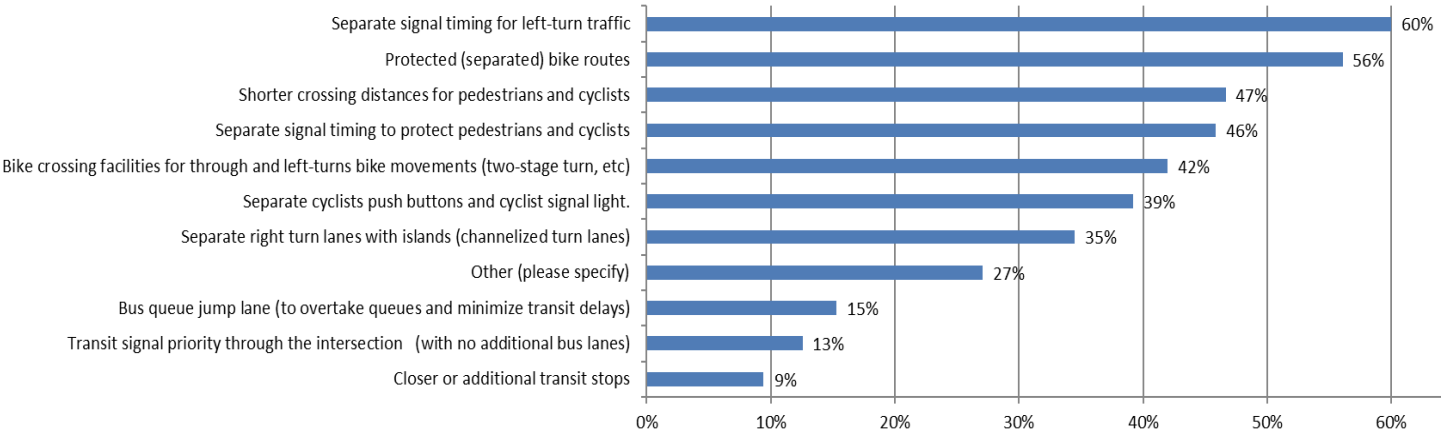


Figure 3-9 – Improvements to Encourage Active Transportation

Respondents answered with possible improvements that would encourage them to walk, cycle or take transit. The most common improvement options were that 60% of respondents indicated separate signal timing or left-turn traffic would be beneficial and 56% of respondents indicated protected bike routes would encourage them to cycle.
An additional 69 comments were received with suggestions to:

- Lower the speed limit and enforce vehicle speeds
- Enforce amber and red-light violations with red light camera
- Restrict right on red
- Increase walk times
- Separate cycling facilities and integrate with the cycling network

There were also a few comments indicating that respondents felt channelized islands were dangerous.

Question 10: Which of the following trade-offs would you generally support? (Check one only)

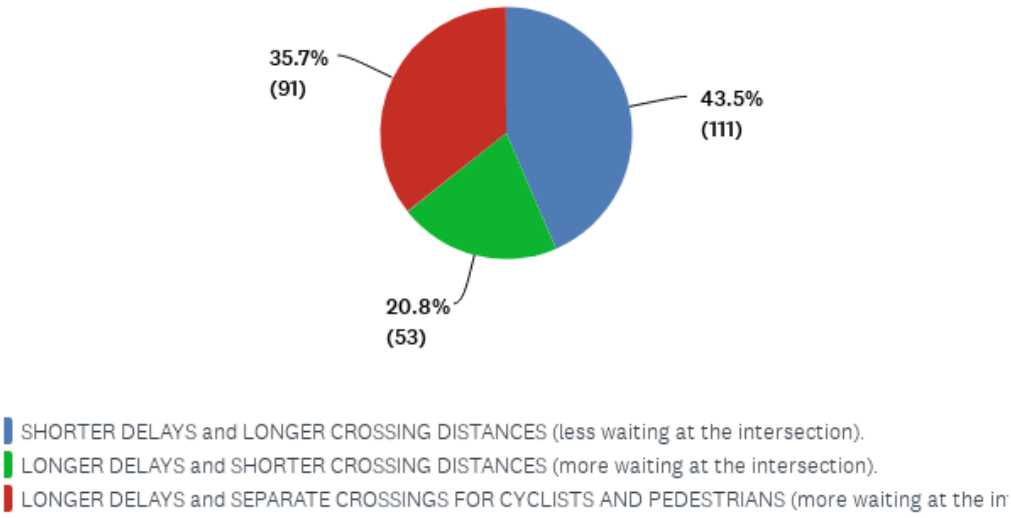


Figure 3-10 – Preferred Trade-off

Most respondents prefer shorter delays and longer crossing distances, with 44% selecting this as their preferred trade-off. 36% preferred longer delays and separate crossing for cyclists and pedestrians. Finally, 21% of respondents preferred longer delays and shorter crossing distances.

Question 11: Rank the three above options from the MOST preferred to the LEAST preferred (a rank of 1 is most preferred, 3 is least preferred)

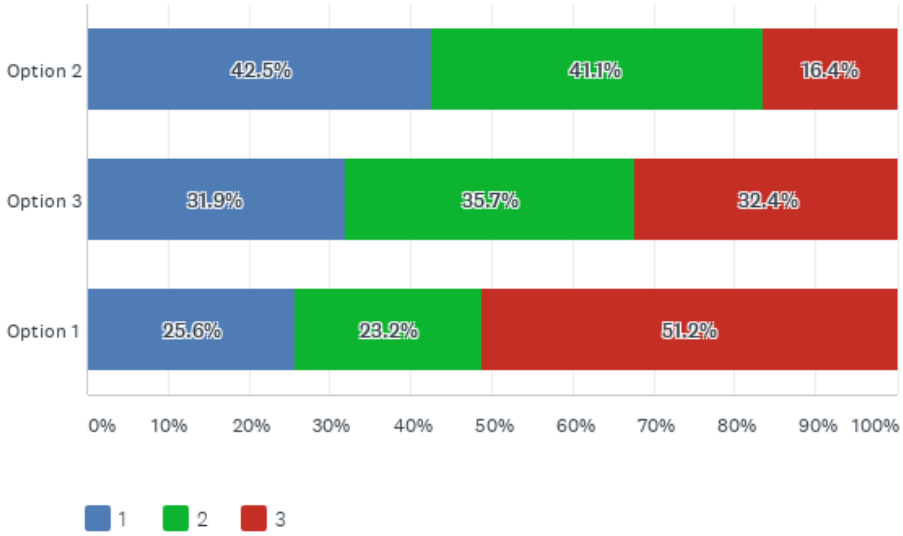


Figure 3-11 – Option Ranking

42% of respondents ranked Option 2 as 1st, the most preferred option, followed by Option 3 (32%), Option 1 (26%).

Question 12: Do you have any additional comments or feedback regarding the proposed intersection improvements? (Optional)

132 responses were received for this question. Key concerns and comments from respondents are as follows:

- Concerns about speeding vehicles and vehicles speeding up for amber lights and running red lights
- More enforcement measure by RCMP for speeding, and lower speed limits
- More green time to cross the intersection
- A dedicated left-turn lane for the southbound left movement from Range Road to the eastbound Two Mile Hill.
- Different intersection treatments such a roundabout to increase safety and decrease delays
- Dislike of channelized right-turn lanes due to pedestrian unsafety
- Dislike of additional lanes that would increase crossing distances.

Suggestions about were also received about curb bulges, raised crosswalks, and center median refuges.

A full compilation of all specific responses are available in Appendix B.

Question 13: Your Contact Information

207 of respondents provided their name and phone number, 128 left provided their email address, 109 gave information on who they were representing with the vast majority indicating that they were representing themselves.

4 NEXT STEPS

Overall, the engagement process provided valuable input from respondents regarding the preferred layout of the intersection. The comments and concerns help identity issues that are experienced as everyday issues. The challenge with the intersection of Range Road and Two Mile Hill is balancing the priorities of vehicle traffic along with pedestrians and cyclists. The safety of all users is important, and the intersection improvements should focus on increasing safety for all users while balancing the performance for all users.

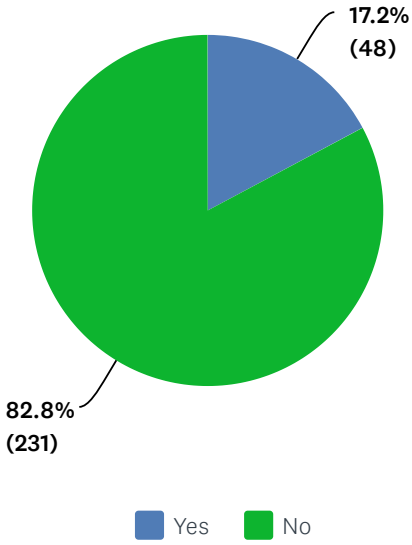
The results from the public engagement will be incorporated in the Final Conceptual Report and contribute to the final recommended design.

ATTACHMENT 1

The questionnaire and results summary from Survey Monkey is attached.

Q1 Please indicate if you attended the Webinar prior to completing the survey.(Click Here to view a recording of the Webinar)

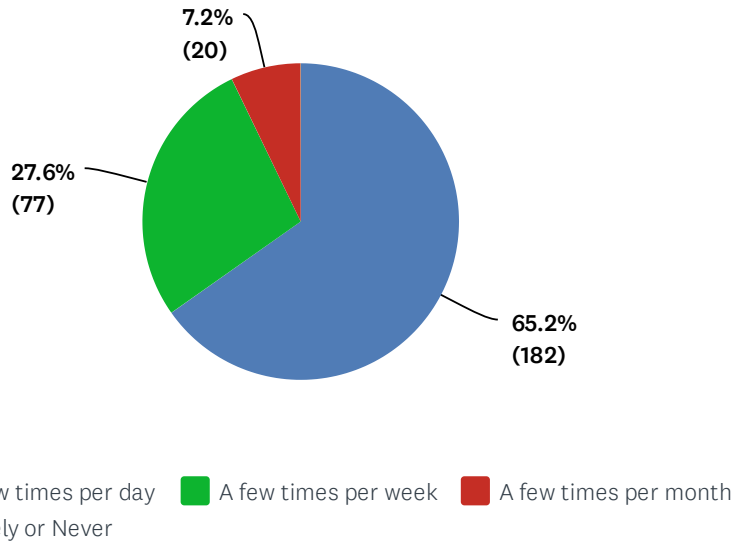
Answered: 279 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	17.2%	48
No	82.8%	231
TOTAL		279

Q2 How frequently do you use the intersection of Range Road and Two Mile Hill Road?

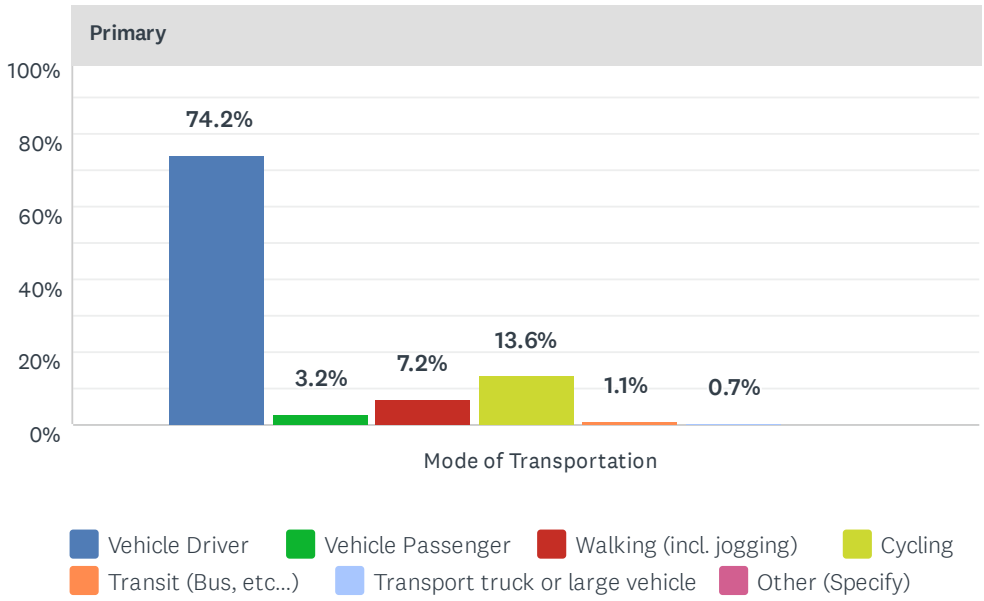
Answered: 279 Skipped: 0

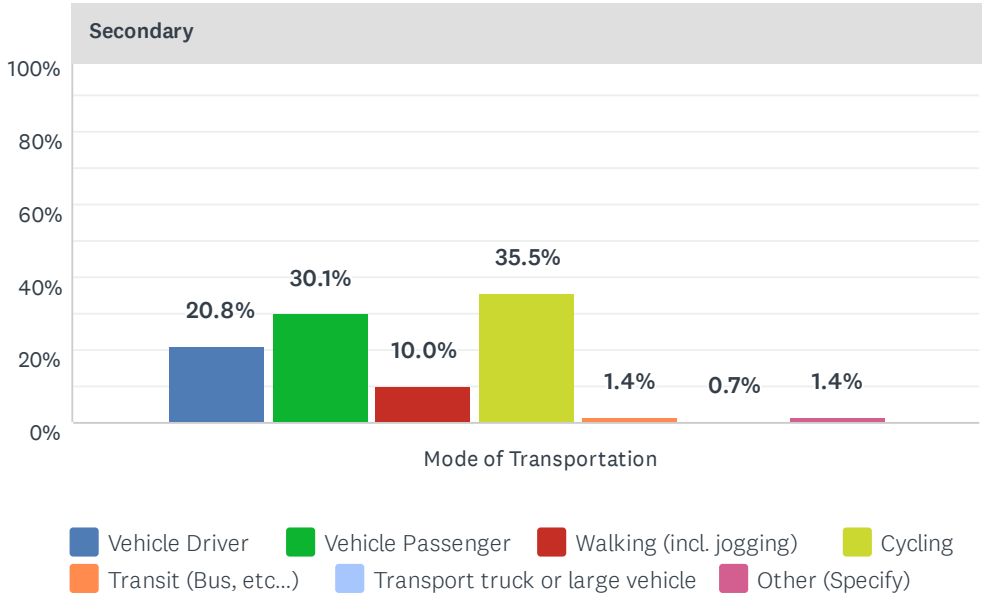


ANSWER CHOICES	RESPONSES	
A few times per day	65.2%	182
A few times per week	27.6%	77
A few times per month	7.2%	20
Rarely or Never	0.0%	0
TOTAL		279

Q3 What are your PRIMARY and SECONDARY modes of transportation when using this intersection?

