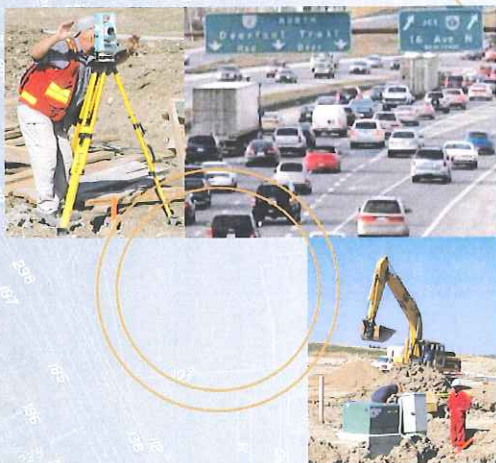


GRANUM MARKET SQUARE & GILEAD FOUNDATION OF ALBERTA

Traffic Impact Assessment



Contact Information:

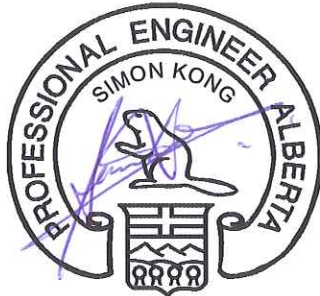
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GRANUM MARKET SQUARE & GILEAD FOUNDATION OF ALBERTA

Traffic Impact Assessment



March 31, 2010

PERMIT TO PRACTICE
D. A. WATT CONSULTING GROUP LTD.
Signature <u><i>[Signature]</i></u>
Date <u>March 31, 2010</u>
PERMIT NUMBER: P 3818
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

Prepared for: **Foundation Capital Corporation**

Prepared by: **D.A. Watt Consulting**

Our File: **2714.T01**

Date: **March 31, 2010**

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1.0 INTRODUCTION & CONCLUSIONS

1.1 Background to this Study

On behalf of Foundation Capital Corporation, Alvin Reinhard Fritz Architect Inc. retained D.A. Watt Consulting (DAW) to complete a Traffic Impact Assessment (TIA) in support of a proposed mixed-use commercial/residential and addiction healing centre development. The site is located on the southwest quadrant of the intersection of Highway 2 / Highway 519 west of the Town of Granum in Southern Alberta. According to the 2007 municipal census, Granum had a population of approximately 445 residents¹.

Originally conceived as the addiction healing centre and a truck stop with a restaurant to primarily serve traffic on adjacent Highway 2, the proposed site plans were amended after community consultation to include a residential, retail, and office component to further benefit local area residents. The truck stop and addiction healing centre will be completed first, with the remaining residential and commercial site development proceeding when demand from local residents becomes sufficient.

1.2 Study Scope

The scope of work for this study was confirmed through a meeting with Alberta Transportation (AT) on October 26, 2009, and via additional email and telephone correspondence as documented in **Appendix A**. The key study objectives agreed upon were as follows:

- Review existing traffic and technical data available on AT's website, and complete a site visit to record the existing configuration and dimensions of the existing at-grade intersection.
- Determine site traffic generation, distribution, and assignment.
- Complete capacity analysis at the intersection of Highway 2/Highway 519, as well as the proposed access point(s) west of the intersection on Township Road 110, during the AM and PM peak traffic hours for the following four scenarios:
 - Existing (Opening Day background) traffic
 - Long range (20-year background) traffic
 - Combined Opening Day background + site generated traffic

¹ Government of Alberta Municipal Affairs (2009). *2009 Official Population List*. Retrieved March 3, 2010 from <http://www.municipalaffairs.alberta.ca/documents/ms/2009pop.pdf>.

- Combined 20-year background + site generated traffic
- Provide recommendations to address operational issues arising from background traffic growth, and identify any improvements required to accommodate site-generated traffic.
- Review AT geometric design, pedestrian, and lighting requirements, ensuring appropriate treatments at each intersection.
- Confirm that sight distances approaching site accesses are adequate.

1.3 Conclusions

The following conclusions were drawn from the analysis:

Existing Conditions

- The intersections of Highway 2 / Highway 519 / Township Road 110 and Township Road 110 / Site Access Road are currently operating at Level of Service (LOS) B or better. Therefore, both intersections have capacity to accommodate additional traffic.

Future Background (20-Year) Conditions

- As a result of background traffic growth over the 20-year planning period, eastbound LOS at Highway 2 / Highway 519 is expected to drop slightly from 'B' to 'C' with delays increasing by approximately five seconds in each of the peak periods. Other movements show no appreciable increase in delay with respect to existing conditions and the results confirm that both intersections will accommodate traffic effectively at the future background horizon.

Site Traffic Generation

- At opening day, the site is expected to generate in the order of 97 and 99 vehicles during the AM and PM peak hours, respectively.
- At full build-out, the site is expected to generate approximately 217 vehicles in the AM peak hour and 289 vehicles in the PM peak hour.

Post-Development Conditions

- For the opening day scenario, the analysis confirms that both intersections will continue to operate at acceptable levels. Negligible increases in delay (one second or less) were observed over existing conditions on most movements as a result of site traffic, with all movements expected to continue operating at LOS B or better.
- At the 20-year post-development horizon, eastbound LOS drops from 'C' to 'D' in each of the peak periods, while westbound LOS drops from 'B' to 'C'. All other movements will continue to operate at service levels similar to background conditions and the results indicate that both intersections will continue to operate at acceptable levels.

Other Considerations

- To facilitate truck ingress and egress from the site, it is recommended that the existing intersection at Township Road 110 and the future site access be upgraded to provide a westbound left turn lane and flaring on the south approach.
- Pedestrian demand is anticipated to be minimal. We have allowed for a conservatively high estimate of ten pedestrians per hour in our pedestrian crossing control warrant calculation and the result is that no crossing control improvements are warranted.
- Site distances are adequate on all approaches at each of the study intersections, exceeding 500 m with the exception of the eastbound approach to the future site access, which was measured to be approximately 352 m in the field. This meets the AT left-turning sight distance requirement of 350 m for passenger vehicles.
- The median is sufficiently wide (approximately 25 m) to accommodate two-stage crossings and left turns for up to 25 m in length (WB-21 or WB-23 design vehicle). The crossing time for each of the northbound and southbound lanes was determined to be approximately 13 seconds for a WB-23 truck, and crossing sight distances were confirmed to be adequate. Thus, it is concluded that truck crossings will not significantly impact the safety or operation of the Highway 2 / Highway 519 intersection.

2.0 EXISTING CONDITIONS

2.1 Site Context

As highlighted in **Figure 1**, the proposed development site is located on the southwest quadrant of the intersection of Highway 2 and Highway 519 immediately west of the Town of Granum in Southern Alberta.



FIGURE 1: SITE CONTEXT

2.2 Existing Road Network

The proposed development site is bordered by the following roadways, as depicted in Figure 1:

- Highway 2: Part of the CANAMEX trade corridor, Highway 2 is the principal north-south route in Alberta and is currently classified as a major expressway in the study area. Access to the expressway is limited to interchanges and intermittent at-grade intersections, such as at the junction with Highway 519. Approaching the intersection, Highway 2 provides two through lanes in each direction as well as exclusive right and left turn lanes and acceleration lanes for entering traffic.

