TRANSPORTATION PLANNERS AND ENGINEERS

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Copithorne Gravel Pit

Transportation Impact Assessment Update

Final report

Prepared for

Roy & Judy Copithorne

Date

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Project Number

02-20-055

CORPORATE AUTHORIZATION

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Engineer's Stamp

This document entitled "Copithorne Gravel Pit Transportation Impact Assessment Update" was prepared by Bunt & Associates for the benefit of the client to whom it is addressed, in support of their Development Permit application to Rocky View County. The analysis and conclusions/recommendations in the report reflect Bunt & Associates' best professional judgment in light of the knowledge and information available to Bunt & Associates at the time of preparation.

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1. EXECUTIVE SUMMARY

An update to the 2016 dated Copithorne Gravel Pit TIA has been requested by the business owners in light of new available traffic data. This updated TIA is provided for use by the owners of the gravel pit site located at SW-18-24-04-W5M. The site is located 5 kilometres west of Highway 22 on Township Road 242.

This updated Transportation Impact Assessment (TIA) is submitted in accordance with County Servicing Standards. Bunt & Associates Engineering (AB) Ltd. was retained to undertake this study. The key findings and corresponding recommendations are summarized below.

1.1 Proposed Development

The site will operate with the following conditions:

- Hauling will occur from 7:00-17:00 on Monday-Saturday. Generally hauling will occur from May 1 to October 30; however, dependant on weather, hauling may also fall outside this period.
- A total of 2 full time employees will work on-site, there are no extra employees when crushing is occurring.
- All traffic will access the site via the parcel to the east, which is also owned by Mr. Copithorne. Traffic will travel to Highway 22 via Township Road 242. This is the current route used by previous operations on the site.
- All outbound truck traffic will turn right at Highway 22 and proceed to the south on Highway 22. Trucks will enter the site from both the north and south on Highway 22.

Expected site trip generation is summarized in **Table 1.1.**

Table 1.1: Development Trip Generation

LAND USE	AM PEAK HOUR			PM PEAK HOUR			DAILY		
	Total	In	Out	Total	In	Out	Total	In	Out
Passenger Vehicle Trips	2	2	0	2	0	2	4	2	2
Truck Trips	9	5	4	9	4	5	90	45	45
Total Trips	**11**	**7**	**4**	**11**	**4**	**7**	**94**	**47**	**47**

1.2 Highway 22 & Township Road 242 Operations

Highway 22 & Township Road 242 has a type I intersection treatment. A review of existing, background, and post development conditions at the intersection indicated the following:

1.2.1 Collision History

A total of 5 collisions occurred at the intersection over a 14-year period. Three of the collisions were single-vehicle (struck animal; run-off-road). A collision occurred in 2005 that involved 3 vehicles with 4 injuries and 2 fatalities. A 2015 rear-end collision involving 2 trucks is also documented.

1.2.2 Sight Distance

All minimum and desirable sight distance requirements are met at the intersection.

1.2.3 Background Intersection Capacity Analysis

The Background intersection capacity analysis indicates Highway 22 & Township Road 242 will continue operating within acceptable capacity parameters during the Opening Day (2020) and Long Term (2040) horizons.

1.2.4 Post Development Intersection Capacity Analysis

The Post Development intersection capacity analysis indicates no appreciable change in peak hour operations will occur at the intersection of Highway 22 & Township Road 242 due to the proposed development.

1.2.5 Alberta Transportation Intersection Warrant

Intersection type warrant were reviewed for the intersection of Highway 22 & Township Road 242 following the AT Highway Geometric Design Guide. The left turning volume will remain below 5% of advancing volumes (at approximately 1%). Given the low volume of traffic along Highway 242, and low turning volume off of Highway 22 onto Township Road 242, as well as the consideration of future planned improvements along Highway 22 at this intersection; Bunt & Associates recommends that the existing Type 1 intersection treatment be maintained at this location.

1.2.6 Alberta Transportation Illumination Warrant

Street light illumination is not warranted at the intersection.

1.3 Roadway Link Capacity Analysis

The daily traffic volumes on Highway 22 and Township Road 242 were reviewed to determine the impact of background and post development traffic volumes.

1.3.1 Highway 22

The Background road link analysis suggests twinning of Highway 22 may be required by the Long Term Background horizon (2040). This matches with the recommendations from the *Highway 22 Functional Planning Study*. No appreciable change will occur due to development traffic volumes.

1.3.2 Township Road 242

The roadway is expected to continue operating within its daily vehicle capacity. Due to the expected truck traffic, annual dust control (through the application of Calcium Chloride) will be required on Township Road 242.

It is recommended that the gravel pit operator require all truck drivers operate at a maximum speed of 50 km/h along Township Road 242. The roadway has rolling terrain, as such a reduction in operating speed from 60 km/h to 50 km/h would improve stopping sight distances by 20 metres. This could also be implemented for all road users by reducing the speed limit on the roadway to 50 km/h.

2. INTRODUCTION

2.1 Scope of Work

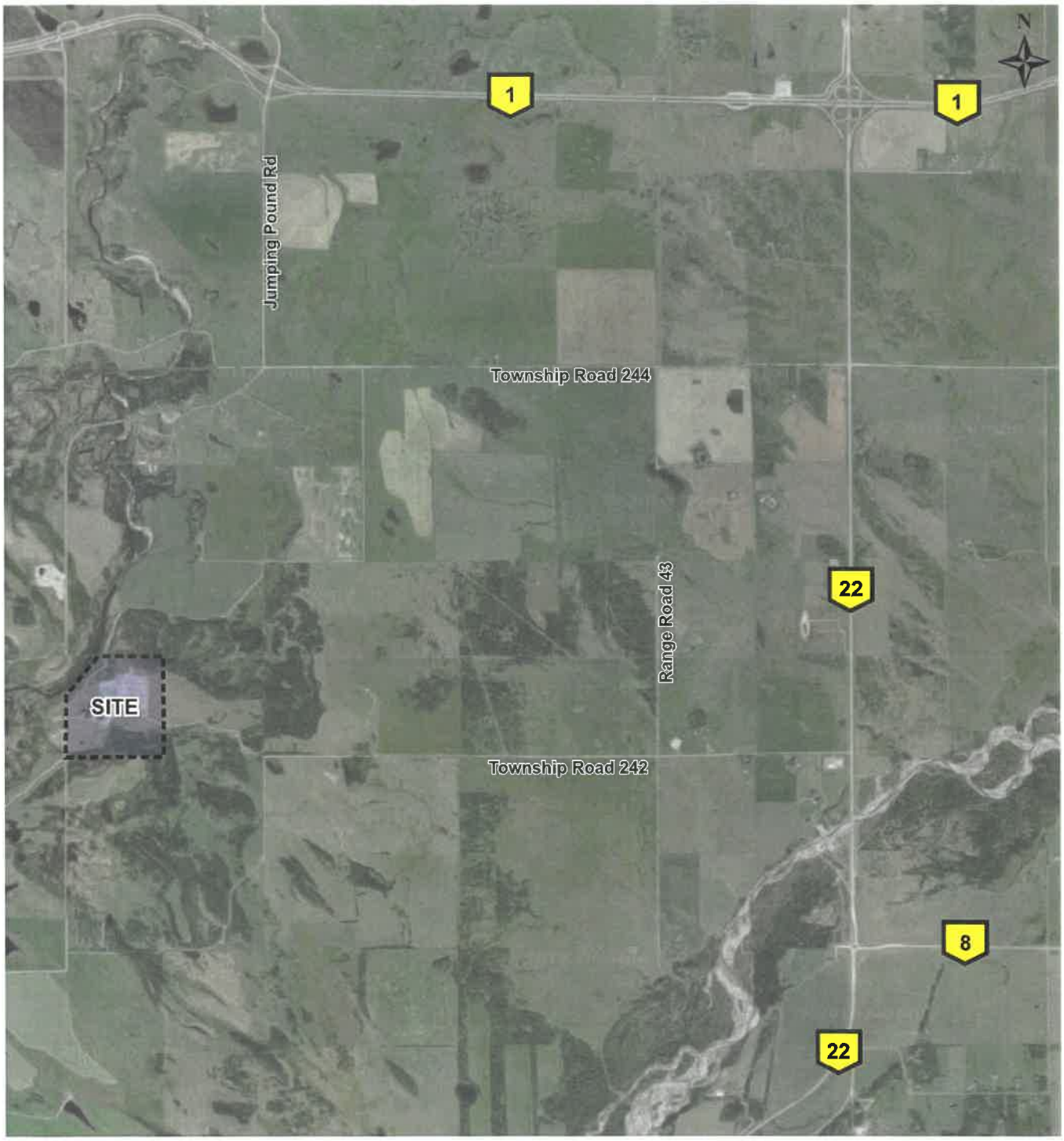
Based on discussions with Rocky View County and Alberta Transportation, the scope of work for the original TIA was confirmed as follows, noting that the analysis horizons have been adjusted for this TIA update:

- Determine expected site generated traffic volumes for the proposed uses based on first principles and in-house data.
- Assign expected site generated traffic volumes to the road network based on anticipated site traffic distribution.
- Complete capacity analysis for Opening Day (2020), and Long Term (2040) horizons during the AM and PM Peak hour at the following intersections:
    - Highway 22 & Township Road 242.
- Complete sight distance analysis.
- Review collision data at the intersection of Highway 22 & Township Road 242.
- Complete intersection type and illumination warrants for Highway 22 & Township Road 242.
- Identify transportation improvements required to support the development.

The study scope correspondence is included in **Appendix A.**

2.2 Site Context

The subject lands are zoned as NRI (Natural Resource Industrial District). Vehicular access to the development is provided from Township Road 242 via Highway 22. The site context and adjacent external road network is illustrated in **Exhibit 2.1**.



Base Map Source: Google Maps

Exhibit 2.1

Site Context

Copithorne Gravel Pit TIA Update
June 2020 Scale NTS

3. BACKGROUND TRAFFIC CONDITIONS

To assess the impacts of the proposed development on existing infrastructure, Bunt & Associates established the impacts of background traffic without consideration of site traffic. This provided the basis for comparing the incremental impact due to the proposed development.

3.1 Existing Road Network

The roadways in the vicinity of the site are described below:

- **Highway 22** is a two-lane undivided provincial Highway (control section #14) that runs in the north-south direction with a posted speed limit of 100 km/h near Township Road 242. The roadway's current cross-section near Township Road 242 has one driving lane per direction with shoulders on both sides of the roadway. Illumination is not provided on the roadway except near major intersection approaches (Highway 8 roundabout intersection; Highway 1 interchange).
- **Township Road 242** is a two-lane unpaved County roadway that runs the east-west direction from the site to Highway 22. The roadway has a right-of-way (ROW) of 20 metres and a posted a speed limit of 60 km/h. Non-regulatory signage is provided stating "film crew reduce speed 50 km/h." No illumination is provided on the roadway. The roadway is illustrated in **Figure 3.1** and **Figure 3.2.**

Figure 3.1: Township Road 242 (Facing west from Highway 22)

Figure 3.2: Township Road 242 at Range Road 43 (Facing East)

3.2 Existing Lane Configurations & Traffic Control

The following lane configurations and traffic control are in place at study area intersections:

- *Highway 22 & Township Road 242* – The intersection is unsignalized with stop control in the eastbound direction. Type I intersection treatment is provided.

The following other major intersections are located along Highway 22:

- *Highway 22 & Highway 1* – A cloverleaf interchange is provided. (Parclo interchange improvement is underway)
- *Highway 22 & Highway 8* – A single lane roundabout controls the intersection.

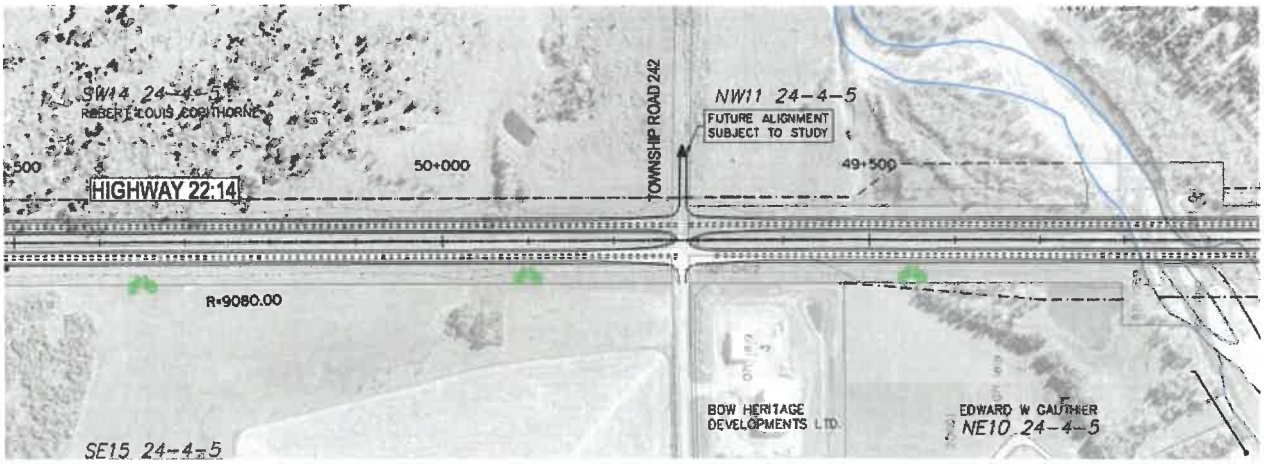
3.3 Highway 22 Functional Planning Study

ISL Engineering completed a *Highway 22 Functional Planning Study*[1] for Alberta Transportation. The functional planning study recommended the following:

- *At the interim stage (2030)* – Highway 22 be twinned to a four-lane divided arterial and be connected to Highway 1 via a newly upgraded Parclo A interchange. The design contains auxiliary turn lanes at intersections including Township Road 242.
- *At the ultimate stage (2050)* – Highway 22 be upgraded to a six-lane cross-section with auxiliary turn lanes at intersections.

The ultimate Highway 22 cross-section near Township Road 242 is illustrated in **Figure 3.3.**

Figure 3.3: Ultimate Highway 22 Cross-Section (Oriented to the East)



The traffic projections provided in the March 2014 report are summarized in **Table 3.1** and compared to Alberta Transportation AADT (Average annual daily traffic) data.

Table 3.1: Functional Study – Daily Traffic Projections (vehicles per day)

HIGHWAY	FUNCTIONAL STUDY HORIZONS				AT AADT DATA		
	2014	2030	2050 (Scenario 1)	2050 (Scenario 2)	2014	2015	2019
Highway 22 (South of Hwy 1)	9,700	15,200	20,000	22,000	10,340	12,140	10,140

[1] *Highway 22 Functional Planning Study south of Highway 8 to Town of Cochrane Corporate Limits*, ISL Engineering and Land Services, March 2014. http://www.transportation.alberta.ca/projects/assets/Area_7_Calgary_Area/Hwy_22_twinning_from_Hwy_8_to_Cochrane/Executive%20Summary.pdf

Alberta Transportation AADT data indicates traffic volumes on Highway 22 had a spike in growth in 2015 and since then have been decreasing annually, resulting in an overall growth of approximately 1.5% per year when compared to the "current volumes" stated in the March 2014 functional study. If this rate of growth is to continue, twinning would be required at a later stage than the 2030 horizon provided in the functional study.