Answered: 279 Skipped: 0





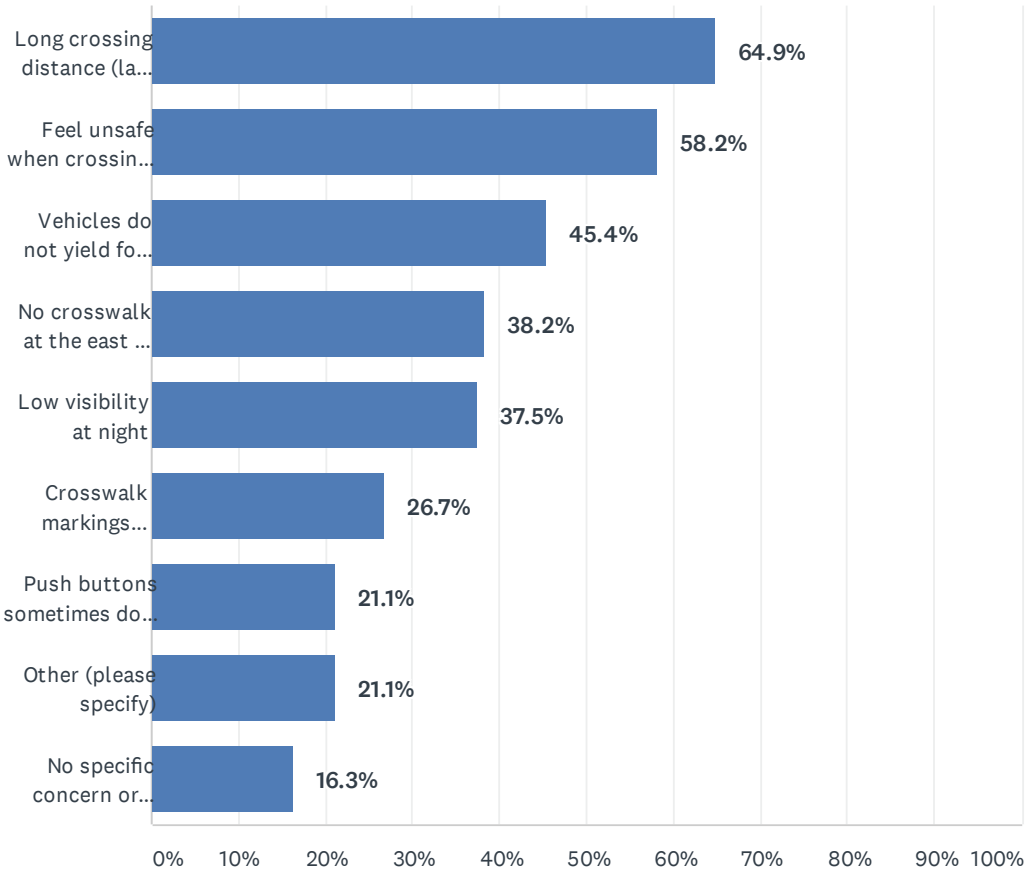
Primary

	VEHICLE DRIVER	VEHICLE PASSENGER	WALKING (INCL. JOGGING)	CYCLING	TRANSIT (BUS, ETC...)	TRANSPORT TRUCK OR LARGE VEHICLE	OTHER (SPECIFY)	TOTAL
Mode of Transportation	74.2% 207	3.2% 9	7.2% 20	13.6% 38	1.1% 3	0.7% 2	0.0% 0	279

Secondary								
	VEHICLE DRIVER	**VEHICLE PASSENGER**	**WALKING (INCL. JOGGING)**	**CYCLING**	**TRANSIT (BUS, ETC...)**	**TRANSPORT TRUCK OR LARGE VEHICLE**	**OTHER (SPECIFY)**	**TOTAL**
Mode of Transportation	20.8% 58	30.1% 84	10.0% 28	35.5% 99	1.4% 4	0.7% 2	1.4% 4	279

Q4 Please indicate what are your main observations and/or concerns with this intersection as a pedestrian (Check all relevant boxes):

Answered: 251 Skipped: 28



ANSWER CHOICES	RESPONSES	
Long crossing distance (large intersection size)	64.9%	163
Feel unsafe when crossing the intersection (conflicts with other road users)	58.2%	146
Vehicles do not yield for pedestrians	45.4%	114
No crosswalk at the east leg to cross Two-Mile Hill Road.	38.2%	96
Low visibility at night	37.5%	94
Crosswalk markings difficult to see	26.7%	67
Push buttons sometimes do not trigger pedestrian crossing signal	21.1%	53
Other (please specify)	21.1%	53
No specific concern or observation.	16.3%	41
Total Respondents: 251		

#	OTHER (PLEASE SPECIFY)	DATE
1	South side access to bike trail by cyclists conflicts with cars waiting on Range Road.	9/14/2020 11:24 PM
2	Vehicles do not stop before the pedestrian intersection, sometimes they stop on or beyond it. In both cases it makes crossing on foot dangerous	9/14/2020 4:11 PM
3	zero priority for pedestrians - even if you reach the intersection when the light is green, and it stays green for a long time, the walk signal will not come on until the next full cycle. The lights are not smart - even if there are zero cars on 2 mil, and the light is still green, it can take a long time for the cycle to change. check out other signals - they stay green based on the demand from other users, and switch really quickly	9/14/2020 8:49 AM
4	Curb extensions shorten crossing distances and allow crossing bicyclists and pedestrians to make use of shorter gaps. They may be used in conjunction with a variety of other intersection treatments, and should only be used as a stand-alone crossing device where they will provide additional crossing gaps in a location with insufficient existing crossing opportunities.. A bicycle forward stop bar—used in conjunction with a curb extension—is placed closer to the intersection than the motor vehicle stop bar in a location that does not block the crosswalk. Encouraging bicyclists to stop at the nose of the curb extension helps bicyclists take full advantage of the design by decreasing the crossing distance. It also improves bicyclists' view of cross traffic and provides better visibility of bicyclists waiting for a crossing opportunity. Colored paint may be used to bring further attention to this space. Read More+ Intersection crossing markings or standard crosswalks can be used to highlight to cross traffic that bicyclists are crossing the roadway in that location. They may be used with crossing warning signs for bicycles or bicycles and pedestrians (MUTCD sign W11-1 or W11-15). A raised intersection is a Speed Management device that increases motorist awareness of the crossing while reducing motor vehicle speeds on the cross street. See Route Planning for a discussion of bicycle boulevards and emergency vehicle routes. Crossings of higher order streets with three or more travel lanes and posted speeds over 35 mph should improve safety and comfort for bicyclists. Treatments include the following elements: A Median Refuge Island allows bicyclists to cross one direction of traffic at a time when gaps in traffic allow. Islands placed in the middle of the intersection narrow the cross street, providing some speed management benefit. They can also be used to prohibit left turns by motor vehicles on the cross street and through movements on the bicycle boulevard, thus also acting as a volume management treatment. Median refuge islands should be wide enough along bicycle boulevards to accommodate more than one bicyclist or longer bicycles such as cargo bikes and trail-a-bikes. Active Warning Beacons can be placed across a bicycle boulevard crossing of a major street. Rectangular Rapid Flash Beacons (RRFBs) are commonly used to alert drivers to crossing bicyclists and increase yielding behavior." Hybrid Beacons can facilitate bicycle crossing of a busy street where cross traffic does not stop but side street volumes do not warrant installation of a conventional traffic signal, or where a full traffic signal installation is not desired.	9/14/2020 8:48 AM
5	Vehicles do not stop at stop line before turning Right on Red. Would prefer if Stop line sign indicated it was a Stop Line and not just a means of triggering a green light (ie, for cars travelling south on Range Rd turning Right onto 2 Mile Hill). Enforcement of traffic laws would be appreciated.	9/13/2020 11:17 PM
6	(1) Thank you for working to redesign this intersection. From a pedestrian/cyclist standpoint, it is an unfriendly and dangerous intersection. (2) Pedestrians and cyclists should be prioritized over vehicles, or at least given equal standing - this is not done in Whitehorse. Maybe if pedestrians/cyclists are given priority, more people will feel safe walking cycling. Treat cyclists/pedestrians at least as well as you treat cars!!! (2) Vehicles rarely respect the cross-walk markings (whether visible or not), and attention is not focussed on pedestians (most guilty parties are drivers turning right off Range Road to westbound on 2-mile hill - they are laser-focussed on traffic cresting the hill. (3) In winter, when the sidewalk is piled with plowed snow, the pushbuttons are hard to get to as they are on the wrong side of the poles. This is actually not unusual in Whitehorse (e.g. the new Range Rd./Alaska Highway intersection, and Ogilvie/2nd).	9/13/2020 9:24 PM
7	No warning the light is going to turn orange (like 2 Mile Hill @ Alaska Highway coming down from the CGC)	9/12/2020 8:09 PM
8	Never a pedestrian...	9/12/2020 5:38 AM
9	Low visibility for oncoming traffic when making a left turn heading east. People drive much too	9/11/2020 3:22 PM

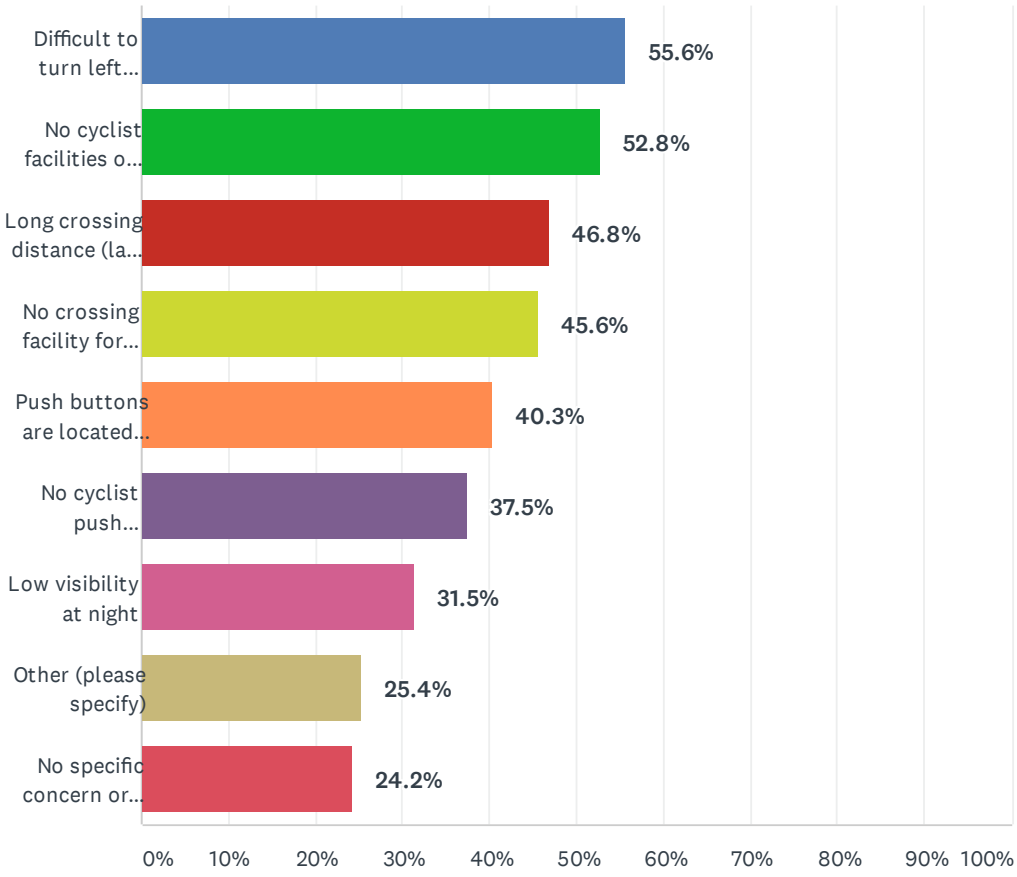
	fast and race the lights in all directions. Unclear for cyclers how to use the intersection safely.	
10	cyclists not obeying traffic rules and riding across the intersection	9/11/2020 9:54 AM
11	it's hard to get across range road on the north side of two mile hill road	9/11/2020 9:40 AM
12	Bicycle boulevards are streets with low motorized traffic volumes and speeds, designated and designed to give bicycle travel priority. Bicycle Boulevards use signs, pavement markings, and speed and volume management measures to discourage through trips by motor vehicles and create safe, convenient bicycle crossings of busy arterial streets.	9/11/2020 9:21 AM
13	1. No side walk approach in front of post office 2. North of Normandy parking lane used as lane in front of Takhini Arena making Normandy crosswalk dangerous and left turn into Normandy unsafe. 3. Stop line on Range heading south into intersection is quite set back, leads to cars stopped on crosswalk. Cars turning right here also stop on crosswalk.	9/11/2020 9:08 AM
14	Cars passing on the right in the parking lane	9/10/2020 9:29 PM
15	push button triggers light but by the time you get to the crosswalk the walk sign is off (crossing range road on the north side of 2 mile hill heading east)	9/10/2020 4:38 PM
16	Not enough time to cross the intersection	9/10/2020 2:37 PM
17	Contra-flow bicycle lanes are bicycle lanes designed to allow bicyclists to ride in the opposite direction of motor vehicle traffic. They convert a one-way traffic street into a two-way street: one direction for motor vehicles and bikes, and the other for bikes only. Contra-flow lanes are separated with yellow center lane striping. Combining both direction bicycle travel on one side of the street to accommodate contra-flow movement results in a two-way cycle track. The contra-flow design introduces new design challenges and may introduce additional conflict points as motorists may not expect on-coming bicyclists.	9/10/2020 9:00 AM
18	too many cars run yellow and red lights	9/10/2020 8:59 AM
19	The light to cross two mile hill is quick. You have to really hustle to make it across before the light turns red.	9/9/2020 4:10 PM
20	Intersections are the place where the most vehicle-bike conflicts occur. In 2017, 43% of urban bicyclist fatalities occurred at intersections. On many streets, large turn radii and wide lanes encourage drivers to make sweeping, fast turns. These design decisions increase exposure and risk for people walking and biking, reduce the safety and comfort of the bike network, and discourage cycling. As cities work to make streets safer and more welcoming for bicyclists of all ages and abilities, intersection design is key.	9/9/2020 8:48 AM
21	As a cyclist the crosswalk buttons are on the wrong side of the pole	9/9/2020 7:28 AM
22	Universal Accessibility Pedestrian Ramps Pedestrian ramps are inclined planes facilitating the access of sidewalks for people using wheelchairs and other personal mobility devices, as well as those pushing strollers, carts, or heavy luggage. They are generally composed of three elements: the slope, the top landing, and the side flares. Slope The slope should be constructed of non-slip materials and be of a maximum slope of 1:10 (10%)—ideally 1:12 (8%). The ramp width should be as wide as the clear path: minimum 1.8 m wide, 2.4 m recommended. Top Landing The top landing is located at the top of the ramp and allows ramp access across side flares. The landing should be as wide as the clear path or minimum 1.8 m wide. Side Flares Side flares are intended to prevent tripping hazards. Side flare slopes cannot exceed 1:10. Grade breaks at the top and the bottom must be perpendicular to the direction of the ramp.	9/8/2020 9:36 AM
23	Develop car-free areas, discourage over-use of cars in city centres, and prevent parking on pavements and pedestrian crossings. Develop national pedestrian planning guidance for local administrations. Plans should routinely consider the impact of projects on pedestrians and cyclists. They should also include targets for future levels of walking.	9/8/2020 9:24 AM
24	Intersection of two miles road and range road is sustaining increased traffic every year. I am concerned by safety and lack of efficiency of this intersection. In the morning, range road traffic extends almost to the young offender center. Right turn is affected by people parking on the street. Bus takes space in the lane. Bikers and walkers are at risk. In the afternoon, the biggest concern is the left turn from south two miles hill to range road. Cars always cross on the yellow lights. Space is limited on the flashing green light. I am so tired of this intersection, especially in the morning.	9/8/2020 7:06 AM

