TRANSPORTATION PLANNERS AND ENGINEERS

Allan Beach Resort
Traffic Impact Assessment

Prepared for

TRG Developments Corp.

Date

June 13, 2012

Prepared by

Bunt & Associates

Project No.

3384.01

CORPORATE AUTHORIZATION

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EXHIBITS

TABLES

1. INTRODUCTION

IBI Group, on behalf of TRG Developments Corp., is currently preparing a re-zoning application to create a recreational vehicle (RV) resort on the southeast side of Hubbles Lake in Parkland County, Alberta. As part of the re-zoning process, a traffic impact assessment (TIA) was identified as being required to identify any potential impacts along the adjacent roadway network. Therefore, IBI Group retained Bunt & Associates to complete a TIA on behalf of TRG Developments Corp.

1.1 Study Purpose and Objectives

The traffic generated by the proposed development has the potential to impact adjacent Parkland County and Alberta Transportation (AT) roadway facilities. To provide safe and efficient access capabilities to existing and future land uses, consideration must be given to the incremental increase in traffic anticipated to be generated by the plan area lands.

The primary purpose for completing the study was to ensure that the existing and future roadway network and key study area intersections are appropriately designed and constructed to accommodate all roadway users at safe and satisfactory levels of transportation service.

The primary objectives of the assignment were to:

- Identify anticipated trip generation characteristics of the proposed RV resort;
- Assess the traffic impacts of the proposed development on the adjacent roadway network;
- Evaluate projected traffic activity along Highway 16, Highway 16A, and RR 13 (Allan Beach Road) including operations at the key intersection and access points; and,
- Identify roadway and intersection improvements required, if any, to accommodate background and site generated traffic.

1.2 Study Methodology

The assessment presented in the following sections reflects an understanding of the development site's locational attributes, site access requirements, and adjacent traffic accommodation issues and concerns. The assessment was completed using the following methodology:

- An examination of the development area with respect to existing conditions: land use, roadways, traffic conditions and traffic operations;
- Identification of the proposed future roadway network adjacent to and internal to the development area including access locations;

- An estimation of forecasted background traffic conditions;
- Identification of future vehicular trip patterns generated to and from the development site based on the number of RV lots proposed;
- Distribution and assignment of the projected vehicular demands on adjacent corridors based on the proposed roadway network, access strategy, and the relative location of trip origins and destinations;
- Completion of an overall analysis and assessment of the estimated roadway volumes within the study area to identify roadway lane requirements, to identify possible roadway capacity restrictions, and to assess the overall traffic impacts associated with the development area; and,
- Recommendation of roadway improvements and traffic control mitigation measures to ensure that safe and reasonable levels of traffic service are maintained.

2. SITE CONTEXT – AREA CONDITIONS

2.1 Site Location and Adjacent Land Uses

The proposed RV resort is located west of the City of Spruce Grove and south of Highway 16 on the south half of NE ¼ SEC 9-53-1-W5 in Parkland County, as shown in **Exhibit 2-1**. The site is currently zoned CR – Country Residential District under the Parkland County Land Use Bylaw 20-2009.

Lands surrounding the proposed subdivision are designated CR – Country Residential District, while lands south of the proposed RV resort and north of Highway 16A are designated AGG – Agricultural General District.

2.2 Existing Conditions

2.2.1 Existing Roadway Network

The existing network in the vicinity of the proposed development site includes the following roadways:

- ***Highway 16 (Yellowhead Highway)*** is an east-west, paved, four-lane divided highway with a posted speed limit of 110 km/hr. Based on a review of AT's TIMS WebMap V2, the horizontal alignment in the vicinity of the study area includes a simple curve with a radius of approximately 3,400 metres. The Highway 16/RR 13 intersection is located approximately midpoint on a vertical crest curve with a K value of 280. Based on field observations, no sight line issues were identified at the intersection as a result of the vertical and horizontal curves along the highway. No illumination is currently provided along Highway 16 in the vicinity of RR 13.

- ***Highway 16A*** is a paved, four-lane divided highway with a posted speed limit of 100 km/hr in the vicinity of the study area. Highway 16A extends west from the City of Spruce Grove and runs parallel to Highway 16 then curves north, intersecting with Highway 16 approximately 6 km west of RR 13. Based on a review of AT's TIMS WebMap V2, the horizontal alignment is relatively straight and the Highway 16A/RR 13 intersection is located approximately midpoint along a vertical crest curve with K values of 80 and 82 on the westbound and eastbound lanes respectively. Based on field observations, no sight line constraints were identified at the intersection, and no illumination is provided in the vicinity of the study area.

- ***RR 13*** is a paved, two-lane rural roadway that runs north/south adjacent to the east boundary of the proposed development. The roadway is approximately 7.5 metres wide and has a posted speed limit of 70 km/hr. The existing access to the proposed development site intersects RR 13 along a downgrade to the south. Based on field observations, no sight line constraints were noted as a result of the downgrade. Illumination is not currently provided in the vicinity of the study area.

P:\3384.01 - Allan Beach Resort TIA\CAD\Exhibit 2-1, Location Plan.dwg

Exhibit 2-1

Scale NTS

Location Plan

The intersection of ***Highway 16 and RR 13*** is a four-legged intersection with stop control located on the north and south approaches. The north and south approaches currently include one lane that accommodates all traffic movements (left, through, and right movements). On the west approach, left and right turn bays and tapers have been constructed, and on the east approach, a right turn bay and taper has been constructed. Based on site observations and a review of AT's TIMS WebMap V2, the available bay and taper lengths do not appear to meet current AT standards for full parallel deceleration lanes.

In addition to the above, a westbound left turn bay has been painted within the shoulder. Although the paint line markings are not typical, the available length is anticipated to exceed the standard 87.5 metre taper length identified for left turns at a minor road intersection.

Acceleration lanes have been constructed along Highway 16 for northbound to eastbound right turns, southbound to eastbound left turns, and southbound to westbound right turns. Only the northbound to eastbound right turn acceleration lane appears to be constructed to current AT standards.

Based on a review of the AT Highway Geometric Design Guide, the Highway 16/RR 13 intersection exceeds the design elements of a minor road intersection on a four-lane divided highway, but does not quite meet the design elements of a major road intersection on a four-lane divided highway.

The intersection of ***Highway 16A and RR 13*** is a four-legged intersection with stop control located on the north and south approaches. The north and south approaches currently include one lane that accommodates all traffic movements (left, through, and right movements).

Based on site observations and a review of TIMS WebMap V2, the Highway 16A/RR 13 intersection is anticipated to currently be constructed as a major-minor road intersection, where RR 13 south of Highway 16A represents the major side street and RR 13 north of Highway 16A represents the minor side street.

The intersection of the ***Site Access and RR 13*** is a three-legged T-intersection with stop control on the west approach. Each approach includes one lane that accommodates all available movements. No illumination is currently provided at the intersection.

2.2.2 Existing Traffic Characteristics

2011 AM and PM 100th highest hour and Average Annual Daily Traffic (AADT) intersection turning movement volumes for the Highway 16/RR 13 and the Highway 16A/RR 13 intersections were obtained from AT's traffic data website.

Traffic volumes on RR 13 at the site access are assumed to be equal to the traffic volumes on the south approach of the Highway 16/RR 13 intersection. Although some country residential properties take access from RR 13 south of Highway 16, the difference in the volume between Highway 16 and the site access is not anticipated to be significant.

Exhibit 2-2 summarizes the 2011 AM and PM peak hour traffic volumes at the study area intersections, while **Exhibit 2-3** summarizes the 2011 AADT volumes at the study area intersections. Detailed traffic data summaries are included in **Appendix A**.

2.3 Horizon Years

Construction of the proposed RV resort is anticipated to be completed in 2012. Therefore, a 2013 horizon has been selected as the first year of operation for the RV resort. As well, a 2033 horizon was included to ensure that any improvements identified are appropriate for 20 years, or the expected life of the improvements, as per AT's requirements.

2.4 Future Conditions

2.4.1 Future Roadway Network

Based on a review of AT's 2012 – 2015 Tentative Major Construction Projects 2012/13 – 2014/15 document, preservation/overlay has been identified for select portions of the eastbound lanes on Highway 16. No roadway upgrades have been identified for construction along Highway 16A in the three year horizon.

In addition to the above noted maintenance items, a planning study is currently being completed to develop plans for the conversion of Highway 16 to a freeway standard between Kapasiwin Road and Highway 779. Based on a review of preliminary plans presented at an open house on the project, the revised access strategy for Highway 16 includes the closure of the Highway 16/RR 13 intersection in the longer term. Alternate access to RR 13 will be provided by parallel services roads along the south side of Highway 16 connecting to an interchange at Highway 16 and Highway 779.

Through discussions with AT, upgrading of Highway 16 to a freeway standard is not anticipated to occur in the short term. However, AT representatives did identify that they may require the implementation of site specific closures to implement the access management strategy as opposed to completing intersection improvements along Highway 16 as part of a development initiative. Therefore, it is assumed that the access strategy may be implemented by the 2033 horizon through a staged process, and RR 13 would be accessed from Highway 16 via service roads to a potential future interchange at Highway 779.

2.4.2 Background Traffic Volumes

Background traffic is the component of traffic on the adjacent road system that would be present regardless of the proposed development proceeding. The existing volumes illustrated in Exhibits 2-2 and 2-3 were increased using liner growth rates to estimate 2013 and 2033 background traffic volumes.

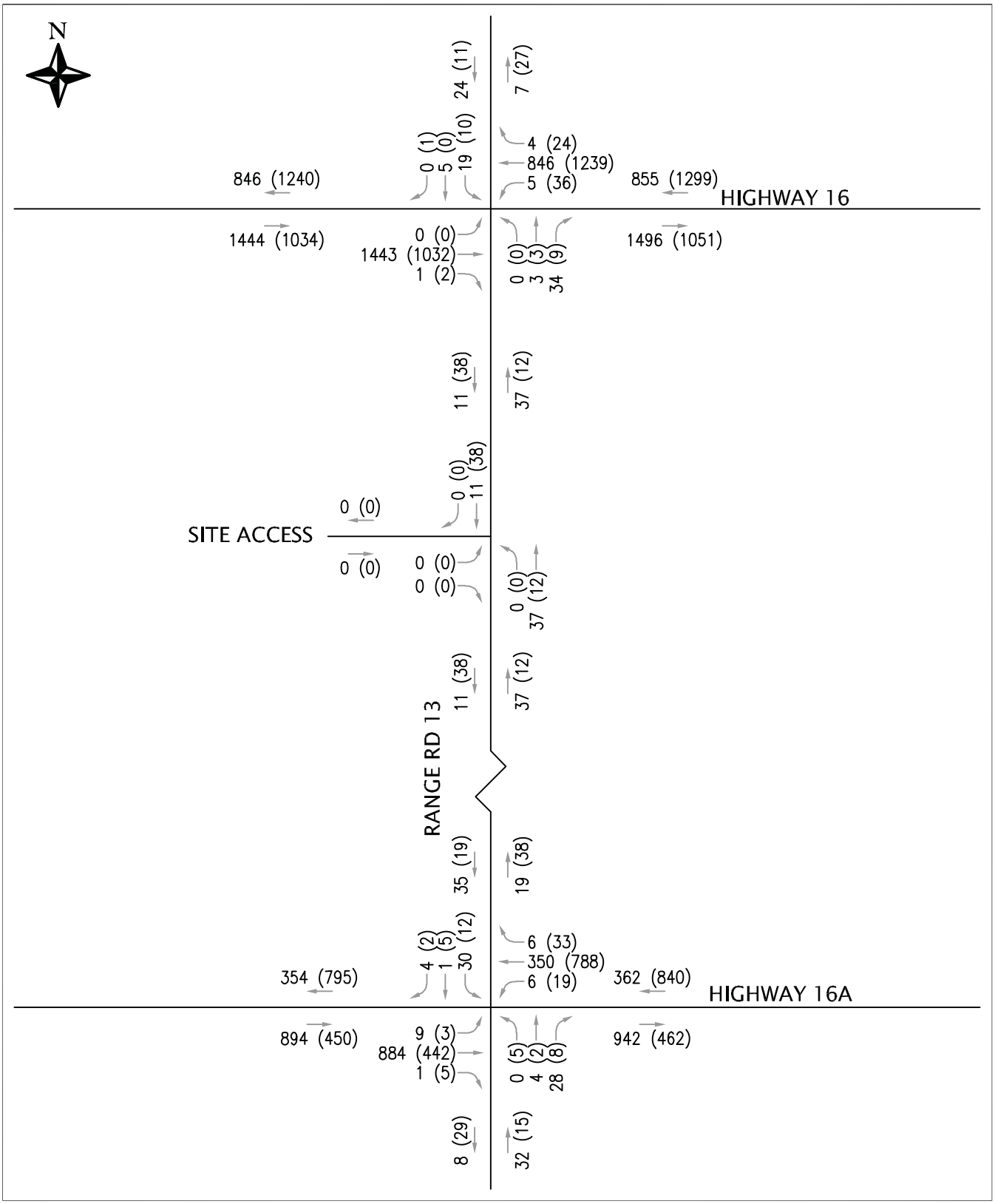
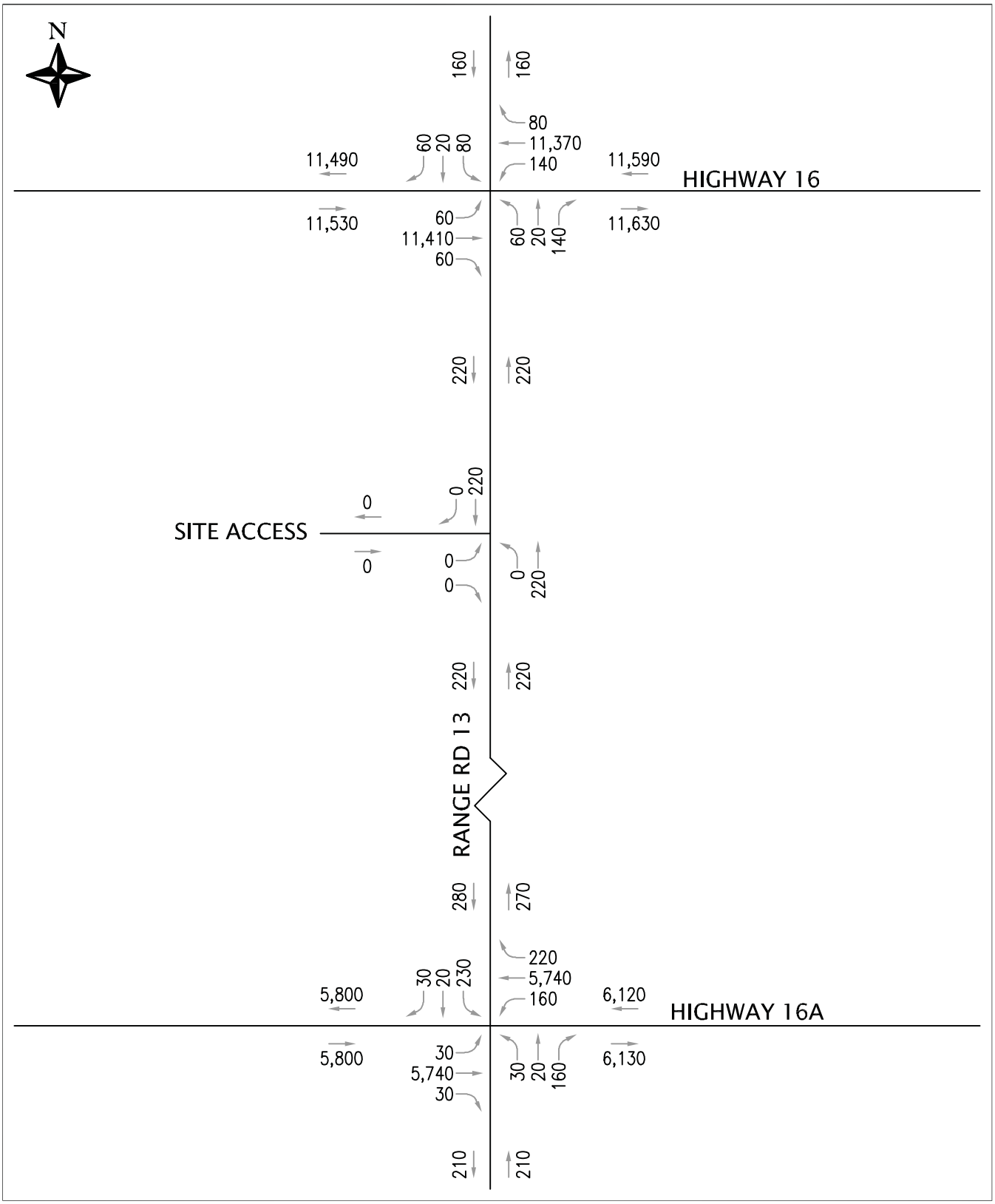


Exhibit 2-2

Scale NTS

2011 AM (PM) Peak Hour Volumes



P:\3384.01 - Allan Beach Resort TIA\CAD\Exhibit 2-3, 2011 Daily.dwg

Exhibit 2-3

Scale NTS

2011 Daily Volumes

The historic linear traffic growth rate along Highway 16 in the vicinity of the site as a percentage of the 2011 AADT is 2.746% for the long term, 3.118% for the ten year horizon, and 1.166% for the five year horizon. The historic linear traffic growth rate along Highway 16A in the vicinity of the site as a percentage of the 2011 AADT is -0.652% for the long term, -3.250% for the ten year horizon, and -2.132% for the five year horizon. The provincial average growth rate is 2.0% per year. Where the historic growth rates are below the provincial average, the provincial average growth rate was used in the assessment.

In the 2013 horizon, the existing roadway network is anticipated to continue to be in operation; therefore, the provincial average growth rate of 2.0% per year was applied to the turning movements at the Highway 16/RR 13 and Highway 16A/RR 13 intersections for two years to estimate the 2013 background traffic volumes.

In the 2033 horizon, the access management strategy is assumed to be in place, and the existing Highway 16/RR 13 intersection is anticipated to be closed. Therefore, background traffic volumes were not estimated for the Highway 16/RR 13 intersection. The Highway 16A/RR 13 intersection is anticipated to continue to be operational in the 2033 horizon; therefore, the provincial average rate of 2.0% per year was applied to existing turning movement volumes at the intersection.

Through volumes at the site access were also assumed to increase at a rate of 2.0% per year for both the 2013 and 2033 horizons.

Exhibits 2-4 and **2-5** illustrate the 2013 AM and PM peak hour and daily traffic volume estimates respectively, while **Exhibits 2-6** and **2-7** illustrate the 2033 AM and PM peak hour and daily traffic volume estimates respectively.

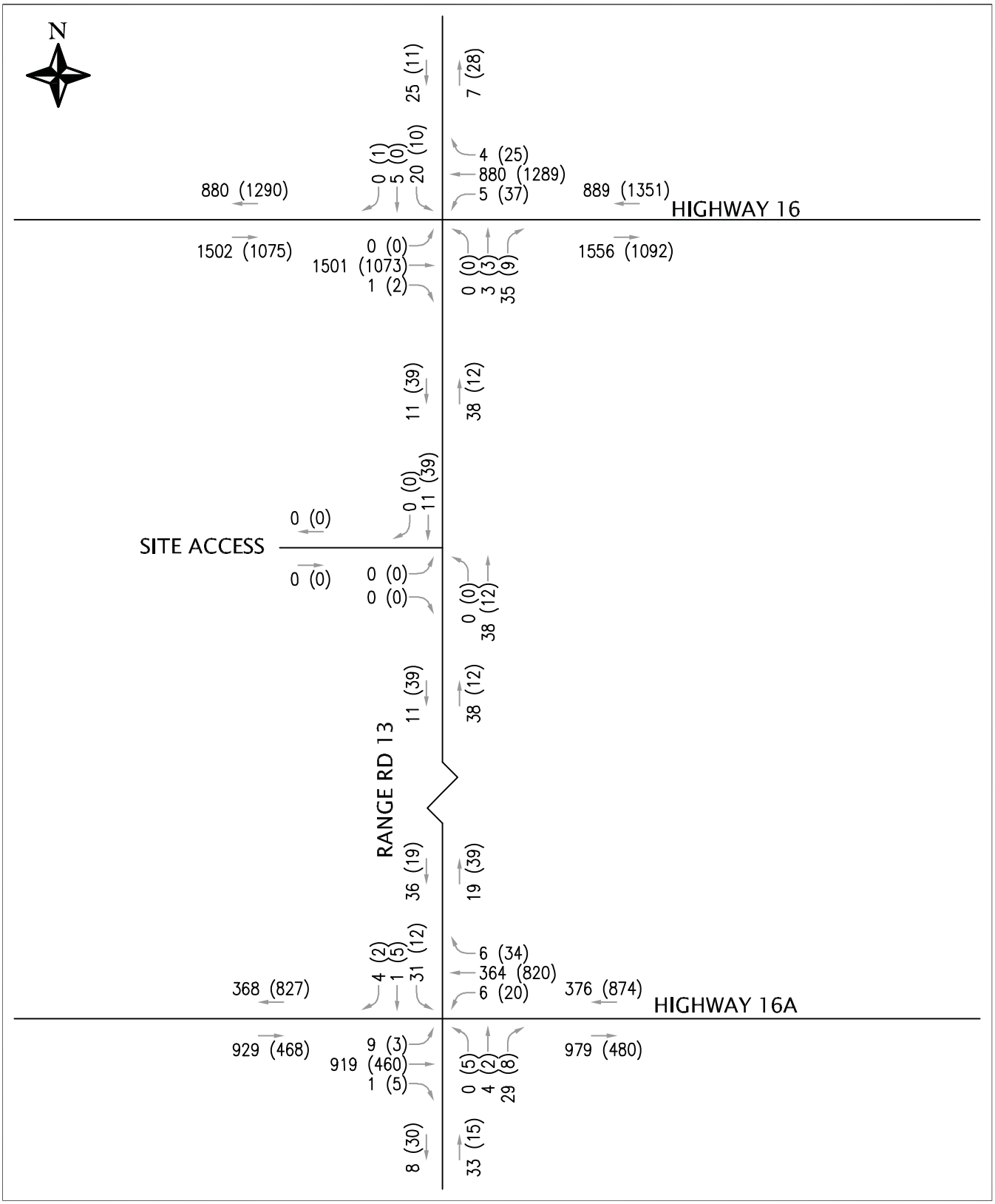


Exhibit 2-4

Scale NTS

2013 Background AM (PM) Peak Hour Traffic Volume Estimates

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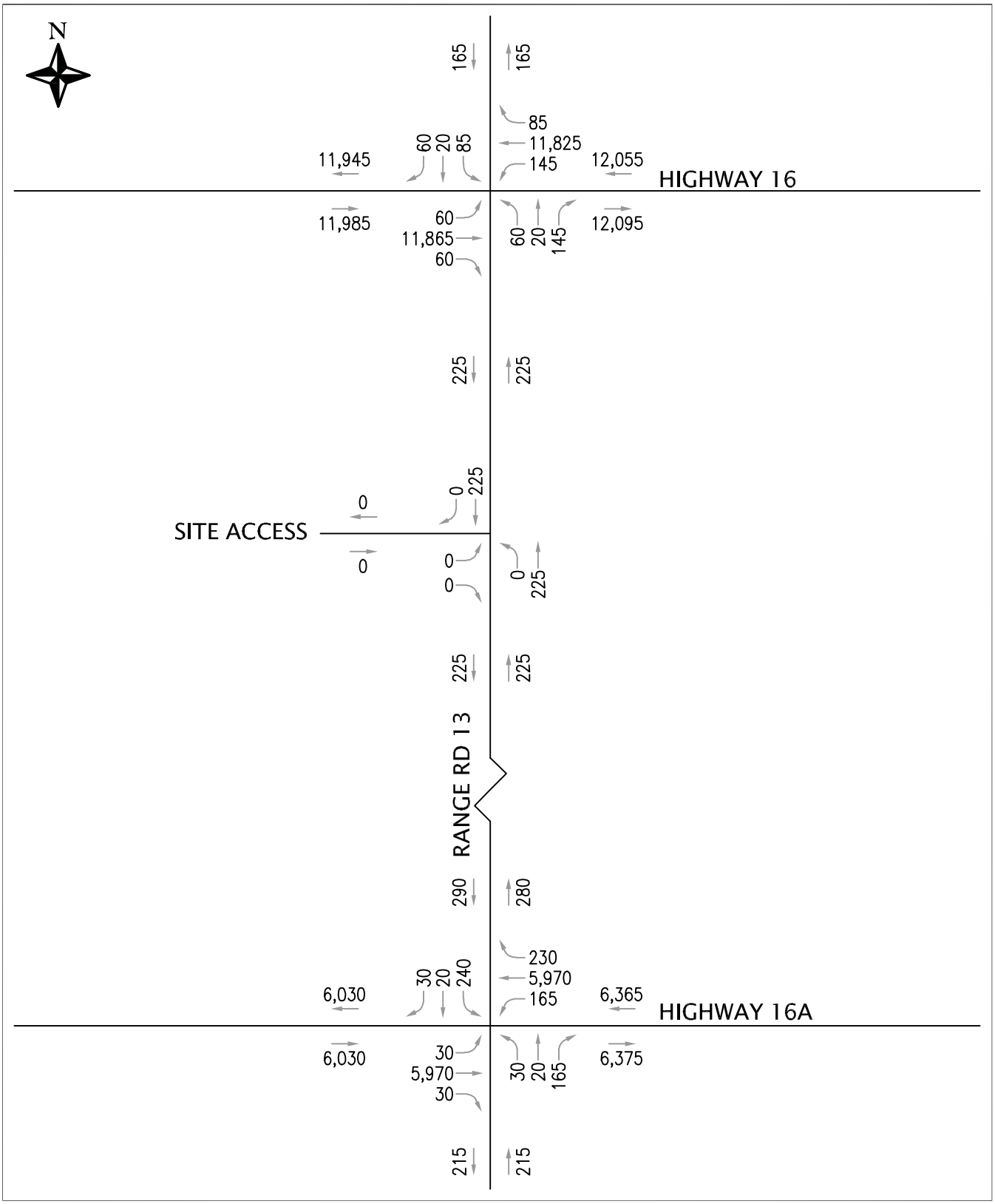

