

MMM Group Limited



Traffic Impact Assessment

Sylvan Lake Subdivision Development

Prepared for:

Qualico Communities

DRAFT

COMMUNITIES
TRANSPORTATION
BUILDINGS
INFRASTRUCTURE



July 2010 | 5310029.000.E01-REP-01-R02

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July 23, 2010

File: 5310029.000.E01

Qualico Communities
300, 3203-93 Street
Edmonton, AB T6N 0B2

c/o Marshall Hundert

RE: DRAFT REPORT

Sylvan Lake Development Subdivision Traffic Impact Assessment

We are pleased to submit five (4) bound hard copies of the Draft TIA report, as support of the rezoning and subdivision approval of the proposed residential development known as Palm Cove. One CD is also provided to you, which includes a digital copy of the draft report.

If you have any questions, please feel free to contact the undersigned by email at arango-diazj@mmm.ca or by phone at (780) 423-4123.

Regards,

MMM Group Limited



Jorge Arango, MSc.
Transportation Planner

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Sylvan Lake Subdivision Development Traffic Impact Assessment

Submitted To:
Qualico Communities

Submitted By:



July 2010

DRAFT

STANDARD LIMITATIONS

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EXECUTIVE SUMMARY

Methodology

MMM Group was retained to complete a traffic impact assessment (TIA) to support the rezoning and subdivision approval of an approximately 59 lot subdivision for single-unit family houses in Stage 1. Given that the total extent of the full development has yet to be agreed upon, MMM was asked to assume a conservative estimate of a maximum of 450 single-unit family houses for the ultimate stage (assumed in the 20 year horizon). Whilst it is unlikely that 450 single-unit family houses will be developed in the foreseeable future, MMM shall use this figure during the analysis to estimate the 'worst case scenario' impact on the community. This TIA includes an assessment of the impacts of the proposed development, known as *Palm Cove*, on the road network and access of the proposed development at the Rainy Creek Road, by the ultimate stage. Recommendations about the type and configuration of the intersection for the ultimate stage are made, as well as any recommendations where improvements are required. Traffic operations were also reviewed for Stage 1.

This TIA reviewed the 2010 and 2030 weekday morning and afternoon peak hours as well as the estimated daily traffic volumes for the post-development scenario. Detail analysis using Synchro traffic modeling software is included for the ultimate stage (assuming full build-out by the year 2030).

Results

The intersection of Rainy Creek Road at Palm Cove development access will have one stop control on the site access road and free flow on Rainy Creek Road. All approach movements will operate at a level of service LOS B or better. The results of the traffic analysis are summarized in **Table ES1.1**

**Table ES1.1: Palm Cove Development Access at Rainy Creek Road Intersection
Analysis – Year 2030**

Critical Movements – Ultimate Stage (Year 2030)						
Scenario	ICU LOS (Intersection Utilization)	Intersection Delay (sec)	WB Thru/Left		NB Right/Left	
			LOS (Delay)	Queue (meters)	LOS (Delay)	Queue (meters)
Weekday Morning Peak Hour	A (35%)	6.4	A (7.8 s)	1.5	B (11.5 s)	11.7
Weekday Afternoon Peak Hour	A (40%)	6.1	A (8.4 s)	6.3	B (11.7 s)	7.9

Conclusions

The analysis shows that a Type IVa intersection will be required at the Palm Cove development access and Rainy Creek Road intersection based on the 2030 post-development traffic volumes (ultimate stage). The Synchro 7 traffic analysis software was used to confirm the need for storage bays and their length for right turn and left turn movements. The westbound left turn movement will require 100 metres of storage (120 m from the centre line) and 210 m of 60:1 taper. The eastbound right turn movement will require 100 metres of storage (120 m from the centre line) and 140 m of 40:1 taper, based on the Alberta Transportation Geometric Standard Guidelines and the detail analysis.

The assessment showed that the weekday afternoon peak hour flow is greater than the weekday morning peak hour flow. During the weekday afternoon peak hour period, the Palm Cove development is expected to generate approximately 70 vehicle trips per hour by the year 2010, and 450 vehicle trips per hour by the year 2030. The total daily traffic generated by the Palm Cove development is estimated to be about 640 and 4310 vehicle trips per day by the year 2010 and 2030, respectively.

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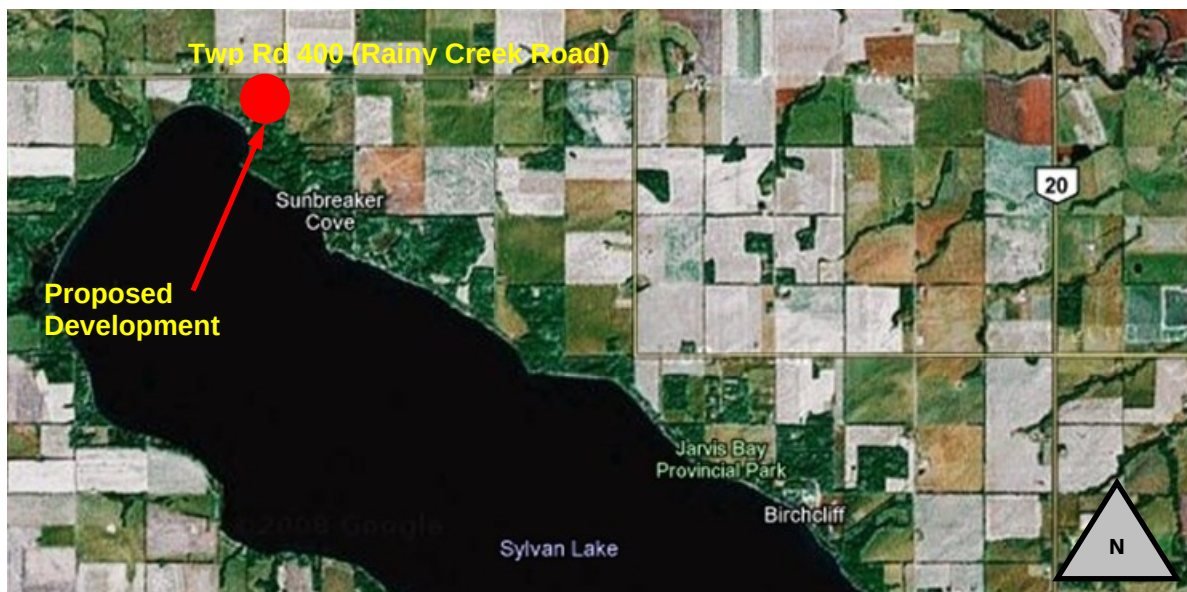
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1.0 INTRODUCTION

1.1 Proposed Development

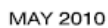
Qualico Communities retained MMM Group Limited (MMM) to conduct a traffic impact assessment (TIA) to support the rezoning and subdivision approval of a proposed new development, known as Palm Cove. The proposed subdivision development contains approximately 63.73 hectares located on the north end of the Sylvan Lake in Lacombe County, Alberta. The proposed development limits are to the north with Rainy Creek Road (Twp Rd 400), between Rg Rd 22 and Rg Rd 24; and to the east with the proposed Skyy Country Golf and RV Park Development. The main access is planned to be located along Rainy Creek Road, 360 m from the east property line and 450 m west of the nearest government road allowance. **Figure 1.1** shows the location of the proposed development (Palm Cove).

Figure 1.1: Site Location (Source: Google maps, 2010)



During the first stage of build-out, the Palm Cove development will be limited to the rezoning and subdivision approval of approximately 59 residential single-unit family lots. Given that the total extent of the full development has yet to be agreed upon, MMM was asked to assume a conservative estimate of maximum 450 single-unit family houses for the ultimate stage (assumed in the 20 year horizon). Whilst it is unlikely that 450 single-unit family houses will be developed in the foreseeable future, MMM shall use this figure during the analysis, to estimate the 'worst case scenario' impact on the community. The current proposed site plan is illustrated in **Figure 1.2**.

Exhibit
Phase 1 Lotting



QUALICO®
Composites

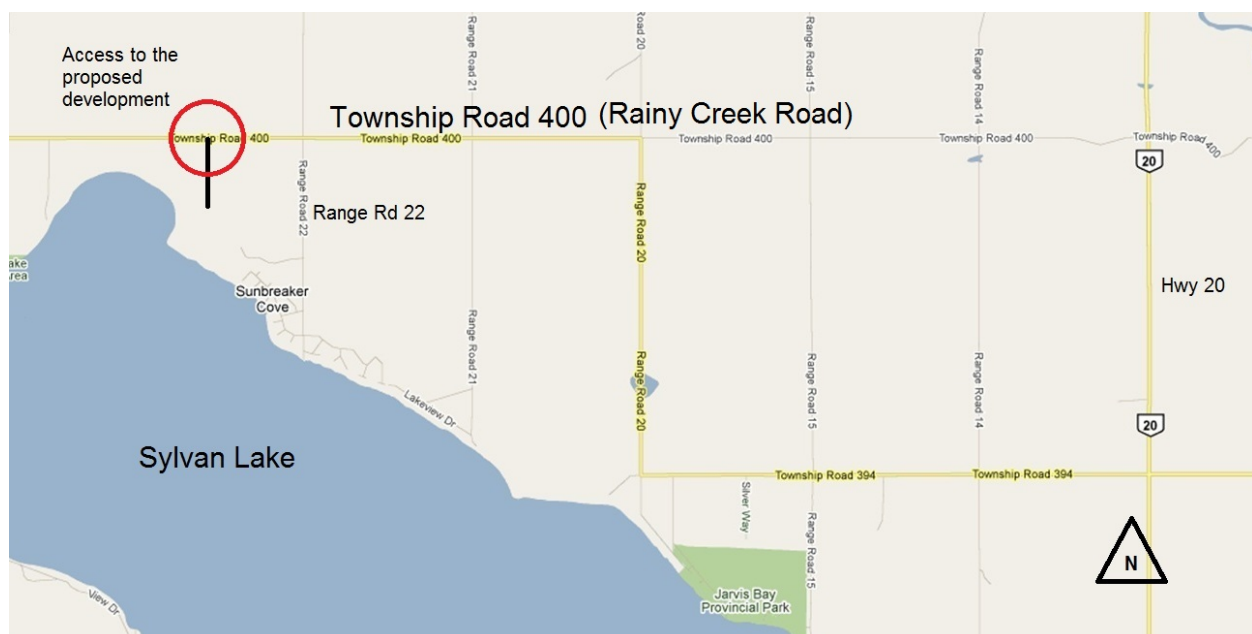
This study investigates the potential traffic impact of the proposed development by its ultimate stage on the Rainy Creek Road in terms of the capacity (daily and weekday peak hours), as well as determine the intersection treatments required for the development access. In addition, a Level 'A' (high level) cost estimate of the new intersection (proposed access on Rainy Creek Road) and potential road improvements required for the Rainy Creek Road is also provided (see **Appendix E**).

1.2 Methodology

MMM first confirmed the scope of the study with the approving authority, Lacombe County. MMM agreed to evaluate the post-development operations at the intersection of the proposed access road and Rainy Creek Road (shown in **Figure 1.3**), for the 2030 horizon.

The Palm Cove development required the introduction of a new intersection for access at Rainy Creek Road. This access was evaluated in terms of its: proximity to adjacent intersections, queuing capacity, intersection type and connectivity to the main roadway network. **Figure 1.3** illustrates the key intersection evaluated in this TIA.