Highway 2 will ultimately be upgraded to a freeway with grade-separated access only. As such, access to/from Highway 2 at Highway 519 will eventually be via an interchange. Although a functional study has not been done, AT did forward the preliminary land requirements of the future interchange to the architect. The architect has incorporated these land requirements in establishing the site layout to ensure that the development will not impact the required right-of-way for the interchange ramps. The posted speed on Highway 2 is 110 km/h.

- Highway 519: Intersecting Highway 2 one kilometer west of Granum, Highway 519 junctions with Highway 23 approximately 30 km east of the town. As such, the highway provides an alternate route to Highway 3 from Highway 2 to the City of Lethbridge, allowing traffic to bypass the Fort MacLeod urban area. The posted speed on the undivided two-lane Highway 519 is 60 km/h through Granum and approaching the intersection with Highway 2.
- Township Road 110: West of Highway 2, Highway 519 continues as Township Road 110. The posted speed on the two-lane undivided paved roadway is 80 km/h.

2.3 Existing (Opening Day) Background Traffic Volumes

The existing AM and PM peak hour turning movement counts for the Highway 2 and Highway 519 intersection were obtained from AT's website as presented in **Appendix B** and summarized in **Figure 2**. These counts were taken as the background traffic volumes for the short-term (opening day) planning scenario. The west approach volumes at Highway 2 / Highway 519 were used to estimate the through volumes at the minor gravel road (proposed site access road) intersection to the west.

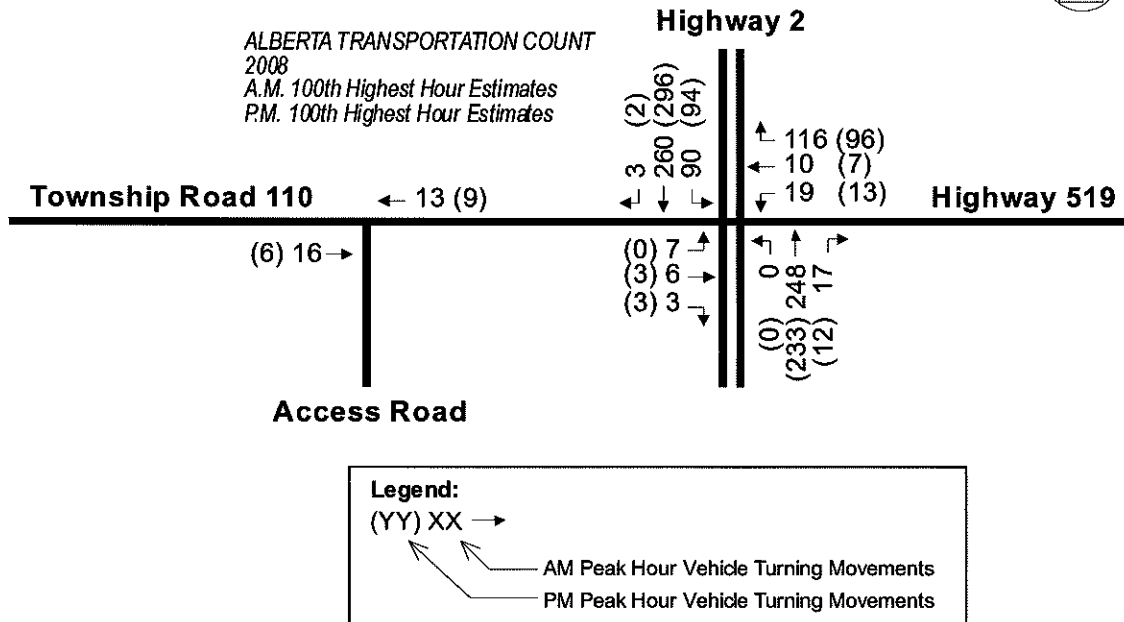


FIGURE 2: EXISTING (OPENING DAY) BACKGROUND TRAFFIC VOLUMES

2.4 Existing Operating Conditions

Operating conditions at the study intersections were evaluated using the Synchro/SimTraffic 7.0 software package (which is based on the methodology outlined in the U.S. Highway Capacity Manual²). For unsignalized (stop-controlled) intersections, the level-of-service (LOS) is based on the computed delays on each of the critical movements. LOS 'A' represents minimal delays for minor street traffic movements, and LOS 'F' represents a scenario with an insufficient number of gaps on the major street for minor street motorists to complete their movements without significant delays. **Table 1** illustrates the LOS criteria for unsignalized intersections as summarized in the Highway Capacity Manual.

² Transportation Research Board, National Research Council. Highway Capacity Manual 2000. Washington, D.C. 2000.

TABLE 1: LEVEL OF SERVICE CRITERIA

Level of Service (LOS)	Average Delay for Unsignalized Intersection Movements
A	0 – 10 seconds per vehicle
B	> 10 – 15 seconds per vehicle
C	> 15 – 25 seconds per vehicle
D	> 25 – 35 seconds per vehicle
E	> 35 – 50 seconds per vehicle
F	> 50 seconds per vehicle

Applying the background traffic volumes summarized in Figure 2, the results of the Synchro analysis for each of the study intersections are summarized in **Table 2**:

TABLE 2: EXISTING OPERATING CONDITIONS

INTERSECTION / MOVEMENT			AM PEAK HOUR			PM PEAK HOUR		
			LOS	Delay (s)	Queue (m)	LOS	Delay (s)	Queue (m)
Highway 2 & Highway 519/ Township Road 110 (Stop Controlled)	EB	Left/Through/Right	B	13.2	0.9	B	11.2	0.2
	WB	Left/Through/Right	B	11.1	5.9	B	10.7	4.4
	NB	Left	-	-	-	-	-	-
		Through	A	0.0	0.0	A	0.0	0.0
		Right	A	0.0	0.0	A	0.0	0.0
	SB	Left	A	8.5	2.1	A	8.2	2.0
		Through	A	0.0	0.0	A	0.0	0.0
		Right	A	0.0	0.0	A	0.0	0.0
Site Access (Stop Controlled)	EB	Through/Right	A	0.0	0.0	A	0.0	0.0
	WB	Through/Left	A	0.0	0.0	A	0.0	0.0
	NB	Left/Right	-	-	-	-	-	-

Note: '-' indicates no volume on movement

The analysis result confirms that at present there are no operational concerns at the intersection of Highway 2 and Highway 519/Township Road 110. All movements are currently operating at LOS B or better during the AM and PM peak hours. Detailed results for the existing conditions evaluation and all subsequent analyses are presented in the Synchro reports presented in **Appendix C**.

2.5 Future (20-Year) Background Traffic Volumes

To estimate future background traffic, the provincial annual average growth rate of 2.5% was applied to the existing highway traffic at the study intersections. Accordingly, the opening day background traffic was grown linearly (non-compounded) over 20 years to arrive at the 20-year background traffic projections presented in **Figure 3**. In instances where the existing movement volume was zero, a value of five was assumed in the future background horizon. This results in conservatively high estimates of traffic, especially at the intersection of Township Road 110/site access road.