Exhibit 2-5

Scale NTS

2013 Daily Background Traffic Volume Estimates

bunt & associates

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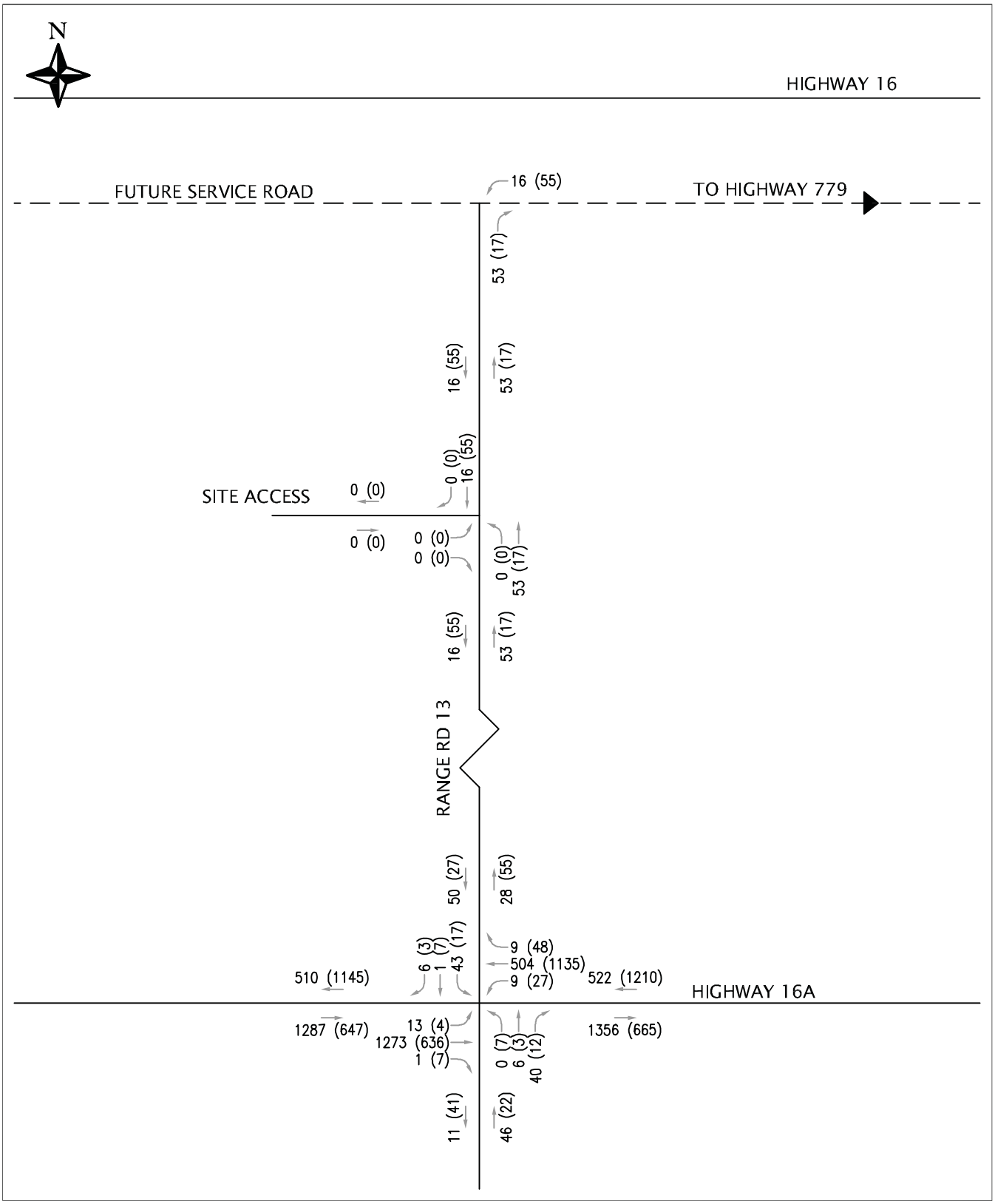

Exhibit 2-6

Scale NTS

2033 Background AM (PM) Peak Hour Traffic Volume Estimates

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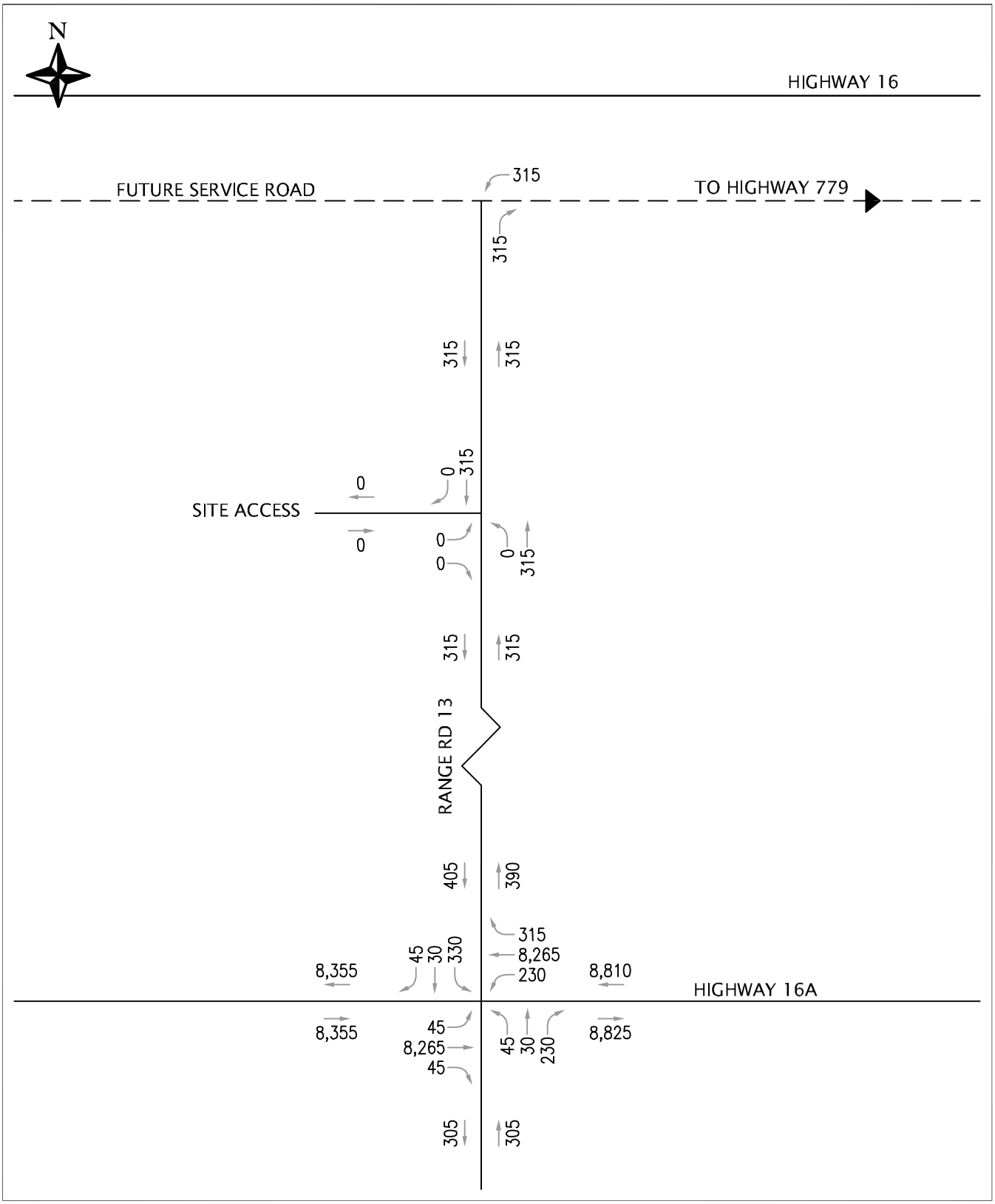

Exhibit 2-7

Scale NTS

2033 Daily Background Traffic Volume Estimates

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3. PROPOSED DEVELOPMENT

3.1 Proposed Site Plan

As shown in **Exhibit 3-1**, the development parcel is anticipated to include common space, a pond, and a maximum of 180 RV lots. The lots are intended to be privately owned for use through the summer months (May to September). Based on discussions with the development group, it is anticipated that services to the lots (i.e. water) would be shut off during the off-season.

Visitors to the site will require day passes obtained through lot owners. It is anticipated that a limited number of day passes will be issued per day; however, details regarding guest access have not yet been finalized. Public access to the beach through the RV resort will not be permitted.

3.2 Internal Traffic Circulation and Access Strategy

The internal roadway system is anticipated to include a series of local roadways and cul-de-sacs. The main roadway extends west from RR 13 along the north side of the site and provides access to three internal local roadways. The eastern local roadway parallels RR 13 with a cul-de-sac developed around a small park space at the south end and the central local roadway circumnavigates the pond. The western local roadway provides access to the majority of the RV lots.

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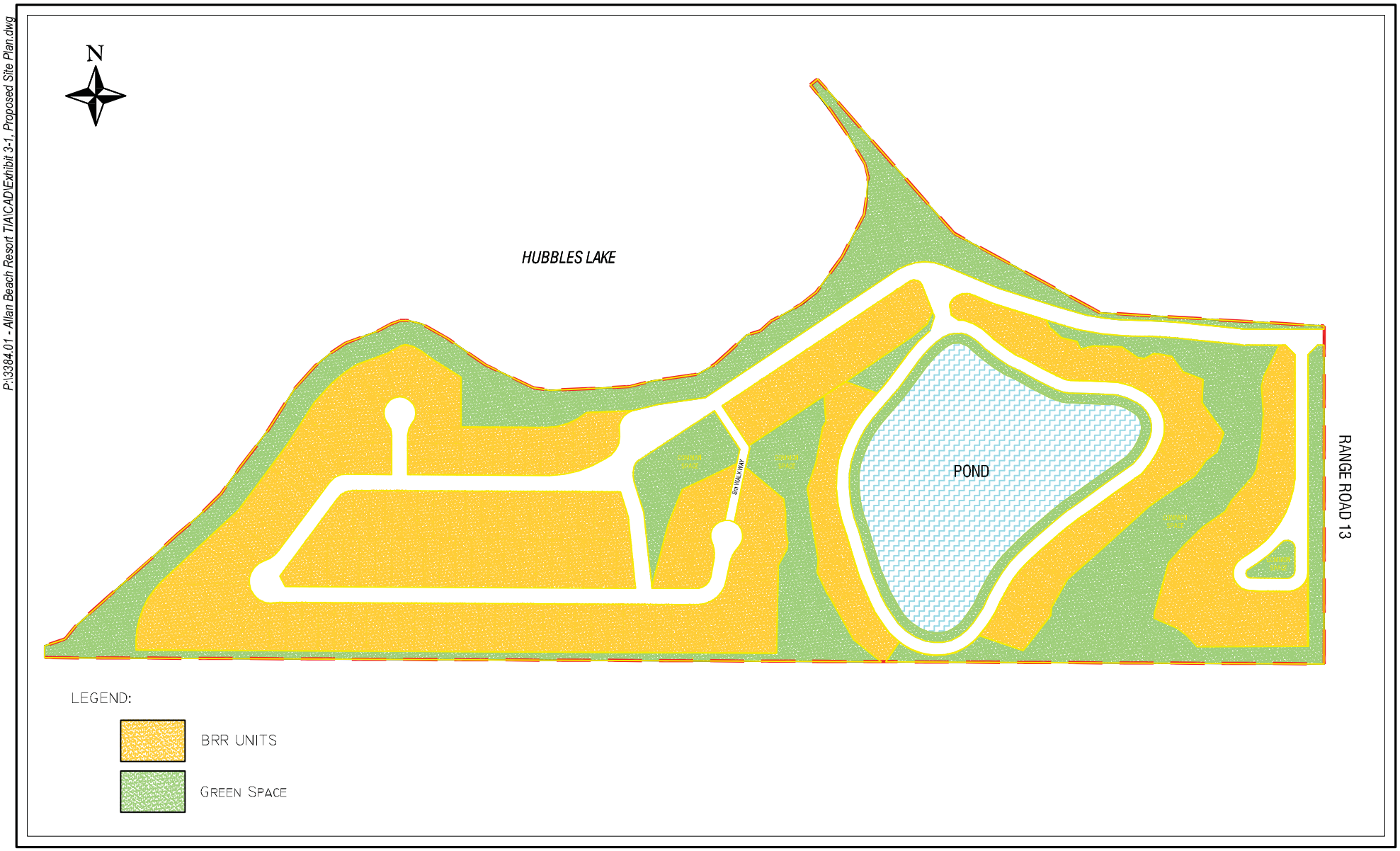

Exhibit 3-1

Scale NTS

Proposed Site Plan

4. SITE TRAFFIC CHARACTERISTICS

4.1 Trip Generation

Trip generation rates were determined based on a review of ITE Trip Generation, 8th Edition. The lots within the RV resort will be held by individual owners; therefore, a campground land use was not considered appropriate. In consideration of the seasonal nature of the resort and the full ownership of the proposed lots, rates published in ITE for Land Use Code (LUC) 260 – Recreational Home, as summarized in **Table 4-1**, were used in the assessment.

Table 4-1: Summary of Assumed Trip Generation Rates

ITE LUC	Time Interval	Trip Rate
260 – Recreational Home	AM Peak Hour	0.16 trips/dwelling unit
	PM Peak Hour	0.26 trips/dwelling unit
	Daily	3.16 trips/dwelling unit

Table 4-2 presents a summary of the projected traffic characteristics associated with the proposed development.

Table 4-2: Summary of Projected Traffic

Land Use	Units	AM Peak Hour		PM Peak Hour		Daily	
		In (67%)	Out (33%)	In (41%)	Out (59%)	In (50%)	Out (50%)
RV sites	180	19	10	19	28	284	**284**
Total Trips		**29**		**47**		**568**	

As presented in Table 4-2, the RV development is expected to generate in the order of 29 two-way trips during a typical weekday AM peak hour, 47 two-way trips during a typical weekday PM peak hour, and about 568 two-way trips during a typical weekday.

4.2 Trip Distribution and Assignment

4.2.1 2013 Horizon

Based on a review of existing turning movement volumes, the traffic anticipated to be generated by the proposed subdivision is assumed to be distributed and assigned to the adjacent roadways within the 2013 horizon as follows:

- 50% to/from Highway 16 east of RR 13;
- 10% to/from Highway 16 west of RR 13; and,
- 40% to/from Highway16A east of RR 13.

The assignment of AM and PM peak hour site generated traffic in the 2013 horizon is illustrated in **Exhibit 4-1**, while the assignment of daily site generated traffic in the 2013 horizon is illustrated in **Exhibit 4-2**.

4.2.2 2033 Horizon

The assignment of traffic in the 2033 horizon has been adjusted to reflect the future closure of the Highway 16/RR 13 intersection. Access to RR 13 from Highway 16 is anticipated to be provided via a service road connection to Highway 779, which is located approximately 5 km east of RR 13. Therefore, the site generated traffic assignment in the 2033 horizon includes the re-allocation of traffic to/from the west to Highway 16A, and also includes a slight increase in the traffic to/from the east that is anticipated to use Highway 16A as follows:

- 40% to/from Highway 16 east of RR 13 via service road to Highway 779;
- 10% to/from Highway 16A west of RR 13; and,
- 50% to/from Highway16A east of RR 13.

The assignment of AM and PM peak hour site generated traffic in the 2033 horizon is illustrated in **Exhibit 4-3**, while the assignment of daily site generated traffic in the 2033 horizon is illustrated in **Exhibit 4-4.**

4.3 Total Traffic

The estimated site generated traffic was superimposed on the background traffic volumes for the 2013 and 2033 horizons to produce anticipated total traffic volumes for use in the assessment. **Exhibits 4-5** and **4-6** illustrate the 2013 total AM and PM peak hour traffic volume estimates and 2013 daily volume estimates respectively, while **Exhibits 4-7** and **4-8** summarize the 2033 total AM and PM peak hour traffic volume estimates and 2033 daily traffic volume estimates respectively.

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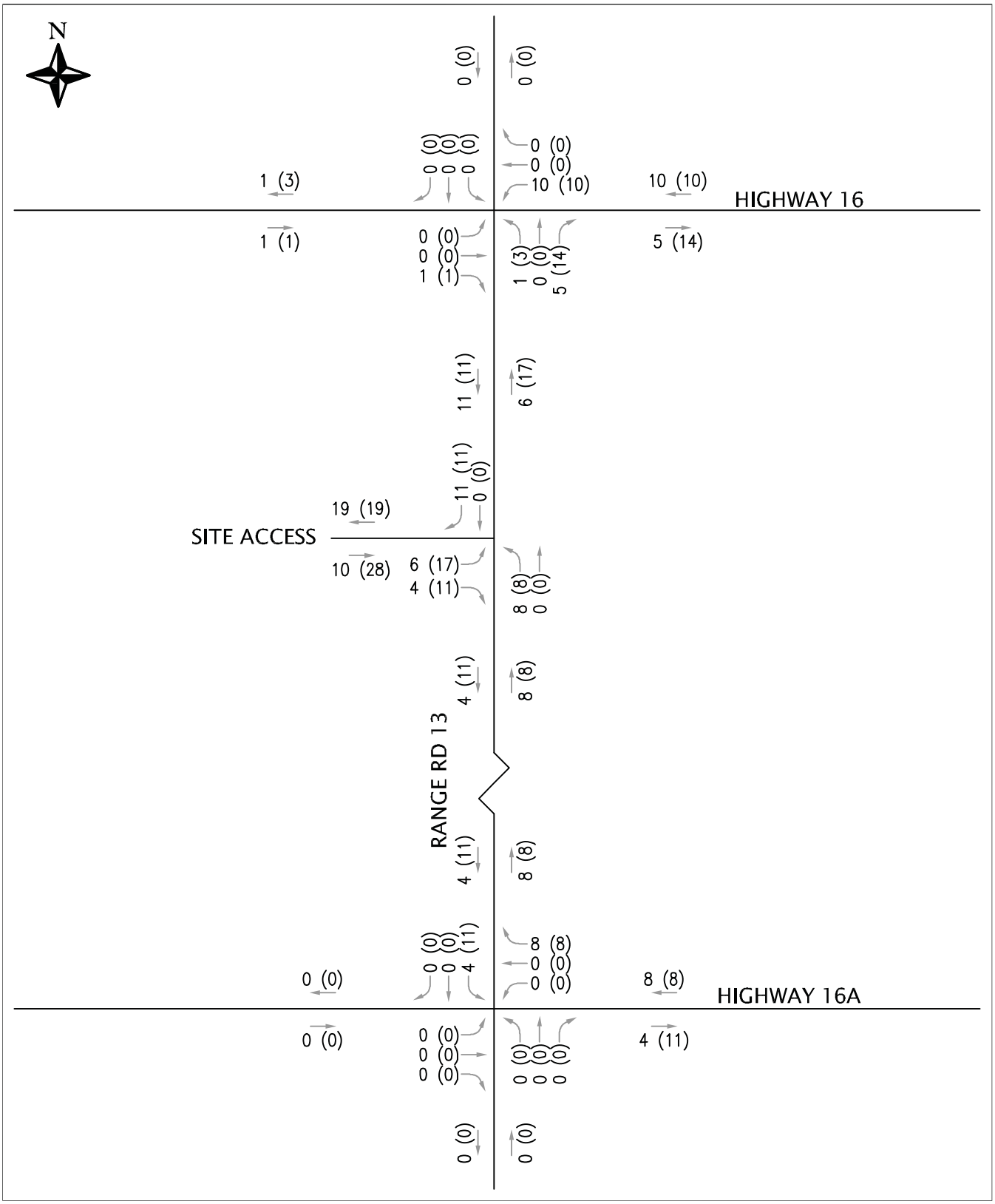

Exhibit 4-1

Scale NTS

2013 Site Generated AM (PM) Peak Hour Volumes

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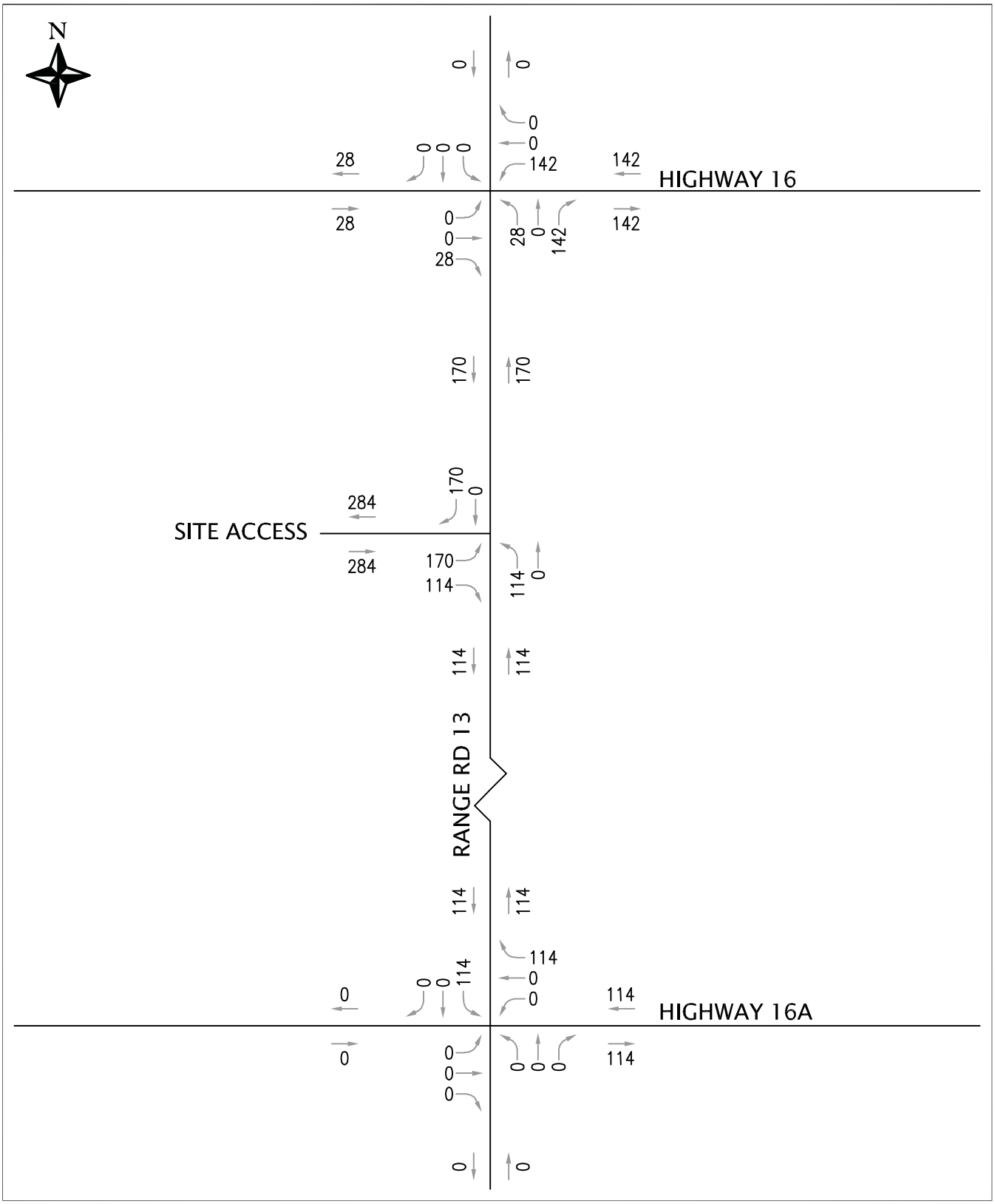

Exhibit 4-2

Scale NTS

2013 Site Generated Daily Volumes

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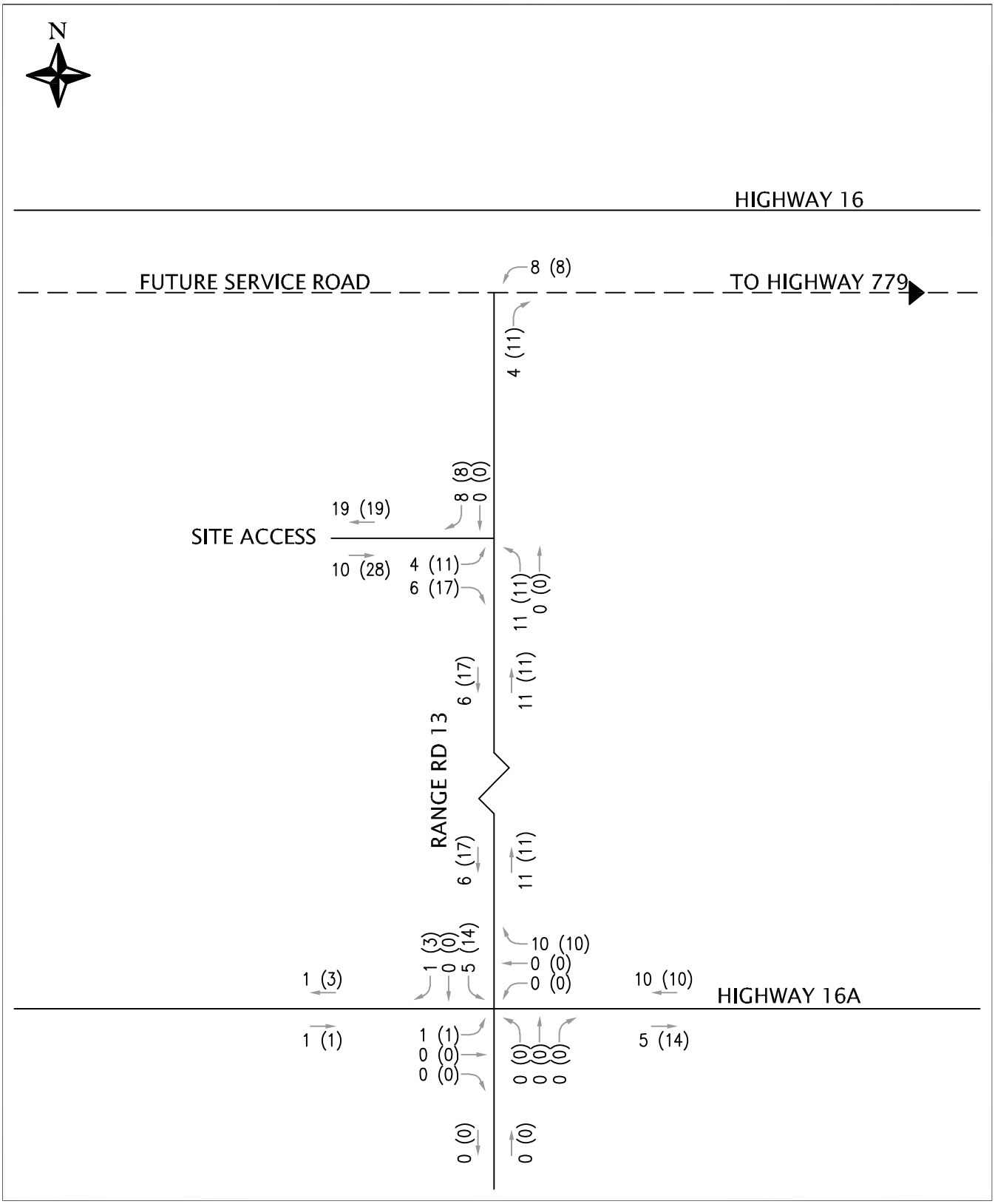