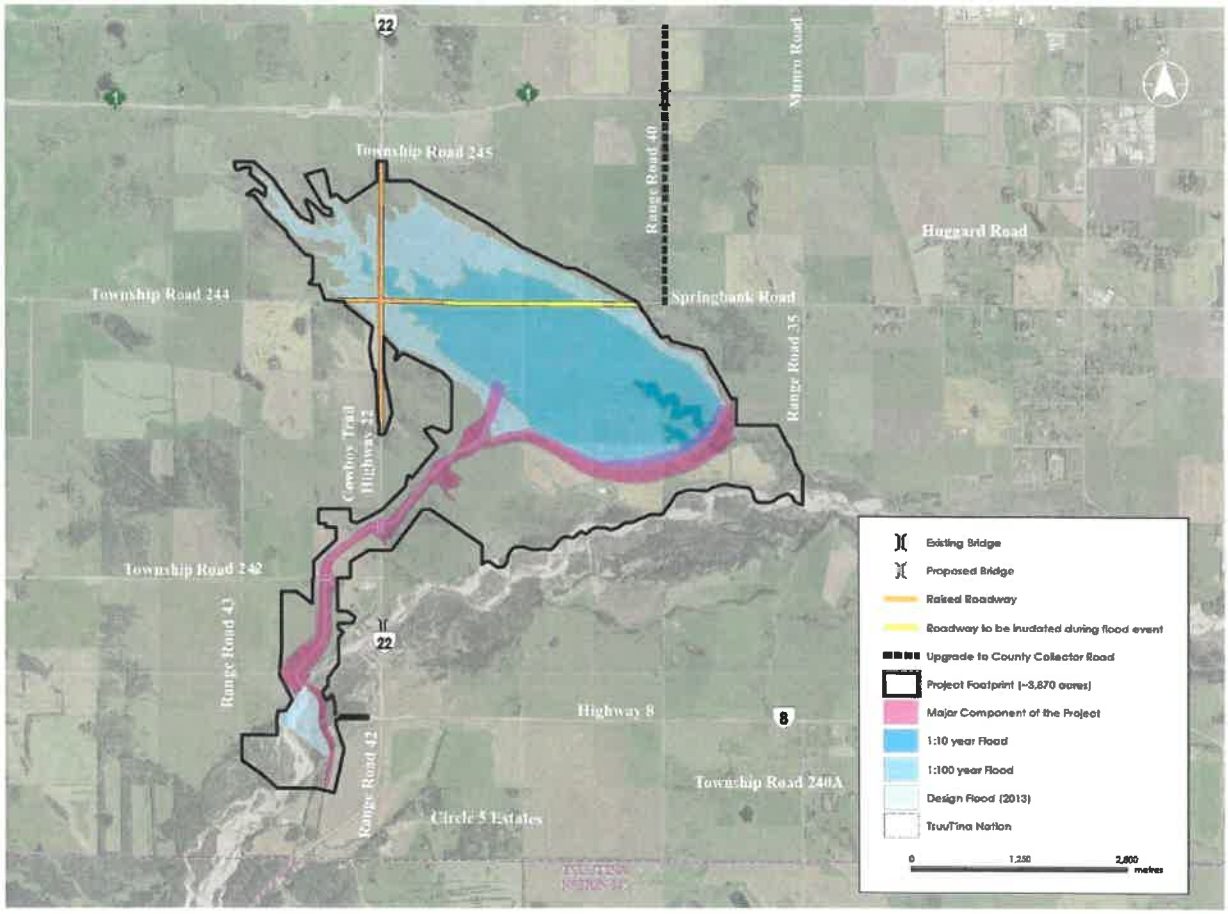
3.4 Springbank Off-stream Reservoir Project

The Springbank Off-stream Reservoir Project (SR1) is in development and will result in changes to the existing road network along Highway 22, Springbank Road, and Township Road 242. The project will result in the following new infrastructure:

- Raise portion of Highway 22 north and south of Springbank Road and shift west to accommodate future twinning.
- Raise portion of Springbank Road east and west of Highway 22.
- New bridge to be constructed along Highway 22, north of Township Road 242.
- New bridge to be constructed along Township Road 242, west of Highway 22.

The above changes to the road network will not impact the analysis completed in this study, nor will impact the intersection of Highway 22 & Township Road 242 in terms of geometry and operation. The proposed SR1 upgrades are presented graphically in **Figure 3.4.**

Figure 3.4: Springbank Off-stream Reservoir Project Proposed Upgrades



3.5 Collision Data

Safety performance at Highway 22 & Township Road 242 was reviewed based on data obtained from Alberta Transportation for the latest 10-Year period available at the time of the original TIA (2003 to 2012). This data is now supplemented with new available data from years up to and including 2016. There were a total of 5 collisions reported at Highway 22 & Township Road 242 between 2003 – 2016 as summarized in **Table 3.2.** The raw collision data is included in **Appendix B.**

Table 3.2: Highway 22 & Township Road 242 Collisions

YEAR	# OF COLLISIONS	TYPE OF COLLISION REPORTED
2004	1	Struck Object - Animal
2005	1	Head-on (2 fatalities)
2009	1	Run-off-road
2013	1	Struck Object - Animal
2015	1	Rear-end (non injury)

The 2005 collision involved 3 vehicles with 4 injuries and 2 fatalities. The collision report states "*V3 slowed for left turning vehicle in front; V1 struck rear of V3; V3 went into ditch; V1 crossed centre line and struck head-on into opposing V2.*" The 2004, 2009, and 2013 collisions were single-vehicle collisions. The 2015 collision was a rear-end collision of a right turning truck from Highway 22.

3.6 Sight Distance Requirements

A sight distance review was undertaken at Highway 22 & Township Road 242 based on the *Alberta Transportation Highway Geometric Guide* and *TAC Geometric Design Guide for Canadian Roads* to confirm the safety of turning movements and through movements on Highway 22. Sight distance requirements are based on the following:

Minimum Stopping Sight Distance (SSD), which is the distance a vehicle travels from the instant the driver sights an object and decides to stop, to the instant the vehicle comes to a complete stop after applying breaks. This distance is usually sufficient to allow reasonably competent and alert drivers to come to a hurried stop under ordinary conditions. Minimum stopping sight distances based on speeds are:

- 100 km/h = 200 metres
- 110 km/h = 235 metres

Desirable Decision Sight Distance (DSD), which is utilized in complex situations and is the distance required for a driver to detect an information source or hazard that is difficult to perceive in a roadway environment that might be visually cluttered, recognize the hazard or its threat potential, selection an appropriate action, and complete the manoeuvre safely and efficiently. A range of distances is provided with lower ranges appropriate for less complex situations and the higher range appropriate for more complex situations. Decisions sight distances based on speeds are:

- 100 km/h = 300 to 390 metres
- 110 km/h = 330 to 430 metres

Intersection Sight Distance (ISD), which is defined as the sight distance required for a vehicle to complete either a crossing or turning manoeuvre safely. Intersection sight distances based on speeds and vehicle types are:

- 100 km/h = 210 metres for passenger vehicle and 270 metres for a single-unit truck design vehicle
- 110 km/h = 230 metres for passenger vehicle and 290 metres for a single-unit truck design vehicle

Assuming a design speed of 110 km/h (posted speed limit of 100 km/h) along Highway 22, the sight distance requirements at the study area intersections are outlined in **Table 3.3.**

Table 3.3: Intersection Sight Distance

INTERSECTION	DESIGN SPEED	SSD	DSD	ISD		AVAILABLE SIGHT DIST.	
				Car	SU Truck	To West	To East
Hwy 22 & TWP Rd 242	110km/h	235m	330-430m	230m	290m	>500m	>500m

The review confirms all minimum and desirable sight distance requirements are met at Highway 22 & Township Road 242.

3.7 Traffic Volumes

3.7.1 Existing Data

Bunt & Associates conducted intersection turning movement counts on Wednesday February 17, 2016 morning (7:00-9:00), mid-day (11:00-13:00), and afternoon (16:00-18:00) periods to document existing traffic movements at the intersection of Highway 22 & Township Road 242. This data is used in this study only to estimate the existing turning movement volumes in and out of Township Road 242 to/from Highway 22. The observed 2016 through volumes at this intersection were disregarded and replaced by 2019 Alberta Transportation 100th Highest Hour counts of Highway 22 & Highway 8. Traffic count data is provided in **Appendix C.**

3.7.2 Background Growth

Background growth is the result of traffic that would be present on the road network in future years regardless of the development of the site. This traffic is representative of yearly growth on the roadways as well as other residential, commercial, or industrial developments that have been approved in the area.

Alberta Transportation AADT data for Highway 22 (north of Highway 8) and Highway 8 (east of Highway 22) was obtained as summarized in **Table 3.4.**

Table 3.4: Highway 22 AADT Data

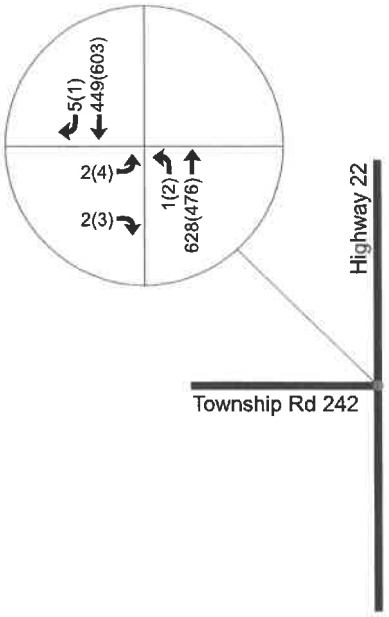
YEAR	HIGHWAY 22 AADT (NORTH OF HIGHWAY 8)	HIGHWAY 8 AADT (EAST OF HWY 22)
2002	-	6,872
2003	-	6,942
2004	-	6,860
2005	-	6,656
2006	-	6,539
2007	9,350	6,510
2008	9,070	6,313
2009	9,110	6,385
2010	9,440	6,627
2011	9,300	6,560
2012	9,300	6,459
2013	9,480	6,396
2014	9,520	6,525
2015	11,320	7,131
2016	10,900	7,450
2017	10,820	7,230
2018	9,930	5,980
2019	9,290	4,960
5-Year Growth Rate (2014-2019)	-0.5% per year	-4.7% per year
All Data Growth Rate to 2019	-0.1% per year	-1.6% per year
5-Year Growth Rate (2012-2017)	3.3% per year	2.4% per year
All Data Growth Rate to 2017	1.6% per year	0.3% per year

As shown in the above table, the most recent 5-year growth rate (2014-2019) exemplifies that traffic is currently decreasing annually along Highway 22 and Highway 8. Traffic volumes along Highway 22 are expected to experience stifled growth in the coming years due to the inclusion of the Calgary Southwest Ring Road project that will pull existing traffic from Highway 8 and Highway 22 instead to Highway 1 exclusively. With this noted, some growth is still expected to occur along Highway 22 over the coming years; therefore a growth rate of 1.5% per year was developed by averaging all data up to 2017, before a significant drop in traffic volumes was observed.

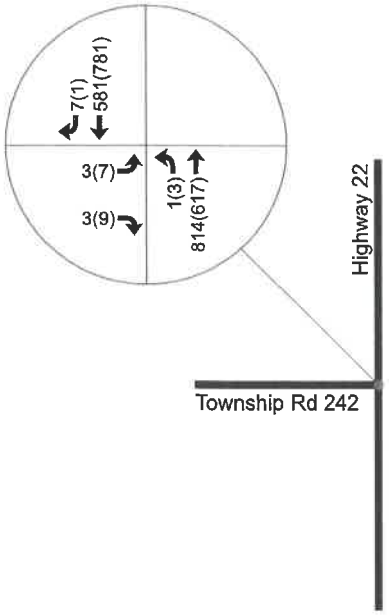
This linear growth rate is applied to all movements at the intersection of Highway 22 & Township Road 242 to develop 2020 and 2040 Background volumes. The resulting Background traffic volumes are summarized in **Exhibit 3.1**.

N

2020 Background Traffic Volumes



2040 Background Traffic Volumes



LEGEND

↰ ↑ ↱	Vehicle Volumes
XX	AM Peak Hour
(YY)	PM Peak Hour

Exhibit 3.1

Background Traffic Volumes

Copithorne Gravel Pit TIA Update
June 2020 Scale NTS

bunt & associates

3.8 Intersection Capacity Analysis

Intersection capacity analysis was undertaken for the study area intersections using Synchro 8.0, a traffic analysis software package based on the methods outlined in the Highway Capacity Manual (HCM) 2000. This model uses standard procedures to determine the Volume to Capacity (v/c) and the corresponding delay-based traffic Level of Service (LOS) for movements at each intersection in the study network.

Alberta Transportation's guidelines for unsignalized intersections accept a v/c ratio of 0.85 or less and a LOS C at highway access intersections with a LOS D on any single approach at full build-out depending on location.

For unsignalized intersections, the LOS methodology considers intersection geometry, traffic volumes, speed limit, and type of intersection control. For signalized intersections, the LOS methodology considers intersection geometry, traffic volumes, speed limit, and signal timing plan. Delays range from LOS 'A' conditions with minimal delay to LOS 'F' which represents significant control delay. The LOS criteria for unsignalized and signalized intersections are summarized in **Table 3.5.**

Table 3.5: HCM Level of Service Summary

LEVEL OF SERVICE (LOS)	AVERAGE CONTROL DELAY FOR UNSIGNALIZED INTERSECTION MOVEMENTS	AVERAGE CONTROL DELAY FOR SIGNALIZED INTERSECTION MOVEMENTS
A	≤ 10 seconds per vehicle	≤ 10 seconds per vehicle
B	> 10 – 15 seconds per vehicle	> 10 – 20 seconds per vehicle
C	> 15 – 25 seconds per vehicle	> 20 – 35 seconds per vehicle
D	> 25 – 35 seconds per vehicle	> 35 – 55 seconds per vehicle
E	> 35 – 50 seconds per vehicle	> 55 – 80 seconds per vehicle
F	> 50 seconds per vehicle	> 80 seconds per vehicle

The results of the intersection capacity analysis were based on expected traffic volumes, traffic control, and lane arrangement at the study intersections. The analysis is completed as per Alberta Transportation TIA guidelines with a saturation flow of 1850 vehicles per hour and peak hour factor of 0.93.

The volume to capacity ratio, level of service, average control delay (in seconds), and 95th percentile queues (in metres) are summarized in the body of this report. Synchro output summaries are provided in **Appendix D.**

The Background intersection capacity analysis is summarized in **Table 3.6**. The 2020 analysis is completed based on existing lane configurations. The 2040 analysis is completed based on both the existing lane configuration and with a twinned Highway 22 as per the recommendations from the *Highway 22 Functional Planning Study*.