25	Longer left turn light on southbound 2 mile hill	9/7/2020 4:19 PM
26	Redesign your roadway If none of these solutions are the right fit for a problem area in your community, you may need to redesign the area entirely. Look into solutions like raised crosswalks, road diets, pedestrian crossing islands and curb extensions. Then, consult with other experts to determine what makes the most sense for the problem area's unique challenges. While pedestrian safety is top of mind for many, tight budgets and competing priorities often get in the way. Don't let them. Identify the right nighttime pedestrian safety solutions for the right places in your community by doing your research and working with reputable providers — so no one else becomes a statistic.	9/7/2020 10:03 AM
27	neck downs are neded, reduce exposure to traffic	9/6/2020 9:43 AM
28	Coming from Range Road from Takhini and turning onto Two Mile Hill to go downtown there often is not enough time for traffic to turn. Need a better turning system or longer light time or a left turn arrow.	9/5/2020 9:42 AM
29	Raised cross walks will allow better visability to traffic	9/5/2020 8:53 AM
30	Vehicles using range road as a doubled lanes road. If a car isn't parked in front of the duplexes others cars use it as a driving lanes through Normandy	9/4/2020 8:51 PM
31	Too many vehicle lanes	9/4/2020 3:17 PM
32	a raised crosswalk would make pedestrians more visable to traffic	9/4/2020 12:01 PM
33	hard for vehicles to see pedestrians when making long left turn and watching for other traffic, especially in dark winter rush-hours	9/3/2020 11:12 PM
34	Confusion about where to be as a cyclist	9/3/2020 12:51 PM
35	Not enough time for the Walk Sign to be on. Whay about a more visible flashing device to show motorists that pedestrians have the walk sign.	9/3/2020 11:12 AM
36	Little thought to bike path connectivity	9/3/2020 9:47 AM
37	reduce size of intersection, raised cross walks will provide better visability	9/3/2020 9:02 AM
38	reduce speed limits!!	9/3/2020 8:55 AM
39	Drivers speeding through red lights	8/31/2020 9:39 PM
40	The green light is NOT long enough	8/31/2020 12:04 PM
41	Light sometimes doesn't last long enough.	8/29/2020 11:49 PM
42	Vehicles speed like crazy through this intersection even on red lights	8/29/2020 11:18 AM
43	I notice cyclist riding on the road they don't respect the signal lights they weave between the road and the sidewalks at most intersections they disregard the lights if any education is required education some cyclist As a driver I find it hard to keep track of these cyclists weaving through the streets and road I don't think this city should spend a lot of money changing this intersection there is a crosswalk and many people use it More lights is what is needed.	8/29/2020 9:17 AM
44	The overall layout is not ideal for pedestrian crossing	8/28/2020 8:37 PM
45	Cars speeding up Two Mile Hill often run the light because they're going too fast to stop.	8/28/2020 4:55 PM
46	Push button way too far from crossing point (northwest corner)	8/28/2020 9:34 AM
47	Very unsafe for pedestrians and cyclists due to inattentive drivers and poor intersection design	8/28/2020 7:51 AM
48	The pedestrian crossing light is too short to get across before it begins to change.	8/28/2020 7:06 AM
49	Traffic passing on the right	8/27/2020 6:18 PM
50	too much stimulation for drivers to see pedestrians	8/27/2020 5:11 PM
51	Vehicles turning right don't always pay attention	8/27/2020 9:48 AM
52	Vehicle drivers are so focused on other cars coming up two mile hill on their left, they sometimes don't see pedestrians coming down the hill to their right	8/27/2020 8:51 AM

53	fast drivers on two mile hill	8/25/2020 9:03 PM

Q5 Please indicate what are your main observations and/or concerns with this intersection as a cyclist (Check all relevant boxes):

Answered: 248 Skipped: 31



ANSWER CHOICES	RESPONSES	
Difficult to turn left through the intersection	55.6%	138
No cyclist facilities or bike-friendly crosswalks (cross-rides)	52.8%	131
Long crossing distance (large intersection size)	46.8%	116
No crossing facility for cyclists at the east leg to cross Two Mile Hill Road.	45.6%	113
Push buttons are located away from my bike facility.	40.3%	100
No cyclist push buttons/cyclist signal	37.5%	93
Low visibility at night	31.5%	78
Other (please specify)	25.4%	63
No specific concern or observation.	24.2%	60
Total Respondents: 248		

#	OTHER (PLEASE SPECIFY)	DATE
1	Unclear where I'm supposed to be biking on Range Road - in centre traffic lane? edge traffic lane? sidewalk? Becomes especially challenging at AM peak when traffic is backed up to Rhine Way	9/14/2020 10:50 PM
2	I had a near miss crossing as a cyclist on the S side going W-E on 2 mile hill because of a vehicle going right on red. There was another vehicle stopped at the light so this car couldn't see me crossing and nearly hit me. I strongly support no pork chops or right on reds for vehicles.	9/14/2020 10:32 PM
3	a better way for cyclists to access from range road the south side 2 mile bike path.	9/14/2020 9:56 PM
4	Vehicles frequently run red light at this intersection (north and southbound on Hamilton). I have seen dozens of near misses, have nearly been hit several times and observed a number of collisions here.	9/14/2020 7:00 PM
5	Because the intersection is so dangerous, I bike on the pedestrian crossings. Vehicles do not stop before the pedestrian intersection, sometimes they stop on or beyond it. In both cases it makes crossing on a bicycle dangerous	9/14/2020 4:11 PM
6	It doesn't feel like cyclists belong there. I have had cars honk at me or turn in front of me as I continue straight through the intersection and stay on Range Road (from the city building side to the college side)	9/14/2020 3:20 PM
7	vehicles coming up and down 2 mile hill turning towards Takhini don't see bikes crossing	9/14/2020 11:05 AM
8	Vehicle turning left or right rarely slow/stop for pedestrians and cyclists, even when we have the right of way. I've almost been hit several times.	9/14/2020 10:57 AM
9	Even when walk signal or green light is on, cars rarely stop for me to go across crosswalk on my bike. I've almost been hit multiple times heading downhill at the Range Rd/2 Mile intersection.	9/14/2020 10:55 AM
10	very confusing if i have the right to cross on a red hand, or only on the green; must dismount at some locations to reach the puch button, especially in winter when there is snow piled all over; when coming up 2 mile and vehicles are turning right onto range rd north, it is very dangerous as vehciles are coming from behind; multi-use means that I am travelling against traffic half the time, and the vehucle drivers are not expecting it; dislike multi-use being directly adjacent to the curb - move it away from the curb and or provide a physical barrier	9/14/2020 8:49 AM
11	Signalized Intersections Full traffic signals may be added to create gaps, overcome visibility issues, or force motorists to stop if needed (see Signals). Signal installation can also alleviate a congestion problem on the main road caused by a high volume bicycle/pedestrian crossing by limiting when bicyclists or pedestrians can cross. On streets with few crossing gaps and high motor vehicle speeds and volumes, a bicycle/pedestrian-actuated hybrid beacon should be considered. This will reduce delay at non-peak times when bicyclists do not otherwise need to wait for a gap in traffic on the cross street as well as for users on the cross street, who are not delayed with a full signal. It also reduces the likelihood of generating cut-through traffic on the bicycle boulevard route. Read More+ If the intersection is fully signalized, it shall provide bicycle signal detection and actuation. Volume management may be required so that the signal does not attract unwanted vehicular cut-through traffic. However, forced turns may increase the frequency of right-turn conflicts between bicyclists and motorists. Enhancements to signals on bicycle boulevards to address these issues include the following treatments: Bicycle Signal Heads can be added to a hybrid beacon to improve function and safety for bicyclists. See Bicycle Signal Heads for additional guidance A separate bicycle signal head can provide a leading bicycle signal phase, which allows bicyclists to begin crossing the street in advance of other traffic. Signs that prohibit through movements, right-in/right-out splitter islands, and partial closures are volume management strategies to reduce cut-through motor vehicle traffic. Signs are typically less effective than physical diversion. Bike boxes allow bicyclists to get to the head of the queue at signalized intersections. This allows them to take advantage of the typically short green time provided to the minor roadway at an intersection with a major roadway. Such boxes also increase bicyclist visibility to drivers. Parking removal should be considered where a bicycle boulevard has insufficient space to provide the ingress lane to a bike box	9/14/2020 8:48 AM
12	Cars turning right onto takhini always cut me off when I'm going up two mile towards cgc	9/14/2020 7:35 AM

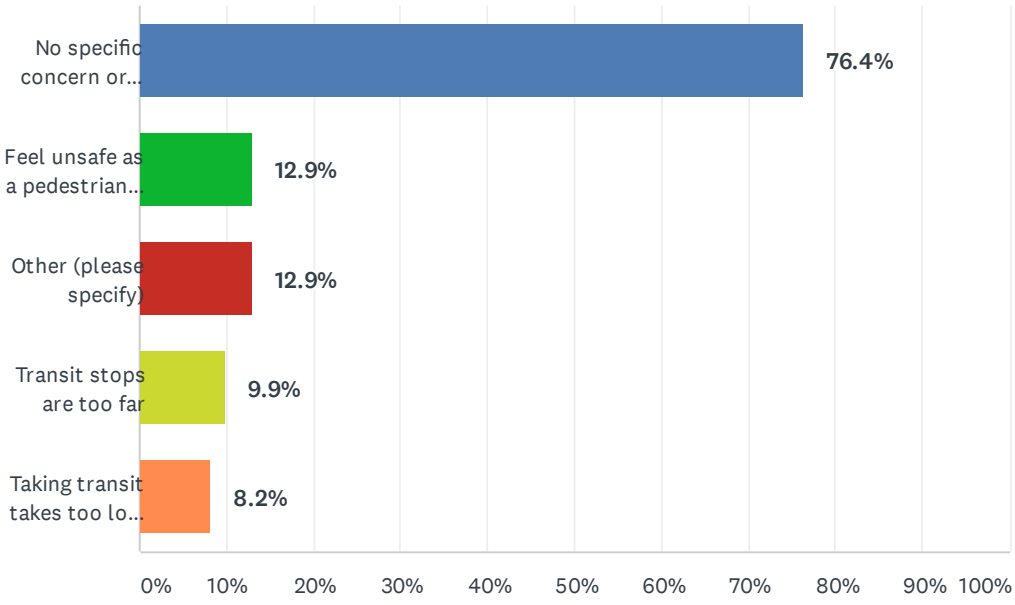
13	None never hiked up there so can’t comment either way	9/14/2020 5:20 AM
14	Right and Left turning cars do not yield to pedestrians or cyclists. Difficult for left turning drivers (east bound turning north onto Range Rd) to see cyclists and pedestrian on crosswalk	9/13/2020 11:17 PM
15	5. (1) When eastbound on Range Rd., you can sometimes push the button on the post (aside: why in this day and age does a pedestrian need to push a button?) and have the green signal turn to walk, but even RIDING A BICYCLE the light will already be blinking red BEFORE you even enter the crosswalk - to put it mildly, the button is way too far from the intersection. (2) The intersection is so large that 2-3 left-turning-onto-RangeRd-northbound vehicles will often push past their advance green and try to cross when it's the cyclist/pedestrian's turn.	9/13/2020 9:24 PM
16	No path on Range rd at intersection	9/13/2020 9:07 PM
17	heading north on Range Road the stop line interferes with cyclists crossing. Vehicles are stopped and in theway.	9/12/2020 8:43 PM
18	Never cycle	9/12/2020 5:38 AM
19	long crossing distance makes it difficult to share the green with oncoming drivers who want to turn left	9/11/2020 3:37 PM
20	Green light heading along range rd is not green for long enough for cyclers to make it through the intersection and vehicles to follow. Drivers get impatient and frustrated with cyclers.	9/11/2020 3:22 PM
21	more education required to ensure all are following traffic controls	9/11/2020 9:54 AM
22	Design Elements Many local streets with low existing speeds and volumes offer the basic components of a safe bicycling environment. These streets can be enhanced using a range of design treatments, tailored to existing conditions and desired outcomes, to create bicycle boulevards. Design treatments are grouped into measures that provide the following benefits. Route Planning: Direct access to destinations Signs and Pavement Markings: Easy to find and to follow Speed Management: Slow motor vehicle speeds Volume Management: Low or reduced motor vehicle volumes Minor Street Crossings: Minimal bicyclist delay Major Street Crossings: Safe and convenient crossings Offset Crossings: Clear and safe navigation Green Infrastructure: Enhancing environments Many of the treatments presented in this section not only benefit people on bicycles, but also help create and maintain “quiet” streets that benefit residents and improve safety for all road users.	9/11/2020 9:21 AM
23	Bicyclists want the most convenient rules of the MV act to use.whatever gets them there the fastest	9/10/2020 8:33 PM
24	No There's no bikelane which often confuses drivers ans requires careful navigation by cyclists. Left turns are made difficult as most drivers don't understand cyclists' hand signals and don't give the right of way when they should.	9/10/2020 10:03 AM
25	Contra-Flow Bike Lane Benefits Provides connectivity and access to bicyclists traveling in both directions. Reduces dangerous wrong-way riding. Decreases sidewalk riding. Influences motorist choice of routes without limiting bicycle traffic. Decreases trip distance, the number of intersections encountered, and travel times for bicyclists by eliminating out-of-direction travel. Allows bicyclists to use safer, less trafficked streets.	9/10/2020 9:00 AM
26	too many cars run yellow and red lights	9/10/2020 8:59 AM
27	No safe connection to 2 mile cycle trail	9/9/2020 11:23 PM
28	cyclists have to cross the street when crossing 2 mile hill. Bikes riding down range road often cut infront of drivers to ride down 2 mile hill.	9/9/2020 4:10 PM
29	Don’t Give Up at the Intersection expands the NACTO Urban Bikeway Design Guide, adding detailed guidance on intersection design treatments that reduce vehicle-bike and vehicle-pedestrian conflicts. This guidance covers protected bike intersections, dedicated bike intersections, and minor street crossings, as well as signalization strategies to reduce conflicts and increase comfort and safety. Used in concert with NACTO’s Urban Bikeway Design Guide and Designing for All Ages and Abilities, this guidance provides the tools cities need to build comprehensive, connected, safe bike networks.	9/9/2020 8:48 AM
30	bike path slopes downward as it intersects range road on south side of intersection, making it very dangerous in slippery winter conditions to turn right from bike path to head south on range road.	9/8/2020 8:22 PM