Exhibit 4-3

Scale NTS

2033 Site Generated AM (PM) Peak Hour Volumes

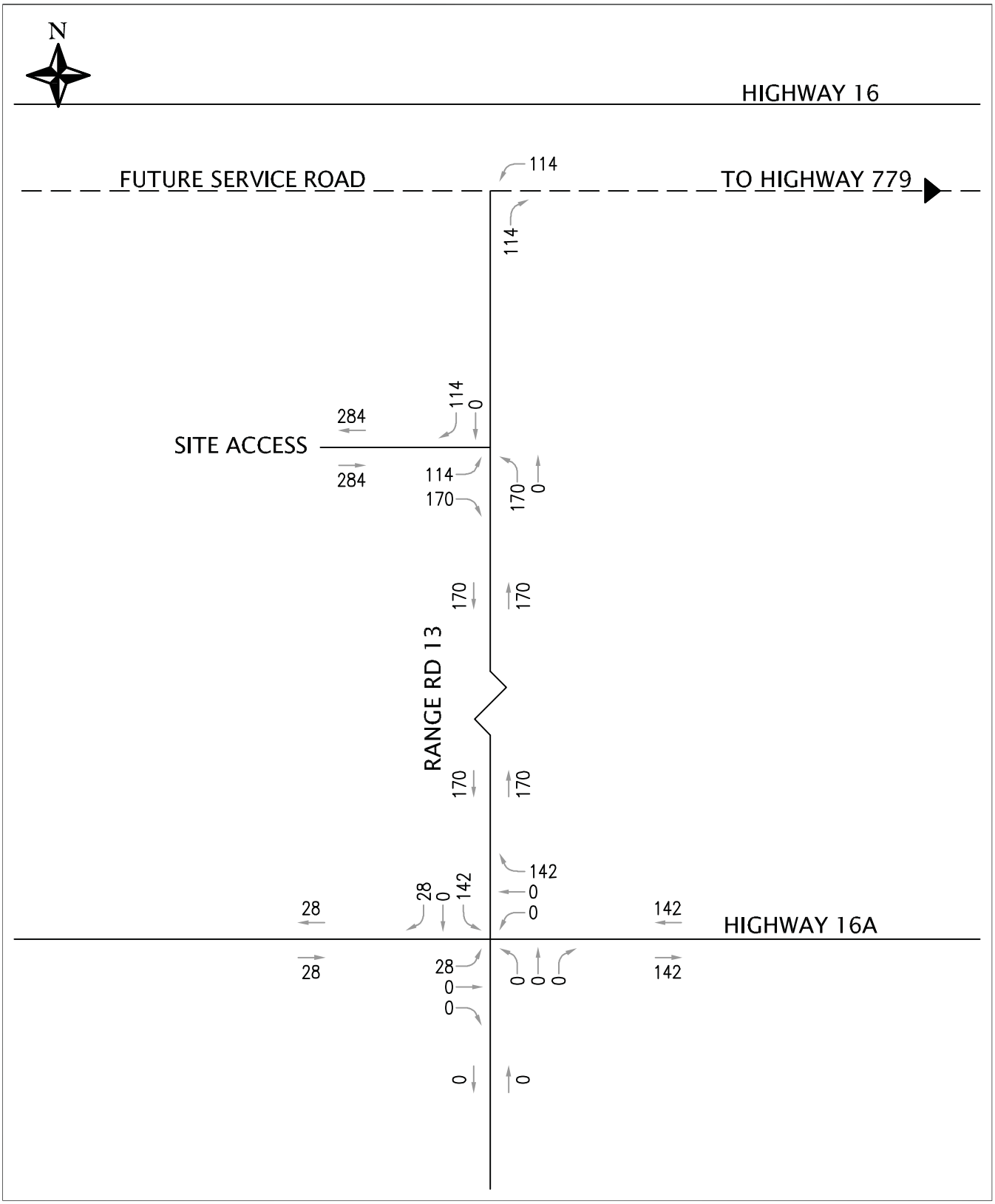

Exhibit 4-4

Scale NTS

2033 Site Generated Daily Volumes

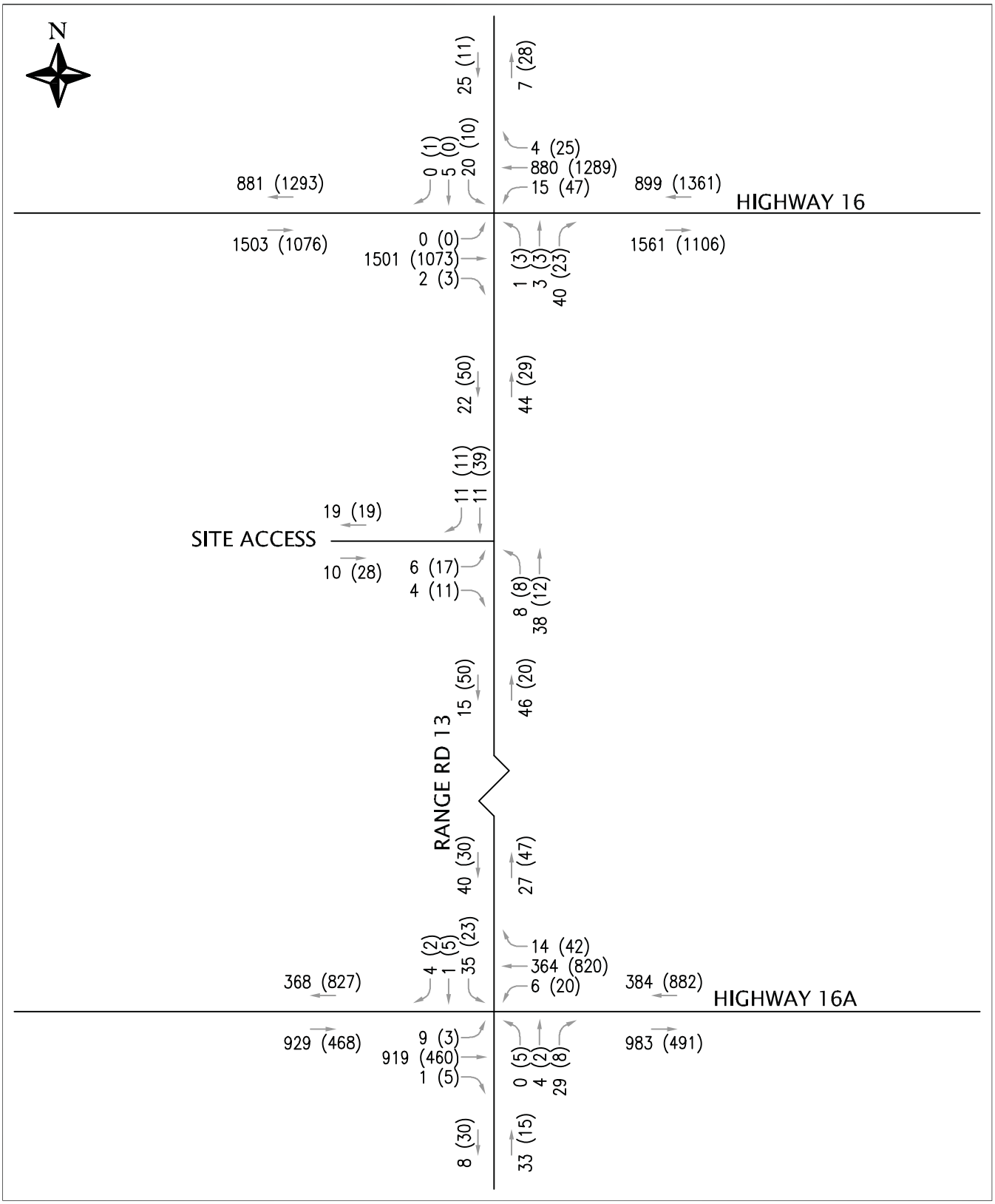

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Exhibit 4-5

Scale NTS

2013 Total AM (PM) Peak Hour Volumes

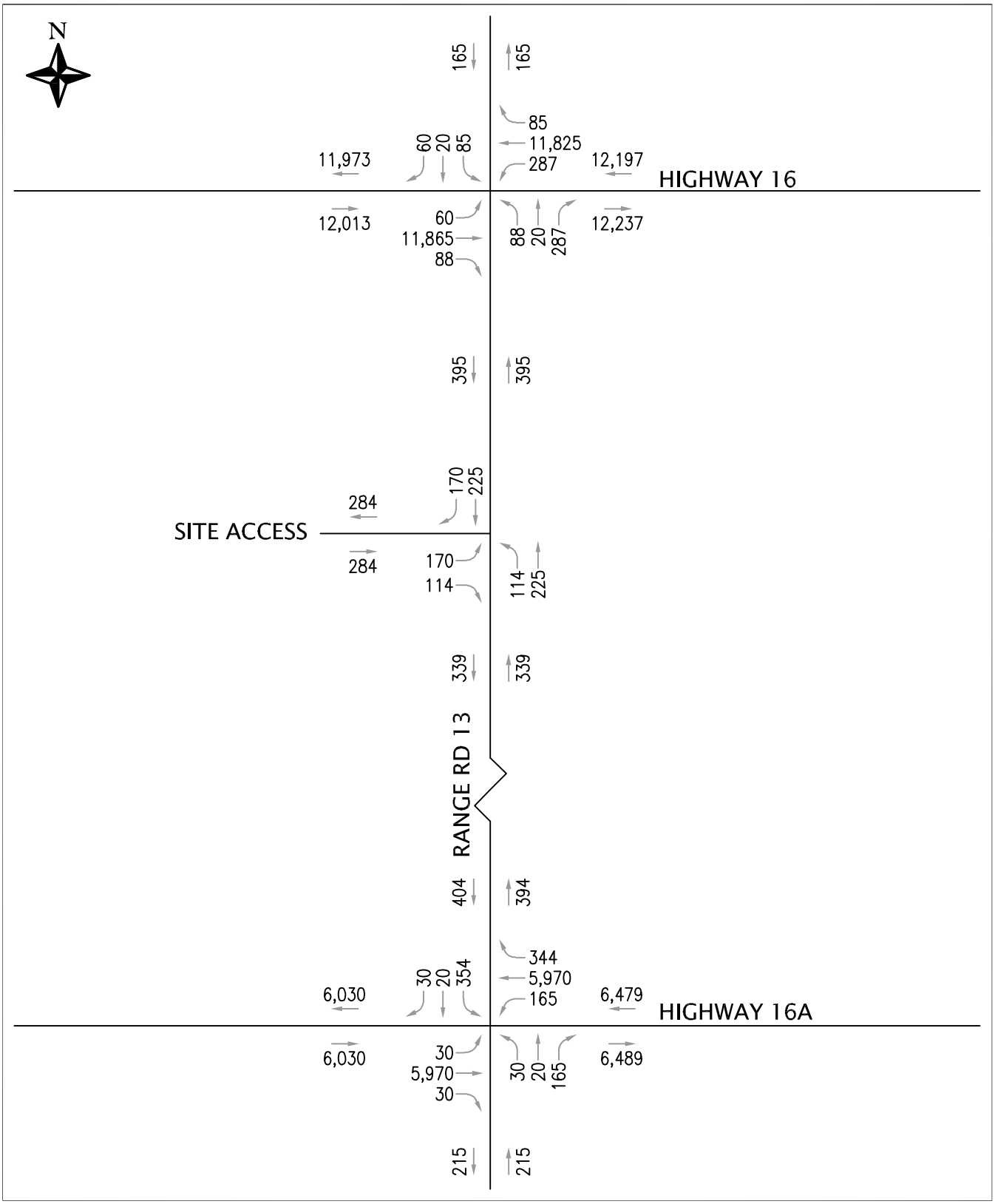

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Exhibit 4-6

Scale NTS

2013 Total Daily Volumes

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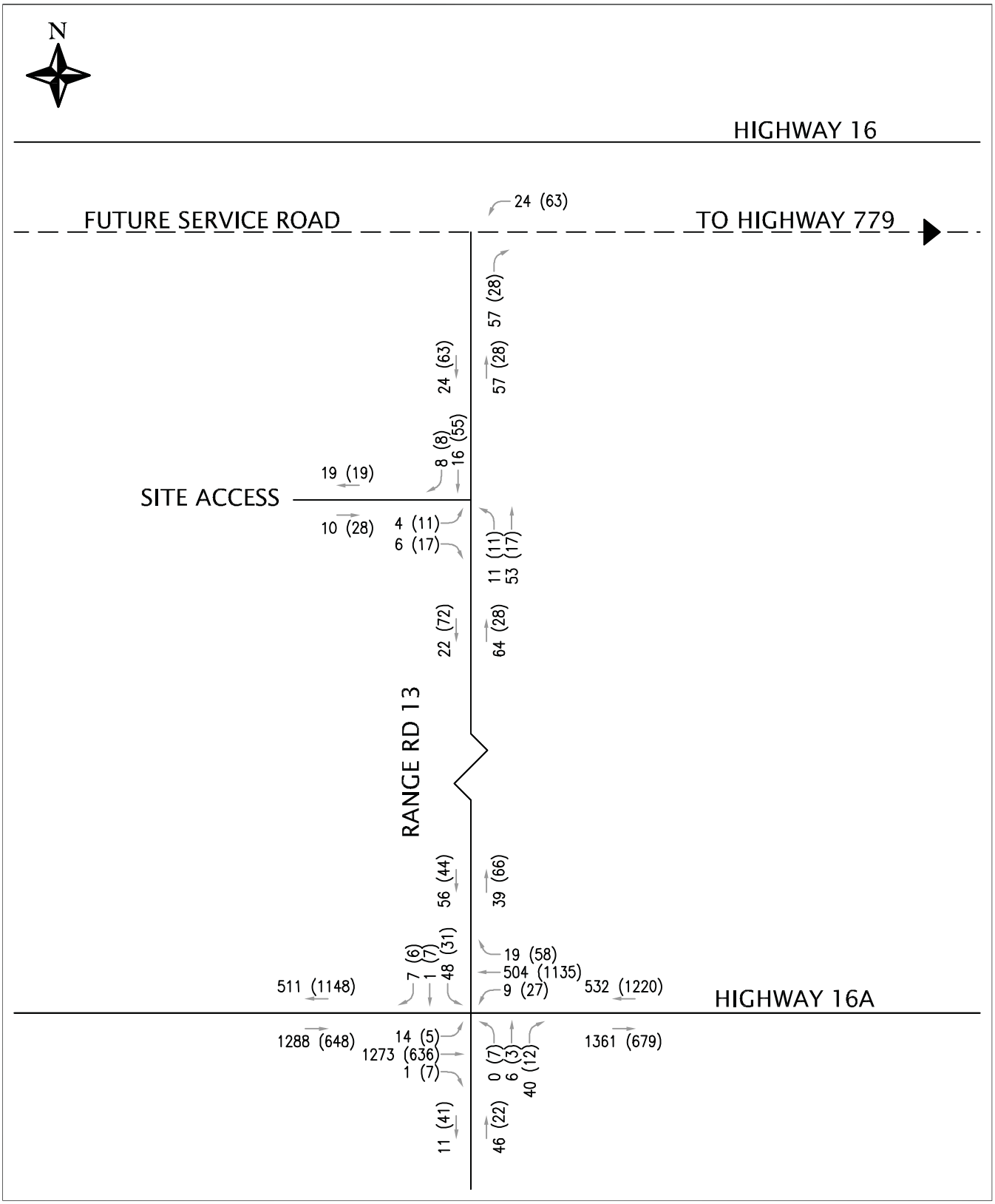

Exhibit 4-7

Scale NTS

2033 Total AM (PM) Peak Hour Volumes

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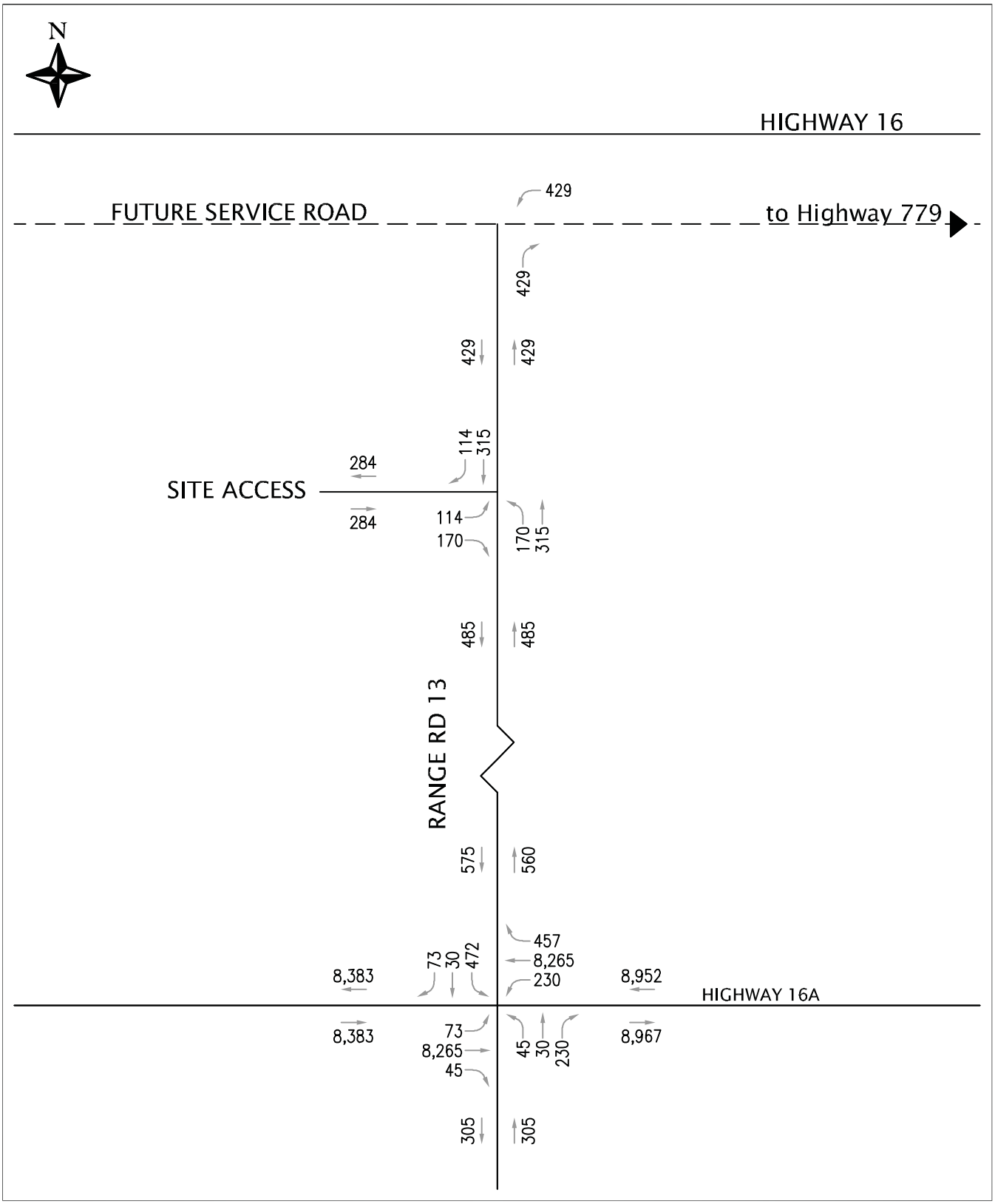

Exhibit 4-8

Scale NTS

2033 Total Daily Volumes

5. TRANSPORTATION ASSESSMENT

5.1 Analysis Methodology

The transportation assessment focused on the key study area intersections that are anticipated to be impacted by the proposed development. These intersections include the Highway 16/RR 13, Highway 16A/RR 13, and the Site Access/RR 13 intersections in the 2013 horizon, and the Highway 16A/RR 13 and the Site Access/RR 13 intersections in the 2033 horizon.

The transportation assessment includes the following five components:

5.1.1 AT Highway Geometric Design Guide

AT's warrants for left and right turn lanes on four-lane divided highways from the Highway Geometric Design Guide (1995) were reviewed to identify any intersection improvements required at the Highway 16/RR 13 intersection under 2013 background and total traffic conditions and the Highway 16A/RR 13 intersection under 2013 and 2033 background and total traffic conditions

5.1.2 Traffic Signal Warrants

Signal warrant analyses were conducted to determine if any of the study area intersections require signalization within the 2013 and 2033 horizons. The Transportation Association of Canada's (TAC) "Canadian Traffic Signal Warrant Matrix Procedure 2005" and the spreadsheets associated with the "Traffic Signal Warrant Handbook 2007" were used in the signal warrant analyses.

5.1.3 Capacity Analysis

Capacity analyses were completed in accordance with the methodology outlined in the Highway Capacity Manual 2000 using Synchro 7.0 software to evaluate traffic operations during peak periods of traffic activity.

5.1.4 Lighting Analysis

Illumination warrant analyses were completed for the study area intersections using the methodology outlined in the "TAC Guide for the Design of Roadway Lighting" 2006 Edition.

5.1.5 County Roadway Requirements

Parkland County's Subdivision Development Standards were used to review the requirements for county roadways, including the classifications of the internal roadway system.

5.2 AT Highway Geometric Design Guide

5.2.1 Highway 16 and RR 13

Table 5-1 summarizes the results of the left turn warrant review completed for the Highway 16/RR 13 intersection based on Figure D-8.6c and Table D.7.6.a of the Highway Geometric Design Guide. Detailed calculations are included for reference in **Appendix B**.

Table 5-1: Warrant Analysis for Left Turn Lanes – Highway 16 and RR 13

Horizon	West Approach		East Approach	
	Left Turn Bay Required?	Total Storage Length Required	Left Turn Bay Required?	Total Storage Length Required
2011 Existing	No	-	Yes	15 m
2013 Background	No	-	Yes	15 m
2013 Total	No	-	Yes	25 m

As shown in Table 5-1, a westbound left turn lane is currently required at the Highway 16/RR 13 intersection. The total storage length required within the left turn lane increases from 15 metres to 25 metres with the addition of site generated traffic.

Currently, a westbound left turn bay has been painted within the shoulder on the east approach of the Highway 16/RR 13 intersection. Although the left turn bay is not constructed to standard, it does provide the ability for left turning traffic to move out of the mainline traffic prior to turning at the intersection. Considering the site is anticipated to add only 10 vph to the westbound left turn movement in the AM and PM peak hours, the requirement for a left turn bay was reviewed further as part of the capacity analysis to determine if a reduction in the mainline level of service would be identified if a bay was not provided.

Based on a review of Table D.8.4 – Standard Design Lengths for Parallel Deceleration Lanes on Multi-Lane Divided Highways, the standard design for a left turn lane with a design speed of 120 km/hr includes 30 metres of storage. Therefore, if AT considered upgrading the intersection to include a standard left turn lane design for the east approach, there would be sufficient storage to accommodate the projected demands.

The intersection currently includes right turn bay and tapers, although they are not anticipated to reflect current AT standards. Therefore, AT's right turn warrants were reviewed to determine if any potential upgrading is required to accommodate background or site generated traffic. As per Section D.8.7 of the Highway Geometric Design Guide, right turn lanes are considered when right turning daily volumes are greater than or equal to 360 vpd. The results of the right turn bay review are summarized in **Table 5-2**.

Table 5-2: Warrant Analysis for Right Turn Lanes – Highway 16 and RR 13

Horizon	West Approach		East Approach	
	Right Turn Volume (vpd)	Right Turn Lane Required?	Right Turn Volume (vpd)	Right Turn Lane Required?
2011 Existing	60	No	80	No
2013 Background	60	No	85	No
2013 Total	88	No	85	No

As shown in Table 5-2, right turn bays are not currently required at the Highway 16/RR 13 intersection, and are not anticipated to be required within the 2013 horizon under either background or total traffic conditions.

5.2.2 Highway 16A and RR 13

The Highway 16A/RR 13 intersection is currently developed as a major-minor road intersection with a westbound left turn lane and an eastbound right turn lane. Warrant analyses were completed to determine if a westbound right turn lane and an eastbound left turn lane are also required at the intersection in either the 2013 or 2033 horizons. **Table 5-3** summarizes the results of the warrant analysis. Detailed calculations for the eastbound left turn lane are included in **Appendix B**.

Table 5-3: Warrant Analysis for Left and Right Turn Lanes – Highway 16A and RR 13

Horizon	West Approach		East Approach	
	EB Left Turn Bay Required?	Total Storage Length Required	WB Right Turn Volume (vpd)	WB Right Turn Lane Required?
2011 Existing	No	-	220	No
2013 Background	No	-	230	No
2013 Total	No	-	344	No
2033 Background	No	-	315	No
2033 Total	No	-	457	Yes

As shown in Table 5-3, an eastbound left turn bay is not anticipated to be warranted within the 2013 or 2033 horizons, but a westbound right turn bay is anticipated to be required within the 2033 horizon.

5.3 Traffic Signal Warrants

Signal warrant analyses were conducted using TAC's "Canadian Traffic Signal Warrant Matrix Procedure 2005" and spreadsheets from the "Traffic Signal Warrant Handbook 2007". The analyses were completed for the Highway 16/RR 13 intersection under existing, 2013 background, and 2013 total traffic conditions and for the Highway 16A/RR 13 intersection under existing, 2013 background, 2013 total, 2033 background, and 2033 total traffic conditions. Analyses were completed for the proposed Site Access/RR 13 intersection under 2013 and 2033 total traffic conditions only.

The TAC warrant matrix procedure uses six hours of traffic volume data: AM, midday, and PM, to determine the requirements for signalization. Ratios of the existing AM and PM peak hour data to the full two hour counts and the existing AM and PM peak hours to the midday two hour count were calculated and used to adjust the projected 2013 and 2033 AM and PM peak hour volumes to six hour volumes at each intersection. The two hour factors were based on available count data at the Highway 16/RR 13 and Highway 16A/RR 13 intersections. Factors for the Site Access/RR 13 intersection were based on volume profiles on the south approach of the Highway 16/RR 13 intersection.

When an analysis score is higher than 100, traffic signalization is warranted at the intersection. However, if the six-hour average side street traffic is below 75 vpd, traffic signalization should not typically be considered, even if an analysis score higher than 100 is achieved. The results of the signal warrant analyses are summarized in **Table 5-4**. **Appendix C** contains a summary of the signal warrant calculation sheets for reference.