Table 3.6: Background Intersection Capacity Analysis (Highway 22 & Township Road 242)

INTERSECTION	MOVEMENT & LANES		AM PEAK HOUR v/c	AM LOS	AM Delay	AM Queue	PM PEAK HOUR v/c	PM LOS	PM Delay	PM Queue
2020 Background	EB	1	0.03	C	18	<5	0.05	C	18	<5
	NB	1	0.01	A	0	<5	0.01	A	0	<5
	SB	1	0.29	A	0	<5	0.38	A	0	<5
	Overall		-	*A*	*0.2*	-	-	*A*	*0.3*	-
2040 Background *(Existing Hwy 22)*	EB	1	0.05	C	25	<5	0.09	D	25	<5
	NB	1	0.01	A	0	<5	0.01	A	0	<5
	SB	1	0.37	A	0	<5	0.49	A	0	<5
	Overall		-	*A*	*0.3*	-	-	*A*	*0.4*	-
2040 Background *(Twinned Hwy 22)*	EB	1	0.03	C	17	<5	0.06	C	19	<5
	NB	2	0.34	A	0	<5	0.26	A	0	<5
	SB	2	0.24	A	0	<5	0.33	A	0	<5
	Overall		-	*A*	*0.2*	-	-	*A*	*0.3*	-

The Background intersection capacity analysis indicates Highway 22 & Township Road 242 will continue operating within acceptable capacity parameters during the 2020 and 2040 horizons in both the existing geometry and twinned highway scenarios.

3.9 Road Link Analysis

The volume of daily traffic on a roadway is one of the factors that aids in determining road classifications and appropriate lane requirements. To confirm roadway capacities, the background daily traffic volumes were calculated in vehicles per day (vpd) and compared to the environmental guidelines from the *Alberta Transportation Highway Geometric Design Guide* and *Rocky View County Servicing Standards*. The environmental guidelines represent the limit of comfortable operation of the roadway under most conditions, while the actual physical capacity of the roadway can be considerably higher.

The analysis is completed assuming a 1.5% growth rate on Highway 22. Traffic growth on Township Road 242 will be from development (i.e. the proposed gravel pit) and therefore is included in the Post Development analysis. The results of the daily link analysis are summarized in **Table 3.7**.

Table 3.7: Background Road Link Analysis

ROADWAY LINK	CLASSIFICATION	GUIDELINE (VPD)	BACKGROUND DAILY TRAFFIC VOLUMES (VPD) 2019	2020	2040
Highway 22 North of Hwy 8	2-Lane Highway	~12,000	9,300	9,400	12,200
Township Road 242 West of Hwy 22	2-lane Regional Moderate Volume	<500	115	No change	No change

The road link analysis suggests twinning of Highway 22 may be required by the 2040 Background horizon. This matches with the recommendations from the *Highway 22 Functional Planning Study*.

3.10 Alberta Transportation Warrants

3.10.1 Intersection Turning Warrants

Intersection type warrant was completed for the intersection of Highway 22 & Township Road 242 following the AT Highway Geometric Design Guide. The AT intersection warrant analysis is utilized at unsignalized at-grade intersections to determine if a left turn is required to eliminate interference caused by standing vehicles waiting to turn or a right turn lane is required to reduce obstruction to through movements.

Right Turn Warrants

The AT exclusive right turn lane warrant for a two-lane undivided highway states that three separate conditions should generally be met in order to warrant the need for such a lane. These criteria are:

- Average Annual Daily Traffic (AADT) volumes on the main road are greater than or equal to 1,800 vehicles per day (vpd);
- The intersected road exhibits daily traffic volumes greater than or equal to 900 vpd; and
- The right turn movement in question is greater than or equal to 360 vpd.

Based on this criteria, an exclusive right is not warranted as the intersected road daily traffic volumes will remain less than 900 vpd and the right turn movement in question will remain less than 360 vpd.

Left Turn Warrants

According to AT guidelines, the following two conditions should generally be met to warrant the need to construct an exclusive left turn taper and/or by-pass through lane on a two-lane highway:

- The peak hour opposing traffic volumes are greater than or equal to 100 vpd; and
- A minimum of five percent of advancing traffic is left turning during the peak hour periods.

Opposing traffic volumes are greater than 100 vpd in all horizons. However, left turning volumes are below 1% of advancing volumes. Since the left turning percentage is less than 5%, an upgraded intersection is not required based on technical warrant analysis, however AT guidelines state that engineering judgement may be used on roadways where main road volumes are greater than 4,000 vehicles per day, such as Highway 22, to determine the appropriate intersection treatment.

In the original TIA, Bunt & Associates recommended a Type IIIa intersection to provide separation from the through lane for vehicles turning left off Highway 22, this supported by a high number of through traffic volumes along Highway 22. Since the original TIA, it has been observed that traffic volumes along Highway 22 are not growing at as large of a rate initially projected, and that traffic volumes are lower now than they were in 2016, as well, the Rocky View County gravel pit that once operated along Township Road 242 is no longer in operation. Given the low volume of traffic along Highway 242, and low turning volume off of Highway 22 onto Township Road 242, as well as the consideration of future planned improvements along Highway 22 at this intersection; Bunt & Associates recommends that the existing Type 1 intersection treatment be maintained at this location.

3.10.2 Illumination Warrant

A street light illumination warrant calculation was completed at the Highway 22 & Township Road 242 based on the *Transportation Association of Canada Illumination of Isolated Rural Intersections* guidelines, which are referred to in the AT Highway Lighting Guide. The warrant for illumination is used to determine if lighting an intersection is required based on several different factors such as geometrics, operations, environmental issues as well as collision history. The analysis (included in **Appendix E**) confirmed illumination is not warranted at any background horizon.

4. PROPOSED DEVELOPMENT

4.1 Land Use Information

The development permit is for a gravel pit operation. As per the development permit conditions, the hours of operation of the gravel pit (including aggregate excavating, hauling, crushing, stock piling, and stripping of overburden) are as follows:

- Hauling is permitted only from 7:00-17:00 on Monday-Saturday;
- Crushing is permitted only from 7:00-19:00 on Monday-Saturday; and
- No operation will occur on Sundays and statutory holidays.

The facility will operate with the following constraints:

- All traffic will access the site via the parcel to the east, which is also owned by Mr. Copithorne. Traffic will travel to Highway 22 via Township Road 242. This is the current route used by previous operations on the site.
- All outbound truck traffic will turn right at Highway 22 and proceed to the south on Highway 22. Trucks will enter the site from both the north and south on Highway 22

The facility will have the following number of employees:

- A total of 2 full time employees will work on-site, there are no extra employees when crushing is occurring.
- No shift changes will occur.

Based on the 2019 haul data for the gravel pit provided in **Appendix** C, the facility will have the following truck trips:

- A maximum of 45 loads in one hauling day, which results in up to 90 truck trips per day (45 In, 45 Out). It is noted that this was the busiest day for the site in 2019, and that the average amount of loads processed on haul days in 2019 was 13. The truck trip generation for the site is therefore based on the worse-case scenario.
- All activity expected to be completed by 5 truck drivers.

4.2 Trip Generation

Trip generation for the proposed development permit was calculated based on first principles. The vehicular trip generation rates used in this study are as follows:

Employees (Passenger vehicle trips) – Based on employment hours, it is expected that both full time employees will arrive before the AM peak hour (7:30-8:30) and leave during the PM peak hour (16:15-

17:15). To be conservative, it is assumed that the employees arrive during the AM peak hour and leave during the PM peak hour.

- AM Peak Hour: 2 trips (2 In, 0 Out)
- PM Peak Hour: 2 trips (0 In, 2 Out)
- Daily: 4 trips (2 In, 2 Out)

Hauling (Truck trips) – Based on site operation information, a worst-case total of 90 daily trips are expected over the daily 10-hour operating period. This results in 9 truck trips during both peak hours (90/10 = 9).

- AM Peak Hour: 9 trips (5 In, 4 Out)
- PM Peak Hour: 9 trips (4 In, 5 Out)
- Daily: 90 trips (45 In, 45 Out)

Vehicular trip generation for the proposed development is summarized in **Table 4.1.**

Table 4.1: Trip Generation

LAND USE	AM PEAK HOUR			PM PEAK HOUR			DAILY		
	Total	In	Out	Total	In	Out	Total	In	Out
Passenger Vehicle Trips	2	2	0	2	0	2	4	2	2
Truck Trips	9	5	4	9	4	5	90	45	45
Total Trips	**11**	**7**	**4**	**11**	**4**	**7**	**94**	**47**	**47**

4.3 Trip Distribution

Site traffic was distributed to the roadway network based on previous traffic patterns and indicated truck routing (i.e. trips oriented to the north/east will use the Highway 8 roundabout intersection to either make a U-turn or turn left). The trip distribution utilized is summarized in **Table 4.2.**

Table 4.2: Gravel Pit Trip Distribution

DIRECTION	AM PEAK HOUR		PM PEAK HOUR	
	In	Out	In	Out
Employee Trips				
To/from the north on Highway 22	40%	40%	40%	40%
To/from the south on Highway 22	60%	60%	60%	60%
Total	*100%*	*100%*	*100%*	*100%*
Truck Trips				
From the north on Highway 22	50%	-	50%	-
To/from the south on Highway 22	50%	80%	50%	80%
To north on Highway 22 via Hwy 8 roundabout	-	20%	-	20%
Total	*100%*	*100%*	*100%*	*100%*

5. POST DEVELOPMENT TRAFFIC CONDITIONS

Site generated traffic volumes were superimposed onto background traffic volumes to obtain Post Development traffic volumes as summarized in **Exhibit 5.1**. The Long Term analysis is completed assuming the site will still be operating by 2040.

5.1 Intersection Capacity Analysis

The Post Development intersection capacity analysis is summarized in **Table 5.1.**

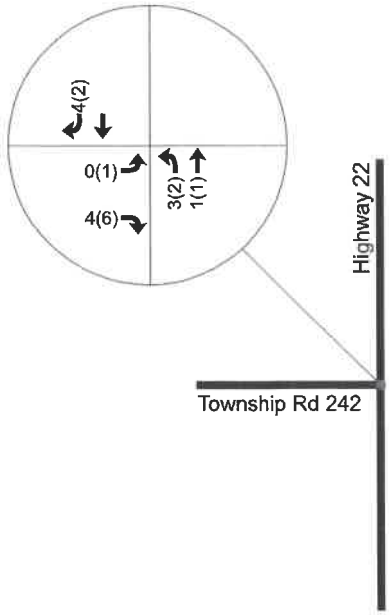
Table 5.1: Post Development Intersection Capacity Analysis (Highway 22 & Township Road 242)

INTERSECTION	MOVEMENT & LANES		AM PEAK HOUR v/c	AM LOS	AM Delay	AM Queue	PM PEAK HOUR v/c	PM LOS	PM Delay	PM Queue
2020 Post Development	EB	1	0.04	C	17	<5	0.08	C	18	<5
	NB	1	0.01	A	0	<5	0.01	A	0	<5
	SB	1	0.29	A	0	<5	0.38	A	0	<5
	Overall		-	*A*	*0.3*	-	-	*A*	*0.4*	-
2040 Post Development *(Existing Hwy 22)*	EB	1	0.07	C	22	<5	0.12	C	25	<5
	NB	1	0.01	A	0	<5	0.01	A	0	<5
	SB	1	0.38	A	0	<5	0.49	A	0	<5
	Overall		-	*A*	*0.4*	-	-	*A*	*0.5*	-
2040 Post Development *(Twinned Hwy 22)*	EB	1	0.04	C	16	<5	0.08	C	18	<5
	NB	2	0.34	A	0	<5	0.26	A	0	<5
	SB	2	0.24	A	0	<5	0.33	A	0	<5
	Overall		-	*A*	*0.2*	-	-	*A*	*0.4*	-

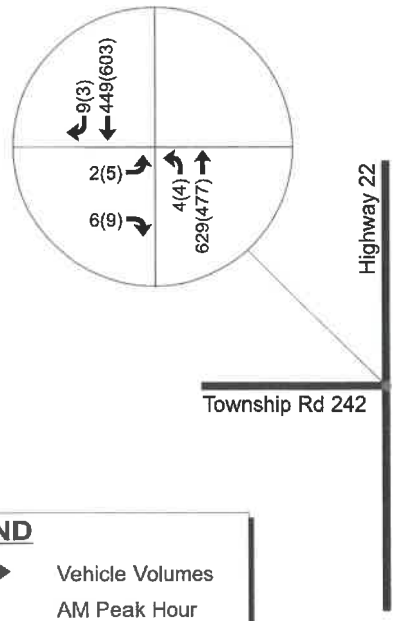
The Post Development intersection capacity analysis indicates no appreciable change in peak hour operations will occur at the intersection of Highway 22 & Township Road 242 due to the proposed development.

N

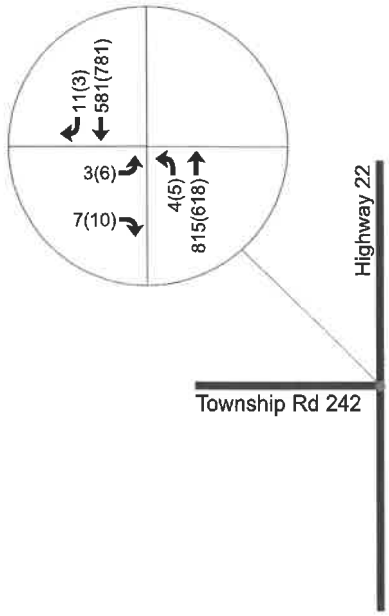
Site Traffic Volumes



2020 Post Development Traffic Volumes



2040 Post Development Traffic Volumes



LEGEND

↰ ↑ ↱	Vehicle Volumes
XX	AM Peak Hour
(YY)	PM Peak Hour

Exhibit 5.1

Post Development Traffic Volumes

Copithorne Gravel Pit TIA Update
June 2020 Scale NTS

bunt & associates

5.2 Road Links

5.2.1 Daily Volume Analysis

Post development daily traffic volumes are summarized in **Table 5.2**. The volumes presented for Township Road 242 represent the average and peak hauling days and not average annual daily traffic (AADT), which would be less than the average haul day as the site would only be operating half of the year.

Table 5.2: Post Development Road Link Analysis

ROADWAY LINK	CLASSIFICATION	GUIDELINE (VPD)	POST DEVELOPMENT DAILY TRAFFIC VOLUMES		
			2019	2020	2040
Highway 22 North of Hwy 8	2-Lane Highway	~12,000	9,400	9,500	12,300
Township Road 242 West of Hwy 22	2-lane Regional Moderate Volume	<500	145 (Average) 210 (Peak)	No change	No change

The analysis confirmed all roadway links in the study area would continue to carry traffic volumes within their respective environmental guidelines after the addition of the proposed development. Therefore, current roadway classifications are adequate to accommodate site traffic volumes.

5.2.2 Township Road 242

Township Road 242 is expected to have an AADT of less than 145 vehicles per day. AADT calculations would normally consider that the proposed gravel pit operations will only operate half of the year. However, this calculation assumes the proposed gravel pit will operate at capacity over the entire operating season.

Due to truck traffic, annual dust control (through the application of Calcium Chloride) will be required on Township Road 242.

It is recommended that the gravel pit operator require all truck drivers operate at a maximum speed of 50 km/h along Township Road 242. The roadway has rolling terrain, as such a reduction in operating speed from 60 km/h to 50 km/h would improve stopping sight distances by 20 metres. This could also be implemented for all road users by reducing the speed limit on the roadway to 50 km/h.