Figure 1.3: Key Intersection (Source: Google maps, 2010)



MMM undertook the following steps to develop the Traffic Impact Assessment Report:

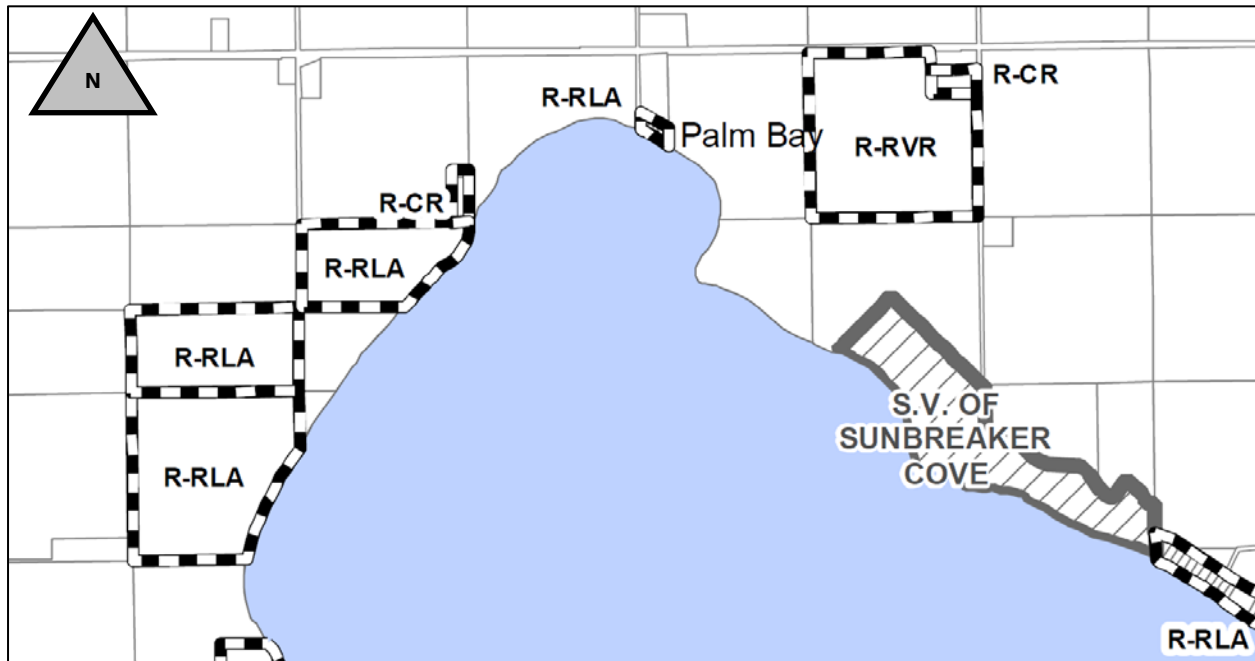
- ▶ Identification and review of background information, including relevant details of previous studies and details concerning future local developments.
- ▶ Confirmation of planned or existing geometric and operational conditions within the study area.
- ▶ Generation of site traffic estimates for the weekday AM and PM peak periods based on land use type and intensity of the proposed development, and using trip generation rates from the Institute of Transportation Engineers (ITE) Trip Generation Manual. The project team also estimated daily traffic volumes generated by the site using ITE trip rates.
- ▶ Trip distribution and trip assignment of the vehicular trips generated by the proposed development and other major developments in the area by the 2010 and 2030 time horizons. Within this task, MMM Group prepared a regional trip distribution and a directional split at the key intersection. These travel patterns were based on available traffic data, the development location, the location of residential and employment centres, road network connectivity, and input from Lacombe County. Our traffic distribution and assignment were accepted by Lacombe County prior to the analysis.
- ▶ Review of traffic operations at the key intersection in terms of its proximity to adjacent intersections, queuing capacity, intersection type and connectivity to the main road network by the year 2010.
- ▶ Review of traffic operations at the key intersection to determine if there are any deficiencies in the local transportation network for the 2030 horizon at post-development traffic conditions (assuming full build-out). This involved a review of the following elements of the intersection:
 - ▶ Control systems and traffic capacity,
 - ▶ Pedestrian and cyclist requirements,
 - ▶ Geometric constraints,
 - ▶ Left and right turn lane requirements and storage, and
 - ▶ Review of illumination requirements.
- ▶ Estimation of volume-to-capacity of Rainy Creek Road based on post-development traffic volumes by the 2030 horizon.

1.3 Existing and Future Developments

Currently, the area located in the southwest quadrant of the intersection of Rainy Creek Road and Rg Rd 22 is designated as *Recreational Vehicle Resort District (R-RVR)* and *Country Residential District (R-CR)* base on the Land Use Bylaw No. 1056/07, as shown on the *Sylvan*

Lake Region Overview Map (viewable on the Lacombe County website). The property west of the proposed Palm Cove development (known as Palm Bay) is classified as *Residential Lake Area District (R-RLA)*. **Figure 1.4** illustrates the existing land use bylaw.

Figure 1.4: Land Use Bylaw (Source: *Land Use Bylaw District Maps, Lacombe County, 2010*)



This traffic impact assessment (TIA) was prepared to support the rezoning and subdivision approval of an approximately 59 lot subdivision for single-unit family houses in Stage 1. As indicated in conversations with Qualico Communities, the size of the full development is unknown although MMM was advised to assume a maximum of 450 single-unit family houses in the ultimate stage (assuming a 20 year horizon).

Lacombe County confirmed and provided the trips generated by the Skyy Country Golf and RV Park development. Trip distribution was also discussed with and accepted by the County.

Lacombe County confirmed that other developments, in various stages of approval, will also take place in the surrounding area. However, the County could not confirm the total number of trips generated by these developments. In order to account for these developments, the County agreed that annual traffic growth rate should be assumed to be 4% (for comparison purposes the provincial average is normally between 2 to 3% pa).

2.0 ROAD DESCRIPTION

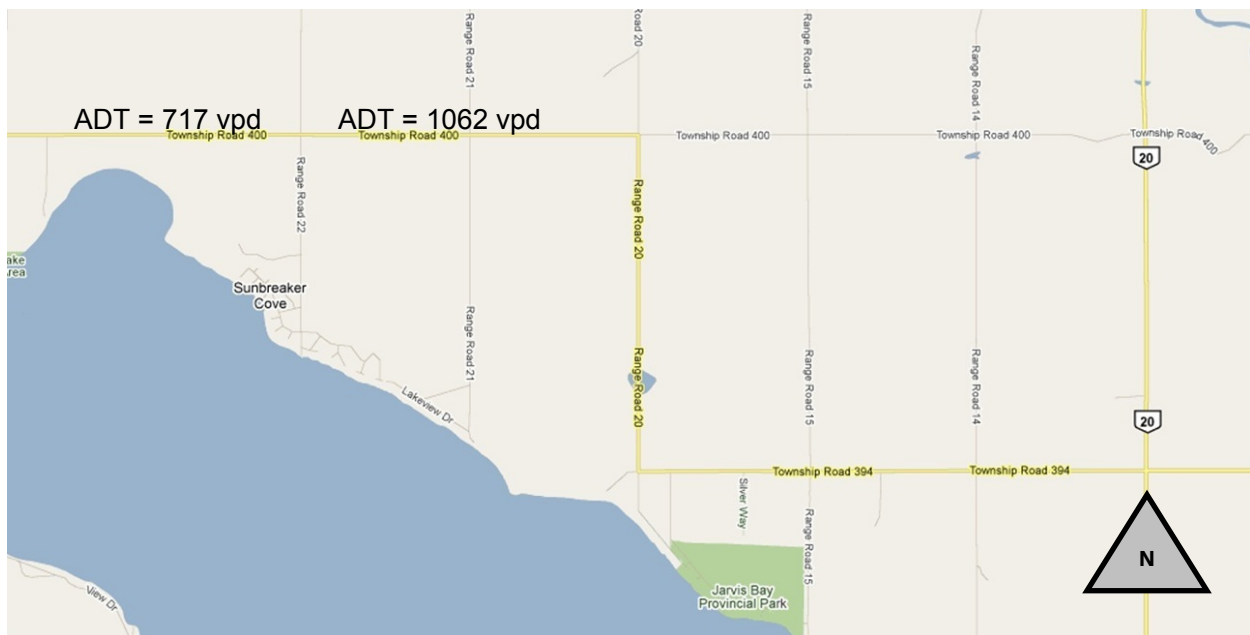
The proposed Palm Cove development access will be located approximately 8.4 km west of the intersection of Hwy 20 and Rainy Creek Road (Twp Rd 400). Rainy Creek Road is classified as being a *County Main Asphalt Road*. It is a two-way undivided paved road having a right-of-way of approximately 40.23 metres. Each lane is approximately 3.5 metres wide and the road has 1.2 m wide shoulders on both sides. The posted speed is 100 kph and the design speed is 110 kph.

3.0 TRAFFIC VOLUMES

3.1 Background Traffic

Background traffic refers to the traffic that already uses the roadway, or will use the roadway in the time horizon, irrespective of the proposed development. The existing (2010) traffic volume along Rainy Creek Road, between Rg Rd 22 and Rg Rd 24, is approximately 717 vehicles per day (vpd). This figure was obtained by applying a 4% growth factor to the 2009 flows provided by the County. The design hour volume is assumed to be approximately 15 percent of the daily traffic volume. **Figure 3.1** shows the daily traffic volumes by the year 2010.

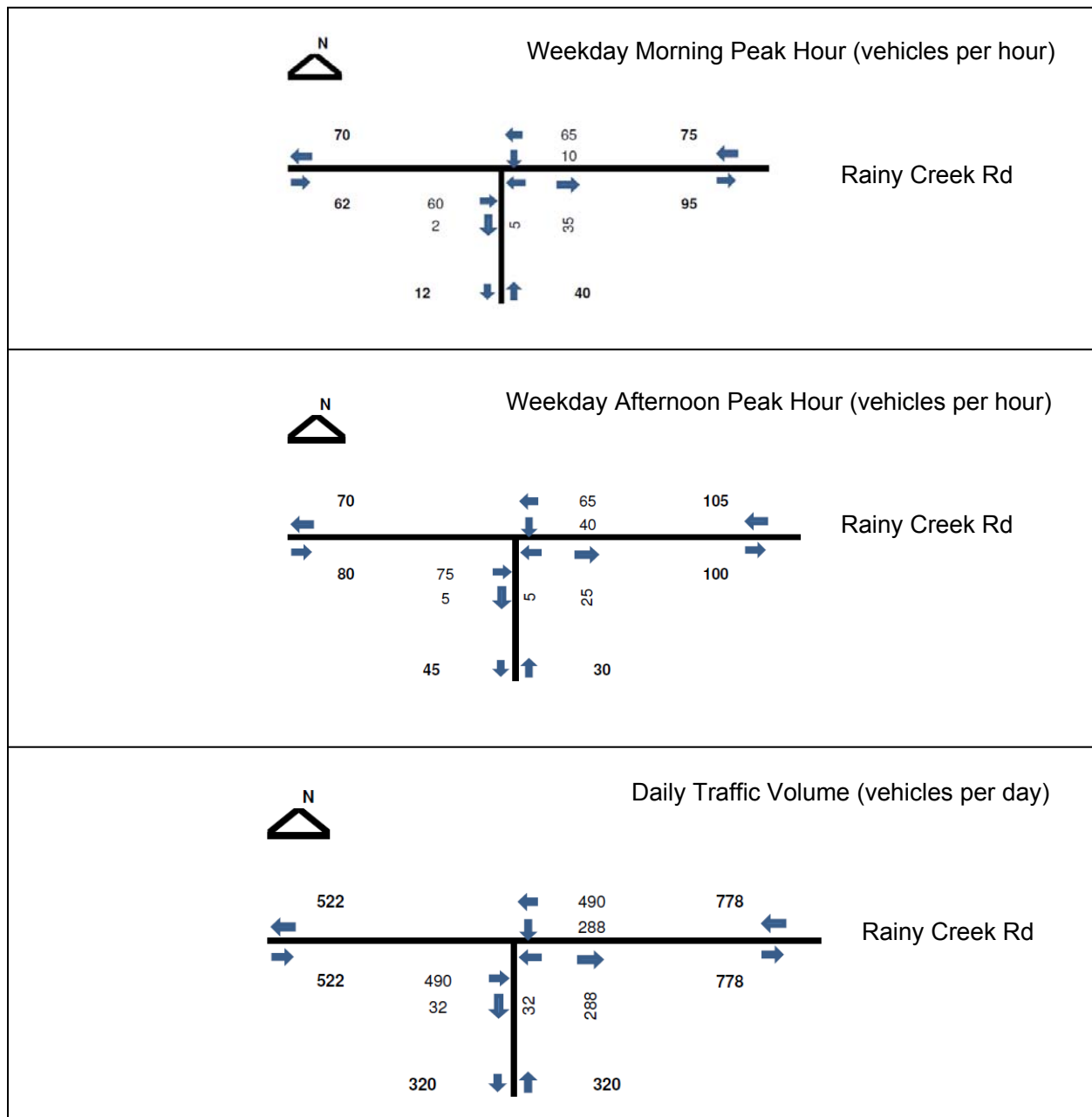
Figure 3.1: 2010 Daily Traffic Volumes (Source: Google Maps, 2010)



3.2 Post-Development Traffic By 2010

Post-Development traffic by 2010 refers to the background traffic (including any traffic generated by other developments) plus the additional traffic generated by the Palm Cove development if Stage 1 were opened by 2010. **Figure 3.2** illustrates the post-development traffic volumes by the year 2010, at the Palm Cove development access.