Table 5-4: Summary of Signal Warrant Analysis Scores

Intersection	2011 Existing	2013 Background	2013 Total	2033 Background	2033 Total	Signal Warranted?
Highway 16 and RR 13	31	33	47	n/a	n/a	No
Highway 16A and RR 13	16	17	19	34	39	No
Site Access and RR 13	n/a	n/a	1	n/a	1	No

As shown in Table 5-4, signalization is not warranted at any of the study area intersections within the 2013 or 2033 horizons.

5.4 Capacity Analysis

The capacity analyses are based on the methods outlined in the Highway Capacity Manual 2000, using Synchro 7 analysis software. Detailed Synchro printouts are included for reference in **Appendix D**.

Intersection operations are typically rated by two measures. The volume-to-capacity (v/c) ratio describes the extent to which the traffic volumes can be accommodated by the physical capacity of the road configuration and traffic control. A value (measured during the peak hour) less than 0.90 indicates that

generally there is sufficient capacity and the projected traffic volumes can be accommodated at the intersection. A value between 0.90 and 1.0 suggests unstable operations may occur and volumes are nearing capacity conditions. A calculated value over 1.0 indicates that traffic volumes are theoretically exceeding capacity. The second measure of performance, Level of Service (LOS), is based on the estimated average delay per vehicle among all traffic passing through the intersection. A low average delay merits a LOS A rating. Average delays greater than 50 seconds per vehicle at an unsignalized intersection generally produce a LOS F rating.

The methodology includes a number of assumptions that relate to the operating conditions present at the intersection. The following assumptions were used in the analysis:

- Peak Hour Factor – As per existing or 0.92 where unknown;
- % Heavy Vehicles – As per existing, 5% for site generated traffic or 2% where unknown.

The intersection geometry used in the assessments is based on existing conditions. Where parallel lanes and tapers have been constructed for left or right turn movements, the assessment includes a separate lane for that movement. If only a taper is provided, the movement is assumed to operate from the adjacent through lane (shared lane operation).

5.4.1 Highway 16 and RR 13

The intersection of Highway 16 and RR 13 is currently an unsignalized intersection. Based on the signal warrant analysis, the intersection is anticipated to be maintained as an unsignalized intersection in the 2013 horizon.

The geometry assumed in the assessment includes the following:

- ***West Approach*** – one left turn bay, two through lanes, one right turn bay;
- ***East Approach*** – one shared left/through lane, one through lane, one right turn bay;
- ***South Approach*** – one shared left/through/right lane; and,
- ***North Approach*** – one shared left/through/right lane.

As noted in the review of the Highway Geometric Design Guide, a westbound left turn lane is warranted under existing conditions. Currently, the intersection includes a painted left turn bay within the inside shoulder. Although this painted left turn bay provides an opportunity for westbound left turns to move out of mainline traffic, the assessment has assumed a shared left/through lane to identify the potential impact of site generated traffic on the intersection operations if left turning vehicles do not move onto the shoulder prior to the turn.

Tables 5-5 and **5-6** present the results of the assessments completed for the Highway 16/RR 13 intersection during the AM and PM peak hours.

Table 5-5: Highway 16 and RR 13 – AM Peak Hour 2011 Existing and 2013 Analyses

	Eastbound			Westbound			Northbound			Southbound		
Movement	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**
2011 Existing – Unsignalized (N/S Stop Control)												
Geometry	L/T/T/R			LT/T/R			LTR			LTR		
Volume (vph)	0	1443	1	5	846	4	0	3	34	19	5	0
v/c	-	0.44	0.00	0.34		0.00	0.16			0.17		
Delay (s)	-	0.0	0.0	0.2		0.0	18.0			27.9		
LOS	-	A	A	A		A	C			D		
95th Queue (m)	-	0	0	0		0	4			5		
2013 Background – Unsignalized (N/S Stop Control)												
Geometry	L/T/T/R			LT/T/R			LTR			LTR		
Volume (vph)	0	1501	1	5	880	4	0	3	35	20	5	0
v/c	-	0.46	0.00	0.35		0.00	0.17			0.19		
Delay (s)	-	0.0	0.0	0.3		0.0	18.8			29.8		
LOS	A	A	A	A		A	C			D		
95th Queue (m)	0	0	0	0		0	5			5		
2013 Total – Unsignalized (N/S Stop Control)												
Geometry	L/T/T/R			LT/T/R			LTR			LTR		
Volume (vph)	0	1501	2	15	880	4	1	3	40	20	5	0
v/c	-	0.46	0.00	0.35		0.00	0.20			0.20		
Delay (s)	-	0.0	0.0	0.6		0.0	19.7			32.1		
LOS	-	A	A	A		A	C			D		
95th Queue (m)	-	0	0	1		0	6			6		

Table 5-6: Highway 16 and RR 13 – PM Peak Hour 2011 Existing and 2013 Analyses

	Eastbound			Westbound			Northbound			Southbound		
Movement	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**
2011 Existing – Unsignalized (N/S Stop Control)												
Geometry	L/T/T/R			LT/T/R			LTR			LTR		
Volume (vph)	0	1032	2	36	1239	24	0	3	9	10	0	1
v/c	-	0.32	0.00	0.50		0.01	0.06			0.22		
Delay (s)	-	0.0	0.0	1.3		0.0	19.7			39.9		
LOS	-	A	A	A		A	C			E		
95th Queue (m)	-	0	0	2		0	1			6		
2013 Background – Unsignalized (N/S Stop Control)												
Geometry	L/T/T/R			LT/T/R			LTR			LTR		
Volume (vph)	0	1073	2	37	1289	25	0	3	9	10	0	1
v/c	-	0.33	0.00	0.52		0.02	0.06			0.24		
Delay (s)	-	0.0	0.0	1.4		0.0	20.6			43.7		
LOS	-	A	A	A		A	C			E		
95th Queue (m)	-	0	0	2		0	2			7		
2013 Total – Unsignalized (N/S Stop Control)												
Geometry	L/T/T/R			LT/T/R			LTR			LTR		
Volume (vph)	0	1073	3	47	1289	25	3	3	23	10	0	1
v/c	-	0.33	0.00	0.52		0.02	0.11			0.26		
Delay (s)	-	0.0	0.0	1.8		0.0	19.0			47.7		
LOS	-	A	A	A		A	C			E		
95th Queue (m)	-	0	0	3		0	3			7		

As shown in Tables 5-5 and 5-6, Highway 16 is anticipated to operate at LOS A under the 2013 background and 2013 total traffic scenarios. The addition of 10 vph to the westbound left turn movement in the AM and PM peak hours is anticipated to have minimal impact to the westbound through traffic along Highway 16. Therefore, the existing geometry, which includes a westbound left turn bay within the shoulder, is anticipated to be sufficient to accommodate the projected background and site generated traffic.

Northbound traffic is anticipated to operate at LOS C during both the AM and PM peak hours under all scenarios analyzed, which is anticipated to be acceptable for the operations of a low volume movement accessing a major roadway. Southbound traffic is anticipated to experience longer delays, with a LOS D identified for the movement in the AM peak hour and a LOS E identified for the movement in the PM peak hour. Although the southbound movements are anticipated to operate at LOS E in the PM peak hour, the total southbound volume is less than 15 vph and the volume to capacity ratio indicates that there is ample capacity to accommodate these volumes. Therefore, the existing geometry and traffic control is anticipated to be appropriate and no improvements have been identified to accommodate southbound traffic.

5.4.2 Highway 16A and RR 13

The intersection of Highway 16A and RR 13 is currently an unsignalized intersection with the following geometry:

- ***West Approach*** – one shared left/through lane, one through lane, one right turn bay;
- ***East Approach*** – one left turn bay, one through lane, one shared through/right lane;
- ***South Approach*** – one shared left/through/right lane; and,
- ***North Approach*** – one shared left/through/right lane.

Based on the review of the Highway Geometric Design Guide, a westbound right turn was identified as being required in the 2033 horizon with the addition of site generated traffic. Therefore, the analysis has included a westbound right turn in the 2033 total traffic scenario. **Tables 5-7** through **5-10** present the results of the assessments completed for the Highway 16A/RR 13 intersection during the AM and PM peak hours.

Table 5-7: Highway 16A and RR 13 – AM Peak Hour 2011 Existing and 2013 Analyses

	Eastbound			Westbound			Northbound			Southbound		
Movement	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**
2011 Existing – Unsignalized (N/S Stop Control)												
Geometry	LT/T/R			L/T/TR			LTR			LTR		
Volume (vph)	9	884	1	6	350	6	0	4	28	30	1	4
v/c	0.36		0.00	0.01	0.16		0.10			0.11		
Delay (s)	0.1		0.0	9.9	0.0		14.3			17.8		
LOS	A		A	A	A		B			C		
95th Queue (m)	0		0	0	0		2			3		
2013 Background – Unsignalized (N/S Stop Control)												
Geometry	LT/T/R			L/T/TR			LTR			LTR		
Volume (vph)	9	919	1	6	364	6	0	4	29	31	1	4
v/c	0.38		0.00	0.01	0.17		0.10			0.12		
Delay (s)	0.1		0.0	10.1	0.0		14.7			18.4		
LOS	A		A	B	A		B			C		
95th Queue (m)	0		0	0	0		3			3		
2013 Total – Unsignalized (N/S Stop Control)												
Geometry	LT/T/R			L/T/TR			LTR			LTR		
Volume (vph)	9	919	1	6	364	14	0	4	29	35	1	4
v/c	0.38		0.00	0.01	0.17		0.10			0.14		
Delay (s)	0.1		0.0	10.1	0.0		14.7			18.8		
LOS	A		A	B	A		B			C		
95th Queue (m)	0		0	0	0		3			4		

Table 5-8: Highway 16A and RR 13 - AM Peak Hour 2033 Analyses

	Eastbound			Westbound			Northbound			Southbound		
Movement	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**
2033 Background – Unsignalized (N/S Stop Control)												
Geometry	LT/T/R			L/T/TR			LTR			LTR		
Volume (vph)	13	1273	1	9	504	9	0	6	40	43	1	6
v/c	0.52		0.00	0.02	0.23		0.20			0.26		
Delay (s)	0.2		0.1	12.1	0.0		20.8			29.6		
LOS	A		A	B	A		C			D		
95th Queue (m)	0		0	1	0		6			8		
2033 Total – Unsignalized (N/S Stop Control)												
Geometry	LT/T/R			L/T/T/R			LTR			LTR		
Volume (vph)	14	1273	1	9	504	19	0	6	40	48	1	7
v/c	0.52		0.00	0.02	0.17	0.01	0.21			0.29		
Delay (s)	0.2		0.0	12.1	0.0	0.0	20.9			30.5		
LOS	A		A	B	A	A	C			D		
95th Queue (m)	0		0	1	0	0	6			9		

Based on the assessment completed, the intersection is anticipated to operate at acceptable levels of service in the AM peak hour through to the 2033 horizon based on the total traffic scenario.

Table 5-9: Highway 16A and RR 13 – PM Peak Hour 2011 Existing and 2013 Analyses

	Eastbound			Westbound			Northbound			Southbound		
Movement	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**
2011 Existing – Unsignalized (N/S Stop Control)												
Geometry	LT/T/R			L/T/TR			LTR			LTR		
Volume (vph)	3	442	5	19	788	33	5	2	8	12	5	2
v/c	0.20		0.00	0.02	0.32		0.05			0.12		
Delay (s)	0.1		0.0	8.5	0.0		14.5			22.4		
LOS	A		A	A	A		B			C		
95th Queue (m)	0		0	1	0		1			3		
2013 Background – Unsignalized (N/S Stop Control)												
Geometry	LT/T/R			L/T/TR			LTR			LTR		
Volume (vph)	3	460	5	20	820	34	5	2	8	12	5	2
v/c	0.20		0.00	0.02	0.33		0.05			0.13		
Delay (s)	0.1		0.0	8.6	0.0		14.8			23.4		
LOS	A		A	A	A		B			C		
95th Queue (m)	0		0	1	0		1			3		
2013 Total – Unsignalized (N/S Stop Control)												
Geometry	LT/T/R			L/T/TR			LTR			LTR		
Volume (vph)	3	460	5	20	820	42	5	2	8	23	5	2
v/c	0.20		0.00	0.02	0.33		0.05			0.21		
Delay (s)	0.1		0.0	8.6	0.0		14.9			26.0		
LOS	A		A	A	A		B			D		
95th Queue (m)	0		0	1	0		1			6		

Table 5-10: Highway 16A and RR 13 - PM Peak Hour 2033 Analysis

	Eastbound			Westbound			Northbound			Southbound		
Movement	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**
2033 Background – Unsignalized (N/S Stop Control)												
Geometry	LT/T/R			L/T/TR			LTR			LTR		
Volume (vph)	4	636	7	27	1135	48	7	3	12	17	7	3
v/c	0.28		0.1	0.03	0.46		0.10			0.31		
Delay (s)	0.2		0.0	9.4	0.0		19.8			42.7		
LOS	A		A	A	A		C			E		
95th Queue (m)	0		0	1	0		3			9		
2033 Total – Unsignalized (N/S Stop Control)												
Geometry	LT/T/R			L/T/T/R			LTR			LTR		
Volume (vph)	5	636	7	27	1135	58	7	3	12	31	7	6
v/c	0.28		0.01	0.03	0.35	0.05	0.10			0.47		
Delay (s)	0.3		0.0	9.4	0.0	0.0	20.1			51.2		
LOS	A		A	A	A	A	C			F		
95th Queue (m)	0		0	1	0	0	3			16		

As shown in Table 5-9 and 5-10 the intersection is anticipated to operate at acceptable levels of service under the 2013 background and total traffic scenarios. With the addition of background traffic in the 2033 horizon, the southbound movements are anticipated to decrease to LOS E, and with the addition of site traffic the operations are projected to decrease to LOS F. However, under both scenarios, the southbound volumes are less than 50 vph, the v/c ratios continue to be below 0.5, and based on the traffic signal warrant analysis, signalization is not anticipated to be warranted. Therefore, no intersection geometry or traffic control improvements are recommended for southbound traffic.

5.4.3 Site Access and RR 13

The intersection of the Site Access and RR 13 operates as a T-intersection with stop control on the west approach. All intersection approaches operate with one shared lane to accommodate all possible traffic movements.

As shown in **Table 5-11** the site access is anticipated to operate at excellent levels of service in the AM and PM peak hours.

Table 5-11 Site Access and RR 13 – AM & PM Peak Hour 2013 and 2033 Analyses

	Eastbound		Northbound		Southbound	
Movement	**L**	**R**	**L**	**T**	**T**	**R**
AM Peak Hour - 2013 Total – Unsignalized (EB Stop Control)						
Geometry	LR		LT		TR	
Volume (vph)	6	4	8	38	11	11
v/c	0.01		0.01		0.01	
Delay (s)	8.8		1.3		0.0	
LOS	A		A		A	
95th Queue (m)	0		0		0	
AM Peak Hour – 2033 Total – Unsignalized (EB Stop Control)						
Geometry	LR		LT		TR	
Volume (vph)	4	6	11	53	16	8
v/c	0.01		0.01		0.02	
Delay (s)	8.7		1.3		0.0	
LOS	A		A		A	
95th Queue (m)	0		0		0	
PM Peak Hour - 2013 Total – Unsignalized (EB Stop Control)						
Geometry	LR		LT		TR	
Volume (vph)	17	11	8	12	39	11
v/c	0.03		0.01		0.03	
Delay (s)	8.9		3.0		0.0	
LOS	A		A		A	
95th Queue (m)	1		0		0	
PM Peak Hour - 2033 Total – Unsignalized (EB Stop Control)						
Geometry	LR		LT		TR	
Volume (vph)	11	17	11	17	55	8
v/c	0.03		0.01		0.04	
Delay (s)	8.9		2.9		0.0	
LOS	A		A		A	
95th Queue (m)	1		0		0	

5.5 Lighting Analysis

Preliminary assessments based on Figure 10-2, Warrants for Intersection Lighting, from the TAC Guide for the Design of Roadway Lighting (2006) were completed to confirm if illumination is anticipated to be warranted at the Highway 16/RR 13, Highway 16A/RR 13, and Site Access/RR 13 intersections. **Table 5-12** summarizes the results of the illumination analyses completed at the study area intersections. The detailed calculations for the illumination warrant analyses are summarized in **Appendix E**.

Table 5-12: Summary of Lighting Assessment

Horizon	Highway 16 and RR 13		Highway 16A and RR 13		Site Access and RR 13	
	Score	Warranted?	Score	Warranted?	Score	Warranted?
2011 Existing	121	Yes	71	No	n/a	n/a
2013 Background	121	Yes	71	No	n/a	n/a
2013 Total	151	Yes	71	No	13	No
2033 Background	n/a	n/a	101	No	n/a	n/a
2033 Total	n/a	n/a	101	No	13	No

As shown in Table 5-12, illumination is currently warranted at the Highway 16/RR 13 intersection under the 2013 total traffic conditions. Illumination is not anticipated to be required at the Highway 16A/RR 13 intersection or the Site Access/RR 13 intersection within the 2033 horizon under background or total traffic conditions.

Further review of the illumination warrant analyses for Highway 16 and RR 13 indicates that the anticipated warranting score of 121 under the existing and 2013 background traffic scenarios is a combination of a geometric score of 41 and an operational score of 80. Under the 2013 total traffic scenario, the total warrant score is comprised of a geometric score of 41 and an operational score of 110. The TAC Guide for the Design of Roadway Lighting indicates that for a score comprised of secondary warranting factors, the type of appropriate lighting should be based on a review of the highest scoring individual factor and the identification of circumstances contributing to the score. Therefore, the operational characteristics indicate that delineation lighting to illuminate cross street traffic is best suited to address the illumination needs of the Highway 16/RR 13 intersection.

5.6 County Roadway Requirements

The proposed RV resort is anticipated to be developed as a condominium; therefore, the internal roadway network is anticipated to be developed as a series of private roads that will be maintained by the condominium corporation.

Although the internal roadways are anticipated to be private roads, it is recommended that they be constructed to the County's residential access roadway standard. Residential access roadways are designed to a 60 km/hr design speed and include a 7.0 metre paved roadway on a 9.2 metre wide subgrade. Additional design elements, such as minimum horizontal curves and vertical grades should also be respected. It is anticipated that a full 30.0 metre right-of-way will not be required for the private internal roadways; although, the roadway design should ensure appropriate drainage facilities are provided. As well, on-site intersections and cul-de-sacs should be designed to accommodate RV turning movements.

In addition to the above, the first intersection within the RV resort should be a minimum of 30 metres from the west edge of RR 13 as outlined in Drawing 7.11 – Typical Approach Locations. Typical cross-sections for residential access roadways (Drawing 7.1) and the typical approach locations (Drawing 7.11) are included in **Appendix F**.

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6. CONCLUSIONS AND RECOMMENDATIONS

Based on the analysis and assessment completed, the traffic estimated to be generated by the proposed development is anticipated to have a nominal impact on the adjacent roadway network. The following conclusions are advanced:

- The site is anticipated to generate in the order of 29 two-way trips in the AM peak hour, 47 two-way trips in the PM peak hour, and 568 two-way trips on a typical weekday.
- The analysis identified that a westbound left turn parallel deceleration lane and delineation lighting are warranted at Highway 16 and RR 13 under existing conditions. No additional improvements were identified to accommodate site generated traffic at the intersection.
- The analysis identified a westbound right turn deceleration lane is warranted at the Highway 16A/RR 13 intersection under the 2033 total traffic scenario.
- Although the capacity analysis indicated that the southbound movements at the Highway 16A/RR 13 intersection could operate at LOS E in the PM peak hour under the 2033 background traffic scenario and LOS F in the PM peak hour under the 2033 total traffic scenario, the total southbound volumes are low during the peak hours (<15 vph) and there is sufficient capacity to accommodate the movement.
- Signalization was not warranted at any of the study area intersections in the 2013 or 2033 horizons.

Based on the above, the following recommendations are advanced:

- The existing geometry at Highway 16 and RR 13, including the existing westbound left turn lane painted within the inside shoulder should be maintained and considered acceptable for use by traffic anticipated to be generated by the proposed RV resort.
- Parkland County should work with Alberta Transportation to identify temporary lighting opportunities at the Highway 16/RR 13 intersection.
- The developer should design and construct a westbound right turn bay at the Highway 16A/RR 13 intersection.
- Although the internal roadways are anticipated to be developed as private roads, it is recommended that the key design elements, such as the roadway width and minimum horizontal and vertical curves, be designed to reflect the County's residential access roadway standard.

In addition to the above, on-site pedestrian access to Hubbles Lake should be considered at the subdivision and development permit stages to ensure appropriate warning signage is installed, if required.

APPENDIX A

Traffic Count Data

Turning Movement Summary Diagram

Reference No.: 74526

Intersection of:
16 & ALAN BEACH RD 16-53-1-500001480

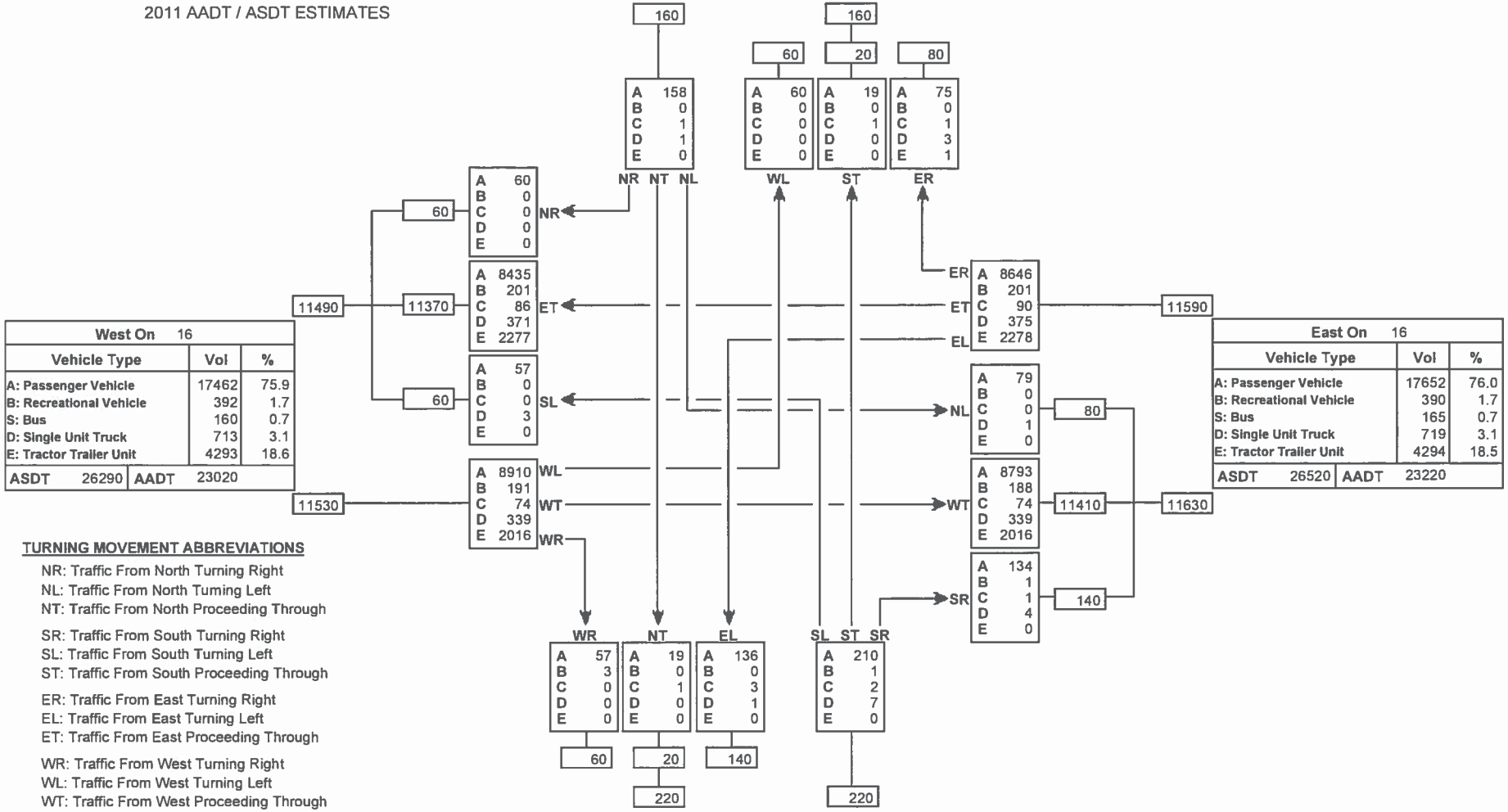
2011 AADT / ASDT ESTIMATES

North On Rge Rd 13		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	312	97.5
B: Recreational Vehicle	0	0.0
S: Bus	3	0.9
D: Single Unit Truck	4	1.3
E: Tractor Trailer Unit	1	0.3
ASDT 370	AADT 320	

West On 16		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	17462	75.9
B: Recreational Vehicle	392	1.7
S: Bus	160	0.7
D: Single Unit Truck	713	3.1
E: Tractor Trailer Unit	4293	18.6
ASDT 26290	AADT 23020	

East On 16		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	17652	76.0
B: Recreational Vehicle	390	1.7
S: Bus	165	0.7
D: Single Unit Truck	719	3.1
E: Tractor Trailer Unit	4294	18.5
ASDT 26520	AADT 23220	

South On Rge Rd 13		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	422	95.9
B: Recreational Vehicle	4	0.9
S: Bus	6	1.4
D: Single Unit Truck	8	1.8
E: Tractor Trailer Unit	0	0.0
ASDT 500	AADT 440	



TURNING MOVEMENT ABBREVIATIONS

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

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

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

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

TURNING MOVEMENT ABBREVIATIONS

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

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

Turning Movement Summary Diagram

Reference No.: 74526

Intersection of:

16 & ALAN BEACH RD 16-53-1-500001480

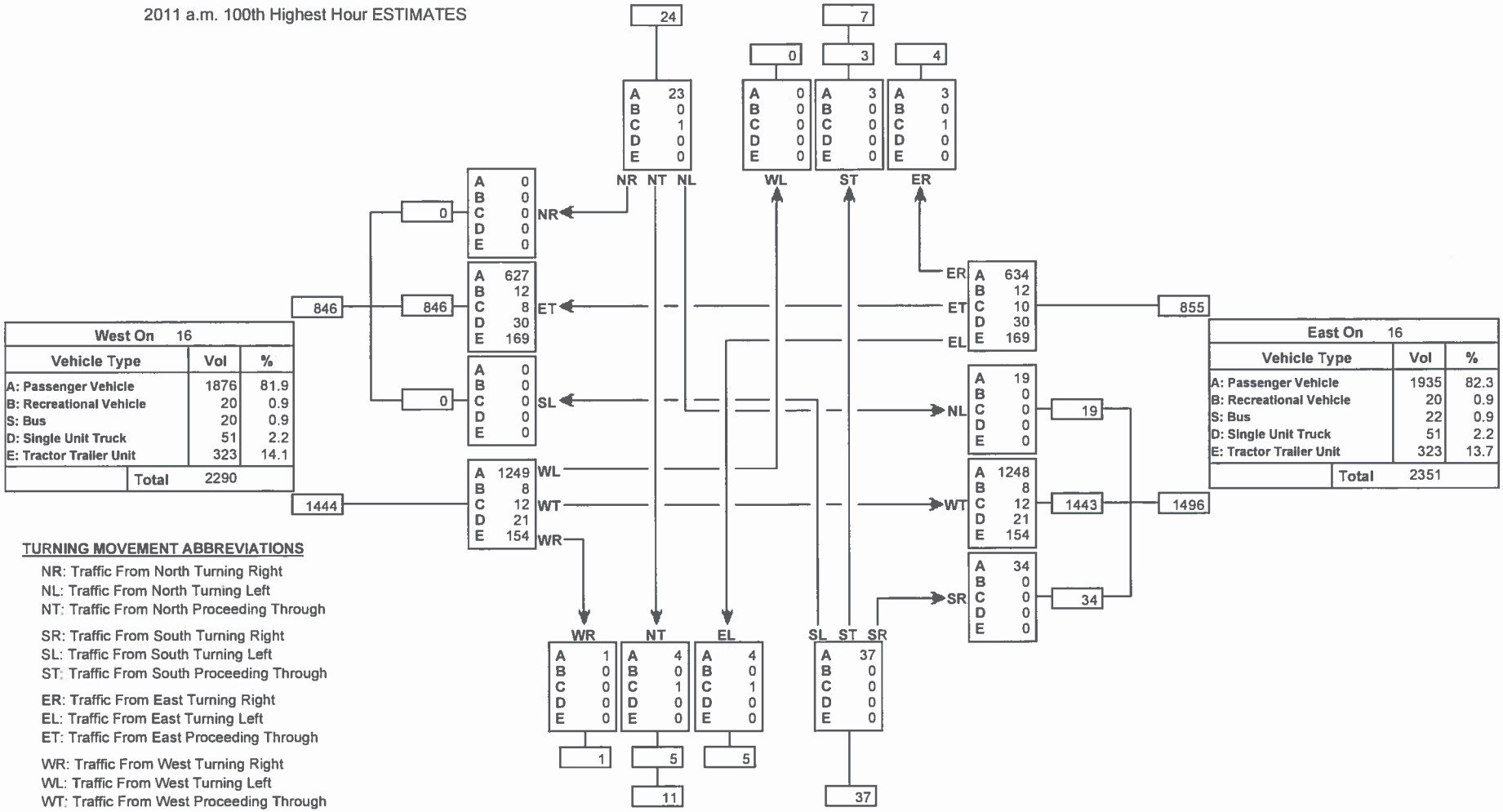
2011 a.m. 100th Highest Hour ESTIMATES

North On Rge Rd 13		
Vehicle Type	Vol	%
A: Passenger Vehicle	29	93.5
B: Recreational Vehicle	0	0.0
S: Bus	2	6.5
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	0	0.0
Total	31	

West On 16		
Vehicle Type	Vol	%
A: Passenger Vehicle	1876	81.9
B: Recreational Vehicle	20	0.9
S: Bus	20	0.9
D: Single Unit Truck	51	2.2
E: Tractor Trailer Unit	323	14.1
Total	2290	

East On 16		
Vehicle Type	Vol	%
A: Passenger Vehicle	1935	82.3
B: Recreational Vehicle	20	0.9
S: Bus	22	0.9
D: Single Unit Truck	51	2.2
E: Tractor Trailer Unit	323	13.7
Total	2351	

South On Rge Rd 13		
Vehicle Type	Vol	%
A: Passenger Vehicle	46	95.8
B: Recreational Vehicle	0	0.0
S: Bus	2	4.2
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	0	0.0
Total	48	



TURNING MOVEMENT ABBREVIATIONS

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

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

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

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

Turning Movement Summary Diagram

Reference No.: 74526

Intersection of:
16 & ALAN BEACH RD 16-53-1-500001480

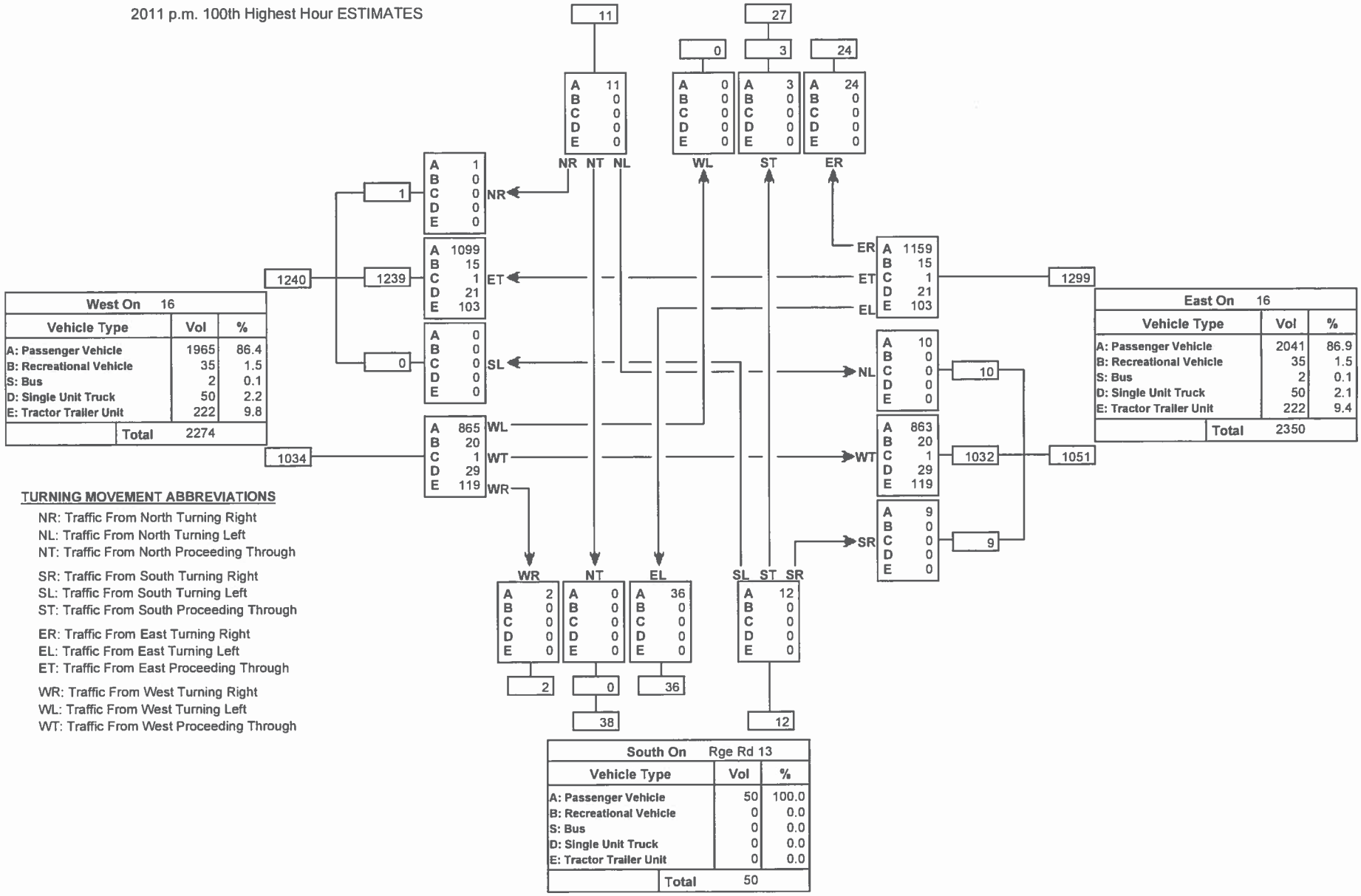
2011 p.m. 100th Highest Hour ESTIMATES

North On Rge Rd 13		
Vehicle Type	Vol	%
A: Passenger Vehicle	38	100.0
B: Recreational Vehicle	0	0.0
S: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	0	0.0
Total	38	

West On 16		
Vehicle Type	Vol	%
A: Passenger Vehicle	1965	86.4
B: Recreational Vehicle	35	1.5
S: Bus	2	0.1
D: Single Unit Truck	50	2.2
E: Tractor Trailer Unit	222	9.8
Total	2274	

East On 16		
Vehicle Type	Vol	%
A: Passenger Vehicle	2041	86.9
B: Recreational Vehicle	35	1.5
S: Bus	2	0.1
D: Single Unit Truck	50	2.1
E: Tractor Trailer Unit	222	9.4
Total	2350	

South On Rge Rd 13		
Vehicle Type	Vol	%
A: Passenger Vehicle	50	100.0
B: Recreational Vehicle	0	0.0
S: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	0	0.0
Total	50	



TURNING MOVEMENT ABBREVIATIONS

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

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

Turning Movement Summary Diagram

Reference No.: 997185

Intersection of:
16A & ALLEN BEACH RD 33-52-1-500000000

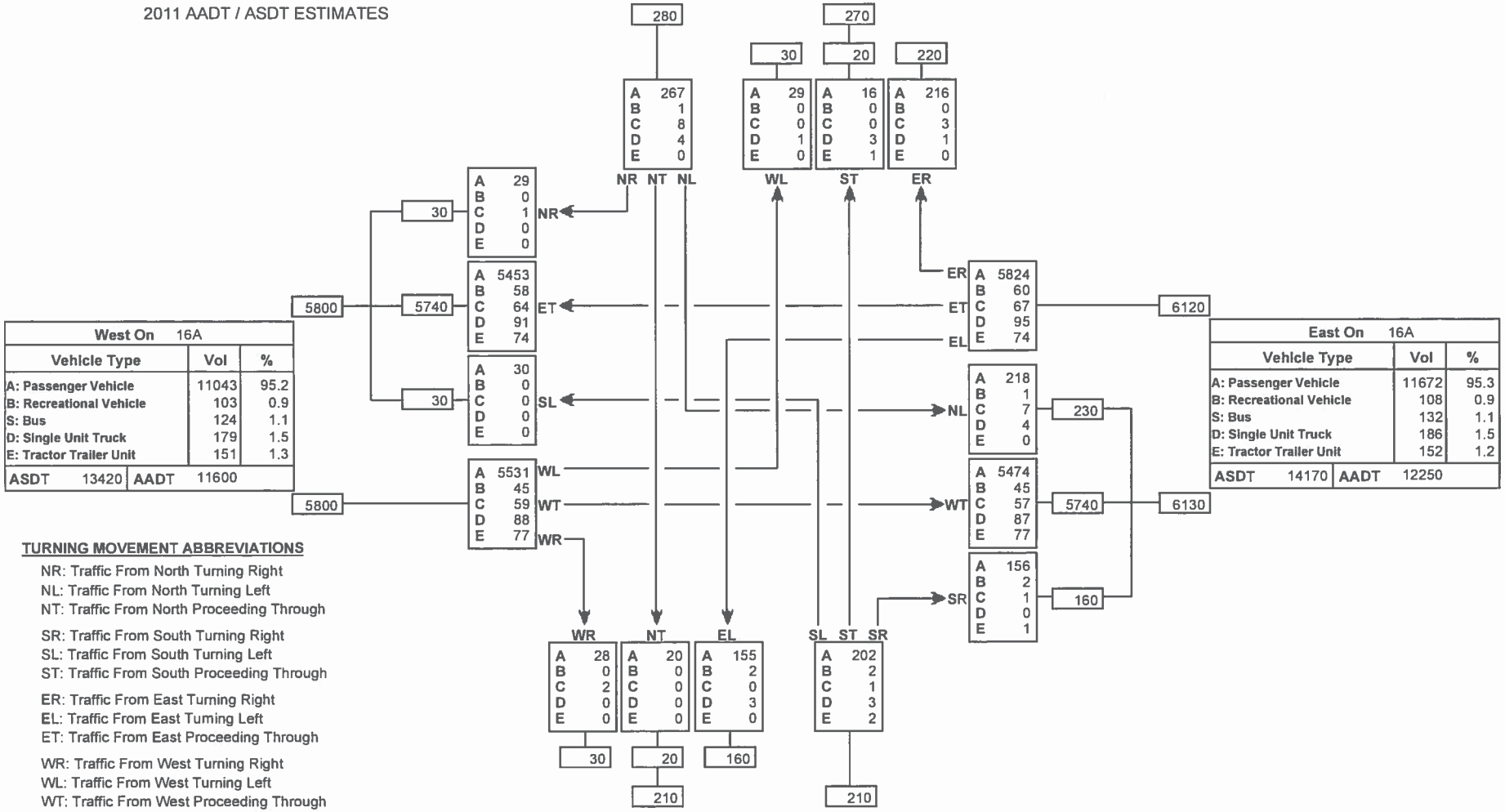
2011 AADT / ASDT ESTIMATES

North On Rge Rd 13		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	528	96.0
B: Recreational Vehicle	1	0.2
S: Bus	11	2.0
D: Single Unit Truck	9	1.6
E: Tractor Trailer Unit	1	0.2
ASDT 640	AADT 550	

West On 16A		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	11043	95.2
B: Recreational Vehicle	103	0.9
S: Bus	124	1.1
D: Single Unit Truck	179	1.5
E: Tractor Trailer Unit	151	1.3
ASDT 13420	AADT 11600	

East On 16A		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	11672	95.3
B: Recreational Vehicle	108	0.9
S: Bus	132	1.1
D: Single Unit Truck	186	1.5
E: Tractor Trailer Unit	152	1.2
ASDT 14170	AADT 12250	

South On Rge Rd 13		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	405	96.4
B: Recreational Vehicle	4	1.0
S: Bus	3	0.7
D: Single Unit Truck	6	1.4
E: Tractor Trailer Unit	2	0.5
ASDT 490	AADT 420	



TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
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SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

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

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

TURNING MOVEMENT ABBREVIATIONS

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

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

Turning Movement Summary Diagram

Reference No.: 997185

Intersection of:
16A & ALLEN BEACH RD 33-52-1-500000000

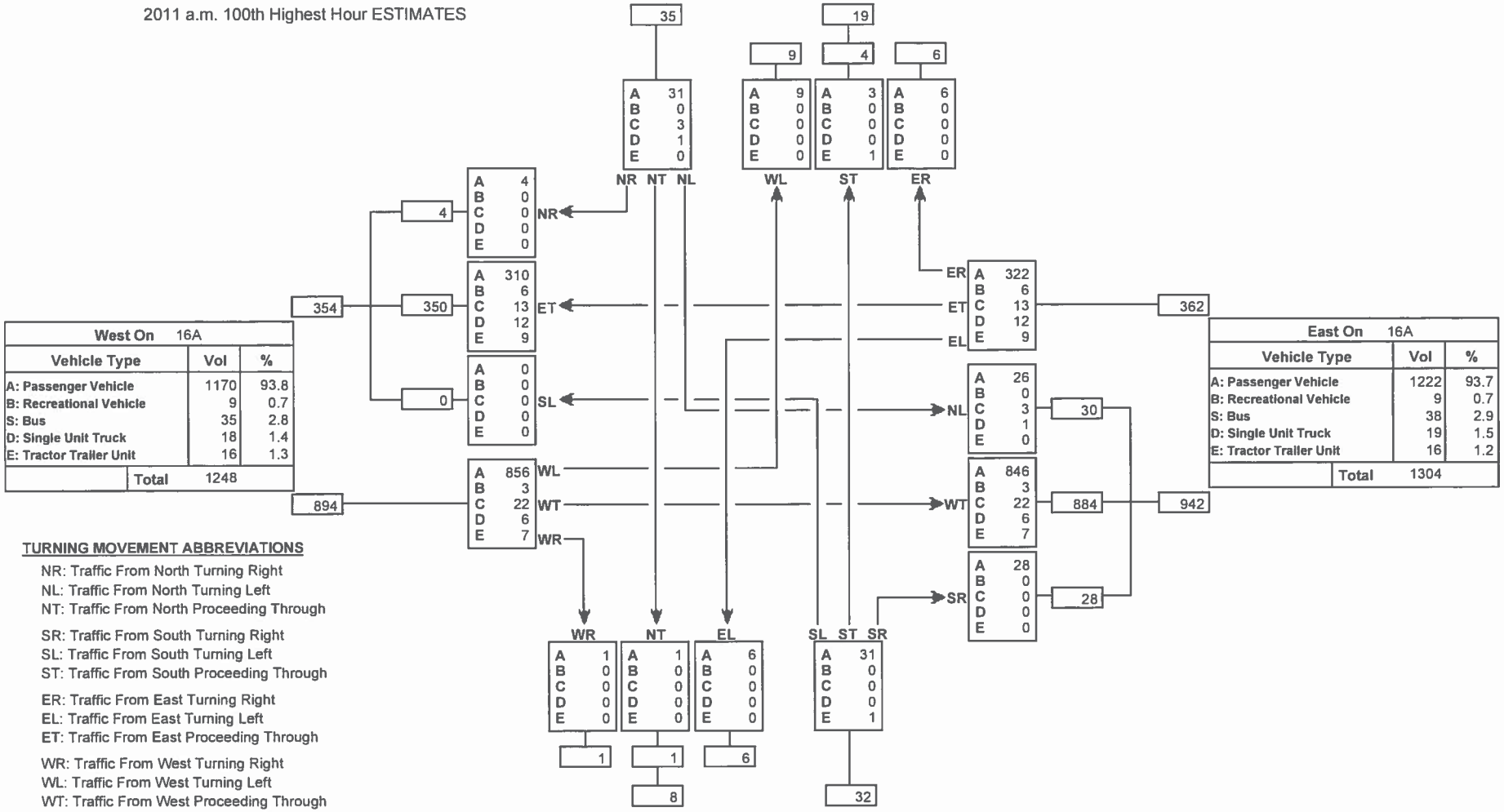
2011 a.m. 100th Highest Hour ESTIMATES

North On Rge Rd 13		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	49	90.7
B: Recreational Vehicle	0	0.0
S: Bus	3	5.6
D: Single Unit Truck	1	1.9
E: Tractor Trailer Unit	1	1.9
Total	54	

West On 16A		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	1170	93.8
B: Recreational Vehicle	9	0.7
S: Bus	35	2.8
D: Single Unit Truck	18	1.4
E: Tractor Trailer Unit	16	1.3
Total	1248	

East On 16A		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	1222	93.7
B: Recreational Vehicle	9	0.7
S: Bus	38	2.9
D: Single Unit Truck	19	1.5
E: Tractor Trailer Unit	16	1.2
Total	1304	

South On Rge Rd 13		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	39	97.5
B: Recreational Vehicle	0	0.0
S: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	1	2.5
Total	40	



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

Turning Movement Summary Diagram

Reference No.: 997185

Intersection of:
16A & ALLEN BEACH RD 33-52-1-500000000

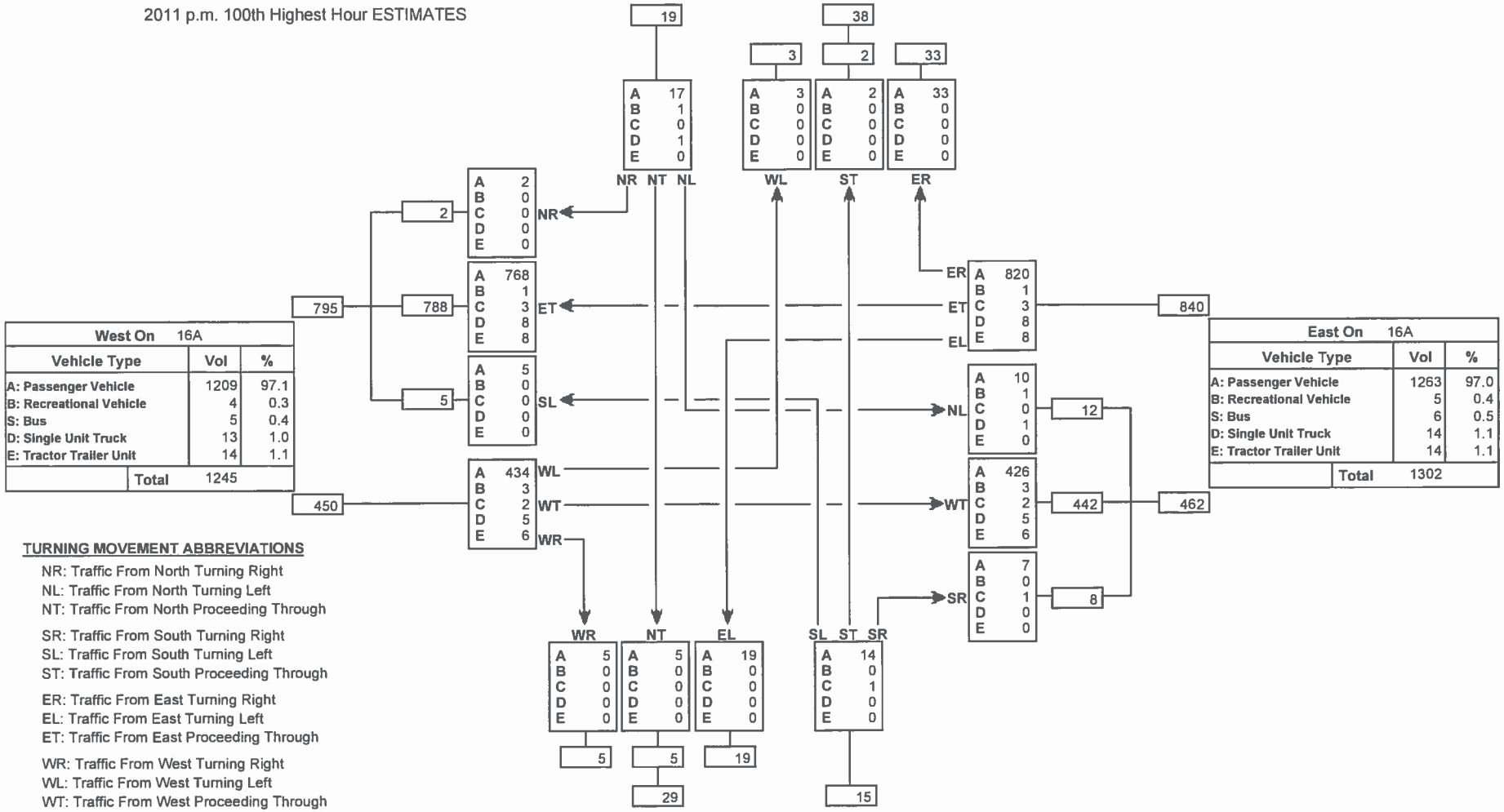
2011 p.m. 100th Highest Hour ESTIMATES

North On Rge Rd 13		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	55	96.5
B: Recreational Vehicle	1	1.8
S: Bus	0	0.0
D: Single Unit Truck	1	1.8
E: Tractor Trailer Unit	0	0.0
Total	57	

West On 16A		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	1209	97.1
B: Recreational Vehicle	4	0.3
S: Bus	5	0.4
D: Single Unit Truck	13	1.0
E: Tractor Trailer Unit	14	1.1
Total	1245	

East On 16A		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	1263	97.0
B: Recreational Vehicle	5	0.4
S: Bus	6	0.5
D: Single Unit Truck	14	1.1
E: Tractor Trailer Unit	14	1.1
Total	1302	

South On Rge Rd 13		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	43	97.7
B: Recreational Vehicle	0	0.0
S: Bus	1	2.3
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	0	0.0
Total	44	



TURNING MOVEMENT ABBREVIATIONS

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

APPENDIX B

Highway Geometric Design Guide Left Turn Warrants

Warrant Analysis for Left Turn Lanes - HWY 16 & RR 13

Highway 16 & RR 13	AM Peak Hour							PM Peak Hour						
Location	Advancing Left Turn Volume, vph	Percent Trucks in ALTV, %	Opposing Volume (V-o), vph	Left Turn Lane Required? Figure D-8.6c	Storage Required?	Extra Storage for Trucks? Table D.7.6a	Additional Storage Required in Additional to Standard Design	Advancing Left Turn Volume, vph	Percent Trucks in ALTV, %	Opposing Volume (V-o), vph	Left Turn Lane Required? Figure D-8.6c	Storage Required?	Extra Storage for Trucks? Table D.7.6a	Additional Storage Required in Additional to Standard Design
2011 Existing Traffic														
West Approach (EB)	0	0%	855	no	-	-	-	0	0%	1299	no	-	-	-
East Approach (WB)	5	13%	1444	no	-	-	-	36	0%	1034	yes	s=15	no	0
2013 Background														
West Approach (EB)	0	0%	889	no	-	-	-	0	0%	1351	no	-	-	-
East Approach (WB)	5	13%	1502	no	-	-	-	37	0%	1075	yes	s=15	no	0
2013 Total														
West Approach (EB)	0	0%	899	no	-	-	-	0	0%	1361	no	-	-	-
East Approach (WB)	15	13%	1503	yes	s=15	s=10	0	47	2%	1076	yes	s=25	no	0

Notes:

WB left AM % HV = ((25% * 5veh back)+(5%*10veh site))/(5veh back +10veh site gen) = 13%
WB left PM % HV = ((0% * 37veh back)+(5%*10veh site))/(37veh back +10veh site gen) = 2%

Warrant Analysis for Left Turn Lanes - HWY 16A & RR 13

Highway 16A & RR 13	AM Peak Hour							PM Peak Hour						
Location	Advancing Left Turn Volume, vph	Percent Trucks in ALTV, %	Opposing Volume (V-o), vph	Left Turn Lane Required? Figure D-8.6c	Storage Required?	Extra Storage for Trucks? Table D.7.6a	Additional Storage Required in Additional to Standard Design	Advancing Left Turn Volume, vph	Percent Trucks in ALTV, %	Opposing Volume (V-o), vph	Left Turn Lane Required? Figure D-8.6c	Storage Required?	Extra Storage for Trucks? Table D.7.6a	Additional Storage Required in Additional to Standard Design
2011 Existing Traffic														
West Approach (EB)	9	0%	362	no	-	-	-	3	0%	840	no	-	-	-
East Approach (WB)	6	0%	894	no	-	-	-	19	4%	450	no	-	-	-
2013 Background														
West Approach (EB)	9	0%	376	no	-	-	-	3	0%	874	no	-	-	-
East Approach (WB)	6	0%	929	no	-	-	-	20	4%	468	no	-	-	-
2013 Total														
West Approach (EB)	9	0%	384	no	-	-	-	3	0%	882	no	-	-	-
East Approach (WB)	6	0%	929	no	-	-	-	20	4%	468	no	-	-	-
2033 Background														
West Approach (EB)	13	0%	522	no	-	-	-	4	0%	1210	no	-	-	-
East Approach (WB)	9	0%	1287	no	-	-	-	27	4%	647	no	-	-	-
2033 Total														
West Approach (EB)	14	0%	532	no	-	-	-	5	0%	1220	no	-	-	-
East Approach (WB)	9	0%	1288	no	-	-	-	27	4%	648	no	-	-	-