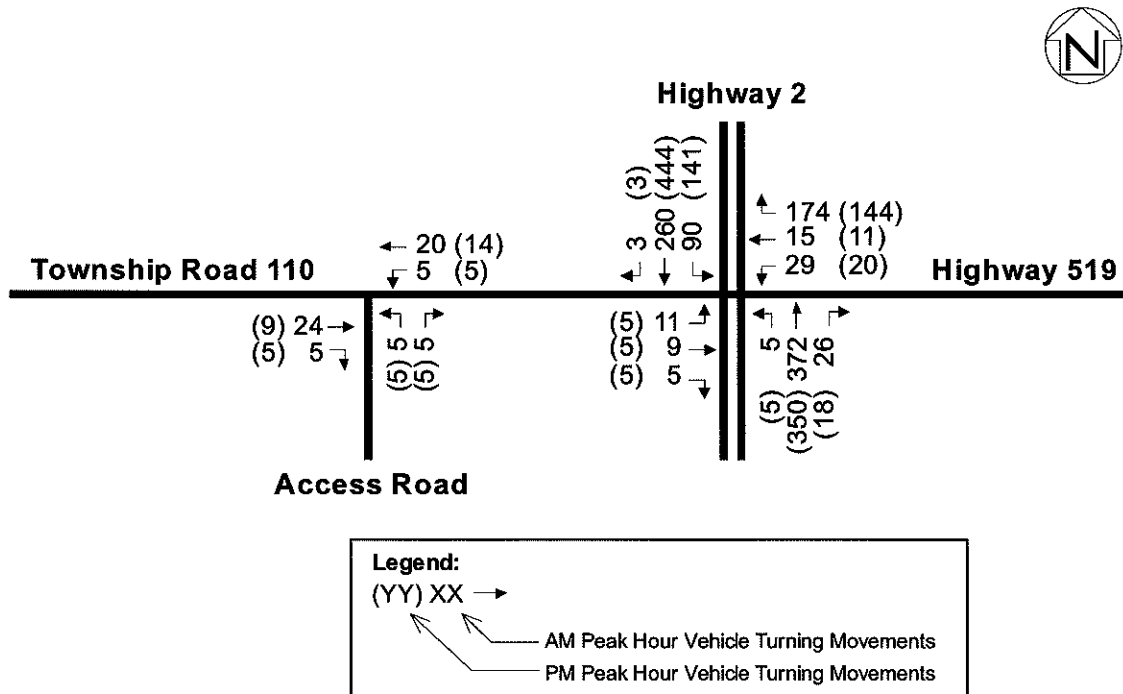


FIGURE 3: FUTURE (20-YEAR) BACKGROUND TRAFFIC VOLUMES

2.6 Future (20-Year) Background Operating Conditions

The future (20-year) background traffic volumes presented in Figure 3 were evaluated in the Synchro model to obtain the results summarized in Table 3:

TABLE 3: FUTURE (20-YEAR) BACKGROUND OPERATING CONDITIONS

INTERSECTION / MOVEMENT			AM PEAK HOUR			PM PEAK HOUR		
			LOS	Delay (s)	Queue (m)	LOS	Delay (s)	Queue (m)
Highway 2 & Highway 519/ Township Road 110 (Stop Controlled)	EB	Left/Through/Right	C	18.7	1.0	C	15.2	1.0
	WB	Left/Through/Right	B	14.1	9.1	B	13.0	9.1
	NB	Left	A	8.1	0.1	A	8.3	0.1
		Through	A	0.0	0.0	A	0.0	0.0
		Right	A	0.0	0.0	A	0.0	0.0
	SB	Left	A	9.3	3.5	A	8.8	3.5
		Through	A	0.0	0.0	A	0.0	0.0
		Right	A	0.0	0.0	A	0.0	0.0
Site Access (Stop Controlled)	EB	Through/Right	A	0.0	0.0	A	0.0	0.0
	WB	Through/Left	A	1.5	0.1	A	1.9	0.1
	NB	Left/Right	A	8.7	0.2	A	8.6	0.2

As a result of background traffic growth over the 20-year planning period, eastbound LOS at Highway 2 / Highway 519 is expected to drop slightly from 'B' to 'C' with delays increasing by approximately five seconds in each of the peak periods. Other movements show no appreciable increase in delay with respect to existing conditions and the results confirm that both intersections will accommodate traffic effectively at the future background horizon.

3.0 PROPOSED DEVELOPMENT

3.1 Site Plan

Currently, the 128-acre site and surrounding lands consist primarily of open agricultural field. At full build-out, the proposed development will include the following:

- Market Square including truck stop, fueling area and three storey mixed-use building (9 retail, 11 office, 18 residential suites)
- Addiction healing center and associated amenities
- Baseball and soccer fields

Joint discussions between AT, Alvin Reinhard Fritz Architect Inc and DAW regarding the eventual interchange at the junction of Highway 2/Highway 519 resulted in AT providing us with an interchange footprint and right-of-way requirements for the future interchange. AT also indicated that the nearest access to the future interchange would be from along the west side of the site, where an existing access road is located. The site plan prepared by the architect, as shown in **Figure 4**, respects both requirements.