Figure 3.2: Post-Development Traffic Volumes by Year 2010 (Source: MMM, 2010)



3.3 Post-Development Traffic By 2030

Post-development traffic refers to the forecast background traffic volumes by the year 2030, with the addition of the traffic generated by the Skyy Country Golf and RV Park development assuming full build-out, and the traffic generated by the Palm Cove residential development, assuming full built-out of 450 units. **Figure 3.3** illustrates the post-development traffic during the weekday morning and afternoon peak hour as well as the estimated combined daily traffic, by the year 2030, at the Palm Cove development access.

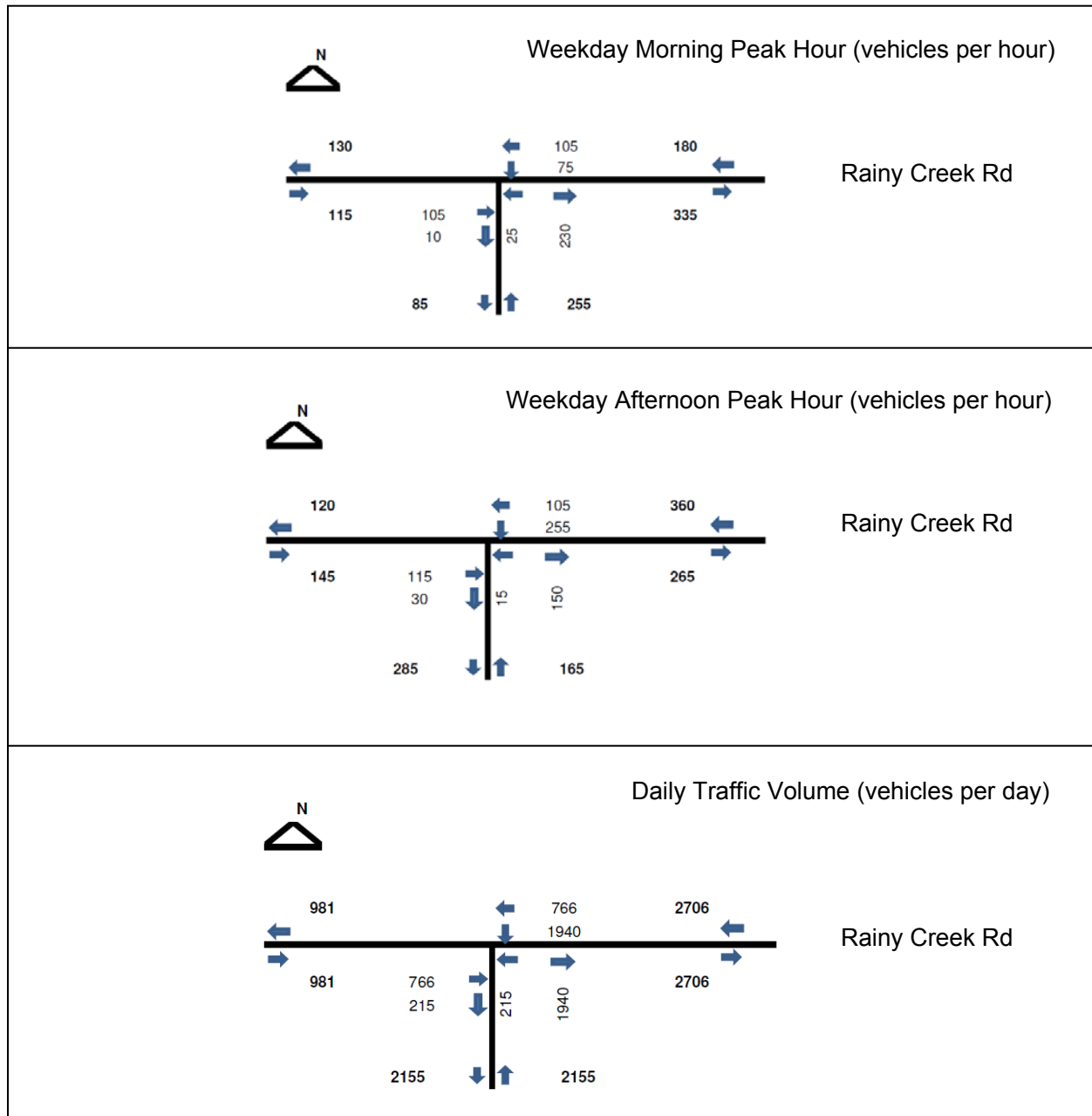
Lacombe County confirmed and provided the trips generated by the Skyy Country Golf and RV Park development. This development is estimated to generate approximately 2,650 vehicles per day at full build-out (assumed by the year 2030); 176 new trips during the weekday morning peak hour and 310 new trips during the weekday afternoon peak hour. **Table 3.1** illustrates the generation of new trips by the Skyy Country Golf and RV Park development and its distribution.

Table 3.1: Skyy Country Golf and RV Park Development Trip Generation

Estimate	Trip Direction		Trips Generated		
	In	Out	In	Out	Total
Daily Traffic Volume (ADT) *	50%	50%	1325	1325	2650
Weekday Morning Peak Hour **	43%	57%	76	100	176
Weekday Afternoon Peak Hour **	60%	40%	186	124	310
* Traffic volumes in vehicles per day ** Traffic volumes in vehicles per hour					

Section 3.4 describes the methodology followed for estimating trip generation, trip distribution, and trip assignment for the post-development traffic.

Figure 3.3: Post-Development Traffic Volumes by Year 2030 (Source: MMM, 2010)



3.4 Travel Forecasting For Future Traffic

3.4.1 Trip Generation

Trips generated by the proposed development were estimated for the weekday morning and afternoon peak hour. The generated daily traffic volumes were also estimated. Estimates of inbound and outbound trips per hour or day are based on trip rates obtained from the Institute of Transportation Engineers (ITE) Trip Generation - An ITE Informational Report, 8th Edition. Currently, the size of the proposed development is a 59 lot subdivision for single-unit family houses in Stage 1. The full development size is assumed to be a maximum size of 450 single-unit family houses in the ultimate stage (2030). **Table 3.2** summarizes the forecast trip generation for the proposed Palm Cove development. Trip estimates have been rounded to the nearest five vehicles per hour.

Table 3.2: Proposed Palm Cove Development Trip Generation

Development Size	Unit (1)	Fitted Curve Equation	Trip Direction		Trips Generated		
			In	Out	In	Out	Total
Year 2010 (Stage 1)							
Daily Traffic Volume (ADT) *	59	$\text{Ln}(\text{T}) = 0.92\text{Ln}(\text{X}) + 2.71$	50%	50%	320	320	640
Weekday Morning Peak Hour **	59	$\text{T} = 0.70\text{X} + 9.43$	25%	75%	13	38	50
Weekday Afternoon Peak Hour **	59	$\text{Ln}(\text{T}) = 0.90\text{Ln}(\text{X}) + 0.53$	63%	37%	44	26	70
Year 2030 (Ultimate Stage)							
Daily Traffic Volume (ADT) *	450	$\text{T} = 9.57\text{X}$	50%	50%	2155	2155	4310
Weekday Morning Peak Hour **	450	$\text{T} = 0.75\text{X}$	25%	75%	85	255	340
Weekday Afternoon Peak Hour **	450	$\text{T} = 1.01\text{X}$	63%	37%	284	167	450
(1) Single-unit family houses							
* Traffic volumes in vehicles per day							
** Traffic volumes in vehicles per hour							

3.4.2 Trip Distribution and Assignment

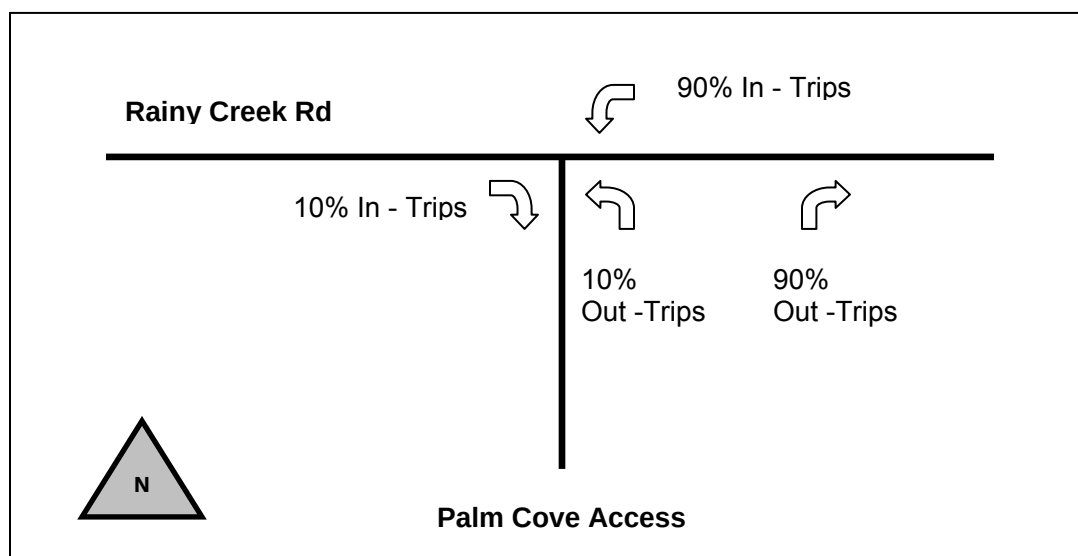
Trip distribution refers to the directional split of traffic entering and exiting the study area. Trip assignment refers to the allocation of the distributed trips to specific links into the road network.

Trip distribution was discussed and agreed upon with Lacombe County and is based on their local knowledge and on the current traffic patterns. The trip distribution is as follows:

- ▶ 10% of development generated traffic will travel to/from the west along Rainy Creek Road.
- ▶ 90% of development generated traffic will travel to/from the east along Rainy Creek Road and will split through the local network.
- ▶ Most of the traffic to/from the east will originate in the main residential areas along Hwy 2, such as Calgary, Edmonton and Red Deer.

Figure 3.4 illustrates trip assignment at the proposed Palm Cove development access along Rainy Creek Road.

Figure 3.4: Trip Assignment at Site Access along Rainy Creek Road (Source: MMM, 2010)



4.0 TRAFFIC ANALYSIS

4.1 Intersection Analysis

The traffic analysis for the proposed Palm Cove development was undertaken using Synchro 7 traffic analysis software. The relative performance of an intersection is measured in terms of level of service (LOS) and the volume-to-capacity (v/c) ratio. Intersection level of service ranges from A (excellent) to F (beyond capacity). Level of service criteria for unsignalized intersections are defined in terms of the delay. Delay is the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line. This includes the time required for the vehicle to travel from the last-in-queue position to the first. In the case of a two-way stop-controlled intersection the LOS is defined for each minor movement, and the LOS is not defined for the intersection as a whole.

Intersection capacity utilization level of service (ICU LOS) provides additional insight into how an intersection is functioning and how much extra capacity is available to handle traffic fluctuations and incidents. ICU LOS ranges from A (excellent) to H (beyond capacity), with ICU LOS E generally considered being at practical capacity.