Notes:
EB 2033 assumes 1HV / 14 total

APPENDIX C

TAC Signal Warrants

Parkland County - Traffic Signal Warrant Analysis

Main Street (name)	**Highway 16**	**Direction (EW or NS)**	**EW**	**Road Authority:**	**Parkland County**
Side Street (name)	**RR 13**	**Direction (EW or NS)**	**NS**	**City:**	**Parkland County**
Quadrant / Int #		**Comments**	**2011 Existing Volumes**	**Analysis Date:**	**2012 May 27, Sun**
for Warrant Calculation Results, please hit 'Page Down'	**CHECK SHEET**			**Count Date:**	**2012 May 27, Sun**
				Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Highway 16	WB		1	1			1	2,500	2
Highway 16	EB	1		2			1	2,500	2
RR 13	NB				1				
RR 13	SB				1				
Are the RR 13 NB right turns significantly impeded by through movements? (y/n)							n		
Are the RR 13 SB right turns significantly impeded by through movements? (y/n)							n		

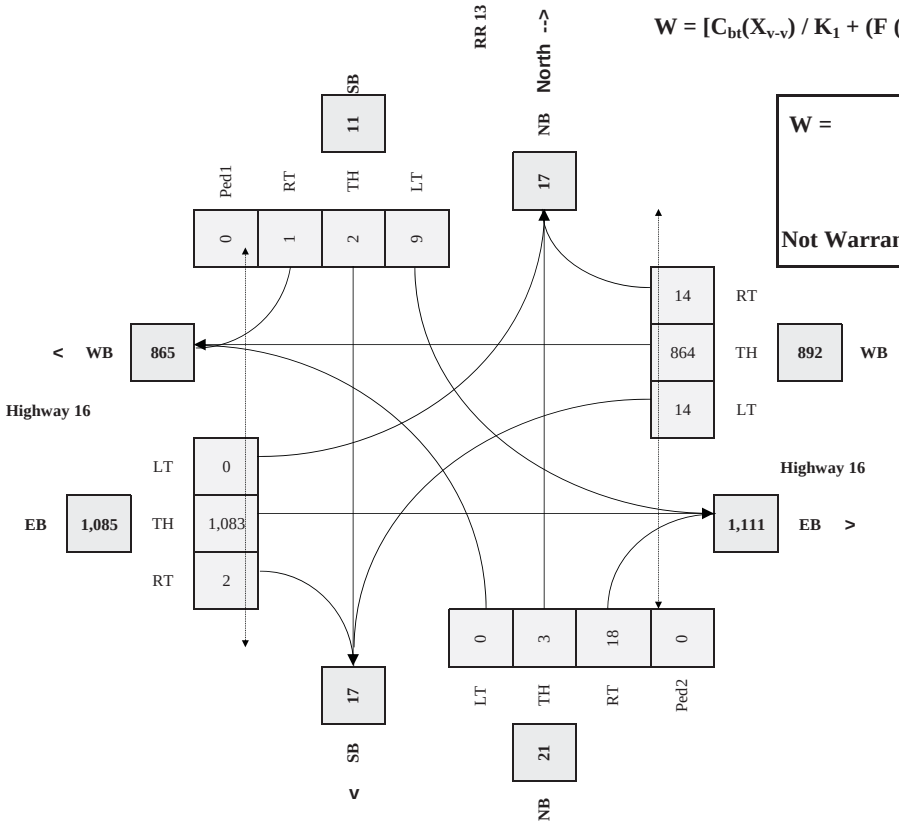
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	27,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Highway 16	EW	110	24.0%	n	22.0
RR 13	NS		4.0%	n	

Set Peak Hours

Traffic Input	**NB**			**SB**			**WB**			**EB**			**Ped1 NS**	**Ped2 NS**	**Ped3 EW**	**Ped4 EW**
	LT	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**W Side**	**E Side**	**N Side**	**S Side**
7:00 - 8:00	0	6	65	26	6	0	8	1590	13	0	2540	2	0	0	0	0
8:00 - 9:00													0	0	0	0
11:30 - 12:30	0	8	20	10	4	0	11	1439	23	0	1782	4	0	0	0	0
12:30 - 13:30													0	0	0	0
16:00 - 17:00	0	6	23	19	0	3	65	2156	47	0	2178	4	0	0	0	0
17:00 - 18:00													0	0	0	0
Total (6-hour peak)	**0**	**20**	**108**	**55**	**10**	**3**	**84**	**5,185**	**83**	**0**	**6,500**	**10**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**0**	**3**	**18**	**9**	**2**	**1**	**14**	**864**	**14**	**0**	**1,083**	**2**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$

W =	**31**	**31**	**0**
		Veh	***Ped***

Not Warranted - Vs<75

RESET SHEET

Parkland County - Traffic Signal Warrant Analysis

Main Street (name)	**Highway 16**	**Direction (EW or NS)**	**EW**
Side Street (name)	**RR 13**	**Direction (EW or NS)**	**NS**
Quadrant / Int #		**Comments**	**2013 Background Volumes**
for Warrant Calculation Results, please hit 'Page Down'	**CHECK SHEET**		

Road Authority:	**Parkland County**
City:	**Parkland County**
Analysis Date:	**2012 May 28, Mon**
Count Date:	**2012 May 28, Mon**
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Highway 16	WB		1	1			1	2,500	2
Highway 16	EB	1		2			1	2,500	2
RR 13	NB				1				
RR 13	SB				1				
Are the RR 13 NB right turns significantly impeded by through movements? (y/n)							n		
Are the RR 13 SB right turns significantly impeded by through movements? (y/n)							n		

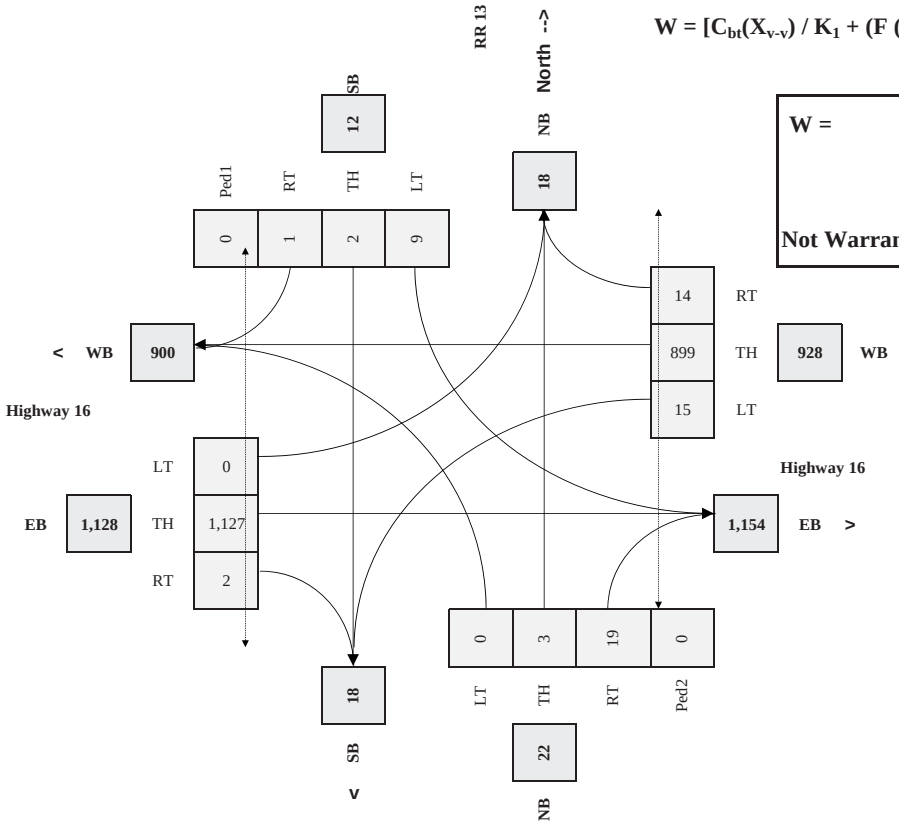
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	27,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Highway 16	EW	110	24.0%	n	22.0
RR 13	NS		4.0%	n	

Set Peak Hours

Traffic Input	**NB**			**SB**			**WB**			**EB**			**Ped1 NS**	**Ped2 NS**	**Ped3 EW**	**Ped4 EW**
	LT	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**W Side**	**E Side**	**N Side**	**S Side**
7:00 - 8:00	0	6	67	27	6	0	8	1654	13	0	2642	2	0	0	0	0
8:00 - 9:00													0	0	0	0
11:30 - 12:30	0	8	21	10	4	0	12	1497	24	0	1853	4	0	0	0	0
12:30 - 13:30													0	0	0	0
16:00 - 17:00	0	6	23	19	0	3	67	2243	49	0	2264	4	0	0	0	0
17:00 - 18:00													0	0	0	0
Total (6-hour peak)	**0**	**20**	**111**	**56**	**10**	**3**	**87**	**5,394**	**86**	**0**	**6,759**	**10**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**0**	**3**	**19**	**9**	**2**	**1**	**15**	**899**	**14**	**0**	**1,127**	**2**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$

W =	**33**	**33**	**0**
		Veh	***Ped***

Not Warranted - Vs<75

RESET SHEET

Parkland County - Traffic Signal Warrant Analysis

Main Street (name)	**Highway 16**	**Direction (EW or NS)**	**EW**
Side Street (name)	**RR 13**	**Direction (EW or NS)**	**NS**
Quadrant / Int #		**Comments**	**2013 Total Volumes**
for Warrant Calculation Results, please hit 'Page Down'	**CHECK SHEET**		

Road Authority:	**Parkland County**
City:	**Parkland County**
Analysis Date:	**2012 May 28, Mon**
Count Date:	**2012 May 28, Mon**
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Highway 16	WB		1	1			1	2,500	2
Highway 16	EB	1		2			1	2,500	2
RR 13	NB				1				
RR 13	SB				1				
Are the RR 13 NB right turns significantly impeded by through movements? (y/n)							n		
Are the RR 13 SB right turns significantly impeded by through movements? (y/n)							n		

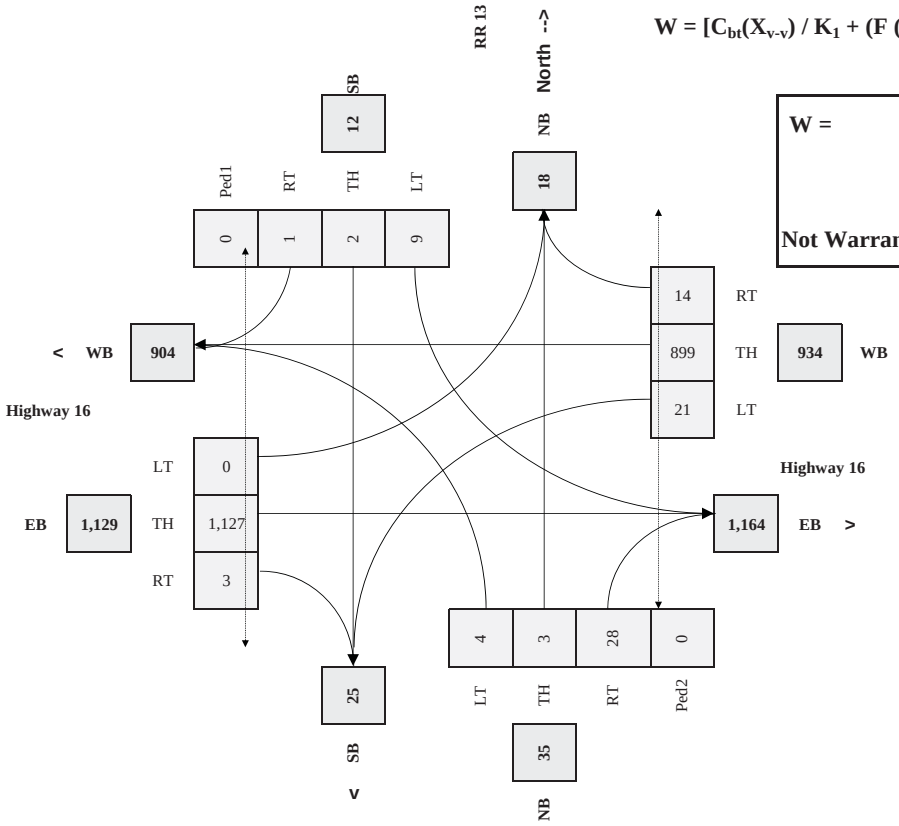
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	27,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Highway 16	EW	110	24.0%	n	22.0
RR 13	NS		4.0%	n	

Set Peak Hours

Traffic Input	**NB**			**SB**			**WB**			**EB**			**Ped1 NS**	**Ped2 NS**	**Ped3 EW**	**Ped4 EW**
	LT	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**W Side**	**E Side**	**N Side**	**S Side**
7:00 - 8:00	2	6	77	27	6	0	23	1654	13	0	2642	4	0	0	0	0
8:00 - 9:00													0	0	0	0
11:30 - 12:30	16	8	30	10	4	0	17	1497	24	0	1853	7	0	0	0	0
12:30 - 13:30													0	0	0	0
16:00 - 17:00	6	6	59	19	0	3	85	2243	49	0	2264	6	0	0	0	0
17:00 - 18:00													0	0	0	0
Total (6-hour peak)	**24**	**20**	**166**	**56**	**10**	**3**	**125**	**5,394**	**86**	**0**	**6,759**	**17**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**4**	**3**	**28**	**9**	**2**	**1**	**21**	**899**	**14**	**0**	**1,127**	**3**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$

W =	**47**	**47**	**0**
		Veh	***Ped***

Not Warranted - Vs<75

RESET SHEET

Parkland County - Traffic Signal Warrant Analysis

Main Street (name)	**Highway 16A**	**Direction (EW or NS)**	**EW**	**Road Authority:**	**Parkland County**
Side Street (name)	**RR 13**	**Direction (EW or NS)**	**NS**	**City:**	**Parkland County**
Quadrant / Int #		**Comments**	**2011 Existing Volumes**	**Analysis Date:**	**2012 May 27, Sun**
for Warrant Calculation Results, please hit 'Page Down'	**CHECK SHEET**			**Count Date:**	**2009 May 27, Wed**
				Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Highway 16A	WB	1		1		1		2,500	2
Highway 16A	EB		1	1			1	2,500	2
RR 13	NB				1				
RR 13	SB				1				
Are the RR 13 NB right turns significantly impeded by through movements? (y/n)							n		
Are the RR 13 SB right turns significantly impeded by through movements? (y/n)							n		

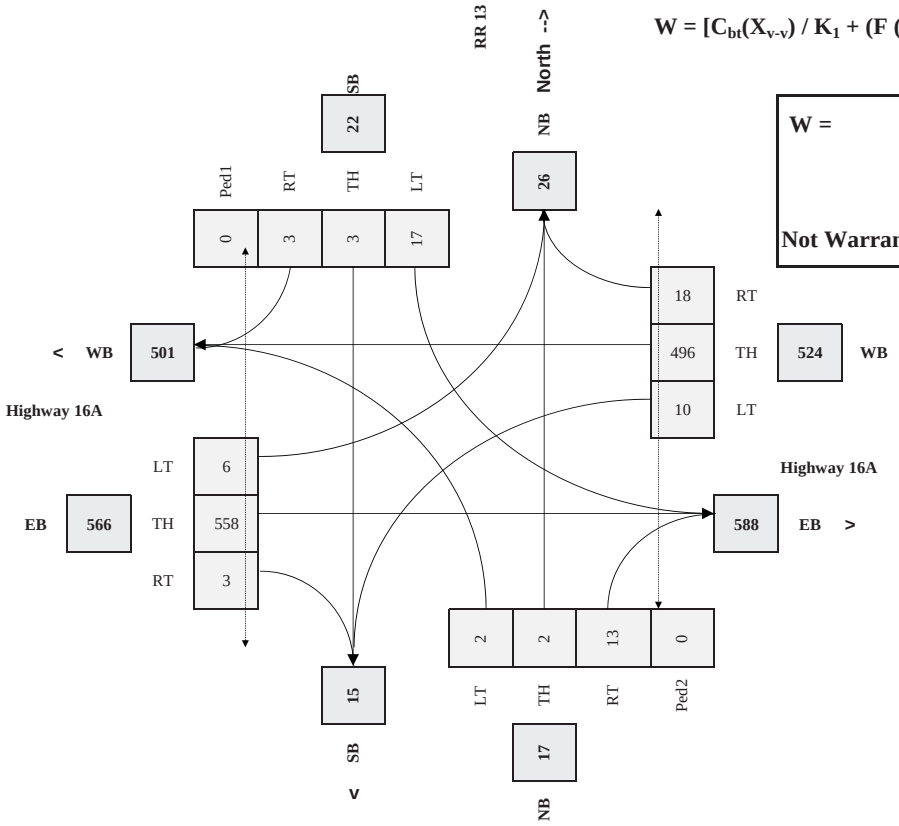
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	27,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Highway 16A	EW	100	5.0%	n	15.0
RR 13	NS		4.0%	n	

Set Peak Hours

Traffic Input	**NB**			**SB**			**WB**			**EB**			**Ped1 NS**	**Ped2 NS**	**Ped3 EW**	**Ped4 EW**
	LT	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**W Side**	**E Side**	**N Side**	**S Side**
7:00 - 8:00	0	7	44	50	1	5	12	658	12	20	1494	2	0	0	0	0
8:00 - 9:00													0	0	0	0
11:30 - 12:30	5	2	20	32	5	6	17	876	37	10	1008	4	0	0	0	0
12:30 - 13:30													0	0	0	0
16:00 - 17:00	8	3	12	21	9	4	29	1442	58	6	844	9	0	0	0	0
17:00 - 18:00													0	0	0	0
Total (6-hour peak)	**13**	**12**	**76**	**103**	**15**	**15**	**58**	**2,976**	**107**	**36**	**3,346**	**15**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**2**	**2**	**13**	**17**	**3**	**3**	**10**	**496**	**18**	**6**	**558**	**3**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\ (X_{v\text{-}p})\ L) / K_2] \times C_i$$

W =	**16**	**16**	**0**
		Veh	***Ped***

Not Warranted - Vs<75

RESET SHEET

Parkland County - Traffic Signal Warrant Analysis

Main Street (name)	**Highway 16A**	**Direction (EW or NS)**	**EW**	**Road Authority:**	**Parkland County**
Side Street (name)	**RR 13**	**Direction (EW or NS)**	**NS**	**City:**	**Parkland County**
Quadrant / Int #		**Comments**	**2013 Background Volumes**	**Analysis Date:**	**2012 May 28, Mon**
for Warrant Calculation Results, please hit 'Page Down'	**CHECK SHEET**			**Count Date:**	**2012 May 28, Mon**
				Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Highway 16A	WB	1		1		1		2,500	2
Highway 16A	EB		1	1			1	2,500	2
RR 13	NB				1				
RR 13	SB				1				
Are the RR 13 NB right turns significantly impeded by through movements? (y/n)							n		
Are the RR 13 SB right turns significantly impeded by through movements? (y/n)							n		

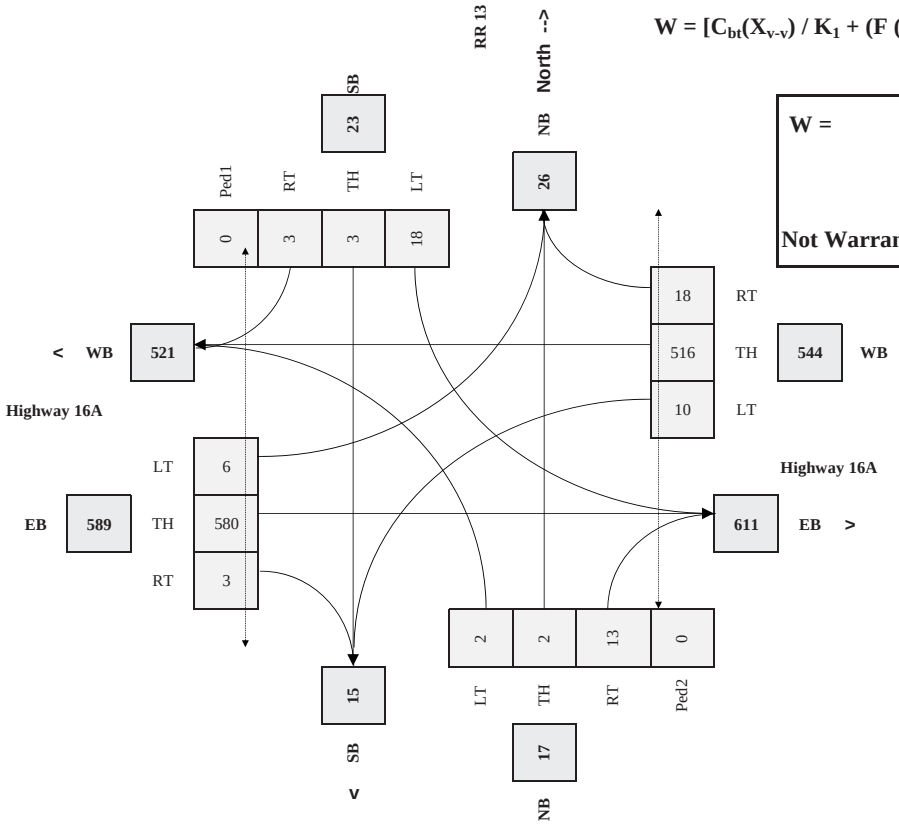
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	27,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Highway 16A	EW	100	5.0%	n	15.0
RR 13	NS		4.0%	n	

Set Peak Hours

Traffic Input	**NB**			**SB**			**WB**			**EB**			**Ped1** **NS**	**Ped2** **NS**	**Ped3** **EW**	**Ped4** **EW**
	LT	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**W Side**	**E Side**	**N Side**	**S Side**
7:00 - 8:00	0	7	46	52	1	5	12	684	12	20	1553	2	0	0	0	0
8:00 - 9:00													0	0	0	0
11:30 - 12:30	5	2	20	32	5	6	17	912	38	10	1048	4	0	0	0	0
12:30 - 13:30													0	0	0	0
16:00 - 17:00	8	3	12	21	9	4	30	1501	60	6	879	9	0	0	0	0
17:00 - 18:00													0	0	0	0
Total (6-hour peak)	**13**	**12**	**78**	**105**	**15**	**15**	**59**	**3,097**	**110**	**36**	**3,480**	**15**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**2**	**2**	**13**	**18**	**3**	**3**	**10**	**516**	**18**	**6**	**580**	**3**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$

W =	**17**	**17**	**0**
		Veh	***Ped***

Not Warranted - Vs<75

RESET SHEET

Parkland County - Traffic Signal Warrant Analysis

Main Street (name)	**Highway 16A**	**Direction (EW or NS)**	**EW**
Side Street (name)	**RR 13**	**Direction (EW or NS)**	**NS**
Quadrant / Int #		**Comments**	**2013 Total Traffic**
for Warrant Calculation Results, please hit 'Page Down'	**CHECK SHEET**		

Road Authority:	**Parkland County**
City:	**Parkland County**
Analysis Date:	**2012 May 28, Mon**
Count Date:	**2012 May 28, Mon**
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Highway 16A	WB	1		1		1		2,500	2
Highway 16A	EB		1	1			1	2,500	2
RR 13	NB				1				
RR 13	SB				1				
Are the RR 13 NB right turns significantly impeded by through movements? (y/n)							n		
Are the RR 13 SB right turns significantly impeded by through movements? (y/n)							n		

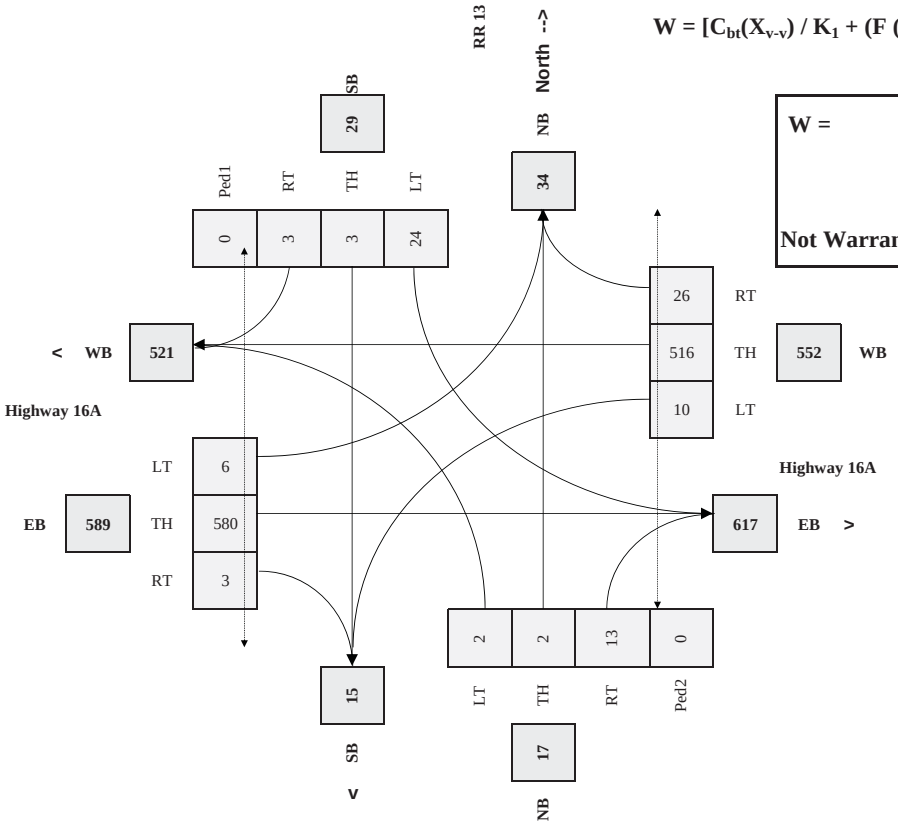
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	27,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Highway 16A	EW	100	5.0%	n	15.0
RR 13	NS		4.0%	n	