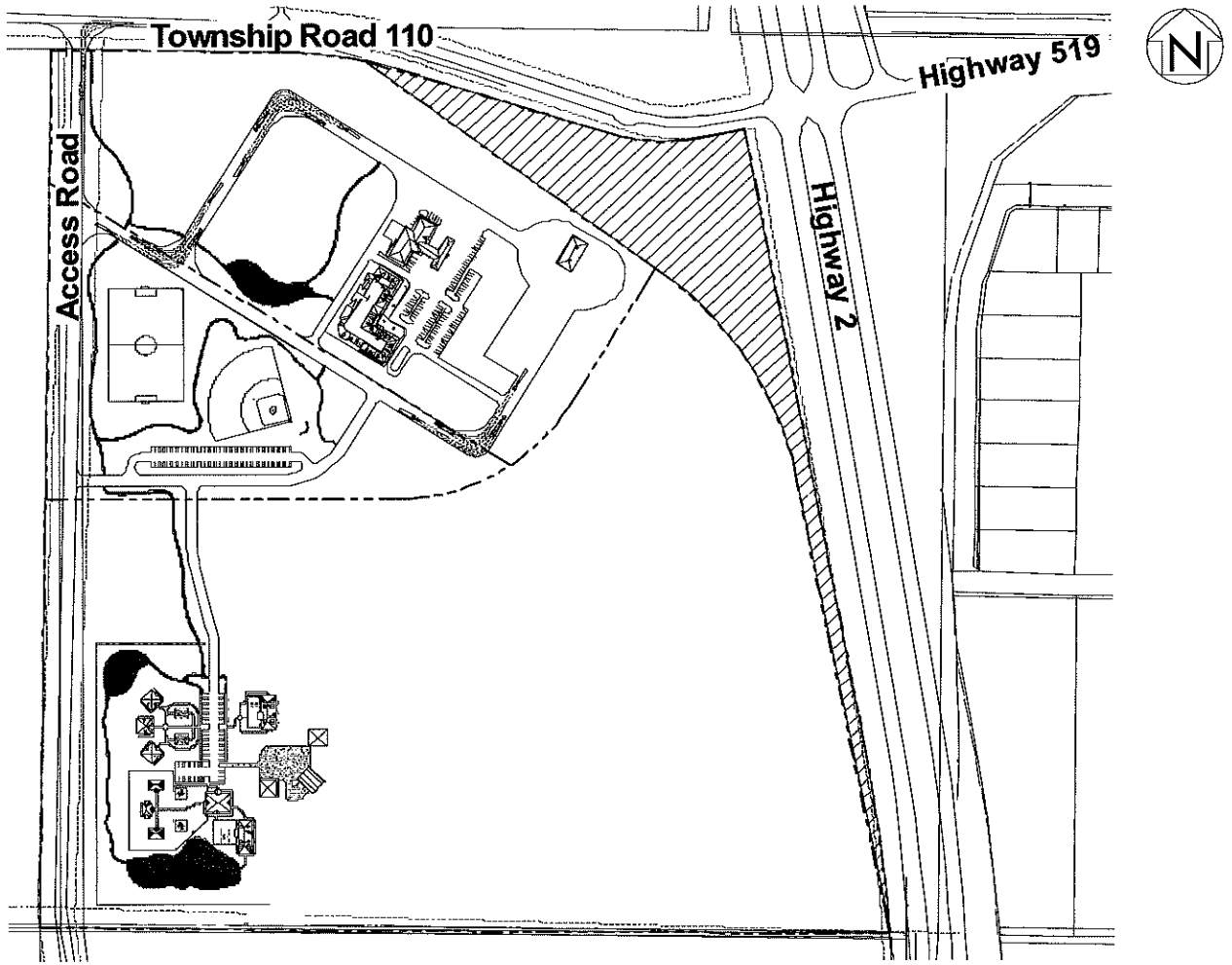


FIGURE 4: SITE PLAN

3.2 Opening Day Site Traffic Generation

The truck stop and addiction healing centre will be developed in advance of the remaining commercial and residential uses ultimately proposed for the site. Thus, opening day site traffic includes trips generated by the truck stop and addiction healing centre only, with the full build-out development trips assessed in the long-range planning horizon.

Typically, Institute of Transportation Engineers (ITE) trip generation rates are used to estimate site traffic based on development intensity. However, ITE trip generation rates for service stations/convenience stores are based on urban surveys and do not accurately reflect the isolated, rural nature of the site. Appreciating the fact that truck stops primarily draw business from pass-by trips on adjacent roadways, trip generation at these sites is strongly dependent on existing background traffic volumes. The majority of highway drivers will look for gas or convenience items as needed and stop at the next available service station.

Therefore, to estimate the trip generation at the site, DAW conducted morning and evening counts at a truck stop/restaurant of similar size adjacent to the interchange at Highway 2 / Highway 7 near Aldersyde, approximately 100 km north of the study area. From the count results, the current trip generation level at the Aldersyde Truck Stop is approximately 268 vehicles per hour in both the AM and PM peak hours. The total inbound intersection volumes at Highway 2 / Highway 7 are 2,554 and 2,383 vehicles per hour during the AM and PM peak hours respectively.

Since the total traffic entering the Highway 2 / Highway 519 intersection is currently less than 800 vehicles in each of the peak hours (or less than 1/3 of the total traffic at the Highway 2 / Highway 7 intersection), it would be unrealistic to apply the Aldersyde Truck Stop traffic generation directly to the proposed development because it will simply overestimate the trip generation by a factor of three. **Table 4** provides a more detailed comparison of the inbound intersection volumes.

In order to more accurately estimate the trip generation of the proposed truck stop, we have taken 1/3 of the trip generation of the Aldersyde truck stop and applied it to the proposed truck stop.

TABLE 4: COMPARISON OF OPENING DAY INBOUND INTERSECTION VOLUMES

Location	AM Inbound Trips	PM Inbound Trips
Highway 2 / Highway 547 (Aldersyde)	2,554	2,383
Highway 2 / Highway 519 (Granum)	779	759
Proportion of Granum to Aldersyde Trips:	31%	32%

In the 20-year scenario, the background traffic volumes at Highway 2 / Highway 519 are expected to be higher due to background growth. To determine the future traffic volumes at the intersection, a 2.5% annual traffic growth rate (average for provincial highways) was applied to existing traffic volumes at the Granum intersection and the results were again compared to Aldersyde intersection traffic (existing volumes), as summarized in **Table 5**. As shown, the intersection volumes at the Granum intersection will be less than 1/2 of the existing volumes at the Aldersyde intersection. Therefore, in order to estimate the trip generation of the proposed truck stop, we have taken 1/2 the existing Aldersyde truck stop trip generation and applied it to the proposed truck stop. The approach of estimating trip generation of the proposed truck stop was approved for use by AT, as documented in Appendix A.

TABLE 5: COMPARISON OF 20-YEAR INBOUND INTERSECTION VOLUMES

Location	AM Inbound Trips	PM Inbound Trips
Highway 2 / Highway 547 (Aldersyde)	2,554	2,383
Highway 2 / Highway 519 (Granum)	1,169	1,139
Proportion of Granum to Aldersyde Trips:	46%	48%

Trip generation from the addiction healing centre was determined based on first principles through consultation between DAW and Gilead Foundation staff, and the devised rates were also approved by AT (Appendix A). The results are shown in **Table 6**, combining the trip generation from the addiction healing centre and the truck stop to obtain the anticipated opening day traffic impacts of the proposed development.

TABLE 6: OPENING DAY SITE TRIP GENERATION

Land Use	Floor Area (ft ²)	AM Peak Hour Trips			PM Peak Hour Trips		
		Total	In	Out	Total	In	Out
Truck Stop: 1/3 Aldersyde Trips (Passenger Vehicles)	8,836	66	35	32	69	35	34
Truck Stop: 1/3 Aldersyde Trips (Commercial Vehicles)	8,836	23	11	12	21	10	11
Addiction Healing Centre	31,060	8	7	1	9	5	4
Total:		97	53	45	99	50	49

3.3 Full Build-Out (20-Year) Site Traffic Generation

At full build-out, the truck stop and addiction healing centre on the site at opening day will have been supplemented with additional commercial and residential development as explained in Section 1.2. To predict the trips generated by this additional development, DAW applied the ITE trip rates approved by AT as listed in **Table 7**:

TABLE 7: APPLICABLE ITE TRIP GENERATION RATES

Development Component	Applicable ITE Land Use	AM Peak Hour Trips			PM Peak Hour Trips		
		Rate	% IB	% OB	Rate	% IB	% OB
Residential	(#224) Residential Condominium/ Townhouse	0.44 /unit	17%	83%	0.52 /unit	67%	33%
Office	(#710) General Office Building	1.55 /1000 ft ²	88%	12%	1.49 /1000 ft ²	17%	83%
Retail	(#820) Shopping Centre	1.00 /1000 ft ²	61%	39%	3.73 /1000 ft ²	49%	51%

As noted previously, the approximated trip generation for the truck stop will increase from 1/3 to 1/2 of Aldersyde trips over the 20-year long range planning period, owing to the increase in highway traffic volume during this time and the tendency for truck stops to draw

primarily pass-by trips. Addition healing centre trips are expected to remain constant. The resulting full build-out trips are summarized in **Table 8**.