31	Vehicle drivers ignore cyclists or are even aggressive toward us	9/8/2020 2:47 PM
32	Raised cycle tracks are bicycle facilities that are vertically separated from motor vehicle traffic. Many are paired with a furnishing zone between the cycle track and motor vehicle travel lane and/or pedestrian area. A raised cycle track may allow for one-way or two-way travel by bicyclists. Two-way cycle tracks have some different operational characteristics that merit additional consideration. Raised cycle tracks may be at the level of the adjacent sidewalk, or set at an intermediate level between the roadway and sidewalk to segregate the cycle track from the pedestrian area. A raised cycle track may be combined with a parking lane or other barrier between the cycle track and the motor vehicle travel lane (refer to protected cycle tracks for additional guidance). At intersections, the raised cycle track can be dropped and merged onto the street (see cycle track intersection approach), or it can be maintained at sidewalk level, where bicyclists cross with pedestrians, possibly with a dedicated bicycle signal. When placed adjacent to a travel lane, one-way raised cycle tracks may be configured with a mountable curb to allow entry and exit from the bicycle lane for passing other bicyclists or to access vehicular turn lanes. This configuration has also been known as a ‘raised bike lane.’	9/8/2020 9:36 AM
33	Provide adequate waiting areas for pedestrians to see oncoming traffic and increase visibility for drivers by adding curb extensions or refuge islands. Restrict parking or install curb extensions in order to make pedestrians more visible to motorists and cars more visible to pedestrians. This is called street daylighting and must be provided at all crossings.	9/8/2020 9:24 AM
34	Difficult to turn right (range road to CGC) due to short right-turn lane, lots of people turn left through the intersection and cars park all day-night long for years on range road. Parking should be prohibitted on range road to have safety walk cyclist lane and help with the right turn. People does have back alley to park. Please put a no-parking zone.	9/8/2020 7:06 AM
35	I use the pedestrian crosswalk frequently as be repeatedly have vehicles that do not yield to pedestrians or cyclists	9/7/2020 9:36 PM
36	Focus on left-turn collisions Left turns are the cause of most intersection-related accidents, according to the NHTSA, even outnumbering right turn crashes in heavily congested city streets. This poses a major threat to pedestrians – especially at night – because left-turning drivers are often distracted by watching oncoming traffic, only looking out for pedestrians as “an afterthought,” states the Oregon Transportation Research and Education Consortium (OTREC). Add a traffic signal with a green arrow for left turners, providing them with a protected right of way for a short time when pedestrians are not permitted to enter the crosswalk. The “green light for all” method may seem most efficient, but nighttime pedestrian safety must come first.	9/7/2020 10:03 AM
37	raised crosswalks are needed, increased visability to motorists is needed	9/6/2020 9:43 AM
38	Crossing from road to bike path is challenging, can be unsafe	9/5/2020 8:57 AM
39	construct neckdowns- these structures reduce interection size, greatly needed!	9/5/2020 8:53 AM
40	Winter maintence of bike paths	9/4/2020 3:17 PM
41	please consider neckdowns to reduce the size of intersection	9/4/2020 12:01 PM
42	reduce size of intersection, construct neckdowns/green space	9/3/2020 9:02 AM
43	raised crosswalks provide better visability	9/3/2020 8:55 AM
44	As a cyclist, I mostly use the intersection to go straight across. If I want to turn, I usually connect through the Takhini Arena (parking lot or road behind the arena), or through Takhini North towards the Alaska Highway, avoiding the intersection entirely. That way, I don't have to wait at any traffic light. So I will keep avoiding the intersection, no matter the improvements.	9/2/2020 12:42 AM
45	There is no easy way to access the bike path on the south side of two mile heading into downtown.	9/1/2020 8:28 AM
46	Cars that don't slow down at red lights for right turns. Drivers that treat right lane as slip lane regardless of light colour.	8/31/2020 2:27 PM
47	crossing time is too short on signal	8/31/2020 9:50 AM
48	Vehicles turning right don't always see cyclists crossing Range Rd.	8/31/2020 9:50 AM

49	Laneway for cyclists is too narrow and to cross the intersection means having to ride very close to vehicles. Most vehicles expect the cyclist to give way and ride off into the soft shoulder instead of treating the cyclist like another vehicle and giving them the space they need. Vehicles driving too fast through the intersection.	8/30/2020 10:21 AM
50	Difficult to get from road to bike paths on far side of the intersection without having to become or use pedestrian crosswalks.	8/29/2020 11:49 PM
51	Not understanding That light changes all the time There is an push button on the right hand side of the road If that is the issue then my issue ,is all those pot holes through out my city I have issues with some of these cyclist they are disrespectful to the rules of the road They whip across the roads to the sidewalks then back to the roads These cyclist don't care about road conditions Many times on my way to work I packed my brakes to avoid hitting it	8/29/2020 9:17 AM
52	I have to bike like a pedestrian, can't make the left turn from Range Road onto the Two Mile Hill bike path on the far side without risking car conflicts	8/28/2020 4:55 PM
53	Going south along Range Road there is no obvious/easy way to get onto either of the bike paths heading down the hill. Even as an experienced cyclist it feels dangerous trying to navigate from Range Road onto either path.	8/28/2020 9:34 AM
54	Impossible to turn left safely onto the bike path on 2 mile	8/28/2020 7:51 AM
55	The through crossing is challenging and often dangerous both north and south bound when many vehicles are turning right into two mile hill	8/28/2020 7:06 AM
56	Cars ignoring me and make the place in safe	8/27/2020 6:18 PM
57	during peak commute hours cars are crazy running lights and it is scary on a bike.	8/27/2020 4:27 PM
58	Not a cyclist, own a car	8/27/2020 4:21 PM
59	Under the Motor Vehicles Act, cyclists should NOT be using crosswalks without dismounting. Other than that they are supposed to be like vehicles. Avoiding hypothetical conflicts without any real evidence is a waste of money.	8/27/2020 12:29 PM
60	sometimes cyclists don't slow down/stop and can surprise the vehicles	8/27/2020 12:09 PM
61	I typically cross at Normandy and Range and then cycle through the Takhini Arena parking lot to avoid the intersection	8/27/2020 9:02 AM
62	Size of intersection means that cars feel like they can make very fast right turns which mean that pedestrian crossings are not safe for cyclists.	8/27/2020 8:11 AM
63	fast drivers on two mile hill	8/25/2020 9:03 PM

Q6 Please indicate what are your main observations and/or concerns with this intersection as a transit user (Check all relevant boxes):

Answered: 233 Skipped: 46



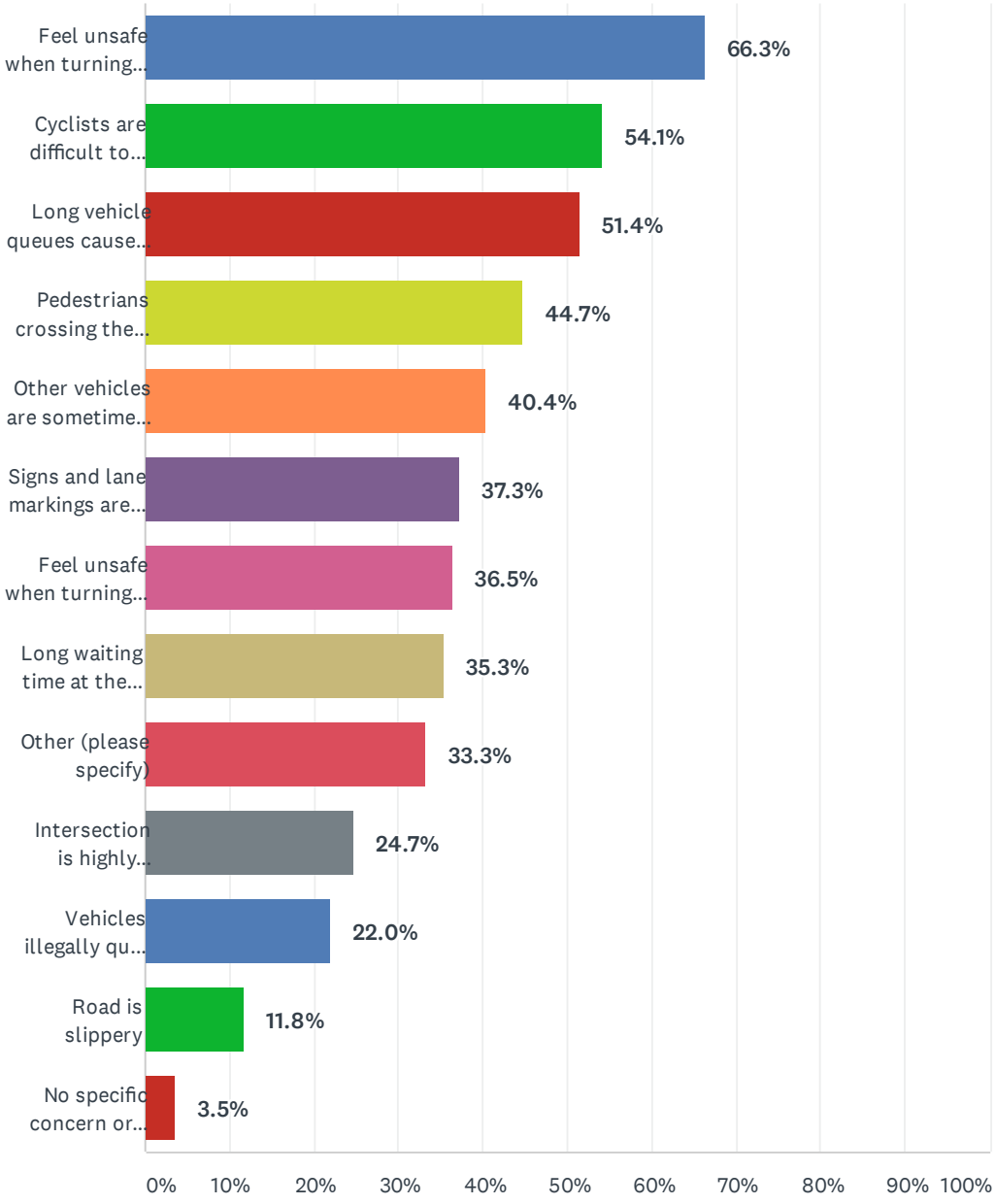
ANSWER CHOICES	RESPONSES	
No specific concern or observation.	76.4%	178
Feel unsafe as a pedestrian getting to/from transit stops near this intersection	12.9%	30
Other (please specify)	12.9%	30
Transit stops are too far	9.9%	23
Taking transit takes too long through this intersection	8.2%	19
Total Respondents: 233		