4.1.1 Stage 1 – Year 2010

The procedure outlined in the Alberta Transportation Geometric Standard Guidelines, Section D, was followed to determine the type of intersection required at the access of the proposed Palm Cove development (based on the forecasted post-development traffic volumes by the year 2010 and the current posted speed on Rainy Creek Road). The analysis shows that an intersection *Type II* or *Type III* treatment will be suitable to accommodate Stage 1 post-development traffic operations by the year 2010.

4.1.2 Ultimate Stage – Year 2030

The procedure outlined in the Alberta Transportation Geometric Standard Guidelines, Section D, was followed to determine the intersection type treatment required at the access of the proposed Palm Cove development as well as the warrants for left and right turns, based on the forecasted traffic volumes by the year 2030 and posted speed of 100 kph on Rainy Creek Road. The analysis showed that an intersection *Type IVa* treatment will be required as well as a detailed traffic analysis in order to determine storage length requirements for left and right turns. Therefore, a detailed traffic analysis was conducted using Synchro 7 traffic analysis software.

Table 4.1 presents the results of the intersection analysis for the 2030 Post-Development weekday morning and afternoon peak traffic conditions.

The proposed Palm Cove development access at Rainy Creek Road will require a T Intersection Treatment (Type IVa). The westbound left turn movement will require 100 m of storage (120 m from the centre line) and 210 m of 60:1 taper. The eastbound right turn movement will require 100 m of storage (120 m from the centre line) and 140 m of 40:1 taper.

Given the proximity of the access to Skyy Country Golf and RV Park development (approximately 380 m from centre line to centre line) and their intersection requirements, it might be necessary to extend the Left turn storage lane between both intersections. As result, Rainy Creek Road would have two lanes in the westbound direction (one for exclusive left turn movements and one for through movements) between both accesses.

Table 4.1: Palm Cove Development Access and Rainy Creek Road Intersection Analysis – Year 2030

Critical Movements – Ultimate Stage (Year 2030)											
Scenario	ICU LOS (Intersection Utilization)	Intersection Delay (sec)	EB Right			WB Thru/Left			NB Right/Left		
			V/C	LOS (Delay)	Queue (meters)	V/C	LOS (Delay)	Queue (meters)	V/C	LOS (Delay)	Queue (meters)
Weekday Morning Peak Hour	A (35%)	6.4	0.01	A (0 s)	0	0.06	A (7.8 s)	1.5	0.34	B (11.5 s)	11.7
Weekday Afternoon Peak Hour	A (40%)	6.1	0.02	A (0 s)	0	0.22	A (8.4 s)	6.3	0.26	B (11.7 s)	7.9

4.1.3 Illumination and Signal Warrant Analysis

Signal warrant calculations were not conducted since the operation analysis provided adequate traffic operational levels.

Based on Alberta Transportation's warrants for illumination, illumination would be required at the proposed Palm Cove development access and Rainy Creek Road by 2030. Collision data along Rainy Creek Road could not be obtained by this time; however, delineation lighting is warranted due to the projected traffic even if the number of night time collisions is zero. **Appendix D** presents the illumination warrant calculations.

4.1.4 Road Segment Capacity

The Rainy Creek Road segment between 500 m west of the proposed Palm Cove development access and 500 m east of the Skyy Country Golf and RV Park development access were analysed to identify the volume-to-capacity ratio and level of service. The analysis was done for the existing and post-development scenarios. The Highway Capacity Software HCS was used for the two-way analysis by the weekday afternoon peak hour as it was identified as the most critical design hour. It was assumed that Rainy Creek Road corresponds to a Class I Highway as defined in the Highway Capacity Manual. **Table 4.2** presents the results of the two-way analysis. The analysis shows minimal impact on Rainy Creek Road in the vicinity area. LOS C could be expected for the post-development traffic volumes by the year 2030, during the weekday afternoon peak hour; except for the road segment west of the Palm Cove development access where a LOS B is expected. It was assumed that the whole road segment has only one lane per direction, although it may be two lanes in the westbound direction between the Palm Cove development and the Skyy Country Golf and RV Park development, which might improve operations at this particular location.

Table 4.2: Two-Way Rainy Creek Road Traffic Operation Analysis

Critical Movements – Weekday Afternoon Peak Hour						
Scenario	West of Palm Cove Access		Btw Proposed Accesses		East of Skyy Country Golf & RV Park Access	
	V/C	LOS	V/C	LOS	V/C	LOS
2010 Existing	0.07	A	0.07	A	0.07	A
2010 Post-Development	0.09	A	0.13	A	0.19	B
2030 Post-Development	0.16	B	0.27	C	0.34	C

5.0 CONCLUSIONS AND RECOMMENDATIONS

The results of the traffic operation analysis indicate that the key intersection (proposed Palm Cove development access at Rainy Creek Road) is expected to operate satisfactorily as a T intersection with a stop sign control in the access approach and free flow along Rainy Creek Road. By the year 2030, it is estimated an approach LOS A on the movements along Rainy Creek Road and an approach LOS B on the movements along Palm Cove access.

The analysis shows that a Type IVa intersection will be required based on the 2030 post-development traffic volumes (ultimate stage). The Synchro 7 traffic analysis software was used to confirm the need for storage bays and their length for right turn and left turn movements. The westbound left turn movement will require 100 metres of storage (120 m from the centre line) and 210 m of 60:1 taper. The eastbound right turn movement will require 100 metres of storage (120 m from the centre line) and 140 m of 40:1 taper, based on the Alberta Transportation Geometric Standard Guidelines and detail analysis.

The analysis uses an assumed development of 450 single-unit family houses by the year 2030. This development is unlikely to happen any time soon but assumptions in type and size of the total development were necessary to estimate future possible demand and delays.

Special consideration must be given to the access of the Skyy Country Golf and RV Park development (approximately 380 metres from centre line to centre line) and their intersection requirements. The need for left turn storage lanes and tapers in both developments will lead to the practical solution of providing, along Rainy Creek Road, two lanes in the westbound direction (one for exclusive left turn movements and one for through movements) between both accesses.

The assessment showed that the weekday afternoon peak hour flow is greater than the weekday morning peak hour flow. During the weekday afternoon peak hour period, the proposed Palm Cove development is expected to generate approximately 70 vehicle trips per hour by the year 2010, and 450 vehicle trips per hour by the year 2030. The total daily traffic generated by the proposed Palm Cove development is estimated to be about 640 and 4310 vehicle trips per day by the year 2010 and 2030, respectively.

Jorge Arango

From: Phil Lodermeier [plodermeier@lacombecounty.com]
Sent: Tuesday, May 11, 2010 4:33 PM
To: Jorge Arango
Cc: Allan Williams
Subject: RE: 4537 Sylvan Lake Residential Development

Hi Jorge

Both Allan and I have reviewed your work plan and you seem to have covered all requirements for the TIA that Lacombe County would normally expect.

If your report identifies issues that require further investigation we do reserve the right to ask for additional information.

Thanks

Phil

From: Jorge Arango [mailto:Arango-DiazJ@mmm.ca]
Sent: May 10, 2010 9:54 AM
To: Phil Lodermeier
Cc: Ryan Olson
Subject: 4537 Sylvan Lake Residential Development

Hello Phil,

On behalf of Red Deer Properties Developments Ltd. I would like to confirm the scope and requirements for the TIA to support the rezoning and subdivision approval of approximately 53 lot subdivision single-unit family houses (stage 1). I have attached our proposed plan for this TIA; our client would like to confirm with the Lacombe Authorities the work plan and scope.

Please let me know if you consider the proposed work plan and scope covers all the Lacombe's TIA requirements or if modifications are necessary.

Regards,

Jorge

Jorge Arango, MSc.
Transportation Planner
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From: Phil Lodermeier [mailto:plodermeier@lacombecounty.com]
Sent: Monday, March 01, 2010 11:02 AM
To: Jorge Arango
Subject: RE: Sylvan Lake Residential Development

No problem and yes the traffic counts are ADT

From: Jorge Arango [mailto:Arango-DiazJ@mmm.ca]
Sent: March 1, 2010 10:59 AM
To: Phil Lodermeier
Subject: RE: Sylvan Lake Residential Development

Hi Phil,
For this preliminary analysis I would use a growth rate of 3.5%.
The volumes you sent me are the Average Daily Traffic volumes?
Thank you for your help and I will be in touch in case I need more information from the County.
Have a great day,

Jorge

Jorge Arango, MSc., EIT.
Transportation Planner
MMM GROUP
#200, 10576 - 113 Street
Edmonton, Alberta T5H 3H5
T: 780-423-4123 ext 231
F: 780-426-0659
E: arango-diazj@mmm.ca
www.mmm.ca

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Sent: Monday, March 01, 2010 10:37 AM
To: Jorge Arango
Cc: Allan Williams
Subject: RE: Sylvan Lake Residential Development

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Here are the 2009 traffic counts on Rainy Creek

Rainy Creek Rd	East of Sunbreaker Cove	Jul 2	1021
	West of Sunbreaker Cove	Jul 2	689
	East of Highway 766	Jul 2	722
	West of Highway 766	Jul 2	521
	East of Clearwater County line	Jul 2	385

You may want to provide your own estimate for projected growth rates but Skyy Country used 3.5%.

Phil

From: Jorge Arango [mailto:Arango-DiazJ@mmm.ca]
Sent: February 26, 2010 5:26 PM
To: Phil Lodermeier
Subject: Sylvan Lake Residential Development

Hi Phil,

Following our telephone conversation, can you please send me the directional or combined traffic data available for TWP 400 (Rainy Creek Road). Our development would be west of the potential Skyy Country Development access and east of the Government Road Allowance. For this preliminary assessment I probably will need also historical data or that you provide me with recommended growth rates.

Thank you for your help,

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Jorge Arango

From: Jorge Arango
Sent: Friday, July 09, 2010 10:38 AM
To: 'Phil Lodermeier'
Subject: RE: Sylvan Lake Residential Development
Attachments: image001.png

Hi Phil,

I want to thank you for the input in this TIA, it's very appreciated. Following our phone conversation I want to confirm:

- 100% of the traffic generated by the Skyy Country Development will access through Twp Rd 400. Of these, ten percent is to/from the west; and 90 percent to/from the east. Most of the traffic to/from the east is likely attracted by Edmonton and Calgary.
- Same distribution will be assumed for the traffic generated by our development.
- Given that the information regarding the three subdivisions on the northwest side of the lake is not available at this moment, an assumed annual growth rate of 4.0% (rather than 3.5%) is believed to compensate for the uncertain trips generated by other developments in the area.

In addition, I would like to obtain data regarding the location and geometrical configuration of the Skyy Country access.

Once again, thank you and have a good weekend,

Jorge

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From: Phil Lodermeier [<mailto:plodermeier@lacombecounty.com>]
Sent: Monday, July 05, 2010 8:19 AM
To: Jorge Arango
Cc: Amanda-Brea Watson; Allan Williams
Subject: RE: Sylvan Lake Residential Development

Hi Jorge

1. You have the most current traffic counts though we will be doing some more in the near future.
2. 3.5% growth rate is adequate
3. According to their TIA (May 2008) – AM Peak 176, Pm Peak 310, AADT 2,650.

4. Other developments on the lake that may affect traffic volumes in the area – three subdivisions on the north west side of lake are in various stages of approval though only one that has started construction – the other two are in limbo at the moment.
5. We haven't discussed lowering the speed limit in this area but it would be considered if and when traffic volumes and turning movements reach a point of creating a dangerous situation. It is not a preferred solution since we have spent a great deal of money increasing the standard of the road to accommodate that speed.
6. I can't help you with the intersection of Highway # 20 and Rainy Creek other than the traffic volumes that are current for Rainy Creek. Traffic Volumes on Highway # 20 should be available on their (Alberta Transportation) web-site.

Phil

From: Jorge Arango [mailto:Arango-DiazJ@mmm.ca]
Sent: June 30, 2010 2:50 PM
To: Phil Lodermeier
Subject: RE: Sylvan Lake Residential Development

Hello Phil,

I hope you are having a great summer.