5.3 Alberta Transportation Warrants

5.3.1 Intersection Turning Warrants

Intersection type warrant were reviewed for the intersection of Highway 22 & Township Road 242 following the AT Highway Geometric Design Guide. The left turning volume will remain below 5% of advancing volumes (at approximately 1%). Given the low volume of traffic along Highway 242, and low turning volume off of Highway 22 onto Township Road 242, as well as the consideration of future planned improvements along Highway 22 at this intersection; Bunt & Associates recommends that the existing Type 1 intersection treatment be maintained at this location.

5.3.2 Illumination Warrant

A street light illumination warrant calculation was completed at the Highway 22 & Township Road 242 confirmed illumination is not warranted at both the 2020 and 2040 Post Development horizons.

6. FINDINGS AND RECOMMENDATIONS

The findings and recommendations made as a result of the TIA update are listed below:

6.1.1 Collision History

A total of 5 collisions occurred at the intersection over a 14-year period. Three of the collisions were single-vehicle (struck animal; run-off-road). A collision occurred in 2005 that involved 3 vehicles with 4 injuries and 2 fatalities. A 2015 rear-end collision involving 2 trucks is also documented.

6.1.2 Sight Distance

All minimum and desirable sight distance requirements are met at the intersection.

6.1.3 Background Intersection Capacity Analysis

The Background intersection capacity analysis indicates Highway 22 & Township Road 242 will continue operating within acceptable capacity parameters during the Opening Day (2020) and Long Term (2040) horizons.

6.1.4 Post Development Intersection Capacity Analysis

The Post Development intersection capacity analysis indicates no appreciable change in peak hour operations will occur at the intersection of Highway 22 & Township Road 242 due to the proposed development.

6.1.5 Alberta Transportation Intersection Warrant

Intersection type warrant were reviewed for the intersection of Highway 22 & Township Road 242 following the AT Highway Geometric Design Guide. The left turning volume will remain below 5% of advancing volumes (at approximately 1%). Given the low volume of traffic along Highway 242, and low turning volume off of Highway 22 onto Township Road 242, as well as the consideration of future planned improvements along Highway 22 at this intersection; Bunt & Associates recommends that the existing Type 1 intersection treatment be maintained at this location.

6.1.6 Alberta Transportation Illumination Warrant

Street light illumination is not warranted at the intersection.

6.1.7 Highway 22

The Background road link analysis suggests twinning of Highway 22 may be required by the Long Term Background horizon (2040). This matches with the recommendations from the *Highway 22 Functional Planning Study*. No appreciable change will occur due to development traffic volumes.

6.1.8 Township Road 242

The roadway is expected to continue operating within its daily vehicle capacity. Due to the expected truck traffic, annual dust control (through the application of Calcium Chloride) will be required on Township Road 242.

It is recommended that the gravel pit operator require all truck drivers operate at a maximum speed of 50 km/h along Township Road 242. The roadway has rolling terrain, as such a reduction in operating speed from 60 km/h to 50 km/h would improve stopping sight distances by 20 metres. This could also be implemented for all road users by reducing the speed limit on the roadway to 50 km/h.

APPENDIX A

Scope of Work

Subject: RE: Scope of TIA - Copithorne Gravel Pit at Twp 242
Date: Monday, 8 February, 2016 9:50:19 AM Mountain Standard Time
From: AYurkowski@rockyview.ca
To: Ezekiel Dada
CC: Trevor.Richelhof@gov.ab.ca, Amrit Uppal

Thanks Ezekiel, sounds good.

Angela

ANGELA YURKOWSKI (BOOTH), P.ENG
Municipal Engineer | Engineering Services

ROCKY VIEW COUNTY
911 - 32 Avenue NE | Calgary | AB | T2E 6X6
Phone: 403-520-7289
ayurkowski@rockyview.ca | www.rockyview.ca

From: Ezekiel Dada [mailto:edada@bunteng.com]
Sent: Friday, February 5, 2016 10:31 AM
To: Angela Yurkowski
Cc: Trevor.Richelhof@gov.ab.ca; Amrit Uppal
Subject: Re: Scope of TIA - Copithorne Gravel Pit at Twp 242

Hi Angela,

Thanks for your reply. We will prepare the TIA to meet both the County and AT's TIA guidelines.

Regarding horizon, we plan on analyzing "Opening Day" that is, existing plus site traffic and 20-year, that is, Highway 22 traffic plus growth plus site traffic (assuming the gravel pit can be mined for more than 20 years).

Thank you.

Ezekiel

From: "AYurkowski@rockyview.ca" <AYurkowski@rockyview.ca>
Date: Friday, February 5, 2016 at 9:54 AM

To: Ezekiel Dada <edada@bunteng.com>
Cc: Amrit Uppal <auppal@bunteng.com>, Trevor Richelhof <Trevor.Richelhof@gov.ab.ca>
Subject: RE: Scope of TIA - Copithorne Gravel Pit at Twp 242

Hi Ezekiel,

The county requirements for TIA's are outlined in our servicing standards (Section 401).
http://www.rockyview.ca/Portals/0/Files/BuildingPlanning/Standards/Servicing-Standards.pdf

Specifically for this application, we want to see a review of TWP 242 to confirm appropriate road designation and identify any road improvements that may be needed based on volume and vehicle classification.

Also, what horizons will you be looking at?

Thanks

ANGELA YURKOWSKI (BOOTH), P.ENG
Municipal Engineer | Engineering Services

ROCKY VIEW COUNTY
911 - 32 Avenue NE | Calgary | AB | T2E 6X6
Phone: 403-520-7289
ayurkowski@rockyview.ca | www.rockyview.ca

From: Ezekiel Dada [mailto:edada@bunteng.com]
Sent: Thursday, February 4, 2016 3:45 PM
To: Trevor Richelhof; Angela Yurkowski
Cc: Vince Diot; Jerry Lau; Clarke Bullock; Amrit Uppal
Subject: Re: Scope of TIA - Copithorne Gravel Pit at Twp 242

Thanks Trevor,

Ezekiel

From: Trevor Richelhof <Trevor.Richelhof@gov.ab.ca>
Date: Thursday, February 4, 2016 at 3:31 PM
To: Ezekiel Dada <edada@bunteng.com>, "ayurkowski@rockyview.ca" <ayurkowski@rockyview.ca>
Cc: "vdiot@rockyview.ca" <vdiot@rockyview.ca>, Jerry Lau <Jerry.Lau@gov.ab.ca>, Clarke Bullock <clarke.bullock@gov.ab.ca>, Amrit Uppal <auppal@bunteng.com>
Subject: RE: Scope of TIA - Copithorne Gravel Pit at Twp 242

Ezekiel, for the intersection of Highway 22 and Township Road 242, I would recommend the scope of

the study follows the attached guideline, in addition to any other requirements of Rocky View County.

Regards,

Trevor Richelhof
Development / Planning Technologist
Delivery Services, Southern Region
Alberta Transportation
Government of Alberta
2nd Floor, 803 Manning Road NE, Calgary AB T2E 7M8

Tel 403-297-6311
Fax 403-297-7682
Trevor.Richelhof@gov.ab.ca

From: Ezekiel Dada [mailto:edada@bunteng.com]
Sent: Thursday, February 04, 2016 2:59 PM
To: ayurkowski@rockyview.ca; Trevor Richelhof
Cc: vdiot@rockyview.ca; Jerry Lau; Clarke Bullock; Amrit Uppal
Subject: Scope of TIA - Copithorne Gravel Pit at Twp 242

Hi Angela and Trevor,
We have been retained by Roy Copithorne to provide a TIA requested by the County in support of a development application for ongoing gravel pit operation located west of Highway 22 on Township Road 242. I attached the Development Appeals Board order for your reference.

Please find below our suggested scope for the study and let me know if it is acceptable to the County and Alberta Transportation.

- **Undertake 6-hour weekday intersection traffic counts for the following intersections:**
  - Highway 22 & Twp 242
  - Range road 45 & Twp 242 (if necessary)

Up-to-date road information, including traffic delays, is a click or a call away. Call 5-1-1 toll-free, visit 511.alberta.ca or follow us on Twitter @511Alberta to get on the road to safer travel.