Set Peak Hours

Traffic Input	**NB**			**SB**			**WB**			**EB**			**Ped1 NS**	**Ped2 NS**	**Ped3 EW**	**Ped4 EW**
	LT	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**W Side**	**E Side**	**N Side**	**S Side**
7:00 - 8:00	0	7	46	58	1	5	12	684	28	20	1553	2	0	0	0	0
8:00 - 9:00													0	0	0	0
11:30 - 12:30	5	2	20	44	5	6	17	912	53	10	1048	4	0	0	0	0
12:30 - 13:30													0	0	0	0
16:00 - 17:00	8	3	12	40	9	4	30	1501	74	6	879	9	0	0	0	0
17:00 - 18:00													0	0	0	0
Total (6-hour peak)	**13**	**12**	**78**	**142**	**15**	**15**	**59**	**3,097**	**155**	**36**	**3,480**	**15**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**2**	**2**	**13**	**24**	**3**	**3**	**10**	**516**	**26**	**6**	**580**	**3**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$

W =	**19**	**19**	**0**
		Veh	***Ped***

Not Warranted - Vs<75

RESET SHEET

Parkland County - Traffic Signal Warrant Analysis

Main Street (name)	**Highway 16A**	**Direction (EW or NS)**	**EW**	**Road Authority:**	**Parkland County**
Side Street (name)	**RR 13**	**Direction (EW or NS)**	**NS**	**City:**	**Parkland County**
Quadrant / Int #		**Comments**	**2033 Background Volumes**	**Analysis Date:**	**2012 May 28, Mon**
for Warrant Calculation Results, please hit 'Page Down'	**CHECK SHEET**			**Count Date:**	**2012 May 28, Mon**
				Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Highway 16A	WB	1		1		1		2,500	2
Highway 16A	EB		1	1			1	2,500	2
RR 13	NB				1				
RR 13	SB				1				
Are the RR 13 NB right turns significantly impeded by through movements? (y/n)							n		
Are the RR 13 SB right turns significantly impeded by through movements? (y/n)							n		

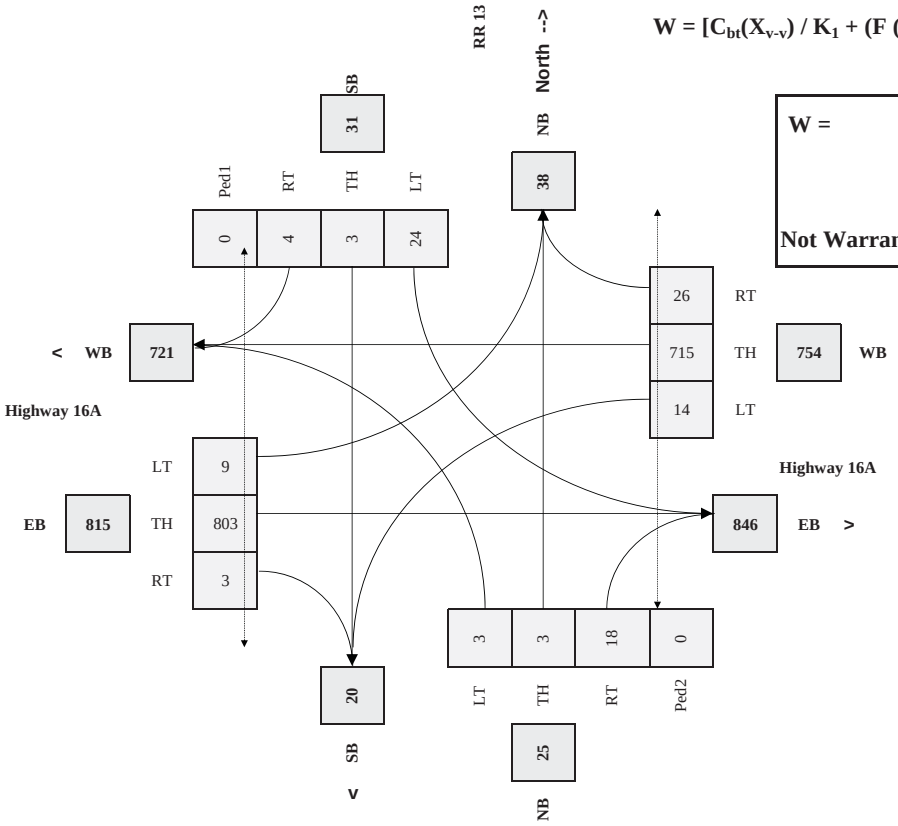
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	27,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Highway 16A	EW	100	5.0%	n	15.0
RR 13	NS		4.0%	n	

Set Peak Hours

Traffic Input	**NB**			**SB**			**WB**			**EB**			**Ped1** **NS**	**Ped2** **NS**	**Ped3** **EW**	**Ped4** **EW**
	LT	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**W Side**	**E Side**	**N Side**	**S Side**
7:00 - 8:00	0	11	63	72	1	8	18	948	18	29	2151	2	0	0	0	0
8:00 - 9:00													0	0	0	0
11:30 - 12:30	7	3	29	45	6	9	24	1262	54	15	1451	5	0	0	0	0
12:30 - 13:30													0	0	0	0
16:00 - 17:00	11	5	18	29	12	6	41	2077	84	8	1215	13	0	0	0	0
17:00 - 18:00													0	0	0	0
Total (6-hour peak)	**18**	**19**	**110**	**146**	**19**	**23**	**83**	**4,287**	**156**	**52**	**4,817**	**20**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**3**	**3**	**18**	**24**	**3**	**4**	**14**	**715**	**26**	**9**	**803**	**3**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$

W =	**34**	**34**	**0**
		Veh	***Ped***

Not Warranted - Vs<75

RESET SHEET

Parkland County - Traffic Signal Warrant Analysis

Main Street (name)	**Highway 16A**	**Direction (EW or NS)**	**EW**	**Road Authority:**	**Parkland County**
Side Street (name)	**RR 13**	**Direction (EW or NS)**	**NS**	**City:**	**Parkland County**
Quadrant / Int #		**Comments**	**2033 Total Traffic**	**Analysis Date:**	**2012 May 28, Mon**
for Warrant Calculation Results, please hit 'Page Down'	**CHECK SHEET**			**Count Date:**	**2012 May 28, Mon**
				Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Highway 16A	WB	1		2			1	2,500	2
Highway 16A	EB		1	1			1	2,500	2
RR 13	NB				1				
RR 13	SB				1				
Are the RR 13 NB right turns significantly impeded by through movements? (y/n)							n		
Are the RR 13 SB right turns significantly impeded by through movements? (y/n)							n		

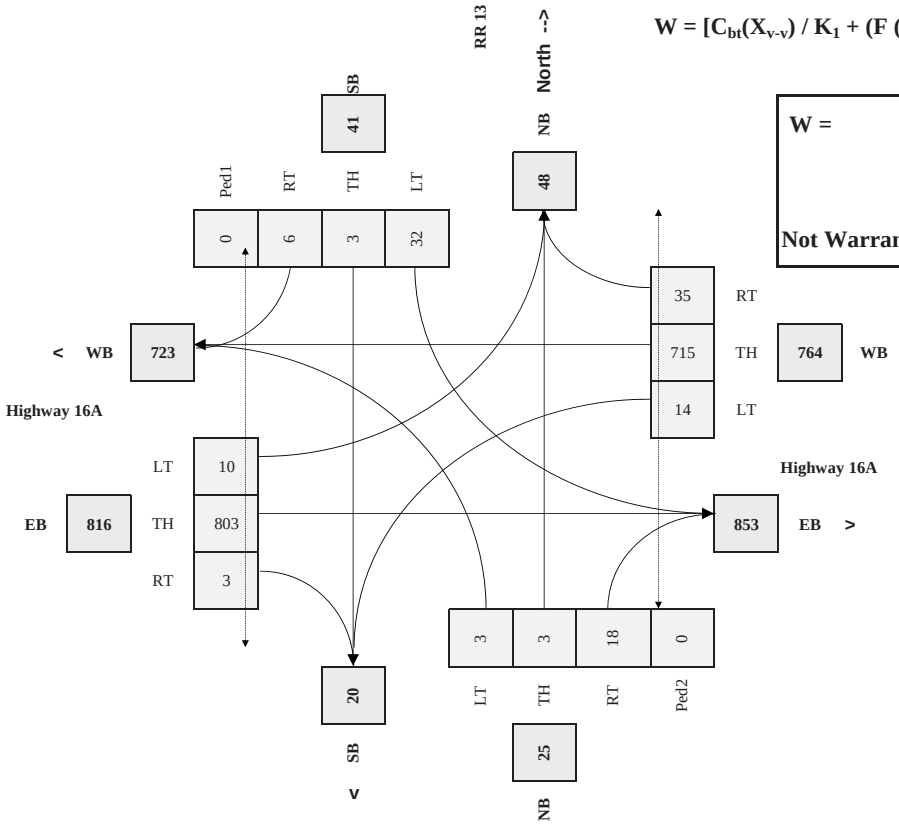
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	27,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Highway 16A	EW	100	5.0%	n	15.0
RR 13	NS		4.0%	n	

Set Peak Hours

Traffic Input	**NB**			**SB**			**WB**			**EB**			**Ped1 NS**	**Ped2 NS**	**Ped3 EW**	**Ped4 EW**
	LT	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**W Side**	**E Side**	**N Side**	**S Side**
7:00 - 8:00	0	11	63	80	1	9	18	948	38	31	2151	2	0	0	0	0
8:00 - 9:00													0	0	0	0
11:30 - 12:30	7	3	29	59	6	13	24	1262	72	16	1451	5	0	0	0	0
12:30 - 13:30													0	0	0	0
16:00 - 17:00	11	5	18	54	12	11	41	2077	102	10	1215	13	0	0	0	0
17:00 - 18:00													0	0	0	0
Total (6-hour peak)	**18**	**19**	**110**	**193**	**19**	**33**	**83**	**4,287**	**212**	**57**	**4,817**	**20**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**3**	**3**	**18**	**32**	**3**	**6**	**14**	**715**	**35**	**10**	**803**	**3**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$

W =	**39**	**39**	**0**
		Veh	***Ped***

Not Warranted - Vs<75

RESET SHEET

Parkland County - Traffic Signal Warrant Analysis

Main Street (name)	**RR 13**	**Direction (EW or NS)**	**NS**	**Road Authority:**	**Parkland County**
Side Street (name)	**Site Access**	**Direction (EW or NS)**	**EW**	**City:**	**Parkland County**
Quadrant / Int #		**Comments**	**2013 Total Volumes**	**Analysis Date:**	**2012 May 28, Mon**
for Warrant Calculation Results, please hit 'Page Down'	**CHECK SHEET**			**Count Date:**	**2012 May 28, Mon**
				Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
RR 13	NB		1					2,500	1
RR 13	SB					1		2,500	1
Site Access	WB								
Site Access	EB				1				
							n		
Are the Site Access EB right turns significantly impeded by through movements? (y/n)							n		

Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	27,000
Central Business District	(y/n)	n

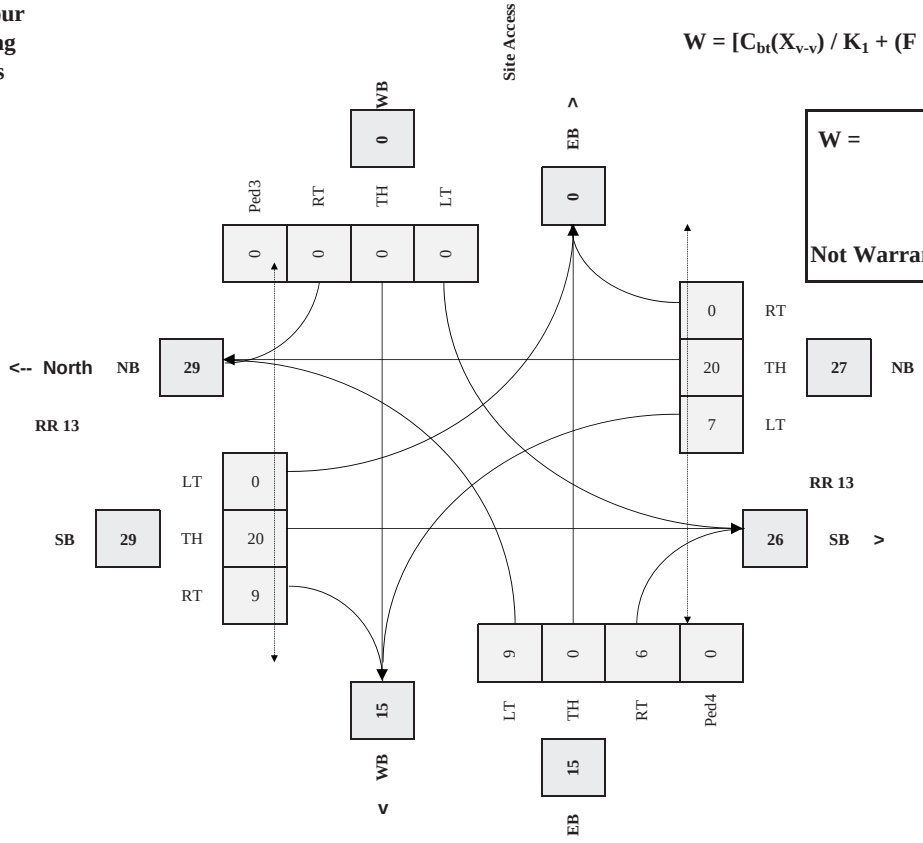
Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
RR 13	NS	80	4.0%	n	0.0
Site Access	EW		5.0%	n	

Set Peak Hours

Traffic Input	**NB**			**SB**			**WB**			**EB**			**Ped1**	**Ped2**	**Ped3**	**Ped4**
	NS			**NS**			**EW**			**EW**			**NS**	**NS**	**EW**	**EW**
	LT	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**W Side**	**E Side**	**N Side**	**S Side**
7:00 - 8:00	15	71	0	0	20	20	0	0	0	11	0	7	0	0	0	0
8:00 - 9:00													0	0	0	0
11:30 - 12:30	8	26	0	0	26	11	0	0	0	12	0	8	0	0	0	0
12:30 - 13:30													0	0	0	0
16:00 - 17:00	16	23	0	0	76	21	0	0	0	33	0	21	0	0	0	0
17:00 - 18:00													0	0	0	0
Total (6-hour peak)	**39**	**120**	**0**	**0**	**122**	**52**	**0**	**0**	**0**	**56**	**0**	**36**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**7**	**20**	**0**	**0**	**20**	**9**	**0**	**0**	**0**	**9**	**0**	**6**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$



W = **1** **1** **0**

Veh ***Ped***

Not Warranted - Vs<75

RESET SHEET

Parkland County - Traffic Signal Warrant Analysis

Main Street (name)	**RR 13**	**Direction (EW or NS)**	**NS**	**Road Authority:**	**Parkland County**
Side Street (name)	**Site Access**	**Direction (EW or NS)**	**EW**	**City:**	**Parkland County**
Quadrant / Int #		**Comments**	**2033 Total Volumes**	**Analysis Date:**	**2012 May 28, Mon**
for Warrant Calculation Results, please hit 'Page Down'	**CHECK SHEET**			**Count Date:**	**2012 May 28, Mon**
				Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
RR 13	NB		1					2,500	1
RR 13	SB					1		2,500	1
Site Access	WB								
Site Access	EB				1				
							n		
Are the Site Access EB right turns significantly impeded by through movements? (y/n)							n		

Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	27,000
Central Business District	(y/n)	n

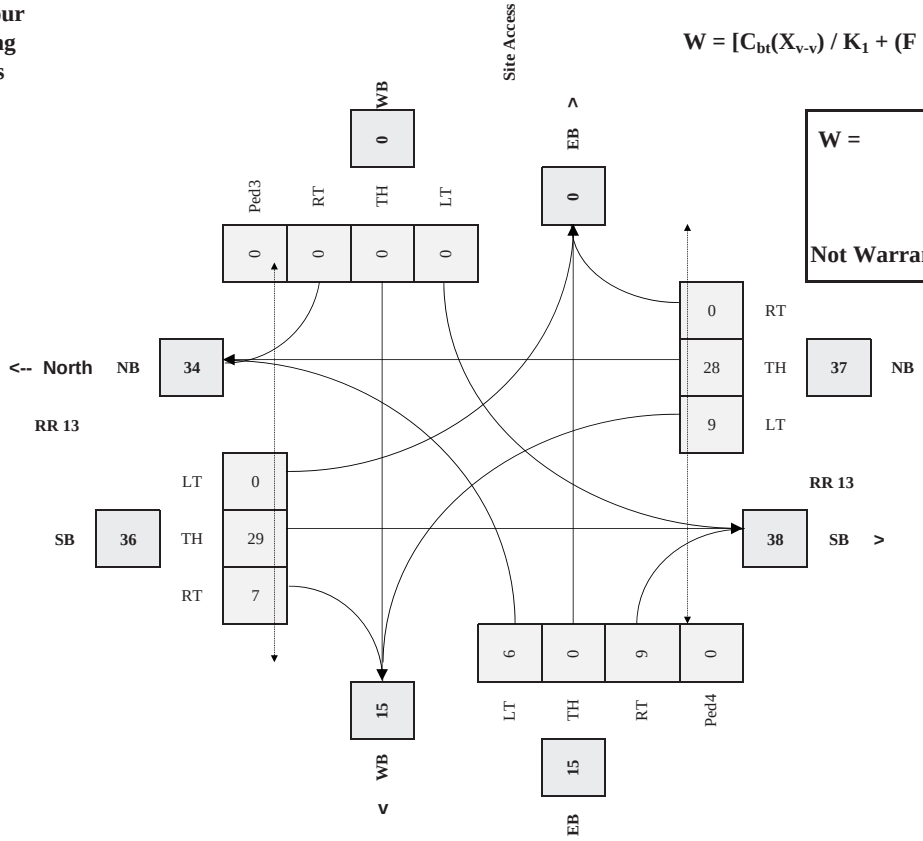
Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
RR 13	NS	80	4.0%	n	0.0
Site Access	EW		5.0%	n	

Set Peak Hours

Traffic Input	**NB**			**SB**			**WB**			**EB**			**Ped1** **NS**	**Ped2** **NS**	**Ped3** **EW**	**Ped4** **EW**
	LT	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**W Side**	**E Side**	**N Side**	**S Side**
7:00 - 8:00	20	99	0	0	30	15	0	0	0	7	0	11	0	0	0	0
8:00 - 9:00													0	0	0	0
11:30 - 12:30	11	36	0	0	37	8	0	0	0	8	0	12	0	0	0	0
12:30 - 13:30													0	0	0	0
16:00 - 17:00	21	33	0	0	107	16	0	0	0	21	0	33	0	0	0	0
17:00 - 18:00													0	0	0	0
Total (6-hour peak)	**52**	**168**	**0**	**0**	**174**	**39**	**0**	**0**	**0**	**36**	**0**	**56**	**0**	**0**	**0**	**0**
Average (6-hour peak)	**9**	**28**	**0**	**0**	**29**	**7**	**0**	**0**	**0**	**6**	**0**	**9**	**0**	**0**	**0**	**0**

Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\,(X_{v\text{-}p})\,L) / K_2] \times C_i$$



W =	**1**	**1**	**0**
		Veh	***Ped***

Not Warranted - Vs<75

RESET SHEET

APPENDIX D

Synchro 7.0 Printouts

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1443	1	5	846	4	0	3	34	19	5	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.96	0.96	1.00	0.98	0.96	0.96	0.96	0.69	0.70	0.96	0.96
Hourly flow rate (vph)	0	1503	1	5	863	4	0	3	49	27	5	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		2			2							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	867			1504			1947	2381	752	1676	2377	432
vC1, stage 1 conf vol							1503	1503		873	873	
vC2, stage 2 conf vol							444	877		802	1504	
vCu, unblocked vol	867			1504			1947	2381	752	1676	2377	432
tC, single (s)	4.1			4.6			7.5	6.5	6.9	7.5	7.0	6.9
tC, 2 stage (s)							6.5	5.5		6.5	6.0	
tF (s)	2.2			2.5			3.5	4.0	3.3	3.5	4.2	3.3
p0 queue free %	100			99			100	98	86	87	96	100
cM capacity (veh/h)	772			343			122	160	353	209	127	572

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	0	752	752	1	293	576	4	52	32
Volume Left	0	0	0	0	5	0	0	0	27
Volume Right	0	0	0	1	0	0	4	49	0
cSH	1700	1700	1700	1700	343	1700	1700	329	189
Volume to Capacity	0.00	0.44	0.44	0.00	0.01	0.34	0.00	0.16	0.17
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.3	0.0	0.0	4.2	4.6
Control Delay (s)	0.0	0.0	0.0	0.0	0.5	0.0	0.0	18.0	27.9
Lane LOS					A			C	D
Approach Delay (s)	0.0				0.2			18.0	27.9
Approach LOS								C	D

Intersection Summary				
Average Delay	0.8			
Intersection Capacity Utilization	54.5%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1501	1	5	880	4	0	3	35	20	5	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.96	0.96	1.00	0.98	0.96	0.96	0.96	0.69	0.70	0.96	0.96
Hourly flow rate (vph)	0	1564	1	5	898	4	0	3	51	29	5	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		2			2							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	902			1565			2025	2476	782	1742	2473	449
vC1, stage 1 conf vol							1564	1564		908	908	
vC2, stage 2 conf vol							462	912		834	1565	
vCu, unblocked vol	902			1565			2025	2476	782	1742	2473	449
tC, single (s)	4.1			4.6			7.5	6.5	6.9	7.5	7.0	6.9
tC, 2 stage (s)							6.5	5.5		6.5	6.0	
tF (s)	2.2			2.5			3.5	4.0	3.3	3.5	4.2	3.3
p0 queue free %	100			98			100	98	85	85	96	100
cM capacity (veh/h)	749			323			112	150	337	197	118	557

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	0	782	782	1	304	599	4	54	34
Volume Left	0	0	0	0	5	0	0	0	29
Volume Right	0	0	0	1	0	0	4	51	0
cSH	1700	1700	1700	1700	323	1700	1700	314	178
Volume to Capacity	0.00	0.46	0.46	0.00	0.02	0.35	0.00	0.17	0.19
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.4	0.0	0.0	4.6	5.1
Control Delay (s)	0.0	0.0	0.0	0.0	0.6	0.0	0.0	18.8	29.8
Lane LOS					A			C	D
Approach Delay (s)	0.0				0.2			18.8	29.8
Approach LOS								C	D

Intersection Summary				
Average Delay	0.9			
Intersection Capacity Utilization	56.2%	ICU Level of Service		B
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1501	2	15	880	4	1	3	40	20	5	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.96	0.96	1.00	0.98	0.96	0.96	0.96	0.69	0.70	0.96	0.96
Hourly flow rate (vph)	0	1564	2	15	898	4	1	3	58	29	5	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		2			2							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	902			1566			2045	2496	782	1769	2494	449
vC1, stage 1 conf vol							1564	1564		928	928	
vC2, stage 2 conf vol							482	932		841	1566	
vCu, unblocked vol	902			1566			2045	2496	782	1769	2494	449
tC, single (s)	4.1			4.6			7.5	6.5	6.9	7.5	7.0	6.9
tC, 2 stage (s)							6.5	5.5		6.5	6.0	
tF (s)	2.2			2.5			3.5	4.0	3.3	3.5	4.2	3.3
p0 queue free %	100			95			99	98	83	84	95	100
cM capacity (veh/h)	749			323			111	148	337	184	109	557

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	0	782	782	2	314	599	4	62	34
Volume Left	0	0	0	0	15	0	0	1	29
Volume Right	0	0	0	2	0	0	4	58	0
cSH	1700	1700	1700	1700	323	1700	1700	307	166
Volume to Capacity	0.00	0.46	0.46	0.00	0.05	0.35	0.00	0.20	0.20
Queue Length 95th (m)	0.0	0.0	0.0	0.0	1.1	0.0	0.0	5.6	5.6
Control Delay (s)	0.0	0.0	0.0	0.0	1.7	0.0	0.0	19.7	32.1
Lane LOS					A			C	D
Approach Delay (s)	0.0				0.6			19.7	32.1
Approach LOS								C	D

Intersection Summary				
Average Delay	1.1			
Intersection Capacity Utilization	56.2%	ICU Level of Service		B
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1032	2	36	1239	24	0	3	9	10	0	1
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.95	0.50	0.67	0.98	0.96	0.96	0.50	0.96	0.35	0.96	0.96
Hourly flow rate (vph)	0	1086	4	54	1264	25	0	6	9	29	0	1
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		2			2							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1289			1090			1827	2483	543	1927	2462	632
vC1, stage 1 conf vol							1086	1086		1372	1372	
vC2, stage 2 conf vol							741	1397		556	1090	
vCu, unblocked vol	1289			1090			1827	2483	543	1927	2462	632
tC, single (s)	4.1			4.1			7.6	6.6	7.0	7.6	6.6	7.0
tC, 2 stage (s)							6.6	5.6		6.6	5.6	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			92			100	96	98	78	100	100
cM capacity (veh/h)	534			636			187	152	479	129	144	418

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	0	543	543	4	475	843	25	15	30
Volume Left	0	0	0	0	54	0	0	0	29
Volume Right	0	0	0	4	0	0	25	9	1
cSH	1700	1700	1700	1700	636	1700	1700	260	132
Volume to Capacity	0.00	0.32	0.32	0.00	0.08	0.50	0.01	0.06	0.22
Queue Length 95th (m)	0.0	0.0	0.0	0.0	2.1	0.0	0.0	1.4	6.2
Control Delay (s)	0.0	0.0	0.0	0.0	2.4	0.0	0.0	19.7	39.9
Lane LOS					A			C	E
Approach Delay (s)	0.0				0.8			19.7	39.9
Approach LOS								C	E

Intersection Summary				
Average Delay	1.1			
Intersection Capacity Utilization	74.2%	ICU Level of Service		D
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1073	2	37	1289	25	0	3	9	10	0	1
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.95	0.50	0.67	0.98	0.96	0.96	0.50	0.96	0.35	0.96	0.96
Hourly flow rate (vph)	0	1129	4	55	1315	26	0	6	9	29	0	1
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		2			2							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1341			1133			1899	2581	565	2003	2559	658
vC1, stage 1 conf vol							1129	1129		1426	1426	
vC2, stage 2 conf vol							769	1452		577	1133	
vCu, unblocked vol	1341			1133			1899	2581	565	2003	2559	658
tC, single (s)	4.1			4.1			7.6	6.6	7.0	7.6	6.6	7.0
tC, 2 stage (s)							6.6	5.6		6.6	5.6	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			91			100	96	98	76	100	100
cM capacity (veh/h)	510			612			176	142	463	119	134	402