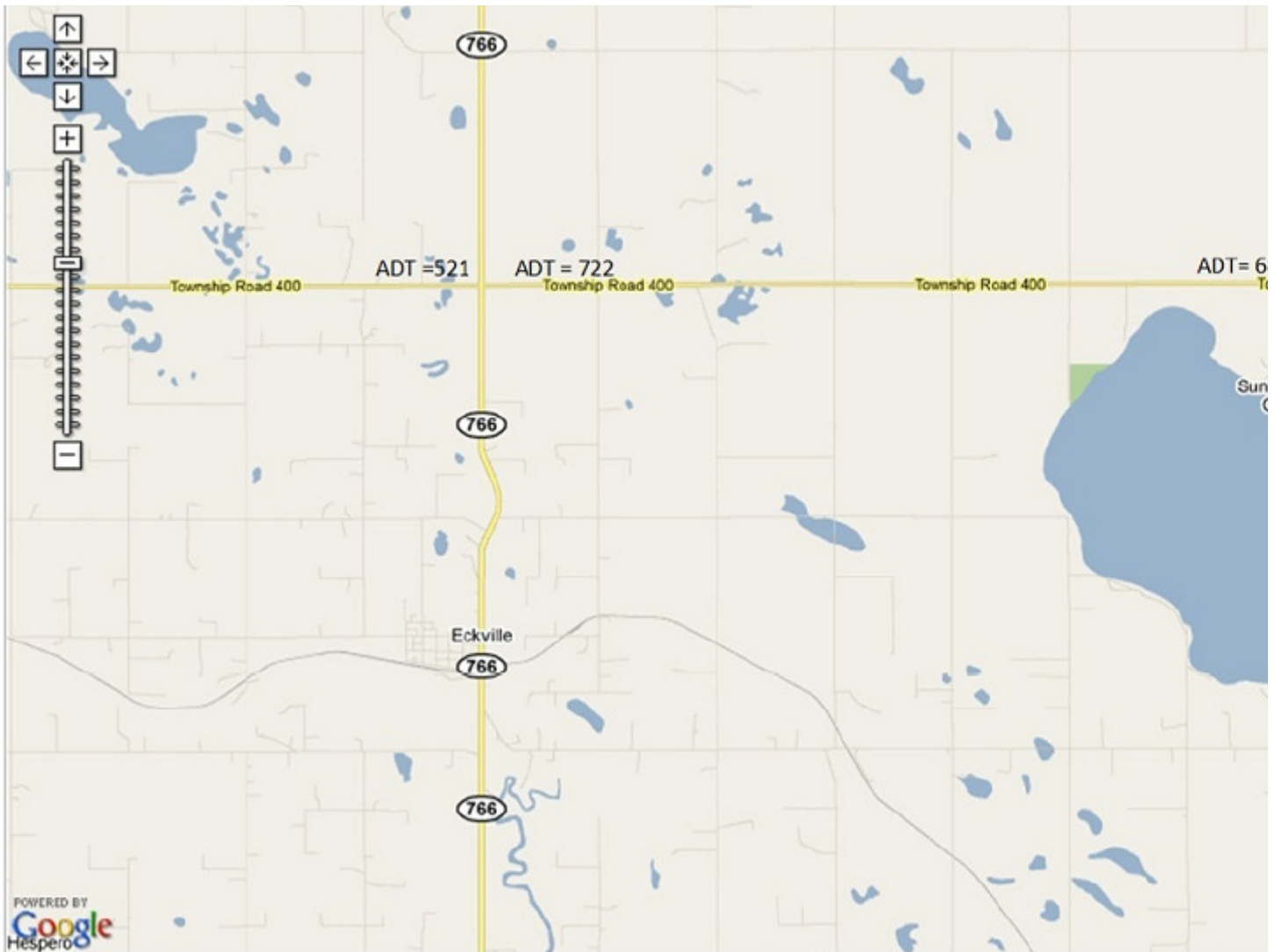
I am currently working on the TIA for the Sylvan Lake residential development, on behalf of Red Deer Properties Developments Ltd.

This project refers to the rezoning and subdivision approval of approximately 53 lot subdivision single-unit family houses (stage 1). For the purposes of this TIA we assumed a maximum development of 450 single-unit family houses by the year 2030.

I would like to confirm the following information:

1. Is this the most recent traffic data available? 2009 Daily traffic Volumes:

Rainy Creek Rd	East of Sunbreaker Cove	Jul 2	1021
	West of Sunbreaker Cove	Jul 2	689
	East of Highway 766	Jul 2	722
	West of Highway 766	Jul 2	521
	East of Clearwater County line	Jul 2	385



2. I don't have any historical data along Rainy Creek Road but you recommended using a projected growth rate of 3.5% as used by the Skyy Country Development.
3. In order to estimated the future traffic volumes along Rainy Creek Road (for the 20 year horizon - year 2030), I would like to get the traffic generated by the Skyy Country Development (weekday morning and afternoon peak hours; and daily traffic volumes).
4. Please let me know if there is additional information regarding other developments in the area that could affect the traffic volumes at Rainy Creek Road. I will assess the access to the proposed residential development; and the intersection of Hwy 20 and Twp Rd 400 (Rainy Creek Rd).
5. I understand the current posted speed on Twp Rd 400 is 100 kph. I would like to know if the Lacombe County agrees in reducing the posted speed on Twp Rd 400 to 80 kph by the 20 year horizon (year 2030) for the purposes of this TIA.
6. Finally, we understand the Skyy County TIA was requested to assess the intersection of Hwy 20 and Twp Rd 400. However, traffic data at this location is not available. I wonder if the Lacombe County has traffic data available at this location (including traffic data generated by other developments in the area).

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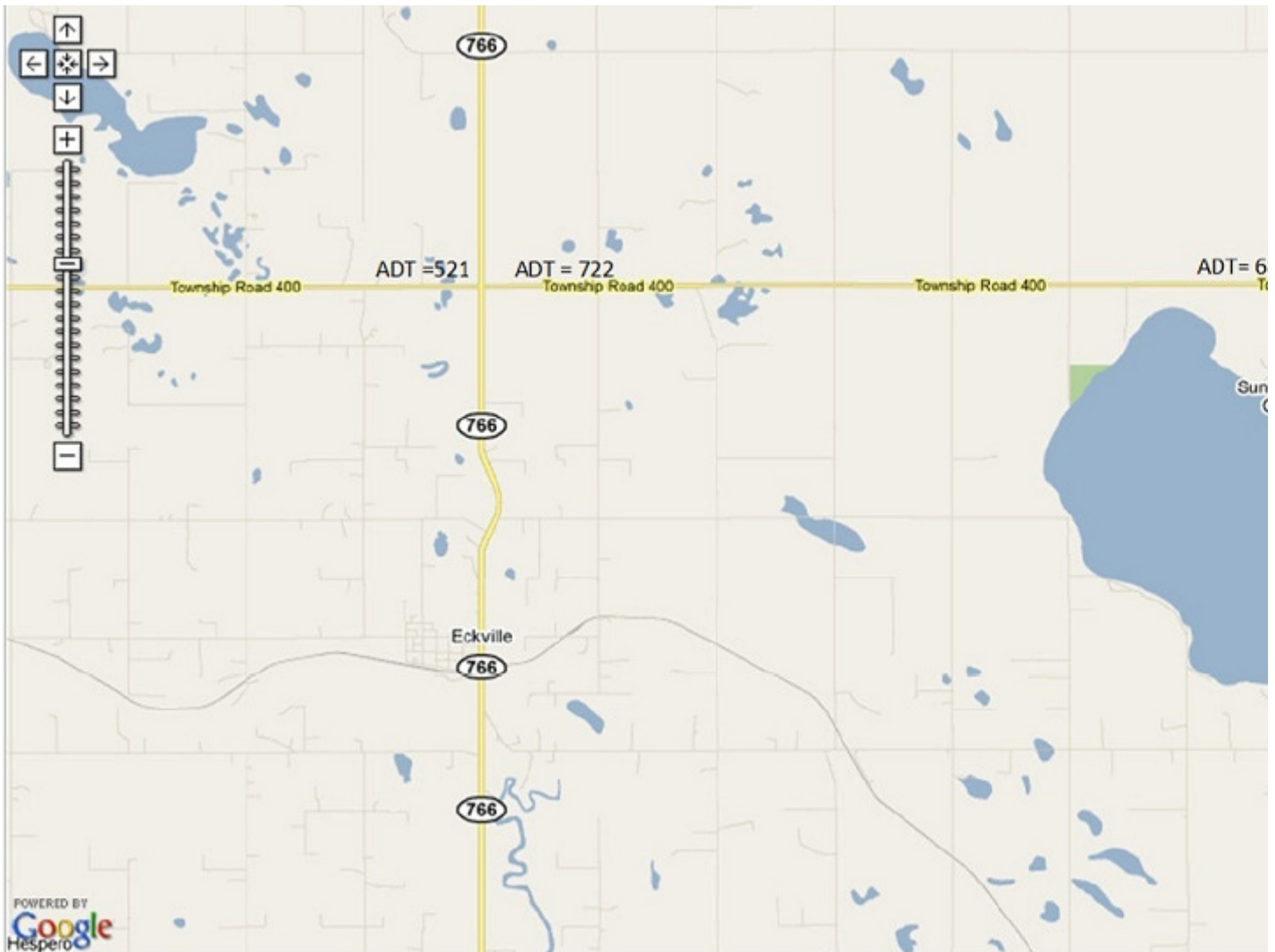
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APPENDIX B – Trip Generation & Distribution, Peak Hour Calcs.

[illegible][illegible]

TOTAL TRIP GENERATION (BASED ON ITE) - USING GENERATION RATES ONLY

[illegible]

PHASE 1 TRIP GENERATION

[illegible]

Background Traffic Data

Growth Rate 4.0%

Location \ Year	ADT 2009	ADT 2010	ADT 2030
Twp Rd 400 West of Rg Rd 24	722	751	1328
Twp Rd 400 btw Rg Rd 24 and 22	689	717	1268
Twp Rd 400 East of Rg Rd 22	1021	1062	1879

K= 0.15

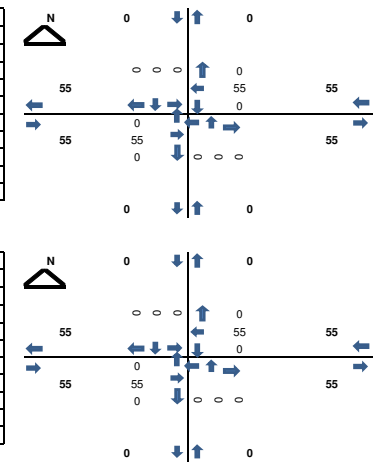
AM Peak Hour	2009	2010	2030
Twp Rd 400 West of Rg Rd 24	108.3	112.65	199.2
Twp Rd 400 btw Rg Rd 24 and 22	103.35	107.55	190.2
Twp Rd 400 East of Rg Rd 22	153.15	159.3	281.85

K= 0.15

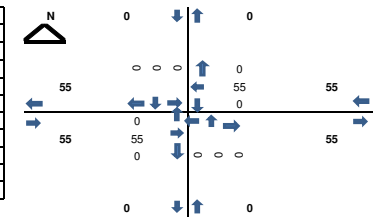
PM Peak Hour	2009	2010	2030
Twp Rd 400 West of Rg Rd 24	108.3	112.65	199.2
Twp Rd 400 btw Rg Rd 24 and 22	103.35	107.55	190.2
Twp Rd 400 East of Rg Rd 22	153.15	159.3	281.85

AM PEAK HOUR - SUMMARY YEAR 2010

Location	Trips	Northbound			Southbound			Westbound			Eastbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Twp Rd 40 and Access	Counted 09								52			52	
	Growth rate	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
	Estimated 2010	0	0	0	0	0	0	0	54	0	0	54	0
TOTAL	Estimated 2010	0	0	0	0	0	0	0	55	0	0	55	0
		0			0			55			55		