http://511.alberta.ca/ab/en.html
https://twitter.com/511Alberta

APPENDIX B

Collision Data

1202-07

Case Year	Case No.	Police Service	In / Near	Place Name	On Hwy	not at intersection distance	not at intersection direction	not at intersection km/metre	not at intersection reference point description	special reference location description	occurrence date	occurrence hour (hh:mm)	collision severity	primary event	Veh1 travel direction	Veh2 travel direction	Veh1 manoeuver	Veh2 manoeuver	collision type	Hwy #	major control section	safety section	km post	environmental condition	surface condition	total injuries	total fatalities	Collision description
2012	2731433	767	2	COCHRANE	22					NEAR HWY 8	2012-01-08	8.3	3	1	1		47		94	22	14	10	33.33			0	0	V1 NB, STRUCK DEER.
2012	2676346	6840	1	INDIAN R	22					2601 HWY 22	2012-12-22		3	9	1		97		68	22	14	15	35.325	4	3	0	0	V1 EB MISSED CORNER & STRUCK DITCH.
2012	2679817	767	2	REDWOOD	22	0.02	S	K	HWY 8		2012-06-16	14.05	2	7	5		24		48	22	14	10	33.369	1	1	2	0	V1 SB WHEN UNKNOWN VEHICLE CROSSED OVER LINE CAUSING V1 TO SWERVE HITTING DITCH AND FLIPPING MOTORBIKE, BOTH RIDERS INJURED. NO COLLISION WITH UNKNOWN TRUCK.
2012	2702570	767	2	BRAGG CR	22	500	S	M	HWY 8 TRAFFIC CIRCLE		2012-11-19	17.3	3	1	1		47		94	22	14	10	33.309	5	97	0	0	V1 NB, STRUCK A DEER.
2012	2704068	767	2	BRAGG CR	22					S OF HIGHWAY 8	2012-10-06	19	3	1	9		47		94	22	14	10	33.307	1	1	0	0	VEH LT SCENE, DEER FOUND DECEASED.
2012	2704146	767	2	COCHRANE	22	1	S	K	HWY 8		2012-10-08	1	3	1	9		47		94	22	14	15	34.649	5	1	0	0	DS 7285982.
2012	2704290	767	2	BRAGG CR	22	7	S	K	HWY 1		2012-07-23	2.3	3	1	9		47		94	22	14	15	34.964	2	2	0	0	N/A.
2012	2781038	767	2	COCHRANE	22					JUST NORTH OF HWY 8	2012-01-04	15.45	3	9	1		47		68	22	14	15	34.924	1	1	0	0	VEH NB, HIT GRDRL ON EAST SHOULDER, DRI SLEEPY.
2012	2787315	767	2	COCHRANE	22	2	N	K	HWY 8		2012-07-15	23.4	3	8	1		47		94	22	14	15	35.706			0	0	VEH NB, HIT MOOSE.
2012	2787473	767	2	BRAGG CR	22	1	N	K	HWY 8		2012-10-03	6.55	3	2	9		47		61	22	14	15	34.026			0	0	N/A.
2012	2794400	767	2	BRAGG CR	22	5	S	K	HWY 1		2012-12-30	7.15	3	1	1		47		94	22	14	15	33.725			0	0	V1 NB, DEER APPEARED FROM LEFT, & COLLIDED W/ V1.
2012	2733586	767	2	BRAGG CR	22	150	S	M	HWY 8		2012-12-31	21	3	1	9		47		94	22	14	10	33.486	1	1	0	0	N/A
2012	2796267	767	2	BRAGG CR	22	1	N	K	BRAGG CREEK	NORTH OF TRAFFIC CIRCLE	2012-09-09	23.3	3	1	5		47		94	22	14	15	34.95			0	0	VEH SB, HIT DEER.
2011	2443041	767	2	COCHRANE	22	152.4	S	M	HWY 8		2011-01-04	5.3	2	2	1		47		41	22	14	10	33.319	1	5	1	0	NB V1 CROSSED LANES TO ONCOMMING & INTO WEST DITCH, TRACTOR SLID 180 DEGREES & CAME TO REST FACING SB.
2011	2559080	767	2	BRAGG CR	22	0.5	N	K	HWY 8	SB	2011-11-25	6	3	1	5		47		94	22	14	15	34.1	1	2	0	0	N/A.
2011	2762594	767	2	BRAGG CR	22	5	S	K	HWY #1		2011-11-21	17.3	3	1	1		47		94	22	14	15	35.726			0	0	V1 NB, COULD NOT AVOID DEER.
2011	2766758	835	2	PRIDDIS	22	10	E	K	BRAGG CREEK TURN OFF		2011-10-20	21.3	3	1	1		47		94	22	14	10	33.282			0	0	V1 EB, DEER CAME OUT FROM NORTH SIDE OF RD.
2011	2757566	767	2	BRAGG CR	22	10	N	K	BRAGG CREEK		2011-03-06	20.3	3	1	9		47		94	22	14	10	33.289			0	0	V1 STRUCK MOOSE.
2011	2653180	767	2	COCHRANE	22	1	N	K	HWY 8		2011-11-01	19.2	3	1	5		47		94	22	14	15	35.026			0	0	SB V1 STRUCK DEER.
2011	2742162	767	2	COCHRANE	22	1.5	N	K	HWY 8		2011-09-17	20.45	3	1	1		47		94	22	14	15	35.134			0	0	NB V1 COLLIDED WITH MOOSE.
2011	2746667	767	2	COCHRANE	22	2	N	K	HWY 8		2011-12-05	7.3	3	1	1		47		94	22	14	15	35.688			0	0	V1 NB, DEER CAME OUT OF WEST DITCH & STRUCK CENTER OF BUMPER.
2011	2746690	767	2	COCHRANE	22	5	S	K	HWY 1		2011-11-23	18.05	3	1	1		47		94	22	14	15	35.74			0	0	V1 NB, DEER ENTERED RD & STRUCK DRI SIDE OF V1.
2011	2653045	767	2	COCHRANE	22	5	S	K	HWY 1		2011-07-19	3.3	3	1	5		47		94	22	14	15	35.732			0	0	VEH HIT DEER.
2010	2500125	767	2	COCHRANE	22	5	S	K	HWY 1		2010-08-18	10.3	3	8	1	1	47	45	28	22	14	15	35.692	1	1	0	0	V1 NB WHEN THEY STOPPED AND V2 ROLLED INTO THE BACK OF V1.
2010	2442922	767	2	COCHRANE	22	1	N	K	HWY 8		2010-10-23	8	3	1	1		47		94	22	14	15	34.58	1	1	0	0	V1 NB, DRI OBSERVED DEER IN DITCH, SLOWED DOWN, DEER JUMPED OUT, HIT V1.
2010	2393208	767	2	COCHRANE	22	1	N	K	HWY 8	TRAFFIC CIRCLE	2010-05-29	8.37	3	9	5		47		68	22	14	15	34.01	4	2	0	0	V1 WENT OFF RD RT, STRIKING A LIGHT STANDARD.
2010	2392925	767	2	COCHRANE	22	5	S	K	HWY 1		2010-08-18	9.3	3	13	9	9	45	30	28	22	14	15	35.75	1	1	0	0	BACKING UP TO TURN TO GO AROUND ACCIDENT AND BACKED INTO MOTORCYCLE.
2010	2731420	767	2	COCHRANE	22	1	N	K	HWY 28		2010-06-18	21.45	3	1	5		47		94	22	14	15	34.606			0	0	V1 SB, DEER ENTERED RD & WAS STRUCK.
2010	2729896	767	2	COCHRANE	22	2	N	K	HWY 8 JCT		2010-10-23	7.3	3	1	1		47		94	22	14	15	35.715			0	0	V1 NB STRUCK DEER.
2010	2728751	767	2	BRAGG CR	22	2	N	K	HWY 8	N/B	2010-10-09	5.3	3	1	1		47		94	22	14	15	35.702			0	0	V1 NB STRUCK ELK.
2010	2729303	767	2	COCHRANE	22	3	S	M	HWY 8		2010-07-26	23.34	3	9	5		47		48	22	14	10	33.479			0	0	V1 SB WENT THRU TRAFFIC CIRCLE, RATHER THAN AROUND AND PUNCTURED ALL TIRES
2010	2653016	767	2	REDWOOD	22	1	N	K	HWY 8		2010-11-24	21.15	3	1	9		47		94	22	14	15	34.198			0	0	N/A.
2010	2443434	767	2	COCHRANE	22					BTWN BRAGG CRK & COCHRANE	2010-02-03	7	3	1	1		47		94	22	14	15	35.508	5	1	0	0	VEH NB, DEER HIT VEH.
2009	2653091	767	2	BRAGG CR	22	2	S	K	HWY 8	2 KM SOUTH OF ROUND ABOUT HEADING NORTH	2009-07-30	8.4	3	1	1		47		94	22	14	15	35.718			0	0	NB.
2009	2672632	767	2	BRAGG CR	22	1	N	K	HWY 8		2009-01-05	5.2	3	1	1		47		94	22	14	15	34.514			0	0	V1 NB, DEER RAN INTO VEH.
2009	2699073	835	2	PRIDDIS	22	10	E	K	BRAGG CREEK		2009-08-17	17.3	3	1	2		47		94	22	14	10	33.282			0	0	V1 EB, DEER CAME OUT OF RT DITCH & COLLIDED WITH V1.
2009	2706068	835	2	PRIDDIS	22	10	E	K	BRAGG CREEK		2009-07-23	6	3	1	5		47		94	22	14	15	34.41			0	0	DRI EB, DEER CAME OUT FROM NORTH DITCH, STRUCK VEH.
2009	2711969	767	2	BRAGG CR	22					AT TRAFFIC CIRCLE	2009-11-20	18.3	3	1	5		47		94	22	14	15	34.139			0	0	DRI SB, UNABLE TO AVOID COLLISION WITH DEER.
2009	2005605	767	2	COCHRANE	22	500	N	M	TWP RD 242		2009-03-03	6.11	3	9	5		24		58	22	14	15	35.825	4	3	0	0	SB, FISH TAILED, VEH SWERVED INTO DITCH, ROLLED ONTO ROOF.
2009	2098623	767	2	COCHRANE	22	1	N	K	HWY 8		2009-08-07	15.05	2	8	5	5	47	47	28	22	14	15	34.526	1	1	1	0	V1 AND V2 SB , V1 STOPPED FOT TRAFFIC , V2 RR V1.
2009	2281161	767	2	COCHRANE	22	15	S	K	COCHRANE	SB	2009-03-12	21	2	9	5		47		48	22	14	10	33.282	1	1	1	0	N/A.
2008	2589975	767	2	BRAGG CR	22	500	N	M	OF RIVER		2008-08-26	21.1	3	1	5		47		94	22	14	15	35.212			0	0	SB, DEER CAME FROM DITCH ACROSS HWY.
2008	2597209	767	2	COCHRANE	22	15	S	K	COCHRANE	SB	2008-03-01	14	3	1	5		47		94	22	14	10	33.34			0	0	N/A.
2008	2600625	835	2	PRIDDIS	22	3	W	K	HWY 22S JUNCTION		2008-03-13	7.45	3	1	3		47		94	22	14	15	35.057			0	0	V1 EB STRUCK DEER COMING OUT OF L DITCH.
2008	2615309	767	2	REDWOOD	22	0.02	N	K	HWY 8		2008-01-11	5.45	3	1	1		47		94	22	14	15	35.724			0	0	NB, DEER HIT VEH.
2008	2660040	767	2	BRAGG CR	22	1	N	K	HWY 8		2008-11-11	19	3	1	1		47		94	22	14	15	34.855			0	0	V1 NB, STRUCK DEER.
2008	2102105	767	2	COCHRANE	22	1	N	K	HWY 8	NORTH TRAFFIC CIRCLE	2008-02-29	13	3	1	1	5	47	47	93	22	14	15	35.042	1	1	0	0	V1 NB, V2 SB, LOAD FROM V1 CAME OUT BACK OF TRUCK, V2 STRUCK V1 LOAD.
2008	2169227	767	2	COCHRANE	22	1	N	K	HWY 8		2008-09-01	16	3	2	1		47		51	22	14	15	34.428	1	1	0	0	V1 NB, DRI PULLING WHEELIES & LOST CONTROL, SENDING V1 ON ITS SIDE INTO & ACROSS ONCOMING TRAFFIC & INTO DITCH.
2008	2227227	767	2	BRAGG CR	22					NORTH OF ROUNABOUT	2008-09-26	21.3	3	1	5		47		94	22	14	15	34.416	1	1	0	0	VEH SB ON HWY HIT A DEAD DEER LAYING ON THE RD.
2007	2578599	767	2	COCHRANE	22	1	N	K	HWY 8		2007-02-02	2	3	9	5		47		68	22	14	15	34.644			0	0	V1 SB, LOST CONTROL, CROSSED CENTER LINE AND STRUCK GUARD RAIL.
2007	2578663	767	2	REDWOOD	22	5	N	K	REDWOOD MEADOWS DRIVE		2007-01-14	18	3	1	6		47		94	22	14	10	33.151			0	0	V1 SB. DEER CROSSED ROAD, SWERVED DOWN AND WAS HIT BY ANOTHER DEER.
2007	2542602	767	2	BRAGG CR	22	15	E	K	BRAGG CREEK		2007-03-31	21.3	3	1	1		47		94	22	14	10	33.183			0	0	V1 EB, WHEN SMALL DARK ANIMAL CAME OUT FROM UNDER THE GUARD RAIL TO THE RT OF THE VEH AND WAS STRUCK.
2007	1884643	767	2	BRAGG CR	22	500	S	M	HWY 8		2007-03-18	17.2	3	2	5		47		61	22	14	10	33.325	3	3	0	0	VEH SB ROR TO EAST AND HIT A POWER POLE.
2007	1967368	767	2	COCHRANE	22	2	N	K	HWY 8	SPRING BANK ROAD	2007-05-06	17	3	1	5	1	47	47	93	22	14	15	35.695	1	1	0	0	V1 SB, TRUCK NB LOST 10 BAILS OF HAY THAT WENT INTO SB ALNES, D1 COLLIDED WITH 1 HAYBAIL.
2007	2005704	767	1	COCHRANE	22	1.5	N	K	HWY 8		2007-11-13		3	10	5	1	28	47	38	22	14	15	35.86	1	1	0	0	V1 NB ON HWY, CROSSED DOUBLE SOLID LINE & STRUCK V2.
2006	1828673	767	2	CALGARY	22	1	N	K	HWY 8		2006-12-23	17.3	3	9	5		47		68	22	14	15	34.598	1	1	0	0	V1 SB SLID, STRUCK GRDRL.
2006	2571906	767	2	BRAGG CR	22	10	N	K	BRAGG CREEK		2006-06-08	18.3	3	1	1		47		94	22	14	10	33.271			0	0	V1 NB STRUCK DEER.
2006	3597136	767	2	COCHRANE	22	14	S	K	COCHRANE		2006-12-27	13.51	2	9	5		24		58	22	14	10	33.361	4	3	1	0	V1 SB. TRAFFIC STOPPED SUDDENLY FOR MVC, V1 UNABLE TO STOP, SWERVED RT, ENTEREDDITCH, OT.
2006	2513525	767	2	BRAGG CR	22	10	E	K	BRAGG CREEK		2006-01-11	14.45	3	1	1		47		94	22	14	10	33.281			0	0	V1 EB STRUCK DEER.
2006	2560512	767	2	BRAGG CR	22	10	W	K	BAGG CREEK		2006-02-19	22	3	9	9		47		46	22	14	10	33.347			0	0	V1 SWERVED TO AVOID DEER, ENTERED DITCH.
2006	2564957	767	2	COCHRANE	22	0.5	N	K	ELBOW RIVER BRIDGE	CLOSE TO HWY JUNCTION	2006-05-30	5.1	3	1	5		47		94	22	14	15	35.215			0	0	V1 SB STRUCK DEER.
2005	2525432	767	2	BRAGG CR	22	0.5	N	K	HWY 8		2005-11-10	7.15	3	1	1		47		94	22	14	15	34.194			0	0	V1 NB STRUCK DEER.
2005	2513494	767	2	COCHRANE	22	5	S	K	HWY 1		2005-12-27	17.15	3	1	5		47		94	22	14	15	35.723			0	0	V1 SB, DEER STRUCK V1.
2005	2528622	767	2	COCHRANE	22	5	S	K	OF #1 INTERCHANGE		2005-01-01	17.15	3	7	9	9	47	32	38	22	14	15	35.722			0	0	VEH2 MAKING U-TURN ON HWY, STRUCK BY VEH1.
2005	2535164	767	2	COCHRANE	22	5	S	K	#1 HWY		2005-07-04	22.3	3	1	5		47		94	22	14	15	35.692			0	0	V1 SB STRUCK DEER.
2005	2536696	767	2	BRAGG CR	22	0.25	N	K	CAMP GARDENER		2005-09-26	15.3	3	1	1		47		94	22	14	15	33.944			0	0	V1 NB STRUCK DEER.
2005	2536711	767	2	COCHRANE	22	5	S	K	SPRING BANK RD		2005-08-26	6	3	1	5		47		94	22	14	10	33.531			0	0	V1 SB STRUCK ELK.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2005	1717607	767	2	COCHRANE	22					NORTHBOUND N OF HWY 8	2005-05-26	4.3	3	1	1		47		94	22	14	15	33.923	1	1	0	0	V1 STRUCK ELK.
2005	2545946	767	2	CALGARY	21	0.5	N	K	OF HWY 8		2005-09-16	20.45	3	1	5		47		94	22	14	15	34.216			0	0	V1 SB STRUCK DEER.
2004	2496993	767	2	COCHRANE	22	2	N	K	HWY 8		2004-11-07	22	3	9	1		24		68	22	14	15	35.691			0	0	V1 NB SWERVED TO AVOID VEH, V1 LOST CTRL ON ICE, SPUN, STRUCK GRDRL SEVERAL TIMES.
2004	3597276	767	2	COCHRANE	22	2	N	K	HWY 8	HIGHWAY 22 AND 2 KMS N OF HWY 8	2004-11-07	22.05	3	2	1		47		51	22	14	15	35.702	2	3	0	0	
2004	3586500	767	2	BRAGG CR	22	10	N	K	BRAGG CREEK		2004-08-26	21.3	3	1	9		47		94	22	14	10	33.407	1	1	0	0	VEH1, STRUCK DEER.
2004	1378756	767	2	SARCEE	22	900	N	M	HIGHWAY 8	ELBOW RIVER BRIDGE	2004-05-10	7.08	2	9	5		47		58	22	14	15	34.692	1	3	1	0	VEH1 SB, LOST CTRL, RORR, OT.
2004	2525301	767	2	BRAGG CR	22	0.5	N	K	HWY 8		2004-12-18	8	3	1	5		47		94	22	14	15	34.19			0	0	VEH1 SB, STRUCK DEER.
2004	2517453	767	2	CALGARY	22	2	N	K	HWY 8		2004-11-26	18.15	3	1	5		47		94	22	14	15	35.691			0	0	VEH1 SB, STRUCK DEER.
2004	2505791	767	2	COCHRANE	22					TOWNSHIP ROAD 242	2004-11-16	20.15	3	1	1		47		94	22	14	15	35.406			0	0	VEH1 NB, STRUCK DEER.
2004	2505602	767	2	BRAGG CR	22	5	S	K	OF #1 HWY		2004-08-30	4.15	3	1	9		47		94	22	14	15	35.704			0	0	VEH1, STRUCK ELK.
2004	2503145	767	2	BRAGG CR	22	6	S	K	HWY 1		2004-09-14	2.3	3	1	5		47		94	22	14	15	34.648			0	0	VEH1 SB, STRUCK ELK.
2004	2503066	767	2	BRAGG CR	22	7	S	K	HWY 1		2004-08-06	5.2	3	1	5		47		94	22	14	15	33.939			0	0	VEH1 SB, STRUCK DEER.
2003	2463090	767	2	BRAGG CR	22	10	N	K	OF BRAGG CREEK		2003-05-25	13.15	3	1	1		47		94	22	14	15	34.412			0	0	VEH1 NB, STRUCK DEER.
2003	2447107	767	2	COCHRANE	22	1	N	K	HIGHWAY #8		2003-08-27	22	3	1	5		47		94	22	14	15	34.454			0	0	VEH1 SB, STRUCK DEER.
2003	2428464	767	2	BRAGG CR	22					ON ELBOW RIVER BRIDGE	2003-05-06	4	3	9	5		47		58	22	14	15	34.684			0	0	VEH1 LOST CTRL, BLACK ICE, RORR AND OVERTURNED.
2003	2463383	767	2	BRAGG CR	22	1	N	K	HIGHWAY #8		2003-07-14	5	3	1	1		47		94	22	14	15	34.937			0	0	VEH1 NB, STRUCK DEER.
2003	2472384	774	2	REDWOOD	22					NEAR HWY 8	2003-10-14	19	3	2	1		47		41	22	14	15	33.888			0	0	VEH1 SLIPPED ON RD AND WENT INTO DITCH.
2003	1321351	767	2	COCHRANE	22	1	NW	K	HY. 008		2003-09-17	6.17	1	10	1	5	47	47	38	22	14	15	34.69	1	3	1	1	VEH 1 NB, CROSSED CENTRE LINE HITTING VEH 2 HEAD-ON. BOTH VEH STOPPED IN CENTER OF HIGHWAY CLOUD OF STEAM. VEH 3 OBSERVED VEHICLES LAST MINUTE, ATTEMPTED TO AVOID BUT CLIPPED VEH 1.
2003	1485730	767	2	COCHRANE	22	900	N	M	HWY #8	SOUTH END OF ELBOW RIVER BRIDGE	2003-10-15	7.04	3	6	5	1	1	47	34	22	14	15	34.583	1	3	0	0	VEH1 SB, HAULING TRLR, LOST CTRL, SSOO VEH2, THEN SS VEH3 WAS NB, VEH4 NB STRUCK PROPANE TANK WHICH FELL FROM TRLR.
2003	2415828	767	2	COCHRANE	22	14	S	K	COCHRANE AB		2003-04-02	14.3	3	9	5		47		68	22	14	10	33.114			0	0	VEH1 SB HIT ICE, STRUCK HWY SIGN.