TABLE 8: LONG RANGE (20-YEAR) SITE TRIP GENERATION

Development Component	Land Use Intensity	AM Peak Hour Trips			PM Peak Hour Trips		
		Total	In	Out	Total	In	Out
Truck Stop: 1/2 Aldersyde Trips (Passenger Vehicles)	8,836 ft ²	99	52	47	103	52	51
Truck Stop: 1/2 Aldersyde Trips (Commercial Vehicles)	8,836 ft ²	35	17	18	31	15	16
Addiction Healing Centre	31,060 ft ²	8	7	1	9	5	4
Residential	18 units	8	1	7	9	6	3
Office	26,237 ft ²	41	36	5	39	7	32
Retail	26,237 ft ²	26	16	10	98	48	50
Total:		217	129	88	289	133	156

3.4 Site Traffic Distribution

The site-generated traffic distribution was estimated based on the existing approach volumes observed at the Highway 2 / Highway 519 intersection. **Figure 5** presents the anticipated directional-distribution pattern of the trips generated by the proposed development.

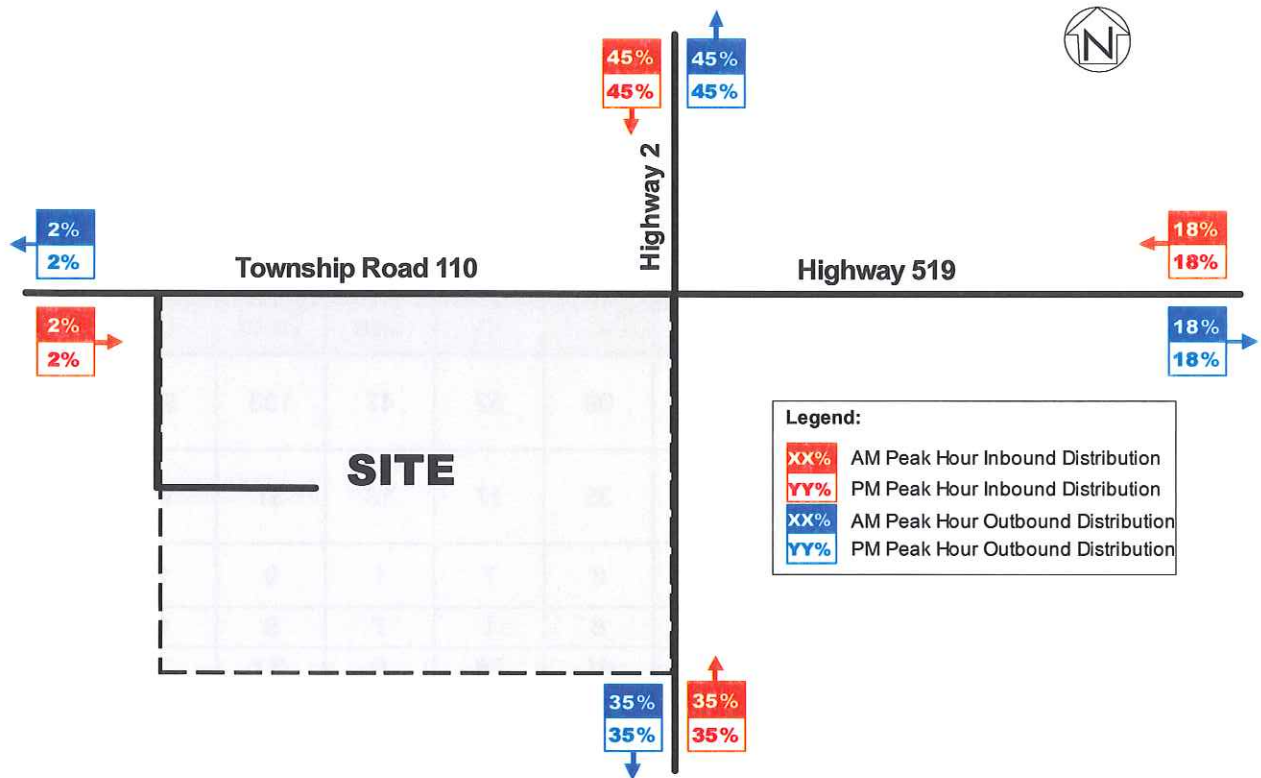


FIGURE 5: TRIP DISTRIBUTION

3.5 Site Traffic Assignment

The trips generated by the site during the opening day (Table 6) and long-range (Table 8) planning scenarios were assigned to the road based on the directional-distribution pattern established in Figure 3. To reflect the fact that truck stops primarily serve passing traffic on the adjacent roadway, it was assumed that 80% of the generated trips are pass-by trips. Accordingly, all site-generated truck trips were assigned as pass-by trips, with the remainder of the 80% pass-by trips attributed to site-generated passenger vehicles.

The pass-by and primary trip assignment at the opening day horizon are presented in **Figure 6** and **Figure 7**, respectively. **Figure 8** and **Figure 9** show the pass-by and primary trip assignment for the long-term (20-year) scenario.