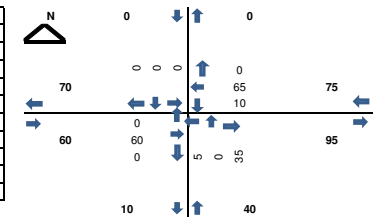


Location	Trips	Northbound			Southbound			Westbound			Eastbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Twp Rd 400 and Skyy Access	Counted 09								52			52	
	Growth rate	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
	Estimated 2010	0	0	0	0	0	0	0	54	0	0	54	0
TOTAL	Estimated 2010	0	0	0	0	0	0	0	55	0	0	55	0
		0			0			55			55		

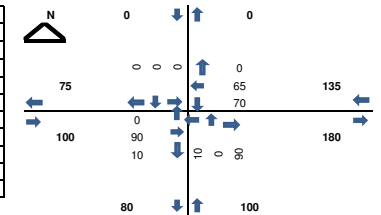


POST-DEVELOPMENT AM PEAK HOUR - SUMMARY YEAR 2010

Location	Trips	Northbound			Southbound			Westbound			Eastbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Twp Rd 40 and Access	Counted 09	0	0	0	0	0	0	0	52	0	0	52	0
	Growth rate	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
	Estimated 2030	0	0	0	0	0	0	0	54	0	0	54	0
	Skyy IN	0	0	0	0	0	0	0	0	0	0	8	0
	Skyy OUT	0	0	0	0	0	0	0	10	0	0	0	0
	IN							12					1
	OUT	4		34									
TOTAL	Estimated 2030	5	0	35	0	0	0	10	65	0	0	60	0
		40			0			75			60		



Location	Trips	Northbound			Southbound			Westbound			Eastbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Twp Rd 400 and Skyy Access	Counted 09	0	0	0	0	0	0	0	52	0	0	52	0
	Growth rate	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
	Estimated 2030	0	0	0	0	0	0	0	54	0	0	54	0
	Skyy IN	0	0	0	0	0	0	68	0	0	0	0	8
	Skyy OUT	10	0	90	0	0	0	0	0	0	0	0	0
	IN							12					
	OUT										34		
TOTAL	Estimated 2030	10	0	90	0	0	0	70	65	0	0	90	10
		100			0			135			100		



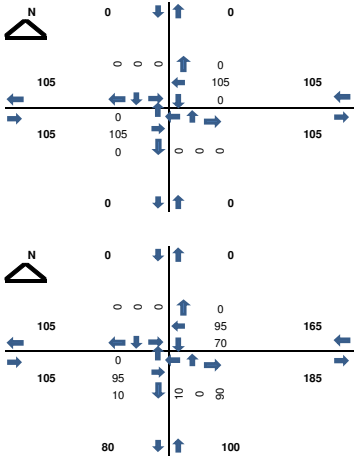
Trip Generation 2030

Skyy IN	76
Skyy OUT	100

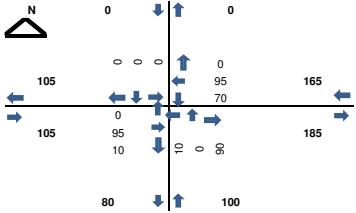
Generated IN	13
Generated OUT	38

BACKGROUND AM PEAK HOUR - SUMMARY YEAR 2030

Location	Trips	Northbound			Southbound			Westbound			Eastbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Twp Rd 40 and Access	Counted 09	0	0	0	0	0	0	0	52	0	0	52	0
	Growth rate	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
	Estimated 2030	0	0	0	0	0	0	0	95	0	0	95	0
	Skyy IN											8	
	Skyy OUT								10				
TOTAL	Estimated 2030	0	0	0	0	0	0	0	105	0	0	105	0
		0			0			105			105		



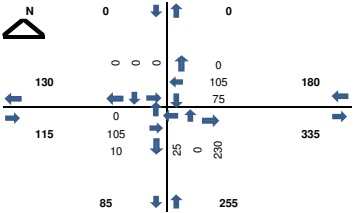
Location	Trips	Northbound			Southbound			Westbound			Eastbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Twp Rd 400 and Skyy Access	Counted 09	0	0	0	0	0	0	0	52	0	0	52	0
	Growth rate	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
	Estimated 2030	0	0	0	0	0	0	0	95	0	0	95	0
	Skyy IN												8
	Skyy OUT	10		90									
TOTAL	Estimated 2030	10	0	90	0	0	0	70	95	0	0	95	10
		100			0			165			105		



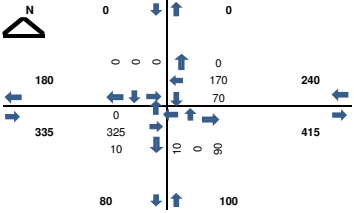
Trip Generation 2030	
Skyy IN	76
Skyy OUT	100

POST-DEVELOPMENT AM PEAK HOUR - SUMMARY YEAR 2030

Location	Trips	Northbound			Southbound			Westbound			Eastbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Twp Rd 40 and Access	Counted 09	0	0	0	0	0	0	0	52	0	0	52	0
	Growth rate	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
	Estimated 2030	0	0	0	0	0	0	0	95	0	0	95	0
	Skyy IN	0	0	0	0	0	0	0	0	0	0	8	0
	Skyy OUT	0	0	0	0	0	0	0	10	0	0	0	0
	IN							77					9
	OUT	26		230									
TOTAL	Estimated 2030	25	0	230	0	0	0	75	105	0	0	105	10
		255			0			180			115		



Location	Trips	Northbound			Southbound			Westbound			Eastbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Twp Rd 400 and Skyy Access	Counted 09	0	0	0	0	0	0	0	52	0	0	52	0
	Growth rate	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
	Estimated 2030	0	0	0	0	0	0	0	95	0	0	95	0
	Skyy IN	0	0	0	0	0	0	68	0	0	0	0	8
	Skyy OUT	10	0	90	0	0	0	0	0	0	0	0	0
	IN							77					
	OUT										230		
TOTAL	Estimated 2030	10	0	90	0	0	0	70	170	0	0	325	10
		100			0			240			335		

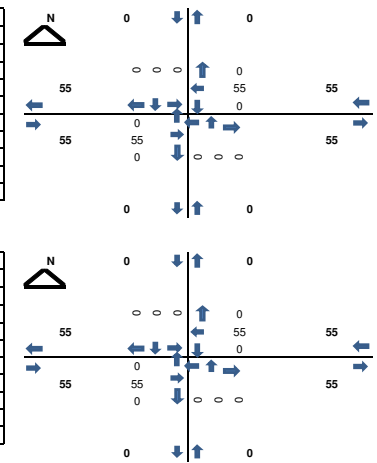


Trip Generation 2030	
Skyy IN	76
Skyy OUT	100

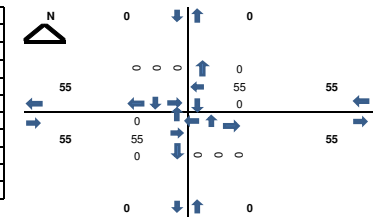
Generated IN	85
Generated OUT	255

PM PEAK HOUR - SUMMARY YEAR 2010

Location	Trips	Northbound			Southbound			Westbound			Eastbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Twp Rd 40 and Access	Counted 09								52			52	
	Growth rate	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
	Estimated 2010	0	0	0	0	0	0	0	54	0	0	54	0
TOTAL	Estimated 2010	0	0	0	0	0	0	0	55	0	0	55	0
		0			0			55			55		

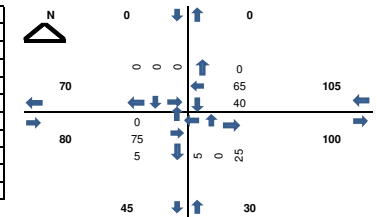


Location	Trips	Northbound			Southbound			Westbound			Eastbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Twp Rd 400 and Skyy Access	Counted 09								52			52	
	Growth rate	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
	Estimated 2010	0	0	0	0	0	0	0	54	0	0	54	0
TOTAL	Estimated 2010	0	0	0	0	0	0	0	55	0	0	55	0
		0			0			55			55		

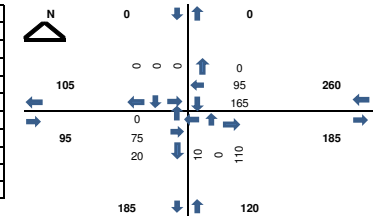


POST-DEVELOPMENT PM PEAK HOUR - SUMMARY YEAR 2010

Location	Trips	Northbound			Southbound			Westbound			Eastbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Twp Rd 40 and Access	Counted 09	0	0	0	0	0	0	0	52	0	0	52	0
	Growth rate	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
	Estimated 2030	0	0	0	0	0	0	0	54	0	0	54	0
	Skyy IN	0	0	0	0	0	0	0	0	0	0	19	0
	Skyy OUT	0	0	0	0	0	0	0	12	0	0	0	0
	IN							40					4
	OUT	3		23									
TOTAL	Estimated 2030	5	0	25	0	0	0	40	65	0	0	75	5
		30			0			105			80		



Location	Trips	Northbound			Southbound			Westbound			Eastbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Twp Rd 400 and Rg Rd 22	Counted 09	0	0	0	0	0	0	0	52	0	0	52	0
	Growth rate	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
	Estimated 2030	0	0	0	0	0	0	0	54	0	0	54	0
	Skyy IN	0	0	0	0	0	0	167	0	0	0	0	19
	Skyy OUT	12	0	112	0	0	0	0	0	0	0	0	0
	IN							40					
	OUT										23		
TOTAL	Estimated 2030	10	0	110	0	0	0	165	95	0	0	75	20
		120			0			260			95		



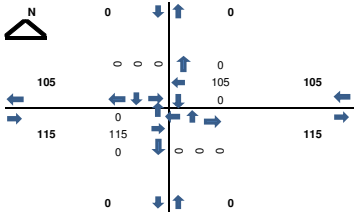
Trip Generation 2030

Skyy IN	186
Skyy OUT	124

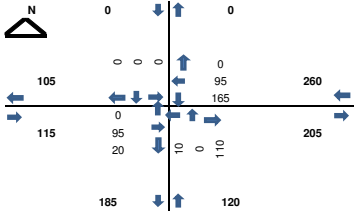
Generated IN	44
Generated OUT	26

BACKGROUND PM PEAK HOUR - SUMMARY YEAR 2030

Location	Trips	Northbound			Southbound			Westbound			Eastbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Twp Rd 40 and Access	Counted 09	0	0	0	0	0	0	0	52	0	0	52	0
	Growth rate	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
	Estimated 2030	0	0	0	0	0	0	0	95	0	0	95	0
	Skyy IN											19	
	Skyy OUT								12				
TOTAL	Estimated 2030	0	0	0	0	0	0	0	105	0	0	115	0
		0			0			105			115		



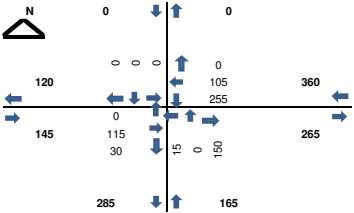
Location	Trips	Northbound			Southbound			Westbound			Eastbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Twp Rd 400 and Skyy Access	Counted 09	0	0	0	0	0	0	0	52	0	0	52	0
	Growth rate	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
	Estimated 2030	0	0	0	0	0	0	0	95	0	0	95	0
	Skyy IN								167				19
	Skyy OUT	12		112									
TOTAL	Estimated 2030	10	0	110	0	0	0	165	95	0	0	95	20
		120			0			260			115		



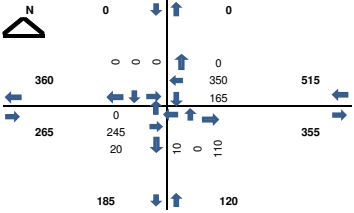
Trip Generation 2030	
Skyy IN	186
Skyy OUT	124