20150563168 00107672COCHRANE022 005.005 KHWY 1 2015/07/1511.0030105 47 94022 014 035.4270010100000000000399VEHICLE 1 TRAVELLING SOUTHBOUND ON HWY 22 - 5 KM SOUTH OF HWY 1 WHEN DEER JUMPED OUT FROM DITCH HITTING DEER ON THE LEFT FRONT CORNER OF VEHICLE.
20150608929 00107672BRAGG CR022 000.00 BETWEEN HIGHWAY 8 AND SPRINGBANK ROAD 2015/10/1006.4530101 47 94022 014 035.4610010100000000000301VEHICLE #1 NORTHBOUND ON HWY 22. COLLIDED WITH DEER. 1 PASSENGER. NO INJURIES.
20150594370 00207672COCHRANE022 TOWNSHIP ROAD 242 000.00 BY VOLKER STEVIN TURNOFF - TOWNSHIP ROAD 242 2015/10/0812.0030607033697340 22 014 035.32000101000000000101MACK TRUCK WAS TRAVELLING SOUTH OF HIGHWAY 22. IT SIGNALED TO TURN INTO TOWNSHIP ROAD 242 AND WHEN IT COMPLETED ITS TURN, IT WAS STRUCK BY THE STERLING.
20150594370 00107672COCHRANE022 TOWNSHIP ROAD 242 000.00 BY VOLKER STEVIN TURNOFF - TOWNSHIP ROAD 242 2015/10/0812.0030607033697340 22 014 035.32000101000000000101MACK TRUCK WAS TRAVELLING SOUTH OF HIGHWAY 22. IT SIGNALED TO TURN INTO TOWNSHIP ROAD 242 AND WHEN IT COMPLETED ITS TURN, IT WAS STRUCK BY THE STERLING.
20150563168 00207672COCHRANE022 005.005 KHWY 1 2015/07/1511.0030105 47 94022 014 035.4270010100000000 VEHICLE 1 TRAVELLING SOUTHBOUND ON HWY 22 - 5 KM SOUTH OF HWY 1 WHEN DEER JUMPED OUT FROM DITCH HITTING DEER ON THE LEFT FRONT CORNER OF VEHICLE.
20150608929 00207672BRAGG CR022 000.00 BETWEEN HIGHWAY 8 AND SPRINGBANK ROAD 2015/10/1006.4530101 47 94022 014 035.4610010100000000 VEHICLE #1 NORTHBOUND ON HWY 22. COLLIDED WITH DEER. 1 PASSENGER. NO INJURIES.
20132515280 00307672COCHRANE022 100.00M MTWP RD 242 2013/07/0517.40208050547472 8022 014 035.45300207000400000101VEH3 STOPPED AT TRAFFIC LIGHT ON HWY 22, JUST NORTH OF TWP RD 242 - SB. VEH2 WAS STOPPED BEHIND VEH3 - CONSTRUCTION ZONE. VEH1 WAS ALSO SB & COLLIDED WITH VEH2, WHICH THEN ALSO REAR ENDED VEH3. VEH2 CROSSED
20132515280 00207672COCHRANE022 100.00M MTWP RD 242 2013/07/0517.40208050547472 8022 014 035.45300207000400000101VEH3 STOPPED AT TRAFFIC LIGHT ON HWY 22, JUST NORTH OF TWP RD 242 - SB. VEH2 WAS STOPPED BEHIND VEH3 - CONSTRUCTION ZONE. VEH1 WAS ALSO SB & COLLIDED WITH VEH2, WHICH THEN ALSO REAR ENDED VEH3. VEH2 CROSSED
20132515280 00107672COCHRANE022 100.00M MTWP RD 242 2013/07/0517.40208050547472 8022 014 035.45300207000400000101VEH3 STOPPED AT TRAFFIC LIGHT ON HWY 22, JUST NORTH OF TWP RD 242 - SB. VEH2 WAS STOPPED BEHIND VEH3 - CONSTRUCTION ZONE. VEH1 WAS ALSO SB & COLLIDED WITH VEH2, WHICH THEN ALSO REAR ENDED VEH3. VEH2 CROSSED
20130281686 00207672REDWOOD 022 001.00N KHIGHWAY 8 51.03784 -114.46676 2013/11/2821.0030105 47 94022 014 035.3060010100000000 VEHICLE TRAVELLING SOUTHBOUND ON HIGHWAY 22, STRUCK A DEER CROSSING THE HIGHWAY WESTBOUND, VEHICLE STOPPING ON SHOULDER, NO INJURIES, DEER DECEASED.
20130281686 00107672REDWOOD 022 001.00N KHIGHWAY 8 51.03784 -114.46676 2013/11/2821.0030105 47 94022 014 035.3060010100000000030VEHICLE TRAVELLING SOUTHBOUND ON HIGHWAY 22, STRUCK A DEER CROSSING THE HIGHWAY WESTBOUND, VEHICLE STOPPING ON SHOULDER. NO INJURIES, DEER DECEASED.

APPENDIX C

Traffic Data

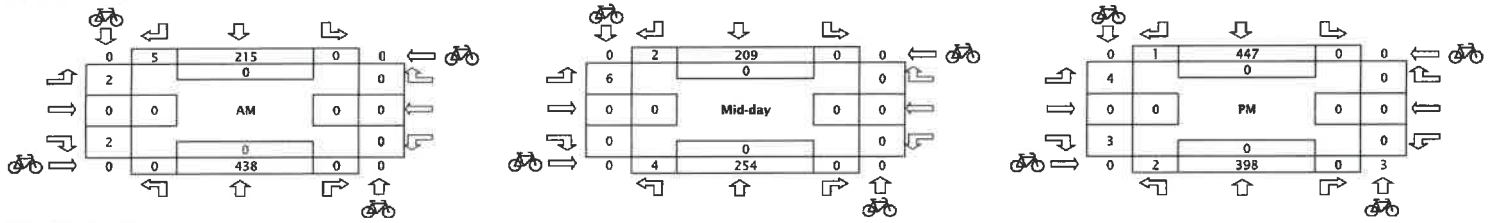
Intersection Turning Movement Count Summary: Highway 22 & Township Road 242

N/S Road:	Highway 22		***AM Peak Hr:***	7:30 AM	to 8:30 AM	***PHF (AM Peak Hr):***	0.95
E/W Road:	Township Road 242		***Mid-day Peak Hr:***	11:00 AM	to 12:00 PM	***PHF (Mid-day Peak Hr):***	0.92
Count Date:	February 17, 2016	Wednesday	***PM Peak Hr:***	4:15 PM	to 5:15 PM	***PHF (PM Peak Hr):***	0.93
Weather:	Clear						
Road Cond:	Good						
Project #:	1202-07						

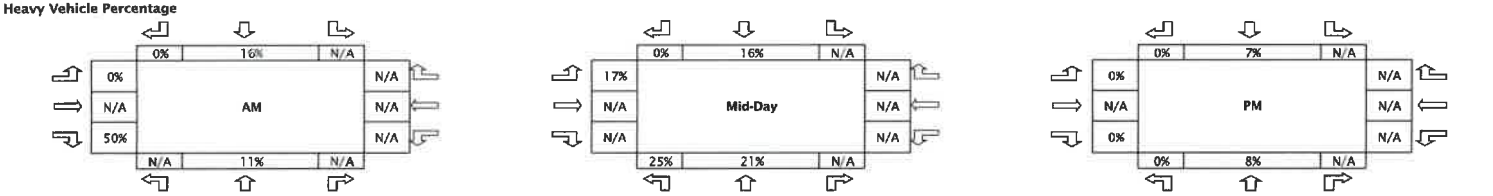
bunt & associates — TRANSPORTATION PLANNERS AND ENGINEERS

	Highway 22																Township Road 242															
	Northbound (South Leg)								Southbound (North Leg)								Eastbound (West Leg)								Westbound (East Leg)								
	Left		Through		Right		-		Left		Through		Right		-		Left		Through		Right		-		Left		Through		Right		-		Total Vehicles
Time Starting	Car	Truck	Car	Truck	Car	Truck	Cycle	Peds	Car	Truck	Car	Truck	Car	Truck	Cycle	Peds	Car	Truck	Car	Truck	Car	Truck	Cycle	Peds	Car	Truck	Car	Truck	Car	Truck	Cycle	Peds	15 Min	Hourly
7:00	2	0	59	6	0	0	0	0	0	0	51	8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	127	
7:15	0	0	63	0	0	0	0	0	0	0	56	13	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	133	
7:30	0	0	108	8	0	0	0	0	0	0	45	8	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	170	
7:45	0	0	82	10	0	0	0	0	0	0	45	8	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	147	577
8:00	0	0	102	22	0	0	0	0	0	0	40	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	175	625
8:15	0	0	100	6	0	0	0	0	0	0	51	8	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	170	662
8:30	0	0	71	11	0	0	0	0	0	0	52	3	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	140	632
8:45	0	0	66	10	0	0	0	0	0	0	48	8	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	133	618
2 hr Total	2	0	651	73	0	0	0	0	0	0	388	66	7	0	0	0	3	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0		
2 hr Total Veh	2		724		0				0		454		7				3		0		5				0		0		0				1195	
Peak hr Total	**0**	**0**	**392**	**46**	**0**	**0**	**0**	**0**	**0**	**0**	**181**	**34**	**5**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		
Peak hr Total Veh	**0**		**438**		**0**				**0**		**215**		**5**				**2**		**0**		**2**				**0**		**0**		**0**					**662**
11:00	1	0	47	13	0	0	0	0	0	0	56	6	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	126	
11:15	2	1	47	14	0	0	0	0	0	0	31	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	103	
11:30	0	0	56	13	0	0	0	0	0	0	48	8	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	129	
11:45	0	0	51	13	0	0	0	0	0	0	40	12	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	117	475
12:00	0	0	44	14	0	0	1	0	0	0	44	3	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	107	456
12:15	0	0	41	18	0	0	0	0	0	0	51	11	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	122	475
12:30	0	0	51	14	0	0	0	0	0	0	54	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	125	471
12:45	0	0	53	12	0	0	0	0	0	0	45	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	118	472
2 hr Total	3	1	390	111	0	0	1	0	0	0	369	62	3	0	0	0	7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
2 hr Total Veh	4		501		0				0		431		3				8		0		0				0		0		0				947	
Peak hr Total	**3**	**1**	**201**	**53**	**0**	**0**	**0**	**0**	**0**	**0**	**175**	**34**	**2**	**0**	**0**	**0**	**5**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		
Peak hr Total Veh	**4**		**254**		**0**				**0**		**209**		**2**				**6**		**0**		**0**				**0**		**0**		**0**					**475**
16:00	1	0	63	6	0	0	0	0	0	0	100	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	192	
16:15	0	0	89	10	0	0	0	0	0	0	96	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	201	
16:30	1	0	100	5	0	0	0	0	0	0	113	7	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	229	
16:45	0	0	84	11	0	0	3	0	0	0	107	8	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	212	834
17:00	1	0	93	6	0	0	0	0	0	0	98	12	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	213	855
17:15	0	0	70	7	0	0	0	0	0	0	103	9	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	191	845
17:30	0	0	65	6	0	0	0	0	0	0	98	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	176	792
17:45	0	0	73	5	0	0	0	0	0	0	97	7	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	184	764
2 hr Total	3	0	637	56	0	0	3	0	0	0	812	78	1	0	0	0	5	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0		
2 hr Total Veh	3		693		0				0		890		1				5		0		6				0		0		0				1598	
Peak hr Total	**2**	**0**	**366**	**32**	**0**	**0**	**3**	**0**	**0**	**0**	**414**	**33**	**1**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		
Peak hr Total Veh	**2**		**398**		**0**				**0**		**447**		**1**				**4**		**0**		**3**				**0**		**0**		**0**					**855**
6 hr Total	8	1	1678	240	0	0	4	0	0	0	1569	206	11	0	0	0	15	1	0	0	10	1	0	0	0	0	0	0	0	0	0	0		
6 hr Total Veh	9		1918		0				0		1775		11				16		0		11				0		0		0					3740