#	OTHER (PLEASE SPECIFY)	DATE
1	no trasnit stop indicated for the corner by the post office	9/14/2020 8:49 AM
2	Benefits Provides bicycle access across streets that can be major barriers along the bicycle boulevard and that compromise bicyclist safety. Because bicycle boulevard retrofits to local streets are typically along facilities without existing signalized accommodation at crossings of collector and arterial roadways, these treatments significantly improve connectivity and access. Reduces the crossing distance and improves visibility of bicyclists, encouraging drivers to allow other users to cross safely. Aids pedestrian crossing and improves pedestrian connectivity. Raises awareness for both bicyclists and drivers of potential conflict areas. Encourages or requires driver yielding behavior, allowing bicyclists to cross. Minimizes delay for bicyclists on the bicycle boulevard. Promotes the multi-modal nature of the corridor. Signals separate bicycle movements from conflicting motor vehicle, streetcar, light rail, or pedestrian movements. Provides priority to bicycle movements at an intersection (e.g., with a leading bicycle interval or bike box). Protects bicyclists in the intersection, which may improve real and perceived safety and comfort.	9/14/2020 8:48 AM
3	NA	9/14/2020 5:47 AM
4	Never taken transit there can’t comment either way	9/14/2020 5:20 AM
5	I am a rare transit user.	9/13/2020 11:17 PM
6	Never take transit	9/12/2020 5:38 AM
7	Speed Management measures for bicycle boulevards bring motor vehicle speeds closer to those of bicyclists. Reducing speeds along the bicycle boulevard improves the bicycling environment by reducing overtaking events, enhancing drivers’ ability to see and react, and diminishing the severity of crashes if they occur. Speed management is critical to creating a comfortable and effective bicycle boulevard. Streets developed as bicycle boulevards should have 85th percentile speeds at 25 mph or less (20 mph preferred). Speed management (traffic calming) measures can be divided into vertical or horizontal features. These measures can be implemented individually or in combination to increase their efficacy. Common combinations include raised crosswalks with pinchpoints, raised intersections with pinchpoints, and speed humps with center island narrowings, chicanes, or pinchpoints. Read More+ Reduced Speed Limits Bicycle boulevards should have a maximum posted speed of 25 mph. Some jurisdictions are starting to sign residential speed limits below 25 mph. Simply changing the speed limit is unlikely to reduce speeds; speed management and street design techniques are necessary. Once actual speeds decrease, lower speed limit signs can reinforce the desired speed with regulatory control. Targeted enforcement is also recommended. Reduced speed limits may require authorizing legislation. The MUTCD designates that speed limits shall be in increments of 5 mph and requires an engineering study to reduce the speed below the statutory speed for the type of roadway. In some jurisdictions, speed limits may be reduced beyond the statutory residential speed limit. State statutory limits might restrict the maximum speed limit that can be established on a particular road.	9/11/2020 9:21 AM
8	cars using the bus lane to pass cars on the right	9/10/2020 9:29 PM
9	A bike box is a designated area at the head of a traffic lane at a signalized intersection that provides bicyclists with a safe and visible way to get ahead of queuing traffic during the red signal phase.	9/10/2020 9:00 AM
10	too many cars run yellow and red lights	9/10/2020 8:59 AM
11	I do not use transit	9/9/2020 5:11 PM
12	Protected Intersections Physically separated crossings that provide a high degree of comfort and safety for people of all ages and abilities. This design can reduce the likelihood of highspeed vehicle turns, improve sightlines, and dramatically reduce the distance and time during which people on bikes are exposed to conflicts.	9/9/2020 8:48 AM
13	I rarely take transit through this intersection, unsure.	9/8/2020 8:22 PM
14	Typical Applications Raised cycle tracks can be considered wherever a bicycle lane would be the standard recommendation. They may be most beneficial: Along higher speed streets with few driveways and cross streets. Along streets on which bike lanes would cause many bicyclists to feel stress because of factors such as multiple lanes, high traffic volumes, high speed traffic, high demand for double parking, and high parking turnover. On streets for which	9/8/2020 9:36 AM

	conflicts at intersections can be effectively mitigated using parking lane setbacks, bicycle markings through the intersection, and other signalized intersection treatments. On streets with numerous curves where vehicle encroachment into bike lanes may be a concern. Along streets with high bicycle volumes. Special consideration should be given at transit stops to manage bicycle & pedestrian interactions. See cycle track intersection approach for transitioning strategies.	
15	Keep crossing distances as short as possible using tight corner radii, curb extensions, pedestrian refuge islands, and medians. Medians and refuge islands create a two-stage crossing for pedestrians, which is easier and safer when crossing multiple lanes of traffic.	9/8/2020 9:24 AM
16	Install a crosswalk illuminator A simple solution to lack of visibility at night is to add light, but it's important to add the right kind of light. Streetlights beam light down on small sections of road, often not reaching the middle where pedestrians are furthest from safety. For two-lane crossings, consider adding the SafeWalk™ Crosswalk Illuminator in tandem with LED-enhanced signs or RRFBs. They use a flood light to illuminate the approach area of the crosswalk and a beam light to illuminate the middle, ensuring motorists' can easily see pedestrians. Crucially, activation can happen concurrently with LED-enhanced warning alerts and be either passively activated via thermal detection or user-actuated. This conserves energy and prevents the lights from becoming "white noise" to motorists. Illuminators are especially great for increasing pedestrian visibility at night in frequently visited areas, such as transportation stops, libraries, parks and shopping areas. Be sure to look for one with minimal glare and a 20 LUX minimum – as recommended by the FHWA – that can be retrofitted if necessary.	9/7/2020 10:03 AM
17	lower speed limits, I dont feel safe walking to the bus stop	9/6/2020 9:43 AM
18	the intersection is to large, it takes pedestrians to long to cross	9/5/2020 8:53 AM
19	Transit goes north to college but is ineffective of trying to go downtown promptly.	9/5/2020 7:33 AM
20	Buses using takhini stop as a transfer station causing back up onto 2 miles hill	9/4/2020 8:51 PM
21	consider lower speed limits- this has a major factor in accidents!!!!	9/4/2020 12:01 PM
22	lower speed limits	9/3/2020 9:02 AM
23	intersection is to large, not safe	9/3/2020 8:55 AM
24	not a transit user	8/31/2020 12:04 PM
25	Not all routes can stop near the intersection, limiting transit options.	8/29/2020 11:49 PM
26	Not a transit user	8/29/2020 9:17 AM
27	Never taken transit	8/28/2020 9:34 AM
28	Not a transit user, own a car	8/27/2020 4:21 PM
29	It's a very cold area in the winter and no benches or shelters.	8/27/2020 12:29 PM
30	needs a north bound right turn lane by takhini arena	8/27/2020 12:09 PM

Q7 Please indicate what are your main observations and/or concerns with this intersection as a driver or vehicle passenger (Check all relevant boxes):

Answered: 255 Skipped: 24



ANSWER CHOICES	RESPONSES	
Feel unsafe when turning left with (close-calls, conflicts, previous collisions, etc.)	66.3%	169
Cyclists are difficult to see and can travel in either direction	54.1%	138
Long vehicle queues cause traffic backups and delays	51.4%	131
Pedestrians crossing the road are difficult to see	44.7%	114
Other vehicles are sometimes not clearly visible causing aggressive stopping or conflicts.	40.4%	103
Signs and lane markings are unclear/hard to follow	37.3%	95
Feel unsafe when turning right with (close-calls, conflicts, previous collisions, etc.)	36.5%	93
Long waiting time at the traffic lights	35.3%	90
Other (please specify)	33.3%	85
Intersection is highly susceptible to weather conditions	24.7%	63
Vehicles illegally queue up at the intersection to make a left turn	22.0%	56
Road is slippery	11.8%	30
No specific concern or observation.	3.5%	9
Total Respondents: 255		

#	OTHER (PLEASE SPECIFY)	DATE
1	Cyclists are forced toward cars waiting on Range Road, south of intersection.	9/14/2020 11:24 PM
2	too many lanes on the road cause confusion and slow down the ability of the drivers to text and drink.	9/14/2020 9:56 PM
3	Vehicles frequently exceed speed limit on Hamilton and run red lights. Makes left turns super dangerous.	9/14/2020 7:00 PM
4	There's too many lanes, especially coming up Two Mile Hill. Vehicles swerve trying to get into what they feel is the correct lane.	9/14/2020 4:11 PM
5	No left turning light from range rd to two miles	9/14/2020 3:58 PM
6	visibility when heading downtown on Two Mile is not great if you are turning on to Range Rd	9/14/2020 3:20 PM
7	vehicle doesn't always trigger the light change from range road unless in precise location ALSO lane markings disapear in winter and most of spring all along 2 mile hill - should get raised or overhead lane markers	9/14/2020 11:05 AM
8	intersection way too big; people race as soon as the light turns yellow to get into the intersection; more than one vehcile is past the line when turning left; many times there are still cars in the intersection when the light changs, delaying when the next people can proceed	9/14/2020 8:49 AM
9	Description Route selection for bicycle boulevards is critical. Bicycle boulevards will not work if they are routed in illogical ways, if they require frequent or unnecessary stopping, or if they follow higher traffic speed and volume roadways. Bicycle boulevards have the potential to play a key role in a low-stress bikeway network, as they can complement, and provide strategic connections between, off-street paths, cycle tracks and bike lanes. Read More+ A bicycle boulevard should be considered where local streets offer a continuous and direct route along low-traffic streets (or a route interspersed with bicycle/pedestrian-only connections). A candidate route can be enhanced by treatments described elsewhere in this section: speed management to reduce traffic speeds, volume management to lessen traffic volumes, minor street crossing treatments to reduce bicyclist delay, and major street crossing treatments where a route crosses a major street. Connectivity Potential routes for bicycle boulevards should closely follow a desire line for bicycle travel that is ideally long and relatively continuous (2-5 miles, or the length of a typical urban bicycle trip). While a given route may already have low motor vehicle speeds and volumes and provide continuous travel with safe major street crossings, most corridors will present at least a few sections that call for intervention to achieve the desired low speed/volume conditions and adequate crossings. Read More+ Identification The advantage of the bicycle boulevard—bicycling on a quiet, safe and residential roadway,—can also be its downside, as these routes may be less visible and intuitive than major parallel streets. Thus one goal of marking a bicycle boulevard route is to make it as clearly visible to people as a bicycle route as are streets striped with bicycle lanes or developed with cycle tracks. A second goal is to encourage people to bicycle along the route and to alert drivers that they should expect to encounter people bicycling. A third goal of marking the route is to communicate that bicycle travel has priority on the roadway. This visibility can be accomplished through wayfinding signs and pavement markings. Additional elements, such as art, public spaces, and landscaping, further increase the visibility of the corridor. The bicycle boulevard should also be actively marketed through events, activities, and maps to help reach its potential. Facilitating awareness of and education regarding the many benefits of bicycle boulevards for all types of roadway users can improve public perception, build support for additional treatments and provide confidence to new bicyclists.	9/14/2020 8:48 AM
10	Vehicles driving at high speeds	9/14/2020 6:32 AM
11	Turning left onto range road very challenging with oncoming traffic and turning right onto two mile Hill, if you need to turn left on Alaska highway you need to cross three lanes of travel in 50 metres	9/14/2020 6:24 AM
12	Poor sight lines down 2-Mile Hill. Why not a roundabout to get everyone to slow down, yet keep traffic moving? Did you know that there used to be a roundabout at 2-Mile Hill/Alaska Highway?	9/13/2020 9:24 PM
13	Turning left from Range road to go down two mile hill... the light is far to short to clear the intersection. Only 2-3 cars can go per light cycle. There needs to be an advanced left tur signal to down two mike.	9/13/2020 9:03 PM

14	Cyclists do not following traffic laws and sometimes act as vehicles slowing traffic.	9/13/2020 3:19 PM
15	I often have to wait for a green light to turn right from Range onto 2 mile heading west because I have to make my way across three lanes of traffic to turn south on Alaska Hwy. Can be conflict with north bound vehicles turning left onto 2 mile. There is a lot of traffic changing lanes in a very short section of road.	9/12/2020 8:43 PM
16	People not knowing orange light doesn't mean "race before it turns red"	9/12/2020 8:09 PM
17	Vehicles speed up the hill to catch the light. Had many close calls.	9/11/2020 5:48 PM
18	Oncoming traffic coming up the hill are often driving fast to make the light and are impossible to see, which makes turning left onto range road very dangerous. We have to inch out into the intersection to see anything.	9/11/2020 3:37 PM
19	to clarify other vehicles not being clearly visible, turning right off range road, heading north, it is nearly impossible to tell what lane a vehicle heading down the hill is in and vehicles often switch lanes just before or in the middle of the intersection.	9/11/2020 3:22 PM
20	Cyclists often cause confusion by riding through intersections	9/11/2020 9:54 AM
21	Horizontal Deflection Horizontal speed control measures cause motorists to slow down in response to either a visually narrower roadway or a need to navigate a curving travel lane. Where traffic calming features do not extend beyond the parking lane, they visually narrow the road and improve the approaching bicyclists' view of cross traffic, but do not act as speed management. When motor vehicle speeds are already below target thresholds, elements can either extend into the travel lane or narrow a bi-directional street to a single lane. Under these conditions bicyclists are comfortable taking the lane and overtaking cars do not encroach on bicyclists' space. Where possible, provide sufficient space for bicyclists to pass around the outside of the elements. Examples of horizontal deflection include the following: Curb extensions or bulb-outs extend the sidewalk or curb face into the parking lane at an intersection. When placed on the bicycle boulevard, they visually narrow the roadway. Curb extensions on the cross street act as a minor street crossing. All curb extensions reduce the crossing distance for pedestrians, can increase the amount of space available for street furniture and trees, and can act as stormwater management features. Edge islands are curb extensions that leave a 1- to 2-foot gap by the curb to improve drainage. Neighborhood traffic circles are minor street crossing treatments that also provide speed management. They are raised or delineated islands placed at intersections that reduce vehicle speeds by narrowing turning radii, narrowing the travel lane, and, if planted, obscure the visual corridor along the roadway. It should be noted that the City of Portland has found such circles to be less effective than frequently spaced speed humps, and many people on bicycles complain that motorists overtake them when approaching the circles, creating a hazardous condition. Read More+ Chicanes are a series of raised or delineated curb extensions, edge islands, or parking bays on alternating sides of a street forming an S-shaped travel way. This reduces vehicle speeds by requiring drivers to shift laterally through narrowed travel lanes. Read More+ A pinchpoint or choker narrowing includes curb extensions or edge islands placed on either side of the street to narrow the center of the lane such that two drivers have difficulty passing through simultaneously. Pinchpoints should only be used where traffic speeds are already low. Cut-through passageways should be provided to the outside of the pinchpoint to accommodate bicyclists. Read More+ Neckdowns are pinchpoints at intersections; they are minor street crossing treatments that narrow at least one side of an intersection using curb extensions or edge islands on both sides of the street. They are often combined with parking bays on side streets off of commercial main streets. Read More+ A short center island narrowing is a median parallel to the bicycle boulevard that causes a small amount of deflection without blocking driveway access (such treatments can also act as median refuge islands for pedestrians crossing the bicycle boulevard, but in this configuration it is not a crossing treatment for the bicycle boulevard). Medians can be used for volume management and to assist in bicycle turns at offset intersections. Read More+ Skinny streets or queuing streets are narrow residential streets that require low motor vehicle speeds and accommodate travel in a bi-directional lane. These types of streets calm traffic as drivers must yield to each other to allow one direction of travel at a time to pass	9/11/2020 9:21 AM
22	Cars run red lights, do not yield before entering intersection on right turns.	9/11/2020 9:08 AM
23	passing on the right when long line ups at the lights	9/10/2020 9:29 PM
24	poor driving habits cause most of the issues at the intersection	9/10/2020 4:38 PM