POST-DEVELOPMENT PM PEAK HOUR - SUMMARY YEAR 2030

Location	Trips	Northbound			Southbound			Westbound			Eastbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Twp Rd 40 and Access	Counted 09	0	0	0	0	0	0	0	52	0	0	52	0
	Growth rate	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
	Estimated 2030	0	0	0	0	0	0	0	95	0	0	95	0
	Skyy IN	0	0	0	0	0	0	0	0	0	0	19	0
	Skyy OUT	0	0	0	0	0	0	0	12	0	0	0	0
	IN							256					28
	OUT	17		150									
TOTAL	Estimated 2030	15	0	150	0	0	0	255	105	0	0	115	30
		165			0			360			145		



Location	Trips	Northbound			Southbound			Westbound			Eastbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Twp Rd 400 and Rg Rd 22	Counted 09	0	0	0	0	0	0	0	52	0	0	52	0
	Growth rate	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
	Estimated 2030	0	0	0	0	0	0	0	95	0	0	95	0
	Skyy IN	0	0	0	0	0	0	167	0	0	0	0	19
	Skyy OUT	12	0	112	0	0	0	0	0	0	0	0	0
	IN							256					150
	OUT										150		
TOTAL	Estimated 2030	10	0	110	0	0	0	165	350	0	0	245	20
		120			0			515			265		



Trip Generation 2030	
Skyy IN	186
Skyy OUT	124

Generated IN	284
Generated OUT	167

HCM Unsignalized Intersection Capacity Analysis

3: Twp Rd 400 & Access

7/19/2010

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	105	10	75	105	25	230
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	119	11	85	119	28	261
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			131		409	119
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			131		409	119
tC, single (s)			4.2		6.5	6.4
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			94		95	71
cM capacity (veh/h)			1378		539	898
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	119	11	85	119	290	
Volume Left	0	0	85	0	28	
Volume Right	0	11	0	0	261	
cSH	1700	1700	1378	1700	843	
Volume to Capacity	0.07	0.01	0.06	0.07	0.34	
Queue Length 95th (m)	0.0	0.0	1.5	0.0	11.7	
Control Delay (s)	0.0	0.0	7.8	0.0	11.5	
Lane LOS			A		B	
Approach Delay (s)	0.0		3.2		11.5	
Approach LOS					B	
Intersection Summary						
Average Delay			6.4			
Intersection Capacity Utilization			34.8%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

5: Twp Rd 400 & Skyy Access

7/19/2010

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	325	10	70	170	10	90
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	369	11	80	193	11	102
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			381		722	369
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			381		722	369
tC, single (s)			4.2		6.5	6.4
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			93		97	84
cM capacity (veh/h)			1110		348	648
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	369	11	80	193	114	
Volume Left	0	0	80	0	11	
Volume Right	0	11	0	0	102	
cSH	1700	1700	1110	1700	597	
Volume to Capacity	0.22	0.01	0.07	0.11	0.19	
Queue Length 95th (m)	0.0	0.0	1.8	0.0	5.3	
Control Delay (s)	0.0	0.0	8.5	0.0	12.4	
Lane LOS			A		B	
Approach Delay (s)	0.0		2.5		12.4	
Approach LOS					B	
Intersection Summary						
Average Delay			2.7			
Intersection Capacity Utilization			39.4%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

3: Twp Rd 400 & Access

7/19/2010

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Volume (veh/h)	115	30	255	105	15	150
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	131	34	290	119	17	170
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			165		830	131
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			165		830	131
tC, single (s)			4.2		6.5	6.4
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			78		93	81
cM capacity (veh/h)			1338		253	885
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	131	34	290	119	188	
Volume Left	0	0	290	0	17	
Volume Right	0	34	0	0	170	
cSH	1700	1700	1338	1700	722	
Volume to Capacity	0.08	0.02	0.22	0.07	0.26	
Queue Length 95th (m)	0.0	0.0	6.3	0.0	7.9	
Control Delay (s)	0.0	0.0	8.4	0.0	11.7	
Lane LOS			A		B	
Approach Delay (s)	0.0		6.0		11.7	
Approach LOS					B	
Intersection Summary						
Average Delay			6.1			
Intersection Capacity Utilization			39.6%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

5: Twp Rd 400 & Skyy Access

7/19/2010

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Volume (veh/h)	245	20	155	350	10	110
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	278	23	176	398	11	125
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			301		1028	278
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			301		1028	278
tC, single (s)			4.2		6.5	6.4
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			85		95	83
cM capacity (veh/h)			1189		209	730
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	278	23	176	398	136	
Volume Left	0	0	176	0	11	
Volume Right	0	23	0	0	125	
cSH	1700	1700	1189	1700	604	
Volume to Capacity	0.16	0.01	0.15	0.23	0.23	
Queue Length 95th (m)	0.0	0.0	3.9	0.0	6.5	
Control Delay (s)	0.0	0.0	8.6	0.0	12.7	
Lane LOS			A		B	
Approach Delay (s)	0.0		2.6		12.7	
Approach LOS					B	
Intersection Summary						
Average Delay			3.2			
Intersection Capacity Utilization			41.3%		ICU Level of Service	A
Analysis Period (min)			15			

Lanes, Volumes, Timings

3: Twp Rd 400 & Access

7/19/2010

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	105	10	75	105	25	230
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Storage Length (m)		100.0	100.0		0.0	0.0
Storage Lanes		1	1		1	0
Taper Length (m)		2.5	2.5		2.5	2.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.878	
Flt Protected			0.950		0.995	
Satd. Flow (prot)	1539	1308	1462	1539	1344	0
Flt Permitted			0.950		0.995	
Satd. Flow (perm)	1539	1308	1462	1539	1344	0
Link Speed (k/h)	100			100	50	
Link Distance (m)	1411.7			379.6	448.6	
Travel Time (s)	50.8			13.7	32.3	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	119	11	85	119	28	261
Shared Lane Traffic (%)						
Lane Group Flow (vph)	119	11	85	119	289	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	34.8%			ICU Level of Service A		
Analysis Period (min)	15					

Lanes, Volumes, Timings
5: Twp Rd 400 & Skyy Access

7/19/2010

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	325	10	70	170	10	90
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Storage Length (m)		100.0	0.0		0.0	0.0
Storage Lanes		1	1		1	0
Taper Length (m)		2.5	2.5		2.5	2.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.878	
Flt Protected			0.950		0.995	
Satd. Flow (prot)	1539	1308	1462	1539	1344	0
Flt Permitted			0.950		0.995	
Satd. Flow (perm)	1539	1308	1462	1539	1344	0
Link Speed (k/h)	100			100	50	
Link Distance (m)	379.6			217.6	432.5	
Travel Time (s)	13.7			7.8	31.1	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	369	11	80	193	11	102
Shared Lane Traffic (%)						
Lane Group Flow (vph)	369	11	80	193	113	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	39.4%			ICU Level of Service A		
Analysis Period (min)	15					

Lanes, Volumes, Timings

3: Twp Rd 400 & Access

7/19/2010

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	115	30	255	105	15	150
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Storage Length (m)		100.0	100.0		0.0	0.0
Storage Lanes		1	1		1	0
Taper Length (m)		2.5	2.5		2.5	2.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.877	
Flt Protected			0.950		0.995	
Satd. Flow (prot)	1539	1308	1462	1539	1343	0
Flt Permitted			0.950		0.995	
Satd. Flow (perm)	1539	1308	1462	1539	1343	0
Link Speed (k/h)	100			100	50	
Link Distance (m)	1411.7			379.5	448.6	
Travel Time (s)	50.8			13.7	32.3	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	131	34	290	119	17	170
Shared Lane Traffic (%)						
Lane Group Flow (vph)	131	34	290	119	187	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	39.6%			ICU Level of Service A		
Analysis Period (min)	15					

Lanes, Volumes, Timings
5: Twp Rd 400 & Skyy Access

7/19/2010

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	245	20	155	350	10	110
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Storage Length (m)		100.0	0.0		0.0	0.0
Storage Lanes		1	1		1	0
Taper Length (m)		2.5	2.5		2.5	2.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.876	
Flt Protected			0.950		0.996	
Satd. Flow (prot)	1539	1308	1462	1539	1342	0
Flt Permitted			0.950		0.996	
Satd. Flow (perm)	1539	1308	1462	1539	1342	0
Link Speed (k/h)	100			100	50	
Link Distance (m)	379.5			217.6	432.5	
Travel Time (s)	13.7			7.8	31.1	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	278	23	176	398	11	125
Shared Lane Traffic (%)						
Lane Group Flow (vph)	278	23	176	398	136	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.10	1.10	1.10	1.10	1.10	1.10
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	41.3%			ICU Level of Service A		
Analysis Period (min)	15					

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst JAD
Agency/Co. MMM
Date Performed 7/19/2010
Analysis Time Period 2010 PM Peak Hour Existing
Highway Twp Rd 400
From/To All Segment
Jurisdiction
Analysis Year
Description Sylvan Lake Subdivision TIA - Pre development

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.88	
Lane width	3.5	m	% Trucks and buses	15	%
Segment length	1.5	km	% Recreational vehicles	4	%
Terrain type	Rolling		% No-passing zones	0	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V 110 veh/h
Directional split 50 / 50 %

Average Travel Speed

Grade adjustment factor, fG	0.71	
PCE for trucks, ET	2.5	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.814	
Two-way flow rate, (note-1) vp	216	pc/h
Highest directional split proportion (note-2)	108	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	0.0	km/h
Average travel speed, ATS	91.2	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	0.77	
PCE for trucks, ET	1.8	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.893	
Two-way flow rate, (note-1) vp	182	pc/h
Highest directional split proportion (note-2)	91	
Base percent time-spent-following, BPTSF	14.8	%
Adj.for directional distribution and no-passing zones, fd/np	0.0	
Percent time-spent-following, PTSF	14.8	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.07	
Peak 15-min vehicle-kilometers of travel, VkmT15	47	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	165	veh-km
Peak 15-min total travel time, TT15	0.5	veh-h

Notes:

1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst JAD
Agency/Co. MMM
Date Performed 7/19/2010
Analysis Time Period 2010 PM Peak Hour Post-develop
Highway Twp Rd 400
From/To west of development access
Jurisdiction
Analysis Year
Description Sylvan Lake Subdivision TIA - Post development (2010)

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.88	
Lane width	3.5	m	% Trucks and buses	15	%
Segment length	0.5	km	% Recreational vehicles	4	%
Terrain type	Rolling		% No-passing zones	0	%
Grade: Length		km	Access points/km	2	/km
Up/down		%			

Two-way hourly volume, V 150 veh/h
Directional split 53 / 47 %

Average Travel Speed

Grade adjustment factor, fG	0.71	
PCE for trucks, ET	2.5	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.814	
Two-way flow rate, (note-1) vp	295	pc/h
Highest directional split proportion (note-2)	156	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	1.3	km/h

Free-flow speed, FFS 95.9 km/h

Adjustment for no-passing zones, fnp 0.0 km/h
Average travel speed, ATS 92.2 km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	0.77	
PCE for trucks, ET	1.8	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.893	
Two-way flow rate, (note-1) vp	248	pc/h
Highest directional split proportion (note-2)	131	
Base percent time-spent-following, BPTSF	19.6	%
Adj.for directional distribution and no-passing zones, fd/np	0.4	
Percent time-spent-following, PTSF	20.0	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.09	
Peak 15-min vehicle-kilometers of travel, VkmT15	21	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	75	veh-km
Peak 15-min total travel time, TT15	0.2	veh-h

Notes:

1. If $vp \geq 3200$ pc/h, terminate analysis-the LOS is F.
2. If highest directional split $vp \geq 1700$ pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst JAD
 Agency/Co. MMM
 Date Performed 7/19/2010
 Analysis Time Period 2010 PM Peak Hour Post-develop
 Highway Twp Rd 400
 From/To bwt development accesses
 Jurisdiction
 Analysis Year
 Description Sylvan Lake Subdivision TIA - Post development (2010)

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.88	
Lane width	3.5	m	% Trucks and buses	15	%
Segment length	0.4	km	% Recreational vehicles	4	%
Terrain type	Rolling		% No-passing zones	0	%
Grade: Length		km	Access points/km	2	/km
Up/down		%			