Peak Hour Volumes



Heavy Vehicle Percentage

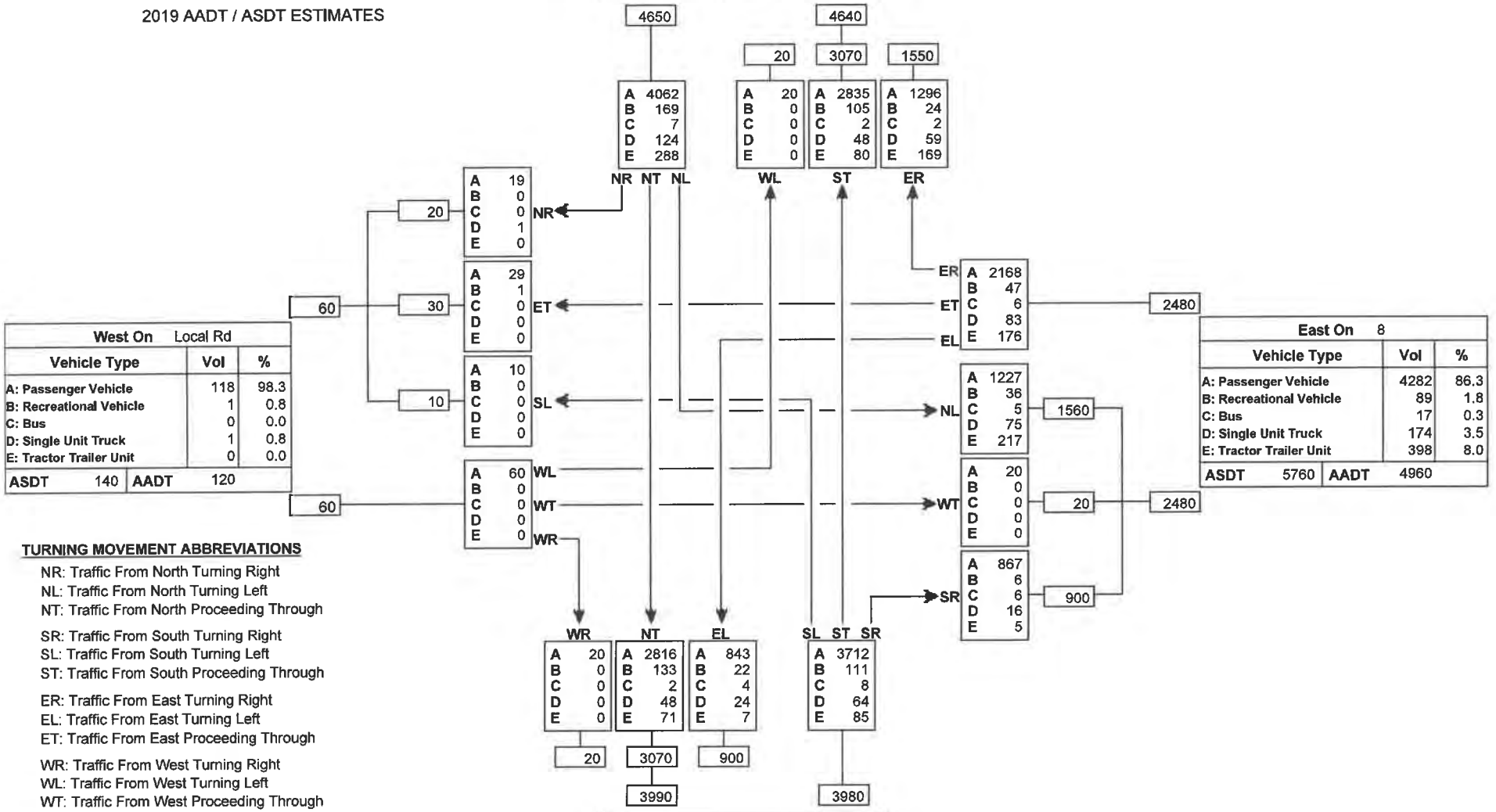


Turning Movement Summary Diagram

Reference No.: 60200

Intersection of:
8 & 22 NE OF BRAGG CREEK

2019 AADT / ASDT ESTIMATES



TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

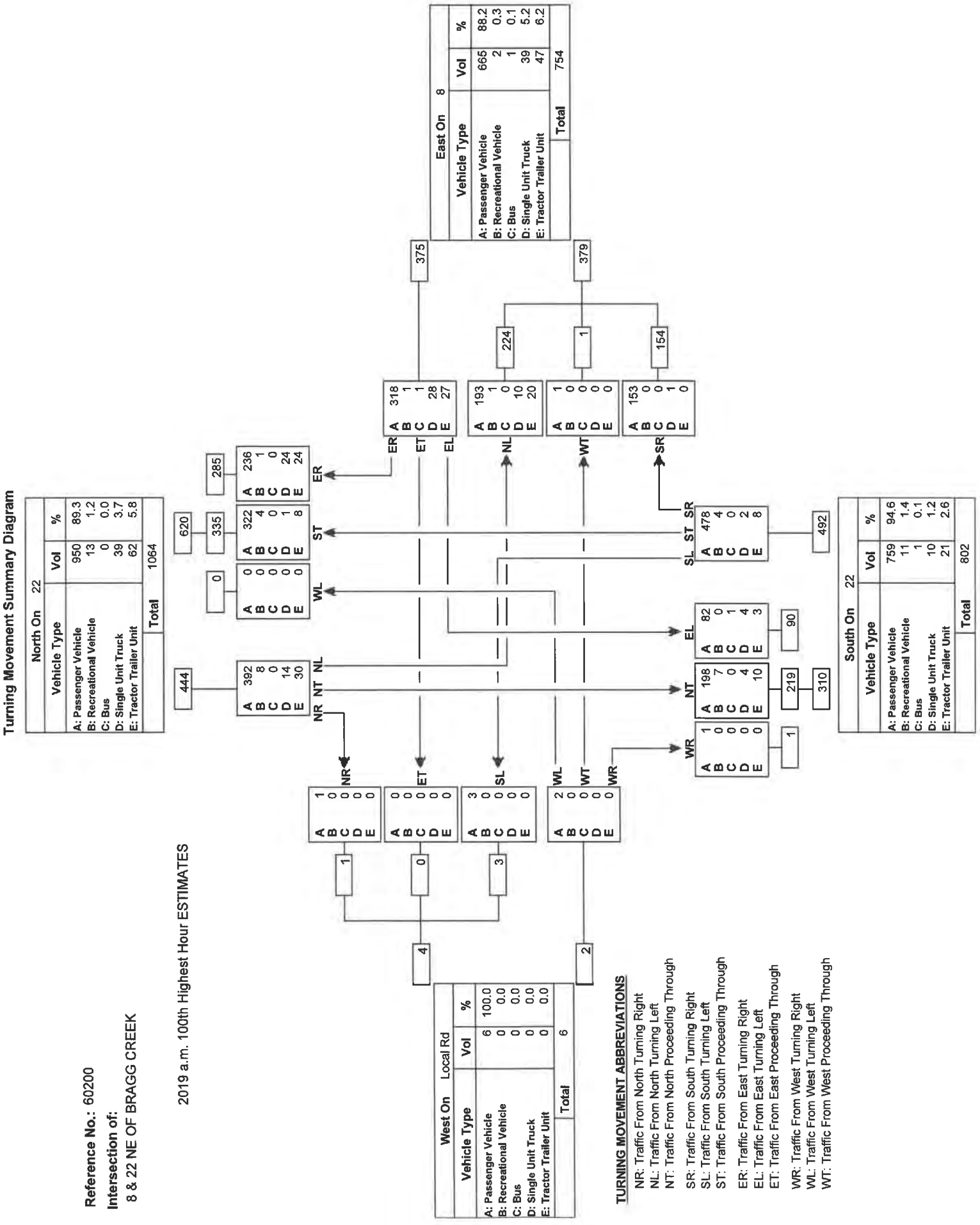
ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Annual Average Daily Traffic
Average daily traffic expressed as vehicles per day fo period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehicles per day fo period of May 1 to September 30 (153 days)


Turning Movement Summary Diagram
North On 22
Vehicle Type | Vol | %
A: Passenger Vehicle | 950 | 89.3
B: Recreational Vehicle | 13 | 1.2
C: Bus | 0 | 0.0
D: Single Unit Truck | 39 | 3.7
E: Tractor Trailer Unit | 62 | 5.8
Total | 1064
East On 8
Vehicle Type | Vol | %
A: Passenger Vehicle | 665 | 88.2
B: Recreational Vehicle | 2 | 0.3
C: Bus | 1 | 0.1
D: Single Unit Truck | 39 | 5.2
E: Tractor Trailer Unit | 47 | 6.2
Total | 754
South On 22
Vehicle Type | Vol | %
A: Passenger Vehicle | 759 | 94.6
B: Recreational Vehicle | 11 | 1.4
C: Bus | 1 | 0.1
D: Single Unit Truck | 10 | 1.2
E: Tractor Trailer Unit | 21 | 2.6
Total | 802
West On Local Rd
Vehicle Type | Vol | %
A: Passenger Vehicle | 6 | 100.0
B: Recreational Vehicle | 0 | 0.0
C: Bus | 0 | 0.0
D: Single Unit Truck | 0 | 0.0
E: Tractor Trailer Unit | 0 | 0.0
Total | 6
Reference No.: 60200
Intersection of:
8 & 22 NE OF BRAGG CREEK
2019 a.m. 100th Highest Hour ESTIMATES
TURNING MOVEMENT ABBREVIATIONS
NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through
SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through
ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through
WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

Turning Movement Summary Diagram

Reference No.: 60200

Intersection of:
8 & 22 NE OF BRAGG CREEK

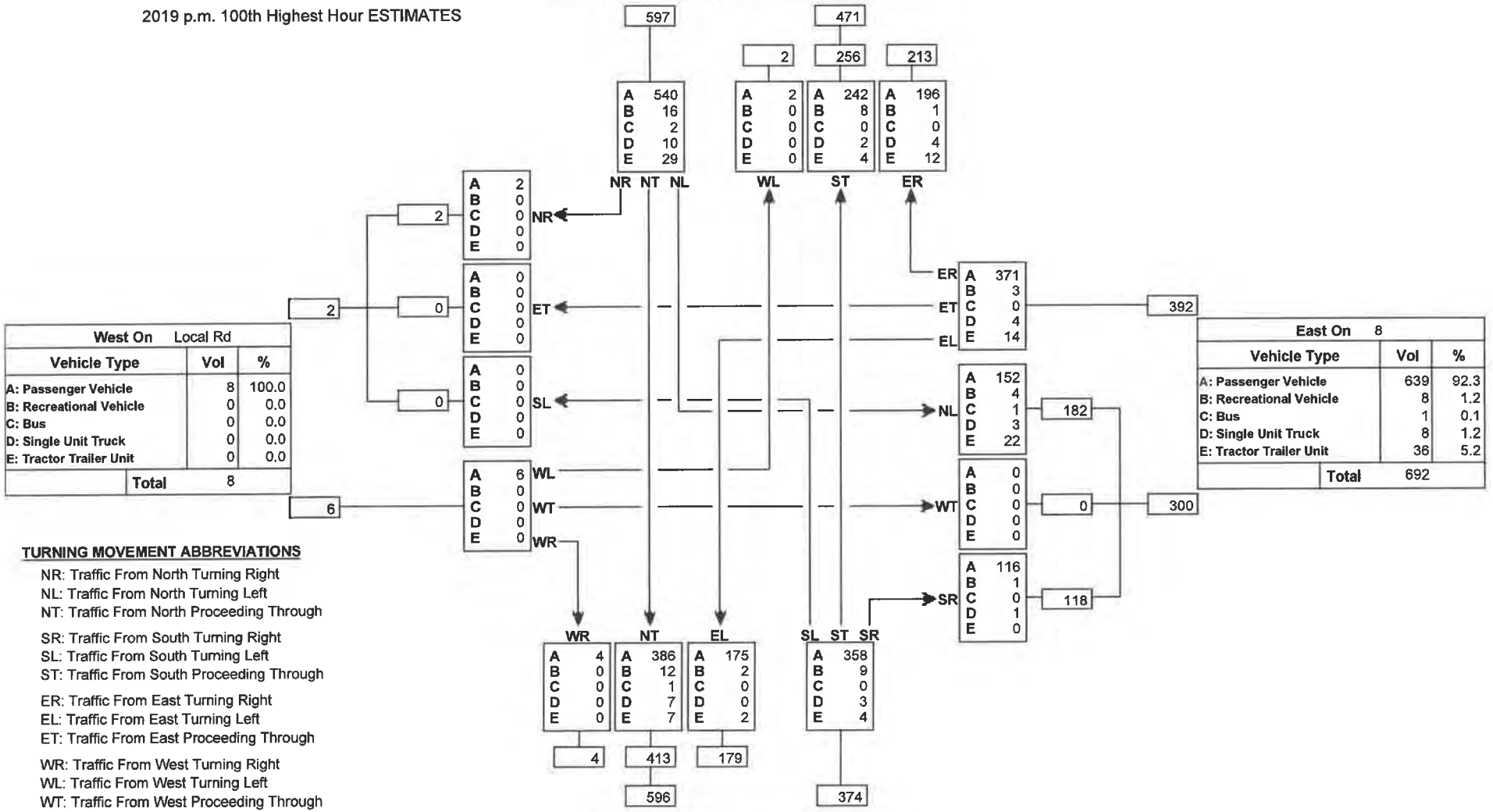
2019 p.m. 100th Highest Hour ESTIMATES

North On 22		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	980	91.8
B: Recreational Vehicle	25	2.3
C: Bus	2	0.2
D: Single Unit Truck	16	1.5
E: Tractor Trailer Unit	45	4.2
Total	1068	

West On Local Rd		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	8	100.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	0	0.0
Total	8	

East On 8		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	639	92.3
B: Recreational Vehicle	8	1.2
C: Bus	1	0.1
D: Single Unit Truck	8	1.2
E: Tractor Trailer Unit	36	5.2
Total	692	

South On 22		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	923	95.2
B: Recreational Vehicle	23	2.4
C: Bus	1	0.1
D: Single Unit Truck	10	1.0
E: Tractor Trailer Unit	13	1.3
Total	970	



TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
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EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

Copithorne Pit
2019 Truck Haul Summary

Month of May	One-Way Trips	Two-Way Trips
13/05/2019	11	22
14/05/2019	4	8
2 days of haul in May		
27 permitted haul days in June		

Month of June	One-Way Trips	Two-Way Trips
04/06/2019	6	12
05/06/2019	12	24
06/06/2019	23	46
07/06/2019	3	6
10/06/2019	9	18
12/06/2019	26	52
13/06/2019	14	28
17/06/2019	3	6
18/06/2019	5	10
20/06/2019	2	4
25/06/2019	3	6
27/06/2019	1	2
29/06/2019	5	10
13 days of haul in June		
25 permitted haul days in June		

Month of July	One-Way Trips	Two-Way Trips
02/07/2019	2	4
03/07/2019	4	8
12/07/2019	5	10
17/07/2019	8	16
18/07/2019	10	20
19/07/2019	16	32
22/07/2019	7	14
23/07/2019	11	22
24/07/2019	31	62
25/07/2019	21	42
26/07/2019	22	44
27/07/2019	10	20
29/07/2019	14	28
30/07/2019	25	50
31/07/2019	24	48
15 days of haul in July		
26 permitted haul days in July		

Copithorne Pit
2019 Truck Haul Summary

Month of August	One-Way Trips	Two-Way Trips
01/08/2019	28	56
02/08/2019	19	38
06/08/2019	4	8
07/08/2019	18	36
08/08/2019	16	32
09/08/2019	4	8
10/08/2019	6	12
13/08/2019	15	30
14/08/2019	15	30
15/08/2019	14	28
16/08/2019	4	8
19/08/2019	14	28
20/08/2019	25	50
21/08/2019	32	64
22/08/2019	14	28
23/08/2019	8	16
26/08/2019	16	32
27/08/2019	16	32
28/08/2019	21	42
29/08/2019	25	50
30/08/2019	8	16

21 days of haul in August

26 permitted haul days in August

Month of September	One-Way Trips	Two-Way Trips
03/09/2019	19	38
04/09/2019	25	50
05/09/2019	13	26
06/09/2019	19	38
09/09/2019	1	2
12/09/2019	6	12
13/09/2019	10	20
14/09/2019	3	6
16/09/2019	14	28
17/09/2019	20	40
18/09/2019	20	40
19/09/2019	5	10
20/09/2019	1	2
21/09/2019	2	4
23/09/2019	27	54
24/09/2019	17	34
25/09/2019	13	26
26/09/2019	8	16
27/09/2019	23	46
28/09/2019	25	50

20 days of haul in September

24 permitted haul days in September

Month of October	One-Way Trips	Two-Way Trips
01/10/2019	5	10
02/10/2019	15	30
03/10/2019	22	44
04/10/2019	30	60
05/10/2019	4	8
07/10/2019	12	24
09/10/2019	1	2
10/10/2019	20	40
11/10/2019	5	10
12/10/2019	5	10
15/10/2019	7	14
16/10/2019	2	4
17/10/2019	10	20
18/10/2019	2	4
19/10/2019	3	6
21/10/2019	8	16
22/10/2019	3	6
23/10/2019	3	6
28/10/2019	2	4
29/10/2019	5	10
30/10/2019	21	42
31/10/2019	38	76

22 days of haul in October

27 permitted haul days in October

Copithorne Pit
2019 Truck Haul Summary

Month of November	One-Way Trips	Two-Way Trips
01/11/2019	22	44
02/11/2019	16	32
04/11/2019	3	6
05/11/2019	7	14
06/11/2019	7	14
07/11/2019	38	76
08/11/2019	5	10
12/11/2019	9	18
13/11/2019	16	32
14/11/2019	13	26
15/11/2019	12	24
18/11/2019	7	14
21/11/2019	20	40
22/11/2019	4	8
25/11/2019	44	88
26/11/2019	24	48
27/11/2019	17	34
28/11/2019	17	34
29/11/2019	26	52
30/11/2019	17	34