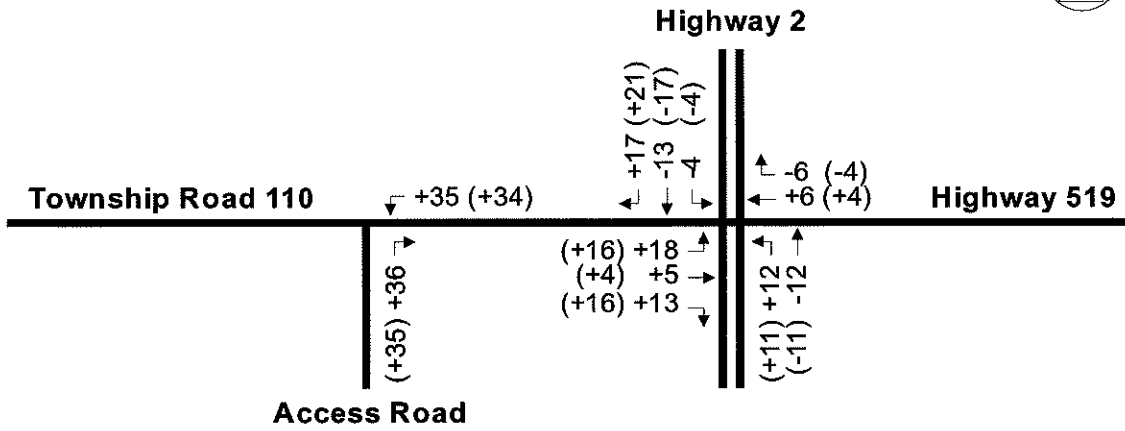


FIGURE 6: OPENING DAY PASS-BY TRIPS

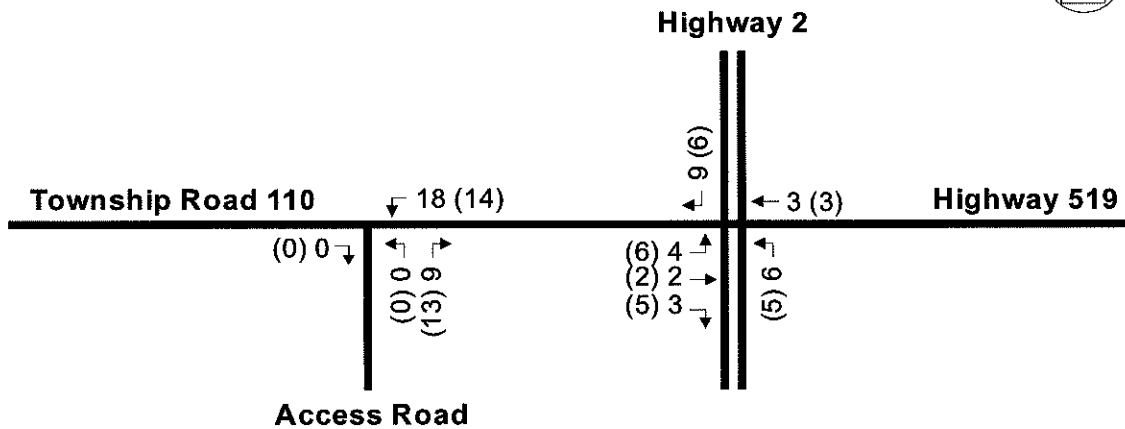


FIGURE 7: OPENING DAY PRIMARY TRIPS

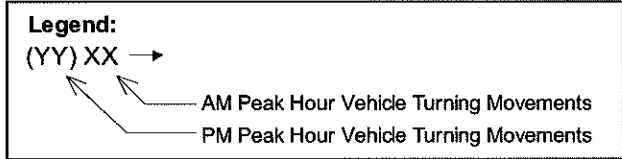
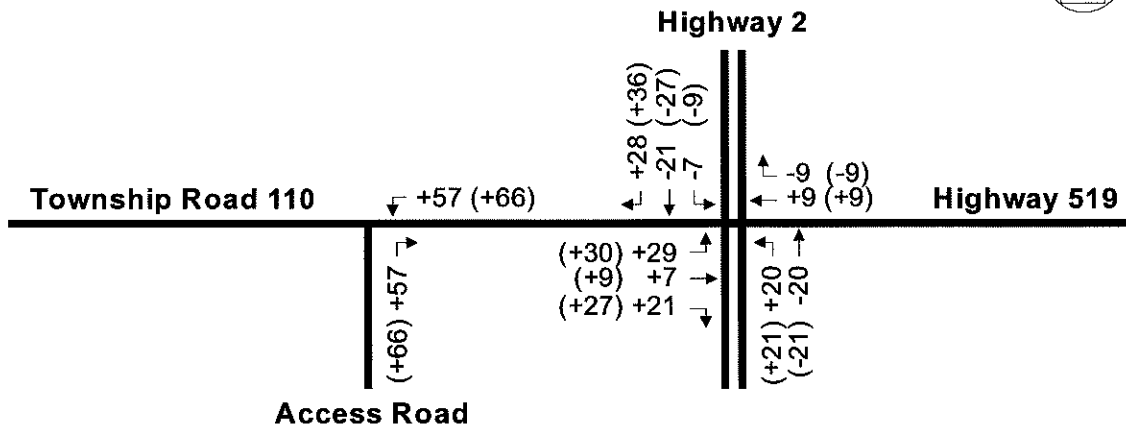


FIGURE 8: LONG TERM (20-YEAR) PASS-BY TRIPS

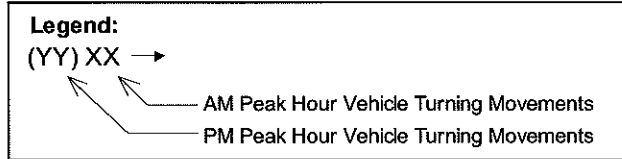
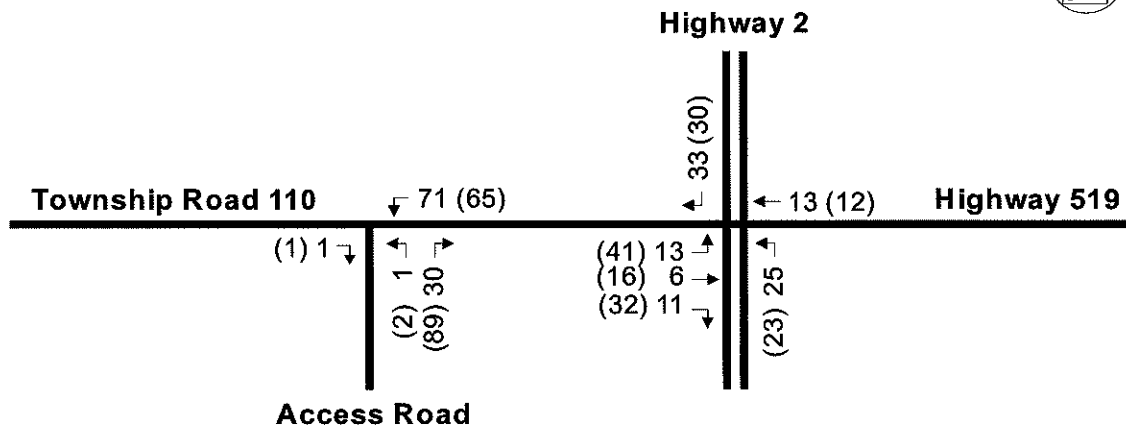


FIGURE 9: LONG TERM (20-YEAR) PRIMARY TRIPS

4.0 POST-DEVELOPMENT CONDITIONS

4.1 Post-Development Traffic Volumes

The site-generated primary and pass-by trips were superimposed onto the 2020 background traffic volumes to obtain the post-development traffic volumes presented in **Figure 10** and **Figure 11** for the opening day and long-term planning horizons, respectively.