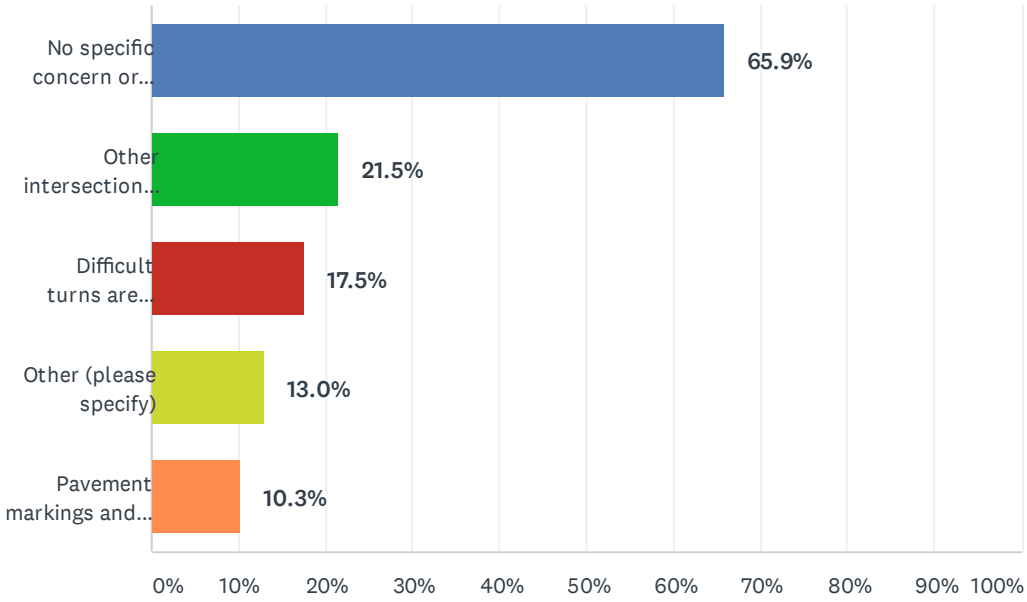
25	Bike Box Benefits Increases visibility of bicyclists. Read More+ Reduces signal delay for bicyclists. Facilitates bicyclist left turn positioning at intersections during red signal indication. This only applies to bike boxes that extend across the entire intersection. Facilitates the transition from a right-side bike lane to a left-side bike lane during red signal indication. This only applies to bike boxes that extend across the entire intersection. Helps prevent 'right-hook' conflicts with turning vehicles at the start of the green indication. Read More+ Provides priority for bicyclists at signalized bicycle boulevard crossings of major streets. Groups bicyclists together to clear an intersection quickly, minimizing impediment to transit or other traffic. Pedestrians benefit from reduced vehicle encroachment into the crosswalk.	9/10/2020 9:00 AM
26	too many cars run yellow and red lights, this is a daily observation !!!	9/10/2020 8:59 AM
27	Speed limits are not adhered to.	9/10/2020 12:03 AM
28	Challenging to turn left from 2 mile onto Range road driving towards town, visibility is very challenging and cars drive up that hill really fast. Long line of cars waiting to turn left in the mornings from range onto 2 mile (from takhini sub)	9/9/2020 4:10 PM
29	Advanced green required allowing Range Road traffic to make left down hill.	9/9/2020 3:26 PM
30	Dedicated Intersections People on bikes can be given a dedicated path through the intersection even where there is not enough space for a full bike setback. By providing excellent visibility and low turn speeds, dedicated bikeway intersections provide key improvements over conventional bike lane intersections.	9/9/2020 8:48 AM
31	I find it most uncomfortable in winter when you can't see the lanes, particularly coming up/down two mile hill. Fewer lanes feels safer.	9/8/2020 8:22 PM
32	No dedicated right turning lanes. No advance left turn for uphill traffic	9/8/2020 8:02 PM
33	Vehicles rushing to get through the intersection make it very unsafe for all users	9/8/2020 2:47 PM
34	the road lines are faded that it's very difficult to see where the lanes are	9/8/2020 2:33 PM
35	If used, the mountable curb should have 4:1 slope edge without any seams or lips to interfere with bike tires to allow for safe entry and exit of the roadway. This curb should not be considered a ridable surface when determining cycle track width.	9/8/2020 9:36 AM
36	Where vehicle speeds are above 30 km/h and pedestrian volumes and crossing demands are moderate to high, provide signalized crossings to support a safe walking environment. Uncontrolled crossings are generally safe on streets with low traffic volumes, and speeds below 30 km/h.	9/8/2020 9:24 AM
37	Vehicles speeding up 2 mile hill	9/7/2020 4:19 PM
38	Replace static signs with flashing LED signs If static signs – no matter how reflective – aren't enough, leverage the BlinkerSign® Pedestrian Crosswalk System, which features signs with flashing solar- or electric-powered LEDs embedded into the sides. With the LEDs, the signs are much easier to see, particularly at night and during adverse weather conditions, such as fog and heavy rain. Plus, these signs can be programmed to flash 24/7, at scheduled times or only when a pedestrian is approaching, thanks to new low-power thermal detector technology that can be mounted on the sign. Increase the rate at which motorists' look out for and yield to pedestrians by placing these attention-grabbing signs in high-risk areas, like crosswalks near parks and schools.	9/7/2020 10:03 AM
39	not enough time for pedestrians to cross safely	9/6/2020 9:43 AM
40	1. the right hand land from 2 mile road onto Range road needs to be a turn lane only. There is often a line-up heading up the hill and it's composed of vehicles going straight to the Alaska hwy turnoff or those turning right onto Range Road. Ideally this would be a physically separate lane, right turn only. 2. Turning left onto Range Road from 2 Mile (pointed towards town) is challenging - the oncoming traffic is hard to see due to the hill slope and vehicles are consistently faster than the speed limit. 3. The left turn lane turning left off of Range road to head downtown onto 2 Mile is backed up quite a bit during peak hours. I'm concerned that additional housing construction will bog this down even further.	9/5/2020 5:48 PM
41	Turning right, then left on the highway requires moving across 4 lanes of traffic in <100m	9/5/2020 8:57 AM
42	Pedestrians are not able to cross before traffic light changes, VERY UNSAFE	9/5/2020 8:53 AM

43	Making a left turn onto two mile hill from range road is hard when behind other cars, it can be difficult to determine safety, often causing one to get stuck in the intersection on amber light	9/4/2020 3:40 PM
44	build seperate pedestrian lanes, better saftey for kids!!!	9/4/2020 12:01 PM
45	SHORT merge lane northbound out of intersection; hard to see oncoming traffic from down hill when turning left from west	9/3/2020 11:12 PM
46	Line markings don't include bicycle lanes.	9/3/2020 9:47 AM
47	intersection is to large and confusing, not clearly designed	9/3/2020 9:02 AM
48	no lane markings for most of year - can be confusing	9/3/2020 9:00 AM
49	decrease size of intersection- construct neckdowns/green space	9/3/2020 8:55 AM
50	other vehicles driving too fast, speeding, aggressively or dangerously	9/2/2020 5:35 PM
51	Pedestrians NEED dedicated lane seperate from traffic	9/2/2020 9:21 AM
52	Drivers coming up the Two Mile Hill often take the right-most lane, because they want to turn right at the *next* intersection onto the Alaska highway. At times, they have to stop at a red light at the intersection with Range Rd. That prevents me from turning right during the red light phase onto Range Rd - an unnecessary delay. I would prefer the rightmost lane, coming up the hill, to be for right turns only - except buses, taxis, medical transports, etc. who would use that lane to jump the queue.	9/2/2020 12:42 AM
53	Turning left from Range onto Two Mile (heading downtown) is increasingly backlogged and it feels dangerous trying to get through the intersection due to conflict with those passing straight through along range.	9/1/2020 8:28 AM
54	My main concern as a driver is that I feel it's unsafe to make left turns there.	8/31/2020 11:41 PM
55	Busy intersection for emergency services vehicles.	8/31/2020 11:36 AM
56	There are so many people turning from Range Rd down onto 2 mile and the green light is too short to accommodate them. Also - hard to see cars coming up 2 mile hill and they are often going very fast.	8/31/2020 9:50 AM
57	When coming up the two mile hill the line is is too long and when the line turn orange car speed up and do not let people engage and waiting at the light turn left onto Range Rd. A turning lane coming up two mile hill would help	8/30/2020 10:28 AM
58	Turning left to go down Two Mile Hill takes too long during peak periods as there is no dedicated turning light.	8/30/2020 10:21 AM
59	Speed. People drive WAY to fast	8/30/2020 8:48 AM
60	Speeding and red light running	8/29/2020 7:51 PM
61	road surface is uneven (dips/bumps) at intersection	8/29/2020 6:58 PM
62	There is a turning light but the most dangerous thing is people running through a yellow light this is very dangerous	8/29/2020 9:17 AM
63	Wide intersection, feels rushed to turn from Range Road left onto Two Mile Hill.	8/28/2020 9:07 PM
64	Cars speeding up Two Mile Hill will run the light because they're going too fast to stop.	8/28/2020 4:55 PM
65	many cars queue in the intersection to turn left leading to multiple left turns on red	8/28/2020 1:47 PM
66	Huge line-up to turn left from Range Road north to Two-mile Hill and no advance left turn so if there is traffic coming across from the other direction only a few cars make it through the left turn, most people run the tail of the yellow light. Why not have advanced green and left turn in oone direction to help clear that traffic back-up?	8/28/2020 1:18 PM
67	Intersection crossings are way too long - hard to clear intersection in time if the light turns yellow. Also hard to line up with the correct lane when you get to the other side.	8/28/2020 9:34 AM
68	cyclists never push the button and cross in front of incoming traffic	8/28/2020 8:25 AM
69	People changing lanes while going up 2 mile hill haphazardly, creating danger. People going	8/28/2020 7:51 AM

	straight at this intersection are in the right hand lane, blocking those turning onto Range rd.	
70	North to south vehicles going straight through clog the left turn lane and reduce traffic flow efficiency. The right turn lane on the north side of the intersection should also accomodate through traffic. The left turn lane should be exclusive to left turning vehicles.	8/27/2020 7:22 PM
71	Above head highway signage is poor when you come up the hill. Particularly for tourists, it is not clear what lane they should take if they want to turn left (southward) on the Alaska Hwy. They either take the left lane too early and turn on to Range Rd., stay in the centre lane and make an illegal left turn onto the AK Hwy, or completely miss the turn and have to drive up to the CGC and find their way back.	8/27/2020 5:26 PM
72	No one accepts the dual lanes by Takhini and it’s not an adequate merge lane, traffic is free to exit takhini arena right into the flow. That entrance should be closed off.	8/27/2020 4:21 PM
73	Signage for tourists is WAY too small for older drivers and results in a lot of confusion at the intersection. So many dedicated lanes makes driving difficult in the winter.	8/27/2020 12:29 PM
74	a northbound right turn lane would be super helpful	8/27/2020 12:09 PM
75	Lately I've seen lots of vehicles stopping, turning and lane changing in this area with brake lights and turn signals that are either not working or not being used correctly, making it more difficult for traffic behind them to assess the situation as they approach the intersection. Also turning left on to Range Road I've found opposite direction traffic when the traffic lights turn amber more often than not multiple vehicles will speed up and continue going despite having more than enough room to safely stop, forcing anyone legally waiting turning left to remain in the intersection on a hard red. Basically 99% of my issues in this intersection are not the rules or the layout, but with other drivers not following basic traffic laws and either not using or not maintaining their vehicle lights. The intersection is fine, people are either lazy or in a hurry and aren't using it properly.	8/27/2020 11:48 AM
76	Road is incredibly bumpy	8/27/2020 9:18 AM
77	No left turn arrow - at busy times, 2-3 vehicles try to turn left on the yellow light if there were vehicles going straight through	8/27/2020 9:02 AM
78	People running the light coming up or down two mile	8/27/2020 8:51 AM
79	Crosswalks are too far back for sightlines. People drive too fast. Left turn into Range Rd coming down two mile from AK highway is very exposed.	8/27/2020 8:11 AM
80	The lines on 2 mile are non-existent for 10 months of the year, until the COW repaints then a mo th before the snow flies, then the paint wears off throughout the winter.	8/26/2020 10:54 PM
81	Cyclists do not follow rules of the road	8/26/2020 10:39 PM
82	Left turn light to go downtown from Takhini does not let many vehicles through.	8/26/2020 9:34 PM
83	Orientation of intersection makes traffic lights difficult to see due to sun directly behind	8/26/2020 8:40 PM
84	The left turn lanes are not in line. And there is no advance arrow eastbto west	8/26/2020 7:06 PM
85	left hand turns up and down range road have poor visibility, drivers are speeding as they approach intersection, right hand lane going up two mile hill backs up a long way (half traffic turns right at range road, half straight), long crossing for left hand turns in all directions, left hand turns from range road impede straight through traffic, sometimes wait through multiple lights to turn left off range road.	8/25/2020 9:03 PM

Q8 Please indicate what are your main observations and/or concerns with this intersection as a truck driver or large vehicle driver (Check all relevant boxes)