20 days of haul in November

26 permitted haul days in November

Month of December	One-Way Trips	Two-Way Trips
02/12/2019	45	90
03/12/2019	16	32
04/12/2019	18	36
05/12/2019	1	2
07/12/2019	31	62
09/08/2019	3	6
10/12/2019	12	24
11/12/2019	25	50
12/12/2019	7	14

9 days of haul in December

26 permitted haul days in December

2019 Haul Summary		
Avg. Trucks per Hour (Days Hauled)		
	One-Way Trips	Two-Way Trips
May	0.75	1.50
June	0.86	1.72
July	1.40	2.80
August	1.53	3.07
September	1.36	2.71
October	1.01	2.03
November	1.62	3.02
December	1.76	3.51
Season Average	**1.34**	**2.68**
Number of Days Hauled in 2019 Season		**122**
Permitted Haul Days in 2019		**304**

**** no pit activity from January to April, 2019.***

APPENDIX D

Synchro Output Summaries

1: Highway 22 & Township Road 242
08-26-2020

AM Peak Hour
2020 Background

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	5	5	625	447	9
Future Volume (Veh/h)	5	5	5	625	447	9
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	5	5	5	672	481	10
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1168	486	491			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1168	486	491			
tC, single (s)	6.4	6.8	4.5			
tC, 2 stage (s)						
tF (s)	3.5	3.8	2.6			
p0 queue free %	98	99	99			
cM capacity (veh/h)	210	480	902			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	10	677	491
Volume Left	5	5	0
Volume Right	5	0	10
cSH	292	902	1700
Volume to Capacity	0.03	0.01	0.29
Queue Length 95th (m)	0.8	0.1	0.0
Control Delay (s)	17.8	0.1	0.0
Lane LOS	C	A	
Approach Delay (s)	17.8	0.1	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		

1: Highway 22 & Township Road 242
08-26-2020

PM Peak Hour
2020 Background

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	6	8	5	476	599	5
Future Volume (Veh/h)	6	8	5	476	599	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	6	9	5	512	644	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1168	646	649			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1168	646	649			
tC, single (s)	6.4	6.6	4.3			
tC, 2 stage (s)						
tF (s)	3.5	3.6	2.4			
p0 queue free %	97	98	99			
cM capacity (veh/h)	209	415	857			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	15	517	649
Volume Left	6	5	0
Volume Right	9	0	5
cSH	298	857	1700
Volume to Capacity	0.05	0.01	0.38
Queue Length 95th (m)	1.3	0.1	0.0
Control Delay (s)	17.7	0.2	0.0
Lane LOS	C	A	
Approach Delay (s)	17.7	0.2	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	42.7%	ICU Level of Service	A
Analysis Period (min)	15		

1: Highway 22 & Township Road 242 — AM Peak Hour
08-26-2020 — 2040 Background

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	5	5	810	579	11
Future Volume (Veh/h)	5	5	5	810	579	11
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	5	5	5	871	623	12
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1510	629	635			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1510	629	635			
tC, single (s)	6.4	6.8	4.5			
tC, 2 stage (s)						
tF (s)	3.5	3.8	2.6			
p0 queue free %	96	99	99			
cM capacity (veh/h)	130	392	790			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	10	876	635
Volume Left	5	5	0
Volume Right	5	0	12
cSH	195	790	1700
Volume to Capacity	0.05	0.01	0.37
Queue Length 95th (m)	1.3	0.2	0.0
Control Delay (s)	24.5	0.2	0.0
Lane LOS	C	A	
Approach Delay (s)	24.5	0.2	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	57.9%	ICU Level of Service	B
Analysis Period (min)	15		

1: Highway 22 & Township Road 242
08-26-2020

PM Peak Hour
2040 Background

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	9	5	617	776	5
Future Volume (Veh/h)	7	9	5	617	776	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	8	10	5	663	834	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1510	836	839			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1510	836	839			
tC, single (s)	6.4	6.5	4.3			
tC, 2 stage (s)						
tF (s)	3.5	3.6	2.4			
p0 queue free %	94	97	99			
cM capacity (veh/h)	130	324	723			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	18	668	839
Volume Left	8	5	0
Volume Right	10	0	5
cSH	194	723	1700
Volume to Capacity	0.09	0.01	0.49
Queue Length 95th (m)	2.4	0.2	0.0
Control Delay (s)	25.4	0.2	0.0
Lane LOS	D	A	
Approach Delay (s)	25.4	0.2	0.0
Approach LOS	D		

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	52.3%	ICU Level of Service	A
Analysis Period (min)	15		

1: Highway 22 & Township Road 242 AM Peak Hour
08-26-2020 2020 Background - Twinned Hwy 22

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	5	5	810	579	11
Future Volume (Veh/h)	5	5	5	810	579	11
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	5	5	5	871	623	12
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1074	318	635			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1074	318	635			
tC, single (s)	6.9	8.1	4.9			
tC, 2 stage (s)						
tF (s)	3.5	3.9	2.6			
p0 queue free %	98	99	99			
cM capacity (veh/h)	208	534	727			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	10	295	581	415	220
Volume Left	5	5	0	0	0
Volume Right	5	0	0	0	12
cSH	300	727	1700	1700	1700
Volume to Capacity	0.03	0.01	0.34	0.24	0.13
Queue Length 95th (m)	0.8	0.2	0.0	0.0	0.0
Control Delay (s)	17.4	0.3	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	17.4	0.1		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay	0.2			
Intersection Capacity Utilization	36.6%	ICU Level of Service		A
Analysis Period (min)	15			

1: Highway 22 & Township Road 242
08-26-2020

PM Peak Hour
2040 Background - Twinned Hwy 22

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	9	5	617	776	5
Future Volume (Veh/h)	7	9	5	617	776	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	8	10	5	663	834	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1178	420	839			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1178	420	839			
tC, single (s)	6.9	7.6	4.5			
tC, 2 stage (s)						
tF (s)	3.5	3.6	2.4			
p0 queue free %	96	98	99			
cM capacity (veh/h)	178	504	686			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	18	226	442	556	283
Volume Left	8	5	0	0	0
Volume Right	10	0	0	0	5
cSH	278	686	1700	1700	1700
Volume to Capacity	0.06	0.01	0.26	0.33	0.17
Queue Length 95th (m)	1.7	0.2	0.0	0.0	0.0
Control Delay (s)	18.9	0.3	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	18.9	0.1		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay	0.3			
Intersection Capacity Utilization	32.2%	ICU Level of Service		A
Analysis Period (min)	15			

1: Highway 22 & Township Road 242
08-26-2020

AM Peak Hour
2020 Post Development

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	8	7	626	447	13
Future Volume (Veh/h)	5	8	7	626	447	13
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	5	9	8	673	481	14
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1177	488	495			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1177	488	495			
tC, single (s)	6.4	7.0	4.6			
tC, 2 stage (s)						
tF (s)	3.5	4.1	2.7			
p0 queue free %	98	98	99			
cM capacity (veh/h)	206	443	861			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	14	681	495
Volume Left	5	8	0
Volume Right	9	0	14
cSH	314	861	1700
Volume to Capacity	0.04	0.01	0.29
Queue Length 95th (m)	1.1	0.2	0.0
Control Delay (s)	17.0	0.2	0.0
Lane LOS	C	A	
Approach Delay (s)	17.0	0.2	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	49.6%	ICU Level of Service	A
Analysis Period (min)	15		

1: Highway 22 & Township Road 242
08-26-2020

PM Peak Hour
2020 Post Development

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	14	5	477	599	4
Future Volume (Veh/h)	7	14	5	477	599	4
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	8	15	5	513	644	4
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1169	646	648			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1169	646	648			
tC, single (s)	6.4	6.7	4.5			
tC, 2 stage (s)						
tF (s)	3.5	3.8	2.6			
p0 queue free %	96	96	99			
cM capacity (veh/h)	209	396	781			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	23	518	648
Volume Left	8	5	0
Volume Right	15	0	4
cSH	302	781	1700
Volume to Capacity	0.08	0.01	0.38
Queue Length 95th (m)	2.0	0.2	0.0
Control Delay (s)	17.9	0.2	0.0
Lane LOS	C	A	
Approach Delay (s)	17.9	0.2	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	42.6%	ICU Level of Service	A
Analysis Period (min)	15		

1: Highway 22 & Township Road 242
08-26-2020

AM Peak Hour
2040 Post Development

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	9	7	811	579	15
Future Volume (Veh/h)	5	9	7	811	579	15
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	5	10	8	872	623	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1519	631	639			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1519	631	639			
tC, single (s)	6.4	7.0	4.6			
tC, 2 stage (s)						
tF (s)	3.5	4.0	2.7			
p0 queue free %	96	97	99			
cM capacity (veh/h)	127	372	753			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	15	880	639
Volume Left	5	8	0
Volume Right	10	0	16
cSH	227	753	1700
Volume to Capacity	0.07	0.01	0.38
Queue Length 95th (m)	1.7	0.3	0.0
Control Delay (s)	22.0	0.3	0.0
Lane LOS	C	A	
Approach Delay (s)	22.0	0.3	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		

1: Highway 22 & Township Road 242
08-26-2020

PM Peak Hour
2040 Post Development

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	8	15	6	618	776	5
Future Volume (Veh/h)	8	15	6	618	776	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	9	16	6	665	834	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1514	836	839			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1514	836	839			
tC, single (s)	6.4	6.7	4.5			
tC, 2 stage (s)						
tF (s)	3.5	3.7	2.6			
p0 queue free %	93	95	99			
cM capacity (veh/h)	129	308	654			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	25	671	839
Volume Left	9	6	0
Volume Right	16	0	5
cSH	205	654	1700
Volume to Capacity	0.12	0.01	0.49
Queue Length 95th (m)	3.3	0.2	0.0
Control Delay (s)	25.0	0.3	0.0
Lane LOS	C	A	
Approach Delay (s)	25.0	0.3	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	52.3%	ICU Level of Service	A
Analysis Period (min)	15		

1: Highway 22 & Township Road 242 — AM Peak Hour
08-26-2020 — 2040 Post Development - Twinned Hwy 22

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	9	7	811	579	15
Future Volume (Veh/h)	5	9	7	811	579	15
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	5	10	8	872	623	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1083	320	639			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1083	320	639			
tC, single (s)	6.9	8.4	5.1			
tC, 2 stage (s)						
tF (s)	3.5	4.0	2.7			
p0 queue free %	98	98	99			
cM capacity (veh/h)	205	502	679			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	15	299	581	415	224
Volume Left	5	8	0	0	0
Volume Right	10	0	0	0	16
cSH	338	679	1700	1700	1700
Volume to Capacity	0.04	0.01	0.34	0.24	0.13
Queue Length 95th (m)	1.1	0.3	0.0	0.0	0.0
Control Delay (s)	16.1	0.4	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	16.1	0.1		0.0	
Approach LOS	C				

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	38.1%	ICU Level of Service	A
Analysis Period (min)	15		

1: Highway 22 & Township Road 242 — PM Peak Hour
08-26-2020 — 2040 Post Development - Twinned Hwy 22

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	8	15	6	618	776	5
Future Volume (Veh/h)	8	15	6	618	776	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	9	16	6	665	834	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1181	420	839			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1181	420	839			
tC, single (s)	6.9	7.8	4.9			
tC, 2 stage (s)						
tF (s)	3.5	3.8	2.6			
p0 queue free %	95	97	99			
cM capacity (veh/h)	177	475	589			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	25	228	443	556	283
Volume Left	9	6	0	0	0
Volume Right	16	0	0	0	5
cSH	296	589	1700	1700	1700
Volume to Capacity	0.08	0.01	0.26	0.33	0.17
Queue Length 95th (m)	2.2	0.2	0.0	0.0	0.0
Control Delay (s)	18.3	0.4	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	18.3	0.1		0.0	
Approach LOS	C				

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	32.2%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX E

Illumination Warrants

Illumination of Isolated Rural Intersections
LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Illumination of Isolated Rural Intersections*, Transportation Association of Canada, February 2001.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Highway 22	Main Road	Date	June 2, 2020
Township Road 242	Minor Road	Other	Horizon: Long Term Background
Rocky View County	City/Town		

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	0		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)	0		5		OK	
Channelization Factor					OK	0
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	100				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =	B	0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
				Geometric Factors Subtotal		6

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	N			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	12,200	4	10	Either Use the two AADT inputs **OR** the Descriptive Signalization	OK	40
AADT on Minor Road (2-way)	115	0	20	Warrant (Unused values should be set to Zero) Refer to Table	OK	0
Signalization Warrant	Descriptive	0	30	1(B) for description and rating values for signalization warrant.	OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	1	5	Refer to Table 1(B) for ratings.	OK	5
Operating Speed or Posted Speed on Major Road (km/h)	110	4	5	Refer to Table 1(B), note #3	OK	20
Operating Speed on Minor Road (km/h)	60	1	5	Refer to Table 1(B), note #3	OK	5
				Operational Factors Subtotal		70

ENVIRONMENTAL FACTOR

Lighted Developments within 150 m radius of intersection	0	0	5	Maximum of 4 quadrants	OK	0
				Environmental Factor Subtotal		0

COLLISION HISTORY

Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)	0.0	0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of all night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
				Collision History Subtotal		0

Check Intersection Signalization:
Intersection is not Signalized

LIGHTING IS NOT WARRANTED

SUMMARY	
Geometric Factors Subtotal	6
Operational Factor Subtotal	70
Environmental Factor Subtotal	0
Collision History Subtotal	0
TOTAL POINTS	**76**

Illumination of Isolated Rural Intersections
LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Illumination of Isolated Rural Intersections*, Transportation Association of Canada, February 2001.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Highway 22	Main Road
Township Road 242	Minor Road
Rocky View County	City/Town

Date: June 2, 2020
Other: Horizon: Long Term Post Development

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	0		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)	0		5		OK	
Channelization Factor					OK	0
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	100				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =	B	0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
					Geometric Factors Subtotal	6

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	N			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	12,300	4	10	Either Use the two AADT inputs **OR** the Descriptive Signalization	OK	40
AADT on Minor Road (2-way)	210	0	20	Warrant (Unused values should be set to Zero) Refer to Table	OK	0
Signalization Warrant	Descriptive	0	30	1(B) for description and rating values for signalization warrant.	OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	1	5	Refer to Table 1(B) for ratings.	OK	5
Operating Speed or Posted Speed on Major Road (km/h)	110	4	5	Refer to Table 1(B), note #3	OK	20
Operating Speed on Minor Road (km/h)	60	1	5	Refer to Table 1(B), note #3	OK	5
					Operational Factors Subtotal	70

ENVIRONMENTAL FACTOR

Lighted Developments within 150 m radius of intersection	0	0	5	Maximum of 4 quadrants	OK	0
					Environmental Factor Subtotal	0

COLLISION HISTORY

Average Annual night-time collision frequency due to inadequate lighting (collisions/yr, rounded to nearest whole #)	0.0	0	0	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)	0	0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of all night to day collisions >= 1.5 (Y/N)	n	0			OK	
					OK	
					Collision History Subtotal	0

Check Intersection Signalization:
Intersection is not Signalized

LIGHTING IS NOT WARRANTED

SUMMARY	
Geometric Factors Subtotal	6
Operational Factor Subtotal	70
Environmental Factor Subtotal	0
Collision History Subtotal	0
TOTAL POINTS	**76**