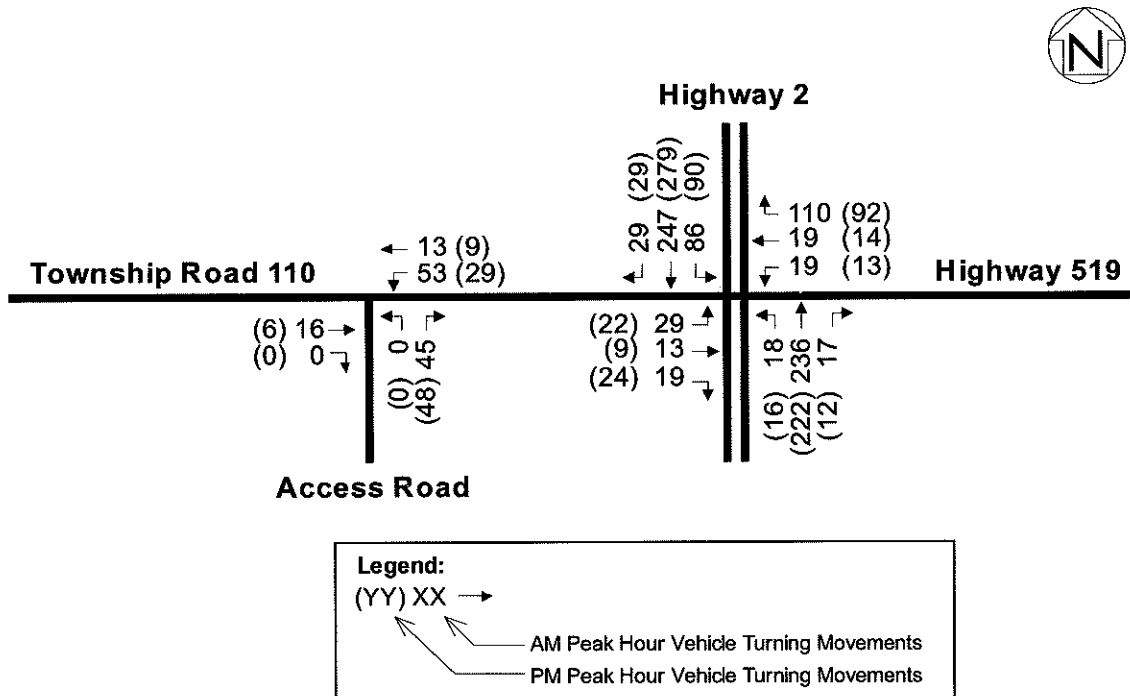


FIGURE 10: OPENING DAY POST-DEVELOPMENT TRAFFIC VOLUMES

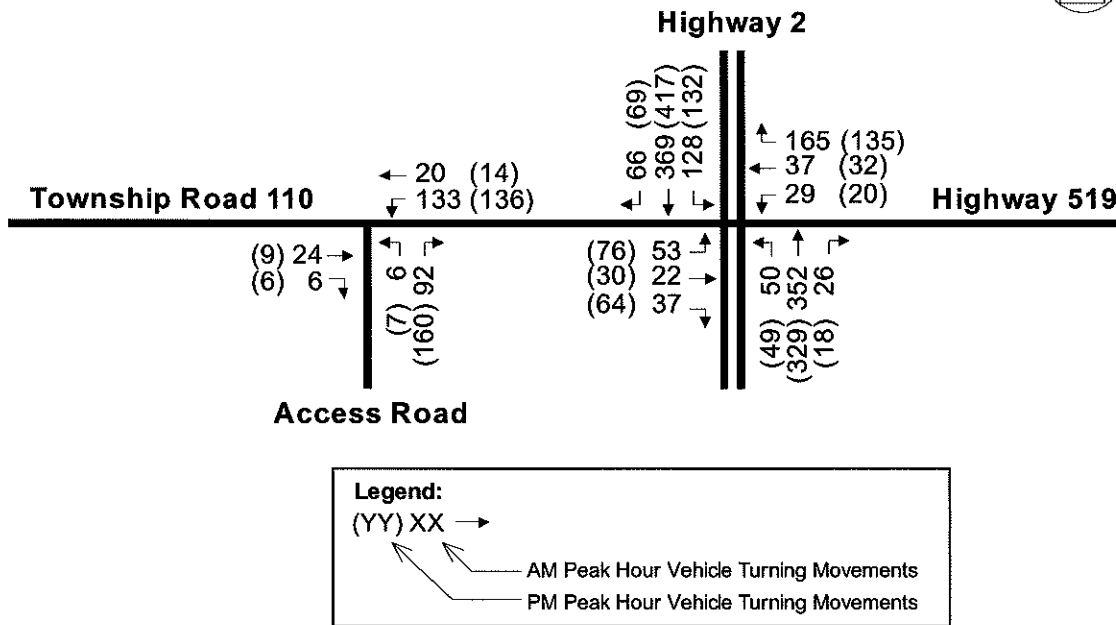


FIGURE 11: FUTURE (20-YEAR) POST-DEVELOPMENT TRAFFIC VOLUMES

4.2 Opening Day Post-Development Operating Conditions

The opening day post-development traffic volumes shown in Figure 10 were evaluated in the Synchro model to obtain the results summarized in **Table 9**:

TABLE 9: OPENING DAY POST-DEVELOPMENT OPERATING CONDITIONS

INTERSECTION / MOVEMENT			AM PEAK HOUR			PM PEAK HOUR		
			LOS	Delay (s)	Queue (m)	LOS	Delay (s)	Queue (m)
Highway 2 & Township Road 110 (Stop Controlled)	EB	Left/Through/Right	B	13.9	3.6	B	12.7	2.8
	WB	Left/Through/Right	B	11.6	6.5	B	11.1	4.8
	NB	Left	A	8.2	0.4	A	8.3	0.3
		Through	A	0.0	0.0	A	0.0	0.0
		Right	A	0.0	0.0	A	0.0	0.0
	SB	Left	A	8.5	2.0	A	8.1	1.8
		Through	A	0.0	0.0	A	0.0	0.0
	Right	A	0.0	0.0	A	0.0	0.0	
Site Access (Stop Controlled)	EB	Through/Right	-	-	-	-	-	-
	WB	Through/Left	A	6.1	0.9	A	6.4	0.8
	NB	Left/Right	A	8.8	1.2	A	8.7	1.2

Note: '-' indicates no volume on movement

The analysis confirms that both intersections will continue to operate effectively with the addition of opening day post-development traffic. Negligible increases in delay (one second or less) were observed over existing conditions on most movements as a result of site traffic. All movements are expected to operate at LOS B or better.

4.3 Future (20-Year) Post-Development Operating Conditions

Similar to the opening day horizon, the future (20-year) background traffic volumes presented in Figure 11 were analyzed using the Synchro model to obtain the results summarized in **Table 10**:

TABLE 10: FUTURE (20-YEAR) POST-DEVELOPMENT OPERATING CONDITIONS

INTERSECTION / MOVEMENT			AM PEAK HOUR			PM PEAK HOUR		
			LOS	Delay (s)	Queue (m)	LOS	Delay (s)	Queue (m)
Highway 2 & Highway 519/ Township Road 110 (Stop Controlled)	EB	Left/Through/Right	D	28.7	16.3	D	27.2	22.5
	WB	Left/Through/Right	C	17.7	18.7	C	16.4	13.7
	NB	Left	A	8.7	1.3	A	8.8	1.3
		Through	A	0.0	0.0	A	0.0	0.0
		Right	A	0.0	0.0	A	0.0	0.0
	SB	Left	A	9.2	3.6	A	8.6	3.2
		Through	A	0.0	0.0	A	0.0	0.0
		Right	A	0.0	0.0	A	0.0	0.0
	Site Access (Stop Controlled)	EB	Through/Right	A	0.0	0.0	A	0.0
WB		Through/Left	A	6.7	2.3	A	6.9	2.3
NB		Left/Right	A	9.2	2.8	A	9.3	4.7

The analysis result confirms that the studied intersections will operate at acceptable levels. The addition of outbound site-generated traffic introduces a minor increase in delay (~10 seconds) for eastbound vehicles in each of the peak hours at the intersection of Highway 2 / Highway 519. Westbound traffic also experiences an incremental increase in delay (~3 seconds) as a result of inbound site trips from the Granum area. Accordingly, eastbound LOS drops from 'C' to 'D' in each of the peak periods, while westbound LOS drops from 'B' to 'C'. All other movements will continue to operate at service levels similar to background conditions and the results indicate that both intersections will continue to operate at acceptable levels in the long-term horizon.