Two-way hourly volume, V 205 veh/h
 Directional split 51 / 49 %

Average Travel Speed

Grade adjustment factor, fG	0.71	
PCE for trucks, ET	2.5	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.814	
Two-way flow rate, (note-1) vp	403	pc/h
Highest directional split proportion (note-2)	206	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	1.3	km/h

Free-flow speed, FFS 95.9 km/h

Adjustment for no-passing zones, fnp 0.0 km/h
 Average travel speed, ATS 90.8 km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	0.77	
PCE for trucks, ET	1.8	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.893	
Two-way flow rate, (note-1) vp	339	pc/h
Highest directional split proportion (note-2)	173	
Base percent time-spent-following, BPTSF	25.8	%
Adj.for directional distribution and no-passing zones, fd/np	0.1	
Percent time-spent-following, PTSF	25.9	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.13	
Peak 15-min vehicle-kilometers of travel, VkmT15	23	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	82	veh-km
Peak 15-min total travel time, TT15	0.3	veh-h

Notes:

1. If $vp \geq 3200$ pc/h, terminate analysis-the LOS is F.
2. If highest directional split $vp \geq 1700$ pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst JAD
Agency/Co. MMM
Date Performed 7/19/2010
Analysis Time Period 2010 PM Peak Hour Post-develop
Highway Twp Rd 400
From/To east of Skyy access
Jurisdiction
Analysis Year
Description Sylvan Lake Subdivision TIA - Post development (2010)

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.88	
Lane width	3.5	m	% Trucks and buses	15	%
Segment length	0.5	km	% Recreational vehicles	4	%
Terrain type	Rolling		% No-passing zones	0	%
Grade: Length		km	Access points/km	0	/km
Up/down		%			

Two-way hourly volume, V 445 veh/h
Directional split 58 / 42 %

Average Travel Speed

Grade adjustment factor, fG	0.93	
PCE for trucks, ET	1.9	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.878	
Two-way flow rate, (note-1) vp	619	pc/h
Highest directional split proportion (note-2)	359	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	0.0	km/h

Free-flow speed, FFS 97.2 km/h

Adjustment for no-passing zones, fnp 0.0 km/h
Average travel speed, ATS 89.5 km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	0.94	
PCE for trucks, ET	1.5	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.930	
Two-way flow rate, (note-1) vp	578	pc/h
Highest directional split proportion (note-2)	335	
Base percent time-spent-following, BPTSF	39.8	%
Adj.for directional distribution and no-passing zones, fd/np	0.0	
Percent time-spent-following, PTSF	39.9	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.19	
Peak 15-min vehicle-kilometers of travel, VkmT15	63	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	223	veh-km
Peak 15-min total travel time, TT15	0.7	veh-h

Notes:

1. If $vp \geq 3200$ pc/h, terminate analysis-the LOS is F.
2. If highest directional split $vp \geq 1700$ pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst JAD
Agency/Co. MMM
Date Performed 7/19/2010
Analysis Time Period 2030 PM Peak Hour
Highway Twp Rd 400
From/To west of development access
Jurisdiction
Analysis Year
Description Sylvan Lake Subdivision TIA - Post development (2030)

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.88	
Lane width	3.5	m	% Trucks and buses	15	%
Segment length	0.5	km	% Recreational vehicles	4	%
Terrain type	Rolling		% No-passing zones	0	%
Grade: Length		km	Access points/km	2	/km
Up/down		%			

Two-way hourly volume, V 265 veh/h
Directional split 55 / 45 %

Average Travel Speed

Grade adjustment factor, fG	0.71	
PCE for trucks, ET	2.5	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.814	
Two-way flow rate, (note-1) vp	521	pc/h
Highest directional split proportion (note-2)	287	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	1.3	km/h

Free-flow speed, FFS 95.9 km/h

Adjustment for no-passing zones, fnp 0.0 km/h
Average travel speed, ATS 89.4 km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	0.77	
PCE for trucks, ET	1.8	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.893	
Two-way flow rate, (note-1) vp	438	pc/h
Highest directional split proportion (note-2)	241	
Base percent time-spent-following, BPTSF	32.0	%
Adj.for directional distribution and no-passing zones, fd/np	0.2	
Percent time-spent-following, PTSF	32.2	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.16	
Peak 15-min vehicle-kilometers of travel, VkmT15	38	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	133	veh-km
Peak 15-min total travel time, TT15	0.4	veh-h

Notes:

1. If $vp \geq 3200$ pc/h, terminate analysis-the LOS is F.
2. If highest directional split $vp \geq 1700$ pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst JAD
Agency/Co. MMM
Date Performed 7/19/2010
Analysis Time Period 2030 PM Peak Hour
Highway Twp Rd 400
From/To bwt development accesses
Jurisdiction
Analysis Year
Description Sylvan Lake Subdivision TIA - Post development (2030)

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.88	
Lane width	3.5	m	% Trucks and buses	15	%
Segment length	0.4	km	% Recreational vehicles	4	%
Terrain type	Rolling		% No-passing zones	0	%
Grade: Length		km	Access points/km	2	/km
Up/down		%			

Two-way hourly volume, V 625 veh/h
Directional split 58 / 42 %

Average Travel Speed

Grade adjustment factor, fG	0.93	
PCE for trucks, ET	1.9	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.878	
Two-way flow rate, (note-1) vp	870	pc/h
Highest directional split proportion (note-2)	505	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	1.3	km/h

Free-flow speed, FFS 95.9 km/h

Adjustment for no-passing zones, fnp 0.0 km/h
Average travel speed, ATS 85.0 km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	0.94	
PCE for trucks, ET	1.5	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.930	
Two-way flow rate, (note-1) vp	812	pc/h
Highest directional split proportion (note-2)	471	
Base percent time-spent-following, BPTSF	51.0	%
Adj.for directional distribution and no-passing zones, fd/np	0.0	
Percent time-spent-following, PTSF	51.0	%

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.27	
Peak 15-min vehicle-kilometers of travel, VkmT15	71	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	250	veh-km
Peak 15-min total travel time, TT15	0.8	veh-h

Notes:

1. If $vp \geq 3200$ pc/h, terminate analysis-the LOS is F.
2. If highest directional split $vp \geq 1700$ pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst JAD
Agency/Co. MMM
Date Performed 7/19/2010
Analysis Time Period 2030 PM Peak Hour
Highway Twp Rd 400
From/To east of Skyy access
Jurisdiction
Analysis Year
Description Sylvan Lake Subdivision TIA - Post development (2030)

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.88	
Lane width	3.5	m	% Trucks and buses	15	%
Segment length	0.5	km	% Recreational vehicles	4	%
Terrain type	Rolling		% No-passing zones	0	%
Grade: Length		km	Access points/km	0	/km
Up/down		%			

Two-way hourly volume, V 870 veh/h
Directional split 59 / 41 %

Average Travel Speed

Grade adjustment factor, fG	0.99	
PCE for trucks, ET	1.5	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.927	
Two-way flow rate, (note-1) vp	1078	pc/h
Highest directional split proportion (note-2)	636	pc/h

Free-Flow Speed from Field Measurement:

Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	0.0	km/h

Free-flow speed, FFS 97.2 km/h

Adjustment for no-passing zones, fnp 0.0 km/h
Average travel speed, ATS 83.7 km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	0.94	
PCE for trucks, ET	1.5	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.930	
Two-way flow rate, (note-1) vp	1131	pc/h
Highest directional split proportion (note-2)	667	
Base percent time-spent-following, BPTSF	63.0	%
Adj.for directional distribution and no-passing zones, fd/np	0.0	
Percent time-spent-following, PTSF	63.0	%

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.34	
Peak 15-min vehicle-kilometers of travel, VkmT15	124	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	435	veh-km
Peak 15-min total travel time, TT15	1.5	veh-h

Notes:

1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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

Township Rd 400	Main Road
Site Access Rd.	Minor Road
	City/Town

Date	July 19, 2010
Other	Post-Development-Year 2030

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)	0			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
	Posted Speed Category =	0				
	Posted Speed Category =	B	4			
	Posted Speed Category =	0				
	Posted Speed Category =	0				
Horizontal Curvature Factor		4	5		OK	20
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	1.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	3	1	3	Number of legs = 3 or more	OK	3
Geometric Factors Subtotal						23

OPERATIONAL FACTORS

Is the intersection signalized ? (Y / N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)	7376	4	10	Either Use the two AADT inputs OR the Descriptive Signalization	OK	40
AADT on Minor Road (2-way)	4310	4	20	Warrant (Unused values should be set to Zero) Refer to Table	OK	80
Signalization Warrant	Descriptive	0	30	1(B) for description and rating values for signalization warrant.	OK	0
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	4	5	Refer to Table 1(B) for ratings.	OK	20
Operating Speed or Posted Speed on Major Road (km/h)	100	4	5	Refer to Table 1(B), note #3	OK	20
Operating Speed on Minor Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
Operational Factors Subtotal						160

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)	n	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	
Collision History Subtotal						0

Check Intersection Signalization:
Intersection is not Signalized

ILLUMINATION WARRANTED
DELINEATION LIGHTING TO ILLUMINATE PEDESTRIANS OR
CROSS STREET TRAFFIC

SUMMARY

Geometric Factors Subtotal	23
Operational Factor Subtotal	160
Environmental Factor Subtotal	0
Collision History Subtotal	0
TOTAL POINTS	183

APPENDIX E – COST ESTIMATE

The intersection traffic operation analysis shows that a *Type IVa* intersection treatment would be required based on the proposed development of 450 single-unit family houses for the ultimate stage (assumed in 2030). A conceptual estimate (in 2010 dollars) of the cost incurred by the proposed *Type IVa* intersection treatment on Rainy Creek Road is presented in this section. **Table E.1** summarizes the conceptual cost estimate.

Table E.1: Conceptual Cost Estimate

	Unit	Unit Cost	Quantity	Cost
North bypass lane and tapers				
Asphalt Concrete Pavement	m ²	\$19.50	2,304	\$44,923
Granular Base Course	m ²	\$8.00	2,304	\$18,432
South bypass lane and tapers				
Asphalt Concrete Pavement	m ²	\$19.50	1,615	\$31,493
Granular Base Course	m ²	\$8.00	1,615	\$12,920
Proposed Main Access Road (including corners and tapers)				
Asphalt Concrete Pavement	m ²	\$19.50	368	\$7,170
Granular Base Course	m ²	\$8.00	368	\$2,941
Common Fill	m ²	\$2.25	368	\$827
Common Excavation	m ²	\$2.06	368	\$758
Sub-total				\$119,464
Contingency (15%)				\$17,920
Total				\$137,384

The conceptual cost estimate was completed base on the following assumptions:

- ▶ This cost estimate is to be used only for discussion and comparison of conceptual options. This cost estimate is not to be used to satisfy Section A – General Conditions, Section 3 Detailed Engineering Design, Item 8 of the Lacombe County Standards Manual.
- ▶ This estimate was prepared independently of a geometric review of the proposed intersection configuration and location.
- ▶ All costs in 2010 dollars.
- ▶ Unit rates obtained from in-house sources and from Alberta Transportation Unit Price Averages Report (2010).
- ▶ Existing Township Road 400 is a paved two-lane undivided roadway with lanes of 3.5 m width and shoulders of 1.25 m width (9.5 m total width) and right-of-way of 40.23 m.

- ▶ Proposed Main Access Road is a paved two-lane undivided roadway with lanes of 3.5 m width and shoulders of 1.1 m width (9.2 m total width) and a right-of-way of 40.23 m.
- ▶ No removal of existing roadway is required.

Cost does not include the following elements:

- ▶ provisions for additional drainage (if required), signage, pavement markings, illumination (if required), land purchase, utilities, noise, environmental, or cultural/historical requirements (if required), pedestrian/cyclist walkways (if required), cut and fill material (if required), barriers, guardrail or fencing, construction of the Main Access Road past the end of the intersection tapers, any imported material (if required), or slope and ditch construction (as required).

It is suggested that a contingency of \$200k should be allowed for the above.