Answered: 223 Skipped: 56



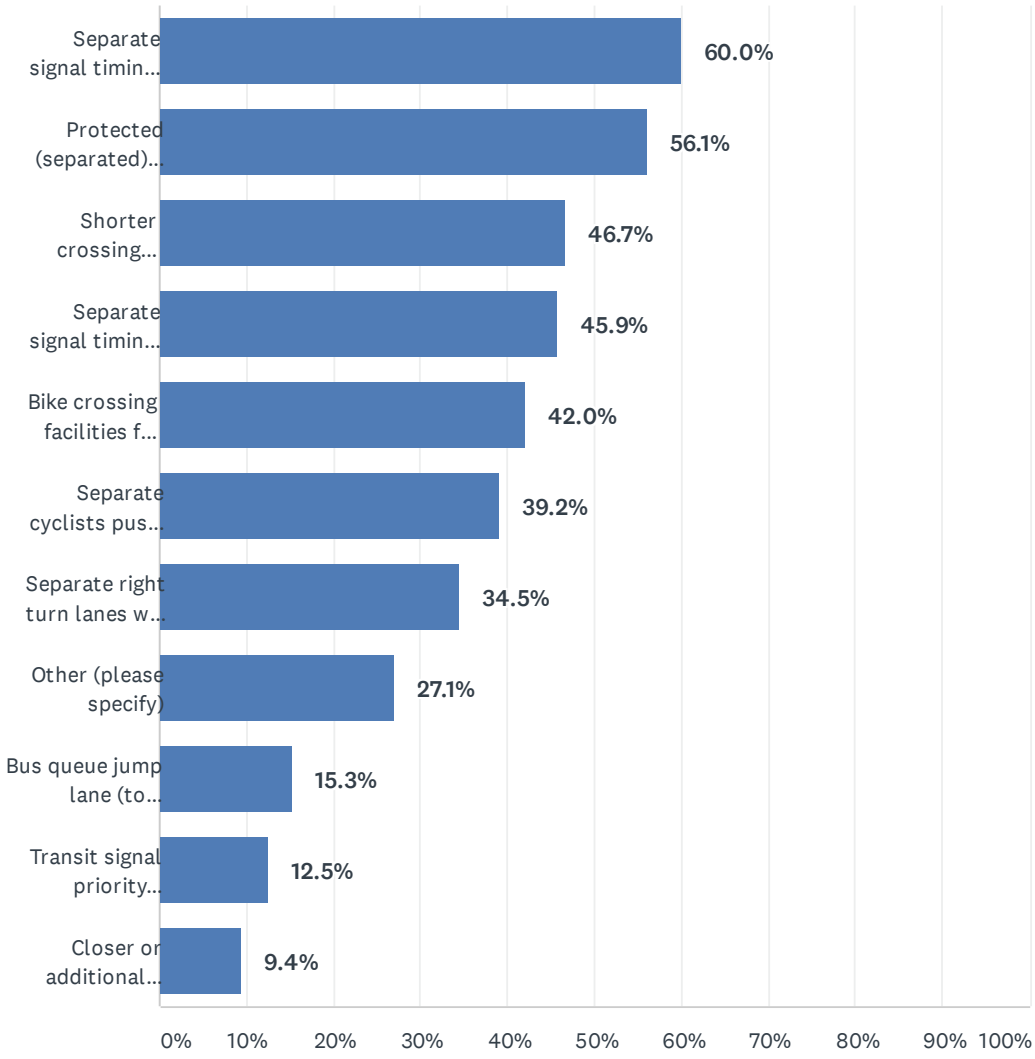
ANSWER CHOICES	RESPONSES	
No specific concern or observation.	65.9%	147
Other intersection users (pedestrians, cyclists, and other vehicles) are not clearly visible when maneuvering the intersection	21.5%	48
Difficult turns are required at this intersection	17.5%	39
Other (please specify)	13.0%	29
Pavement markings and signage are unclear	10.3%	23
Total Respondents: 223		

#	OTHER (PLEASE SPECIFY)	DATE
1	High rate of speed of other vehicles. Not enough to advanced green left turns (should be a dedicated light in the traffic light sequence).	9/14/2020 7:00 PM
2	I'm not a truck driver nor a large vehicle driver	9/14/2020 4:11 PM
3	Motor Vehicle Speeds and Volumes Streets formally designated as bicycle boulevards should meet strict targets of fewer than 3,000 motor vehicles per day (1,500 preferred) and an 85th percentile speed of no more than 25 mph (20 mph preferred). Traffic conditions, including motor vehicle speeds and volumes and bicyclist delay, should be monitored before implementation and on a regular basis after implementation. Should conditions exceed the target thresholds, additional speed and/or volume management treatments should be implemented. Read More+ Bicycle Boulevards and Emergency Vehicle Routes Bicycle boulevards can be compatible with emergency vehicle routes. While not all speed and volume management treatments are appropriate on emergency routes, several treatments that lower general traffic speeds and volumes while minimizing constraints to emergency vehicles can be applied. When identifying the bicycle boulevard network, communities should develop an emergency response route classification map designating primary or major emergency response routes, which focuses the bulk of emergency response activity along major roads.	9/14/2020 8:48 AM
4	NA	9/14/2020 5:47 AM
5	Not applicable can't comment either way	9/14/2020 5:20 AM
6	Orange light warning would be appreciated	9/12/2020 8:09 PM
7	Speed Management Benefits Decreases motor vehicle speeds. Read More+ Decreases the likelihood that crashes will occur, by increasing drivers' response time and minimizing motor vehicles overtaking movements. Decreases the likelihood of an injury resulting from a crash. Read More+ Improves bicyclist comfort and benefits pedestrians and residents by reducing traffic speeds along the corridor. Establishes and reinforces bicycle priority on bicycle boulevards by discouraging through vehicle travel. Provides opportunities for landscaping and other community features such as benches, message boards, and colored pavement in the intersection, benefiting all roadway users and residents.	9/11/2020 9:21 AM
8	Two-stage turn queue boxes offer bicyclists a safe way make left turns at multi-lane signalized intersections from a right side cycle track or bike lane, or right turns from a left side cycle track or bike lane.Two-stage turn queue boxes may also be used at unsignalized intersections to simplify turns from a bicycle lane or cycle track, as for example, onto a bicycle boulevard. At midblock crossing locations, a two-stage turn queue box may be used to orient bicyclists properly for safe crossings. Multiple positions are available for queuing boxes, depending on intersection configuration. Cycle track design often prevents bicyclists from merging into traffic to turn. This makes the provision of two-stage turns critical for basic transportation function. The same principles for two-stage turns apply to bike lanes as well. While two stage turns may increase bicyclist comfort in many locations, this configuration typically results in increased delay for bicyclists. Bicyclists now need to receive two separate green signal indications (one for the through street, followed by one for the cross street) to turn. At unsignalized intersections this configuration may also increase delay for bicyclists due to the need to wait for appropriate gaps in crossing motor vehicle traffic.	9/10/2020 9:00 AM
9	too many cars run yellow and red lights	9/10/2020 8:59 AM
10	Minor Street Crossings A transition zone between a moderate-speed, signalized traffic environment and a very-low speed street. A well-designed minor-street intersection gives everyone—people driving, biking, and walking—a clear indication that bikes and pedestrians have the priority when crossing the minor street.	9/9/2020 8:48 AM
11	Short green light time to advance	9/8/2020 9:26 PM
12	One-way protected cycle tracks are bikeways that are at street level and use a variety of methods for physical protection from passing traffic. A one-way protected cycle track may be combined with a parking lane or other barrier between the cycle track and the motor vehicle travel lane. When a cycle track is elevated above street level it is called a raised cycle track and different design considerations may apply.	9/8/2020 9:36 AM
13	Pedestrian crossings can be located at an intersection or mid-block. Provide pedestrian crossings at all legs of intersections. Pedestrians are unlikely to comply with a three-stage	9/8/2020 9:24 AM

	crossing and may place themselves in a dangerous situation as a result. Install a pedestrian crossing where there is a significant pedestrian desire line. Frequent applications include mid-block bus stops, metro stations, parks, plazas, monuments, or public building entrances.	
14	Upgrade to more reflective signage Drivers can’t obey a sign they can’t see. Many traffic signs are made with outdated sheeting that doesn’t maximize reflectivity. Replace those signs with ones using highly reflective, durable, micro-prismatic lens sheeting with pressure-sensitive adhesive. They’re visible from up to 600 feet away because they reflect more available light, drastically increasing sign visibility and compliance. This is helpful for any type of sign, but especially for those placed in areas with lots of foot traffic. If you’re not sure if your signs meet reflectivity standards, invest in a quality retroreflectometer.	9/7/2020 10:03 AM
15	I cant see pedestrians, raised crosswalk is needed	9/6/2020 9:43 AM
16	The intersection is to large, I often have a green arrow- but pedestrians are still crossing	9/5/2020 8:53 AM
17	pedestrians are not visable, raise crosswalks would help	9/4/2020 12:01 PM
18	decrease size of intersection, pedestrians do not enough time to cross	9/3/2020 8:55 AM
19	pedestrians NEED divided seperate travel lane	9/2/2020 9:21 AM
20	not a truck driver	8/31/2020 12:04 PM
21	Driving a fire truck, it is difficult to clear the intersection travelling N on Range Road. Very little room for waiting traffic to go to allow fire trucks through.	8/31/2020 11:36 AM
22	Long lights can require stopping on the hill; can be slippery in winter and hard to get started again	8/29/2020 11:49 PM
23	People running the yellow light	8/29/2020 9:17 AM
24	lanes are a bit narrow, visibility is poor for turning right out of Range Road north towards the highway.	8/28/2020 1:18 PM
25	NA, I don’t drive a large truck	8/28/2020 7:51 AM
26	North to south vehicles going straight through clog the left turn lane and reduce traffic flow efficiency. The right turn lane on the north side of the intersection should also accomodate through traffic. The left turn lane should be exclusive to left turning vehicles.	8/27/2020 7:22 PM
27	Why is there a left turn signal to go to Takhini but not heading towards the Range Road industrial area? Makes turning with a trailer unsafe.	8/27/2020 4:21 PM
28	N/A	8/27/2020 2:29 PM
29	As a licensed class 1 driver this intersection isn't too bad, but if it is renovated I hope the city does it in such a way that it continues to have room for large trucks to maneuver. Several areas of town used to be fine but "improvements" in recent years have made it more difficult for big trucks to fit, and the newer areas in town often are very poorly designed in the way that there isn't enough room for trucks to safely maneuver. Dense neighborhoods with narrow roads full of fancy curbs and medians in the middle and cars and snow piles on the road because there's nowhere else nearby to put them are the worst. Turning lanes are great but only when they are sized and spaced so trucks can safely fit.	8/27/2020 11:48 AM

Q9 What improvements would encourage you to walk, cycle or take transit more at this intersection? (Check all that apply)

Answered: 255 Skipped: 24



ANSWER CHOICES	RESPONSES	
Separate signal timing for left-turn traffic	60.0%	153
Protected (separated) bike routes	56.1%	143
Shorter crossing distances for pedestrians and cyclists	46.7%	119
Separate signal timing to protect pedestrians and cyclists	45.9%	117
Bike crossing facilities for through and left-turns bike movements (two-stage turn, etc)	42.0%	107
Separate cyclists push buttons and cyclist signal light.	39.2%	100
Separate right turn lanes with islands (channelized turn lanes)	34.5%	88
Other (please specify)	27.1%	69
Bus queue jump lane (to overtake queues and minimize transit delays)	15.3%	39
Transit signal priority through the intersection (with no additional bus lanes)	12.5%	32
Closer or additional transit stops	9.4%	24
Total Respondents: 255		

#	OTHER (PLEASE SPECIFY)	DATE
1	No 2 stage turns!	9/14/2020 10:45 PM
2	fewer vehicle lanes, and more speed limit enforcement.	9/14/2020 9:57 PM
3	Red light radar should be installed to ticket vehiles which run red lights.	9/14/2020 7:02 PM
4	bus stop at the intersection	9/14/2020 11:07 AM
5	My main priorities are slowing traffic, especially as vehicles make turns, so that I can safely cross on my bike, and improving the safety of turning left in a car	9/14/2020 10:59 AM
6	smarter light timing; warning lights when peds/cyclists have the right of way (check out stanely park cycle track)	9/14/2020 8:52 AM
7	Intersection Crossings All intersections along bicycle boulevards should minimize delay and improve safety for bicyclists on the bicycle boulevard. These two goals can be accomplished with a variety of treatments, including supplemental signs and markings, geometric design features, and traffic control. While all crossing treatments should provide both benefits, there are trade-offs between these goals, which vary based on the operational characteristics of the cross street.	9/14/2020 8:49 AM
8	I'm not very concerned with this	9/14/2020 7:39 AM
9	(1) The City of Whitehorse seems to be in love with wide sweeping turns. These encourage drivers to treat stop signs/lights as merge lanes when turning right, and if they do happen to stop, it's on/past the crosswalk. Putting in separate bike/pedestrian crossings will just make this worse. (2) The traffic signals should be placed at the stop line, with no signals on the far side of the intersection - that would stop the overshooting. (3) Square corners on the intersection would make the intersection smaller. (4) Turn lanes with islands will make things worse for pedestrians as then drivers will have absolutely no reason to even slow down when turning right.	9/13/2020 9:24 PM
10	n/a	9/13/2020 10:19 AM
11	right turn signal off of range road to go down the hill. This would solve the problem of not being able to see vehicles coming from the highway and not being able to tell what lane they're in.	9/11/2020 3:39 PM
12	Is there a way to prevent people from changing lanes as they approach the intersection? Is this what challelized lanes are?	9/11/2020 3:25 PM
13	more enforcement of cyclists breaking traffic laws	9/11/2020 10:18 AM
14	Green infrastructure is a planning and design approach to managing stormwater, the urban heat island effect, health,and air quality based on ecosystem network models. A green infrastructure approach is a shift from viewing systems as separate and disjointed components toward viewing systems as interconnected amenities that improve public health. Bicycle boulevards present an opportunity to integrate stormwater treatment facilities, street trees, and publicgathering spaces with traffic speed and volume management treatments. By incorporating green street elements such asbioswales, infiltration basins, permeable pavement, plantings and street trees into curb extensions, pedestrian refuge islands, and chicanes, roadway runoff is slowly attenuated onsite, water quality is improved, paving is reduced, and habitat connectivity is improved. Bioswales are gently sloping depressions planted with dense vegetation or grass that filters stormwater runoff as it flows through the swale, allowing it to slowly infiltrate into the ground. A vegetated infiltration basin or a rain garden is a landscaped depression that holds stormwater as it slowly infiltrates into the ground. Bioswales and rain gardens can be placed in curb extensions, islands, and chicanes to absorb and filter rain water, minimizing sewer runoff. Green streets include treatments such as sidewalk widening, landscaping, and traffic calming to prioritize pedestrian and bicyclist travel. These improvements are ideal for bicycle boulevard corridors, due to the mutual benefits of speed and volume management and prioritizing nonmotorized transportation options. Read More+ Treatment details can be accessed below under design guidance. Benefits Provides an ecological and aesthetic enhancement of traditional traffic speed and volume control measures Provides a more pleasant environment for bicycling, walking or sitting. Improves drainage, reduces sewer costs, and minimizes the risk of basement flooding. Read More+ Improves street crossings because of reduced vehicle volume and speed and/or reduced crossing distance. Improves air quality, reduces the urban heat island effect, and can provide habitat connectivity by increasing urban green space. Reduces motor vehicle speeds along the	9/11/2020 9:22 AM