5.0 OTHER CONSIDERATIONS

5.1 Intersection Treatment Warrants

The existing intersection of Highway 2 and Highway 519/Township Road 110 is consistent with the typical treatment for a major-minor road intersection on a four lane divided highway as depicted in Figure D-9.1c of the Alberta Highway Geometric Design Guide (ATHGDG)³.

Traffic turning to and from Highway 2 at Highway 519 is accommodated with a 160 m deceleration lane of 3.7 m width and a 320 m acceleration lane of 3.0 m width, as well as a 130 m southbound left turn lane of 3.5 m width. Similarly, traffic turning to and from Highway 2 at Township Road 110 is accommodated with a 40 m deceleration lane and 60 m acceleration lane both of 3.0 m width. A short (30 m) northbound left turn lane is also provided.

Currently, the existing intersection at the future site access is a Type Ia configuration. To ensure the intersection will adequately accommodate development traffic, AT right and left turn lane warrants were verified at the 20-year post-development horizon as presented in **Appendix D**. As the through volumes on Township Road 110 are relatively low (24 westbound, 20 eastbound) turning movements are not significantly obstructed and no turn lanes were warranted. However, appreciating that a significant number of vehicles are anticipated to be turning to and from the site access (136 inbound, 160 outbound during PM peak hour) with a large proportion of trucks (9%–20%), it is recommended that the intersection be upgraded to provide for a westbound left turn lane. In addition to the left turn lane, additional flaring on the south approach is recommended to facilitate truck traffic egress from the site.

5.2 Pedestrian Crossing Control Warrants

Pedestrian crossing control at the Highway 2 / Highway 519 / Township Road 110 intersection was evaluated based on the Transportation Association of Canada (TAC) Pedestrian Crossing Control Manual (1998)⁴. In completing the analysis, ten adult pedestrians crossing Highway 2 to access the proposed development were allowed for during the peak hour. As the Town of Granum is over 700 m east of the site and a comfortable pedestrian walking distance is typically considered to be five minutes (approximately one quarter mile or 400 m), DAW feels that this a conservatively high estimate of pedestrian demand at the site.

³ Alberta Transportation (1995). *Highway Geometric Design Guide*.

⁴ Transportation Association of Canada (1998). *Pedestrian Crossing Control Manual*.

Following the methodology outlined in the TAC Pedestrian Crossing Control Manual:

- Equivalent adult units (EAUs) = 10 in the one-hour assessment period.
- Total crossing distance (shoulder to median) is approximately 17m; we have used the table for a 21 m cross-section road to be conservative (TAC Pedestrian Crossing Control Manual, Figure 11).
- Peak hourly traffic volume is 417 vehicles per hour (20-year projected volume during PM peak for southbound through movement).
- Assuming traffic arrival pattern 'A' as there are no signals within 1 km of the study location, there are approximately 50 crossing opportunities (COs) per hour (TAC Pedestrian Crossing Control Manual, Figure 11).
- For community size of less than 10,000 residents, a -10 adjustment is applied to the EAU threshold.
- From Figure 13 of the TAC Pedestrian Crossing Control Manual for $EAU < 10$ and $CO = 50$, no pedestrian crossing control treatment is warranted.

5.3 Lighting

The intersection of Highway 2 / Highway 519 / Township Road 110 is currently illuminated with 10 light standards along Highway 2 approaching the intersection.

5.4 Sight Distances

From Figure D-4.2.2.2 of the Alberta Highway Geometric Design Guide, for a 90 km/h design speed and WB-15 design vehicle, a left turn sight distance of approximately 350 m is required. The existing intersection at the proposed site access affords approximately 352 m of left turn sight distance to passenger cars and approximately 390 m to trucks, thus meeting the requirement. Looking east from the existing intersection, sight distances exceed 500 m.

At the intersection of Highway 2 / Highway 519 sight distances were confirmed to exceed 500 m for all approaches.

5.5 Truck Crossings

The proposed truck stop is expected to attract a significant proportion of heavy vehicles, and residents of Granum have expressed concerns relating to trucks crossing Highway 2 to access the site during the public consultation process. To address these concerns, an investigation of truck crossing time and required sight distance was undertaken to further understand traffic operations at the Highway 2 / Highway 519 intersection.

The existing median width (including shoulders) is approximately 25 metres on the north leg of the intersection and 27 metres on the south leg. Thus, the median is just wide enough to accommodate two-stage crossings or left turns for design vehicles up to 25 m long (WB-21 or WB-23). The legal maximum truck length on Alberta Highways without a permit is 25 m. The truck crossing time was estimated based on the methodology outlined in the Alberta Transportation Highway Geometric Design Guide (ATHGHG) as follows:

- The total crossing distance was computed based on the formula $S = d + W + L$ (ATHGDG p. D-28) where:

- S = the distance travelled during acceleration, in metres.
- d = the distance from the near edge of lane to the front of the stopped vehicle (assume three metres).
- W = width of pavement (lanes only across the path of crossing).
- L = Overall length of the crossing vehicle in metres.

- Applying the formula, the distance to cross the northbound lanes on Highway 2 for a WB-23 design vehicle is:

$$S = (3 \text{ m}) + (13.9 \text{ m}) + (25 \text{ m}) = 41.9 \text{ m}$$

From ATHGDG Figure D-4.2.2.1a, the total time required for the WB-23 design vehicle to accelerate across the northbound lanes and enter the median storage area is approximately 13 seconds.

- The distance to cross the southbound lanes on Highway 2 for a WB-23 design vehicle is:

$$S = (3 \text{ m}) + (14.6 \text{ m}) + (25 \text{ m}) = 42.6 \text{ m}$$

From ATHGDG Figure D-4.2.2.1a, the total time required for the WB-23 design vehicle to accelerate across the southbound lanes and enter the median storage area is also approximately 13 seconds.

Having determined the acceleration time required for a WB-23 design vehicle to cross Highway 2, the minimum crossing sight distance was determined based on the formula $D = V(J + t)/3.6$ (ATHGDG p. D-27) where:

- D = Minimum crossing sight distance in metres.
- V = Design speed of the main roadway in kilometers per hour.
- J = Perception-reaction time of the crossing driver (assume 2 seconds).
- t = Acceleration time to cross the main road's pavement in seconds.

For $t = 13$ seconds as determined above, the minimum crossing sight distance for each travel direction is:

$$D = (110 \text{ km/h})(2 \text{ s} + 13 \text{ s})/3.6 = 458 \text{ m}$$

As the sight distances at the Highway 2 / Highway 519 intersection exceed 500 m for all approaches, it is concluded that truck crossings will not have a significant impact on the safety or operation of the intersection. The median is of sufficient width to allow two-stage crossings or left turns, with a crossing time of approximately 13 seconds from the stop bar to the median for a WB-23 design vehicle.