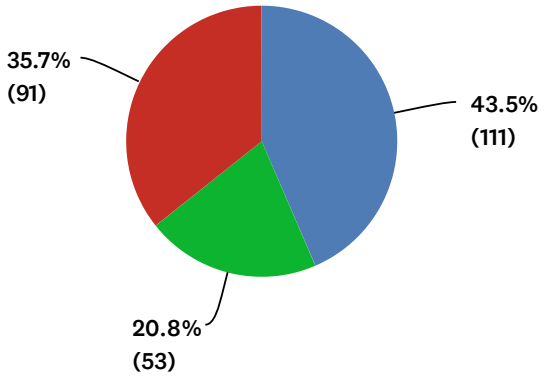
	corridor when used as curb extensions, edge islands, medians, and other speed management treatments. Reduces motor vehicle volumes along the corridor when used as diverters, closures, and other volume management treatments. Can use non-transportation funding sources, such as stormwater management or sewer treatment money, when needed improvements are prioritized along bicycle boulevards. Typical Applications Place street trees and plantings in medians, chicanes, and other speed or volume management treatments. Develop bioswales and rain gardens in curb extensions and along planting strips	
15	1. Sidewalk infront of Canada Post - no use in having pedestrian crossing if you can't get there. 2. Elephant ear curb at Normandy crosswalk - reduce traffic in parking lane, make pedestrian crossing safer there & allow safer left turns onto Normandy (possibly faster turns, clearing lane quicker), 3. Put pedestrian crossing sign for Normandy crosswalk (heading north) at crosswalk, not before driveway into Takhini Arena.	9/11/2020 9:15 AM
16	Ticket bicyclists	9/10/2020 8:34 PM
17	Median refuge islands are protected spaces placed in the center of the street to facilitate bicycle and pedestrian crossings. Crossings of two-way streets are facilitated by allowing bicyclists and pedestrians to navigate only one direction of traffic at a time. Medians configured to protect cycle tracks can both facilitate crossings and also function as two-stage turn queue boxes. See Two-Stage Turn Queue Boxes for guidance details. For bicycle facility crossings of higher volume or multi-lane streets, increased levels of treatment may be desired including bicycle signals, hybrid beacons, or active warning beacons.	9/10/2020 9:02 AM
18	protected bike routes everywhere! overpasses and underpasses!	9/9/2020 5:12 PM
19	Transit accessibility and timing needs to be improved before I would consider taking it, the safety of the intersection doesn't play into my decision to not take transit at all.	9/9/2020 4:12 PM
20	More people will bicycle when they have safe places to ride, and more riders mean safer streets. Among seven NACTO cities that grew the lane mileage of their bikeway networks 50% between 2007–2014, ridership more than doubled while risk of death and serious injury to people biking was halved. Better bicycle facilities are directly correlated with increased safety for people walking and driving as well. Data from New York City showed that adding protected bike lanes to streets reduced injury crashes for all road users by 40% over four years.	9/9/2020 8:51 AM
21	x	9/9/2020 7:45 AM
22	Location of pedestrian/cyclist push buttons	9/9/2020 7:31 AM
23	In order to cycle I'd need a tow rope up to Crestview...	9/8/2020 9:04 PM
24	I believe that eliminating right turns on red lights and/or a pedestrian scramble would be the most impactful, ensuring that no vehicles will come through the intersection while I (or my kids) are biking across it.	9/8/2020 8:25 PM
25	Right hand turning lanes. Priority left turning lanes in all directions.	9/8/2020 8:03 PM
26	above answers don't apply to my needs	9/8/2020 4:53 PM
27	I have nothing to say	9/8/2020 2:10 PM
28	One-Way Protected Cycle Track Benefits Dedicates and protects space for bicyclists in order to improve perceived comfort and safety. Read More+ Eliminates risk and fear of collisions with over-taking vehicles. Reduces risk of ‘dooring’ compared to a bike lane and eliminates the risk of a doored bicyclist being run over by a motor vehicle. Read More+ Prevents double-parking, unlike a bike lane. Low implementation cost by making use of existing pavement and drainage and by using parking lane as a barrier. More attractive for bicyclists of all levels and ages.	9/8/2020 9:37 AM
29	Provide level crossings every 80–100 m in urban environments.1 Distances over 200 m should be avoided, as they create compliance and safety issues. If it takes a person more than three minutes to walk to a pedestrian crossing, he or she may decide to cross along a more direct, but unsafe route. Pedestrian crossing spacing criteria should be determined according to the pedestrian network, built environment, and desire lines. Designers should take into account both existing and projected crossing demand.	9/8/2020 9:25 AM
30	No change needed	9/7/2020 4:21 PM
31	I have a long commute- I won’t use transit, walk or bike	9/7/2020 6:51 AM

32	raised cross walks and lower speed limits	9/6/2020 9:44 AM
33	Turning left onto range road is a art as cars speed up the hill to make the light and hard to see them, then suddenly appear screaming up the hill	9/5/2020 9:40 AM
34	smaller intersection and lower speed limits	9/5/2020 8:54 AM
35	Move bus stop into Takhini Arena parking lot to allow longer merge lane going north from intersection- 2 lanes until furthest Arena driveway; paint dotted line to indicate left turn to stay in left lane leaving intersection (like at Superstore intersection)	9/3/2020 11:49 PM
36	Better line markings and clear signage for Alaska highway turns.	9/3/2020 12:52 PM
37	One stage left turn for cyclists (on par with ALOS) or "vehicle turn" for the non-jargon folks.	9/3/2020 9:49 AM
38	lower speed limits	9/3/2020 9:03 AM
39	lower speed limits	9/3/2020 8:56 AM
40	North-south leg needs to be protected too, not a bike lane. NS protection would create safe, convinient space for left turn down the hill.	9/2/2020 5:36 PM
41	Raised Crossings and Intersections	9/2/2020 9:27 AM
42	This will always be a big intersection. I think the attempt to make left turns for cyclists less challenging is not the best approach. Most cyclists and pedestrians go downhill or come uphill, few actually need to cross Two Mile Hill Rd. So rather than putting a lot of effort into some improvements for cyclists and pedestrians, especially on that left turn to go downhill, it is better to make the alternatives more attractive: First, using the road behind the Takhini Arena and/or the Takhini Arena parking lot to connect to the bike lane along Two Mile Hill Rd. Second, a clear connection through Takhini West to the Two Mile Hill/Alaska Highway intersection, and/or through Takhini North onto the Alaska Highway. The roads in Takhini are fine for cyclists, just the connection at Alaska Highway could use some improvement.	9/2/2020 12:51 AM
43	NONE	9/1/2020 11:41 AM
44	None, i need to drive my car	9/1/2020 11:13 AM
45	I would like to see a dedicated left turn (signal and lane) for drivers and cyclists to allow cyclists heading downtown a clear and protected left turn from range onto two mile.	9/1/2020 8:30 AM
46	No concerns with the intersection	8/31/2020 10:14 PM
47	NO MORE SLIP LANES!!!! They are scary	8/31/2020 2:29 PM
48	No right turn on red onto Range Road to avoid near-misses with vehicles and pedestrians	8/30/2020 11:50 AM
49	A Three lane round about, they work in Europe, they do not stop trafic but slow it down and over or underpass for cyclists and pedestrians.	8/30/2020 10:32 AM
50	Nothing. I don’t need to walk or take transit here.	8/30/2020 8:49 AM
51	less islands, making the intersection narrower and easier to navigate for everyone.	8/30/2020 8:28 AM
52	it's fine as is	8/29/2020 3:44 PM
53	None I have walked this hill yet I respect the lights and I usually wait until the last car/truck has run the yellow light then I walk. My life is very important and I am respecting that Many people walk thinking these cars/truck will stop on a dime Not true use ones head and protect your own safety	8/29/2020 9:24 AM
54	I will not be a pedestrian here	8/28/2020 11:55 PM
55	I am comfortable biking through the intersection. Whitehorse transit is inefficient and until that improves I have no interest in transit in Whitehorse.	8/28/2020 8:39 PM
56	Make the hill disappear - I aint biking up that with all the exhaust and traffic, and I don't want to go down a steep path either. Also, transit takes a long time to get anywhere and I don't wish to double or triple my commute time which is long enough.	8/28/2020 1:22 PM
57	Clearer way to get from Range Road onto the separated bike paths, especially southbound.	8/28/2020 9:36 AM

58	none apply	8/28/2020 8:25 AM
59	Please prioritize safety for pedestrians and cyclists. There's no sidewalk on Range rd by the post office. Please extend the sidewalk to the car dealership area	8/28/2020 7:53 AM
60	Longer north - south green light timing.	8/27/2020 7:24 PM
61	None	8/27/2020 5:28 PM
62	crossing lane on east side (downhill) of the interesection.	8/27/2020 4:29 PM
63	None, fix it for cars, it's a road	8/27/2020 4:21 PM
64	as a pedestrian, crossing to the "pork chop island" on the NE side of the intersection feels very unsafe. Drivers often don't stop.	8/27/2020 3:31 PM
65	Overpass for pedestrians and cyclists avoids all these problems.	8/27/2020 12:30 PM
66	On a road of this size with this traffic level I think it's safest to have cyclists on the trails either side of the road and cross with the pedestrians.	8/27/2020 11:51 AM
67	slower speed (enforced) on two mile hill	8/27/2020 8:12 AM
68	None	8/27/2020 7:19 AM
69	roundabout (turbo-roundabout maybe, signalized if neccessary) with islands for pedestrians/cyclists crossing two-mile hill. Something to slow people down through intersection, too many people running red-lights.	8/25/2020 9:08 PM

Q10 Which of the following trade-offs would you generally support? (Check one only):

Answered: 255 Skipped: 24

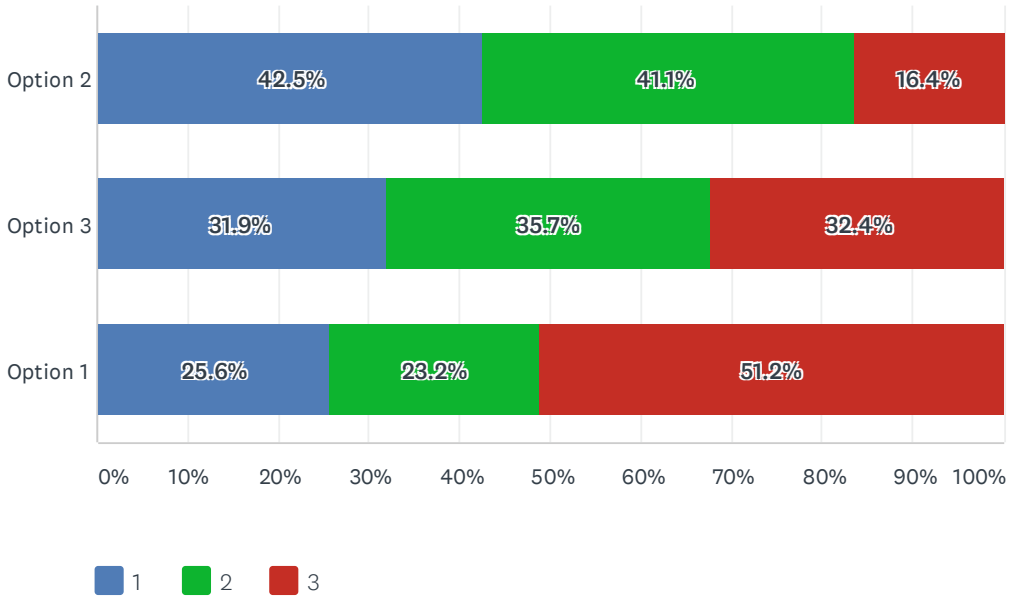


SHORTER DELAYS and LONGER CROSSING DISTANCES (less waiting at the intersection).
LONGER DELAYS and SHORTER CROSSING DISTANCES (more waiting at the intersection).
LONGER DELAYS and SEPARATE CROSSINGS FOR CYCLISTS AND PEDESTRIANS (more waiting at the int

ANSWER CHOICES	RESPONSES	
SHORTER DELAYS and LONGER CROSSING DISTANCES (less waiting at the intersection).	43.5%	111
LONGER DELAYS and SHORTER CROSSING DISTANCES (more waiting at the intersection).	20.8%	53
LONGER DELAYS and SEPARATE CROSSINGS FOR CYCLISTS AND PEDESTRIANS (more waiting at the intersection)	35.7%	91
TOTAL		255

Q11 Rank the three above options from the MOST preferred to the LEAST preferred (a rank of 1 is most preferred, 3 is least preferred):

Answered: 207 Skipped: 72



	1	2	3	TOTAL	SCORE
Option 2	42.5% 88	41.1% 85	16.4% 34	207	2.26
Option 3	31.9% 66	35.7% 74	32.4% 67	207	2.00
Option 1	25.6% 53	23.2% 48	51.2% 106	207	1.74

Q12 Do you have any additional comments or feedback regarding the proposed intersection improvements? (Optional)

Answered: 132 Skipped: 147

Q13 Your Contact Information

Answered: 207 Skipped: 72

ANSWER CHOICES	RESPONSES	
Name	100.0%	207
Company	0.0%	0
Representing Myself, Business, organization, or municipality	52.7%	109
Representing a Business, organization, or municipality	0.0%	0
City/Town	0.0%	0
State/Province	0.0%	0
ZIP/Postal Code	0.0%	0
Country	0.0%	0
Email Address	61.8%	128
Phone Number	100.0%	207

ATTACHMENT 2

Full list of individual survey responses available upon request.