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	0	565	565	4	494	877	26	15	30
Volume Left	0	0	0	0	55	0	0	0	29
Volume Right	0	0	0	4	0	0	26	9	1
cSH	1700	1700	1700	1700	612	1700	1700	246	122
Volume to Capacity	0.00	0.33	0.33	0.00	0.09	0.52	0.02	0.06	0.24
Queue Length 95th (m)	0.0	0.0	0.0	0.0	2.3	0.0	0.0	1.5	6.8
Control Delay (s)	0.0	0.0	0.0	0.0	2.5	0.0	0.0	20.6	43.7
Lane LOS					A			C	E
Approach Delay (s)	0.0				0.9			20.6	43.7
Approach LOS								C	E

Intersection Summary				
Average Delay	1.1			
Intersection Capacity Utilization	76.3%	ICU Level of Service		D
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	1073	3	47	1289	25	3	3	23	10	0	1
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.95	0.50	0.67	0.98	0.96	0.96	0.50	0.96	0.35	0.96	0.96
Hourly flow rate (vph)	0	1129	6	70	1315	26	3	6	24	29	0	1
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		2			2							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1341			1135			1928	2611	565	2047	2591	658
vC1, stage 1 conf vol							1129	1129		1456	1456	
vC2, stage 2 conf vol							799	1482		592	1135	
vCu, unblocked vol	1341			1135			1928	2611	565	2047	2591	658
tC, single (s)	4.1			4.1			7.6	6.6	7.0	7.6	6.6	7.0
tC, 2 stage (s)							6.6	5.6		6.6	5.6	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			89			98	96	95	74	100	100
cM capacity (veh/h)	510			611			172	136	463	110	125	402

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	0	565	565	6	509	877	26	33	30
Volume Left	0	0	0	0	70	0	0	3	29
Volume Right	0	0	0	6	0	0	26	24	1
cSH	1700	1700	1700	1700	611	1700	1700	290	113
Volume to Capacity	0.00	0.33	0.33	0.00	0.11	0.52	0.02	0.11	0.26
Queue Length 95th (m)	0.0	0.0	0.0	0.0	2.9	0.0	0.0	2.9	7.4
Control Delay (s)	0.0	0.0	0.0	0.0	3.2	0.0	0.0	19.0	47.7
Lane LOS					A			C	E
Approach Delay (s)	0.0				1.1			19.0	47.7
Approach LOS								C	E

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	79.9%	ICU Level of Service	D	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	9	884	1	6	350	6	0	4	28	30	1	4
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.96	0.96	0.75	0.85	0.75	0.25	0.50	0.86	0.96	0.96	0.96
Hourly flow rate (vph)	9	921	1	8	412	8	0	8	33	31	1	4
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		1			1							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	420			922			1166	1375	460	947	1372	210
vC1, stage 1 conf vol							940	940		432	432	
vC2, stage 2 conf vol							227	436		516	941	
vCu, unblocked vol	420			922			1166	1375	460	947	1372	210
tC, single (s)	4.1			4.1			7.6	6.8	7.0	7.8	6.6	7.0
tC, 2 stage (s)							6.6	5.8		6.8	5.6	
tF (s)	2.2			2.2			3.5	4.2	3.3	3.6	4.0	3.3
p0 queue free %	99			99			100	96	94	89	100	99
cM capacity (veh/h)	1136			736			230	228	542	297	246	790

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	316	614	1	8	275	145	41	36
Volume Left	9	0	0	8	0	0	0	31
Volume Right	0	0	1	0	0	8	33	4
cSH	1136	1700	1700	736	1700	1700	426	318
Volume to Capacity	0.01	0.36	0.00	0.01	0.16	0.09	0.10	0.11
Queue Length 95th (m)	0.2	0.0	0.0	0.3	0.0	0.0	2.4	2.9
Control Delay (s)	0.3	0.0	0.0	9.9	0.0	0.0	14.3	17.8
Lane LOS	A			A			B	C
Approach Delay (s)	0.1			0.2			14.3	17.8
Approach LOS							B	C

Intersection Summary				
Average Delay	1.0			
Intersection Capacity Utilization	46.1%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	9	919	1	6	364	6	0	4	29	31	1	4
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.96	0.96	0.75	0.85	0.75	0.25	0.50	0.86	0.96	0.96	0.96
Hourly flow rate (vph)	9	957	1	8	428	8	0	8	34	32	1	4
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		1			1							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	436			958			1211	1428	479	983	1425	218
vC1, stage 1 conf vol							976	976		448	448	
vC2, stage 2 conf vol							235	452		535	977	
vCu, unblocked vol	436			958			1211	1428	479	983	1425	218
tC, single (s)	4.1			4.1			7.6	6.8	7.0	7.8	6.6	7.0
tC, 2 stage (s)							6.6	5.8		6.8	5.6	
tF (s)	2.2			2.2			3.5	4.2	3.3	3.6	4.0	3.3
p0 queue free %	99			99			100	96	94	89	100	99
cM capacity (veh/h)	1120			713			219	218	528	286	235	780

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	328	638	1	8	285	151	42	37
Volume Left	9	0	0	8	0	0	0	32
Volume Right	0	0	1	0	0	8	34	4
cSH	1120	1700	1700	713	1700	1700	415	305
Volume to Capacity	0.01	0.38	0.00	0.01	0.17	0.09	0.10	0.12
Queue Length 95th (m)	0.2	0.0	0.0	0.3	0.0	0.0	2.5	3.2
Control Delay (s)	0.3	0.0	0.0	10.1	0.0	0.0	14.7	18.4
Lane LOS	A			B			B	C
Approach Delay (s)	0.1			0.2			14.7	18.4
Approach LOS							B	C

Intersection Summary				
Average Delay	1.0			
Intersection Capacity Utilization	47.1%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	9	919	1	6	364	14	0	4	29	35	1	4
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.96	0.96	0.75	0.85	0.75	0.25	0.50	0.86	0.96	0.96	0.96
Hourly flow rate (vph)	9	957	1	8	428	19	0	8	34	36	1	4
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		1			1							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	447			958			1211	1439	479	989	1431	223
vC1, stage 1 conf vol							976	976		454	454	
vC2, stage 2 conf vol							235	463		535	977	
vCu, unblocked vol	447			958			1211	1439	479	989	1431	223
tC, single (s)	4.1			4.1			7.6	6.8	7.0	7.8	6.6	7.0
tC, 2 stage (s)							6.6	5.8		6.8	5.6	
tF (s)	2.2			2.2			3.5	4.2	3.3	3.6	4.0	3.3
p0 queue free %	99			99			100	96	94	87	100	99
cM capacity (veh/h)	1110			713			219	216	528	284	234	774

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	328	638	1	8	285	161	42	42
Volume Left	9	0	0	8	0	0	0	36
Volume Right	0	0	1	0	0	19	34	4
cSH	1110	1700	1700	713	1700	1700	414	302
Volume to Capacity	0.01	0.38	0.00	0.01	0.17	0.09	0.10	0.14
Queue Length 95th (m)	0.2	0.0	0.0	0.3	0.0	0.0	2.5	3.6
Control Delay (s)	0.3	0.0	0.0	10.1	0.0	0.0	14.7	18.8
Lane LOS	A			B			B	C
Approach Delay (s)	0.1			0.2			14.7	18.8
Approach LOS							B	C

Intersection Summary				
Average Delay	1.1			
Intersection Capacity Utilization	47.3%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	13	1273	1	9	504	9	0	6	40	43	1	6
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.96	0.96	0.75	0.85	0.75	0.25	0.50	0.86	0.96	0.96	0.96
Hourly flow rate (vph)	14	1326	1	12	593	12	0	12	47	45	1	6
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		1			1							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	605			1327			1680	1982	663	1366	1977	302
vC1, stage 1 conf vol							1353	1353		623	623	
vC2, stage 2 conf vol							327	629		743	1354	
vCu, unblocked vol	605			1327			1680	1982	663	1366	1977	302
tC, single (s)	4.1			4.1			7.6	6.8	7.0	7.8	6.6	7.0
tC, 2 stage (s)							6.6	5.8		6.8	5.6	
tF (s)	2.2			2.2			3.5	4.2	3.3	3.6	4.0	3.3
p0 queue free %	99			98			100	91	88	75	99	99
cM capacity (veh/h)	969			516			127	137	399	181	147	688

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	456	884	1	12	395	210	59	52
Volume Left	14	0	0	12	0	0	0	45
Volume Right	0	0	1	0	0	12	47	6
cSH	969	1700	1700	516	1700	1700	286	198
Volume to Capacity	0.01	0.52	0.00	0.02	0.23	0.12	0.20	0.26
Queue Length 95th (m)	0.3	0.0	0.0	0.5	0.0	0.0	5.7	7.7
Control Delay (s)	0.4	0.0	0.0	12.1	0.0	0.0	20.8	29.6
Lane LOS	A			B			C	D
Approach Delay (s)	0.1			0.2			20.8	29.6
Approach LOS							C	D

Intersection Summary				
Average Delay	1.5			
Intersection Capacity Utilization	60.5%	ICU Level of Service	B	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	14	1273	1	9	504	19	0	6	40	48	1	7
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.96	0.96	0.75	0.85	0.75	0.25	0.50	0.86	0.96	0.96	0.96
Hourly flow rate (vph)	15	1326	1	12	593	25	0	12	47	50	1	7
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		1			1							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	618			1327			1683	1997	663	1362	1973	296
vC1, stage 1 conf vol							1355	1355		617	617	
vC2, stage 2 conf vol							328	642		745	1356	
vCu, unblocked vol	618			1327			1683	1997	663	1362	1973	296
tC, single (s)	4.1			4.1			7.6	6.8	7.0	7.8	6.6	7.0
tC, 2 stage (s)							6.6	5.8		6.8	5.6	
tF (s)	2.2			2.2			3.5	4.2	3.3	3.6	4.0	3.3
p0 queue free %	98			98			100	91	88	72	99	99
cM capacity (veh/h)	958			516			126	135	399	181	147	694

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	WB 4	NB 1	SB 1
Volume Total	457	884	1	12	296	296	25	59	58
Volume Left	15	0	0	12	0	0	0	0	50
Volume Right	0	0	1	0	0	0	25	47	7
cSH	958	1700	1700	516	1700	1700	1700	285	199
Volume to Capacity	0.02	0.52	0.00	0.02	0.17	0.17	0.01	0.21	0.29
Queue Length 95th (m)	0.4	0.0	0.0	0.5	0.0	0.0	0.0	5.7	8.9
Control Delay (s)	0.5	0.0	0.0	12.1	0.0	0.0	0.0	20.9	30.5
Lane LOS	A			B				C	D
Approach Delay (s)	0.2			0.2				20.9	30.5
Approach LOS								C	D

Intersection Summary				
Average Delay	1.6			
Intersection Capacity Utilization	61.5%	ICU Level of Service		B
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	3	442	5	19	788	33	5	2	8	12	5	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.50	0.88	0.63	0.92	0.96	0.69	0.92	0.50	0.92	0.69	0.50	0.92
Hourly flow rate (vph)	6	502	8	21	821	48	5	4	9	17	10	2
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		1			1							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	869			510			973	1424	251	1160	1408	434
vC1, stage 1 conf vol							514	514		886	886	
vC2, stage 2 conf vol							459	910		274	522	
vCu, unblocked vol	869			510			973	1424	251	1160	1408	434
tC, single (s)	4.1			4.2			7.6	6.6	7.0	7.9	6.6	7.0
tC, 2 stage (s)							6.6	5.6		6.9	5.6	
tF (s)	2.2			2.2			3.5	4.0	3.4	3.7	4.0	3.3
p0 queue free %	99			98			98	98	99	92	96	100
cM capacity (veh/h)	771			1037			319	241	734	217	245	564

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	173	335	8	21	547	321	18	30
Volume Left	6	0	0	21	0	0	5	17
Volume Right	0	0	8	0	0	48	9	2
cSH	771	1700	1700	1037	1700	1700	399	237
Volume to Capacity	0.01	0.20	0.00	0.02	0.32	0.19	0.05	0.12
Queue Length 95th (m)	0.2	0.0	0.0	0.5	0.0	0.0	1.1	3.2
Control Delay (s)	0.4	0.0	0.0	8.5	0.0	0.0	14.5	22.4
Lane LOS	A			A			B	C
Approach Delay (s)	0.1			0.2			14.5	22.4
Approach LOS							B	C

Intersection Summary				
Average Delay	0.8			
Intersection Capacity Utilization	39.5%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	3	460	5	20	820	34	5	2	8	12	5	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.50	0.88	0.63	0.92	0.96	0.69	0.92	0.50	0.92	0.69	0.50	0.92
Hourly flow rate (vph)	6	523	8	22	854	49	5	4	9	17	10	2
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		1			1							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	903			531			1012	1482	261	1206	1465	452
vC1, stage 1 conf vol							535	535		922	922	
vC2, stage 2 conf vol							478	947		284	543	
vCu, unblocked vol	903			531			1012	1482	261	1206	1465	452
tC, single (s)	4.1			4.2			7.6	6.6	7.0	7.9	6.6	7.0
tC, 2 stage (s)							6.6	5.6		6.9	5.6	
tF (s)	2.2			2.2			3.5	4.0	3.4	3.7	4.0	3.3
p0 queue free %	99			98			98	98	99	92	96	100
cM capacity (veh/h)	748			1019			307	230	722	205	234	550

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	180	348	8	22	569	334	18	30
Volume Left	6	0	0	22	0	0	5	17
Volume Right	0	0	8	0	0	49	9	2
cSH	748	1700	1700	1019	1700	1700	385	225
Volume to Capacity	0.01	0.20	0.00	0.02	0.33	0.20	0.05	0.13
Queue Length 95th (m)	0.2	0.0	0.0	0.5	0.0	0.0	1.1	3.4
Control Delay (s)	0.4	0.0	0.0	8.6	0.0	0.0	14.8	23.4
Lane LOS	A			A			B	C
Approach Delay (s)	0.1			0.2			14.8	23.4
Approach LOS							B	C

Intersection Summary				
Average Delay	0.8			
Intersection Capacity Utilization	40.4%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	3	460	5	20	820	42	5	2	8	23	5	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.50	0.88	0.63	0.92	0.96	0.69	0.92	0.50	0.92	0.69	0.50	0.92
Hourly flow rate (vph)	6	523	8	22	854	61	5	4	9	33	10	2
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		1			1							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	915			531			1012	1493	261	1212	1471	458
vC1, stage 1 conf vol							535	535		928	928	
vC2, stage 2 conf vol							478	959		284	543	
vCu, unblocked vol	915			531			1012	1493	261	1212	1471	458
tC, single (s)	4.1			4.2			7.6	6.6	7.0	7.9	6.6	7.0
tC, 2 stage (s)							6.6	5.6		6.9	5.6	
tF (s)	2.2			2.2			3.5	4.0	3.4	3.7	4.0	3.3
p0 queue free %	99			98			98	98	99	84	96	100
cM capacity (veh/h)	741			1019			307	228	722	204	233	545

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	180	348	8	22	569	346	18	46
Volume Left	6	0	0	22	0	0	5	33
Volume Right	0	0	8	0	0	61	9	2
cSH	741	1700	1700	1019	1700	1700	383	216
Volume to Capacity	0.01	0.20	0.00	0.02	0.33	0.20	0.05	0.21
Queue Length 95th (m)	0.2	0.0	0.0	0.5	0.0	0.0	1.1	5.9
Control Delay (s)	0.4	0.0	0.0	8.6	0.0	0.0	14.9	26.0
Lane LOS	A			A			B	D
Approach Delay (s)	0.1			0.2			14.9	26.0
Approach LOS							B	D

Intersection Summary				
Average Delay	1.1			
Intersection Capacity Utilization	40.7%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	4	636	7	27	1135	48	7	3	12	17	7	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.50	0.88	0.63	0.92	0.96	0.69	0.92	0.50	0.92	0.69	0.50	0.92
Hourly flow rate (vph)	8	723	11	29	1182	70	8	6	13	25	14	3
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		1			1							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1252			734			1399	2049	361	1669	2026	626
vC1, stage 1 conf vol							739	739		1276	1276	
vC2, stage 2 conf vol							660	1311		393	750	
vCu, unblocked vol	1252			734			1399	2049	361	1669	2026	626
tC, single (s)	4.1			4.2			7.6	6.6	7.0	7.9	6.6	7.0
tC, 2 stage (s)							6.6	5.6		6.9	5.6	
tF (s)	2.2			2.2			3.5	4.0	3.4	3.7	4.0	3.3
p0 queue free %	99			97			96	96	98	79	91	99
cM capacity (veh/h)	552			854			206	146	621	119	151	422

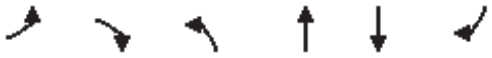
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	249	482	11	29	788	464	27	42
Volume Left	8	0	0	29	0	0	8	25
Volume Right	0	0	11	0	0	70	13	3
cSH	552	1700	1700	854	1700	1700	269	136
Volume to Capacity	0.01	0.28	0.01	0.03	0.46	0.27	0.10	0.31
Queue Length 95th (m)	0.3	0.0	0.0	0.8	0.0	0.0	2.5	9.2
Control Delay (s)	0.6	0.0	0.0	9.4	0.0	0.0	19.8	42.7
Lane LOS	A			A			C	E
Approach Delay (s)	0.2			0.2			19.8	42.7
Approach LOS							C	E

Intersection Summary				
Average Delay	1.3			
Intersection Capacity Utilization	49.6%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	636	7	27	1135	58	7	3	12	31	7	6
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.50	0.88	0.63	0.92	0.96	0.69	0.92	0.50	0.92	0.69	0.50	0.92
Hourly flow rate (vph)	10	723	11	29	1182	84	8	6	13	45	14	7
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		1			1							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1266			734			1406	2068	361	1638	1995	591
vC1, stage 1 conf vol							743	743		1241	1241	
vC2, stage 2 conf vol							663	1325		397	754	
vCu, unblocked vol	1266			734			1406	2068	361	1638	1995	591
tC, single (s)	4.1			4.2			7.6	6.6	7.0	7.9	6.6	7.0
tC, 2 stage (s)							6.6	5.6		6.9	5.6	
tF (s)	2.2			2.2			3.5	4.0	3.4	3.7	4.0	3.3
p0 queue free %	98			97			96	96	98	64	91	99
cM capacity (veh/h)	545			854			203	143	621	125	155	445

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	WB 4	NB 1	SB 1
Volume Total	251	482	11	29	591	591	84	27	65
Volume Left	10	0	0	29	0	0	0	8	45
Volume Right	0	0	11	0	0	0	84	13	7
cSH	545	1700	1700	854	1700	1700	1700	265	141
Volume to Capacity	0.02	0.28	0.01	0.03	0.35	0.35	0.05	0.10	0.47
Queue Length 95th (m)	0.4	0.0	0.0	0.8	0.0	0.0	0.0	2.5	16.2
Control Delay (s)	0.7	0.0	0.0	9.4	0.0	0.0	0.0	20.1	51.2
Lane LOS	A			A				C	F
Approach Delay (s)	0.2			0.2				20.1	51.2
Approach LOS								C	F

Intersection Summary				
Average Delay	2.0			
Intersection Capacity Utilization	48.0%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	6	4	8	38	11	11
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	4	9	41	12	12
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	77	18	24			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	77	18	24			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	100	99			
cM capacity (veh/h)	914	1052	1578			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	11	50	24
Volume Left	7	9	0
Volume Right	4	0	12
cSH	965	1578	1700
Volume to Capacity	0.01	0.01	0.01
Queue Length 95th (m)	0.3	0.1	0.0
Control Delay (s)	8.8	1.3	0.0
Lane LOS	A	A	
Approach Delay (s)	8.8	1.3	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	18.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	4	6	11	53	16	8
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	7	12	58	17	9
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	103	22	26			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	103	22	26			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	99	99			
cM capacity (veh/h)	881	1047	1575			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	11	70	26
Volume Left	4	12	0
Volume Right	7	0	9
cSH	974	1575	1700
Volume to Capacity	0.01	0.01	0.02
Queue Length 95th (m)	0.3	0.2	0.0
Control Delay (s)	8.7	1.3	0.0
Lane LOS	A	A	
Approach Delay (s)	8.7	1.3	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	20.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	17	11	8	12	39	11
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	18	12	9	13	42	12
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	79	48	54			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	79	48	54			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	99	99			
cM capacity (veh/h)	911	1012	1538			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	30	22	54
Volume Left	18	9	0
Volume Right	12	0	12
cSH	948	1538	1700
Volume to Capacity	0.03	0.01	0.03
Queue Length 95th (m)	0.8	0.1	0.0
Control Delay (s)	8.9	3.0	0.0
Lane LOS	A	A	
Approach Delay (s)	8.9	3.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	17.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	11	17	11	17	55	8
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	12	18	12	18	60	9
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	107	64	68			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	107	64	68			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	98	99			
cM capacity (veh/h)	877	992	1520			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	30	30	68
Volume Left	12	12	0
Volume Right	18	0	9
cSH	943	1520	1700
Volume to Capacity	0.03	0.01	0.04
Queue Length 95th (m)	0.8	0.2	0.0
Control Delay (s)	8.9	2.9	0.0
Lane LOS	A	A	
Approach Delay (s)	8.9	2.9	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	18.2%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX E

TAC Illumination Warrants

GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Guide for the Design of Roadway Lighting* , Transportation Association of Canada, 2006 Edition.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Highway 16	ain Road
Range Road 13	Minor Road
Parkland County	City/Town

Date ay 22 2012

Other 2011 Existing

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	3		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)	110		5		OK	
Channelization Factor					OK	15
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)	110				OK	
Radius of Horizontal Curve (m)	1			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =	A	4				
Posted Speed Category =		0				
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%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
					Geometric Factors Subtotal	**41**

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)		0	10		OK	0
AADT on Minor Road (2-way)		0	20	Either Use the two AADT inputs **OR** the Descriptive Signalization	OK	0
Signalization Warrant	Descriptive	1	30	Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	30
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	4	5	Refer to Table 1(B) for ratings.	OK	20
Operating Speed or Posted Speed on Major Road (km/h)	110	4	5	Refer to Table 1(B), note #3	OK	20
Operating Speed on Minor Road (km/h)	70	2	5	Refer to Table 1(B), note #3	OK	10
					Operational Factors Subtotal	**80**

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	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)		0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)		0			Use Y or N	
					OK	
					Collision History Subtotal	**Check Entry**

Check Intersection Signalization:
Intersection is not Signalized

ILLUMINATION WARRANTED
REVIEW SITE AND COLLISIONS TO DETERMINE LIGHTING TYPE (PARTIAL OR DELINEATION)

SUMMARY	
Geometric Factors Subtotal	41
Operational Factor Subtotal	80
Environmental Factor Subtotal	0
Collision History Subtotal	Check Entry
TOTAL POINTS	**121**

GUIDE FOR THE DESIGN OF ROADWAY LIGHTING

LIGHTING WARRANT SPREADSHEET

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Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Highway 16	Main Road
Range Road 13	Minor Road
Parkland County	City/Town

Date May 22, 2012

Other 2013 Background

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	3		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)	110		5		OK	
Channelization Factor					OK	15
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)	110				OK	
Radius of Horizontal Curve (m)	1			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =	A	4				
Posted Speed Category =		0				
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%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
					Geometric Factors Subtotal	**41**

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)		0	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	0
AADT on Minor Road (2-way)		0	20		OK	0
Signalization Warrant	Descriptive	1	30		OK	30
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	4	5	Refer to Table 1(B) for ratings.	OK	20
Operating Speed or Posted Speed on Major Road (km/h)	110	4	5	Refer to Table 1(B), note #3	OK	20
Operating Speed on Minor Road (km/h)	70	2	5	Refer to Table 1(B), note #3	OK	10
					Operational Factors Subtotal	**80**

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	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)		0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)		0			Use Y or N	
					OK	
					Collision History Subtotal	**Check Entry**

Check Intersection Signalization:
Intersection is not Signalized

ILLUMINATION WARRANTED

REVIEW SITE AND COLLISIONS TO DETERMINE LIGHTING TYPE (PARTIAL OR DELINEATION)

SUMMARY

Geometric Factors Subtotal	41
Operational Factor Subtotal	80
Environmental Factor Subtotal	0
Collision History Subtotal	Check Entry
TOTAL POINTS	**121**

GUIDE FOR THE DESIGN OF ROADWAY LIGHTING

LIGHTING WARRANT SPREADSHEET

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Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Highway 16	Main Road
Range Road 13	Minor Road
Parkland County	City/Town

Date May 22, 2012

Other 2013 Total

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	3		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)	110		5		OK	
Channelization Factor					OK	15
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)	110				OK	
Radius of Horizontal Curve (m)	1			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =	A	4				
Posted Speed Category =		0				
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%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
					Geometric Factors Subtotal	**41**

OPERATIONAL FACTORS

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

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	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)		0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)		0			Use Y or N	
					OK	
					Collision History Subtotal	**Check Entry**

Check Intersection Signalization:
Intersection is not Signalized

ILLUMINATION WARRANTED

REVIEW SITE AND COLLISIONS TO DETERMINE LIGHTING TYPE (PARTIAL OR DELINEATION)

SUMMARY

Geometric Factors Subtotal	41
Operational Factor Subtotal	110
Environmental Factor Subtotal	0
Collision History Subtotal	Check Entry
TOTAL POINTS	**151**

GUIDE FOR THE DESIGN OF ROADWAY LIGHTING

LIGHTING WARRANT SPREADSHEET

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Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Highway 16A	Main Road
Range Road 13	Minor Road
Parkland County	City/Town

Date May 22, 2012

Other 2011 Existing

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	3		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)	100		5		OK	
Channelization Factor					OK	15
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	100				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =	B	0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
				Geometric Factors Subtotal		**21**

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)		0	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	0
AADT on Minor Road (2-way)		0	20		OK	0
Signalization Warrant	Descriptive	0	30		OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	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)	70	2	5	Refer to Table 1(B), note #3	OK	10
				Operational Factors Subtotal		**50**

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	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)		0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)		0			Use Y or N	
					OK	
				Collision History Subtotal		**Check Entry**

Check Intersection Signalization:
Intersection is not Signalized

LIGHTING IS NOT WARRANTED

SUMMARY	
Geometric Factors Subtotal	21
Operational Factor Subtotal	50
Environmental Factor Subtotal	0
Collision History Subtotal	Check Entry
TOTAL POINTS	**71**

GUIDE FOR THE DESIGN OF ROADWAY LIGHTING

LIGHTING WARRANT SPREADSHEET

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Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Highway 16A	Main Road
Range Road 13	Minor Road
Parkland County	City/Town

Date May 22, 2012

Other 2013 Background

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	3		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)	100		5		OK	
Channelization Factor					OK	15
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	100				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =	B	0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
				Geometric Factors Subtotal		**21**

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)		0	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	0
AADT on Minor Road (2-way)		0	20		OK	0
Signalization Warrant	Descriptive	0	30		OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	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)	70	2	5	Refer to Table 1(B), note #3	OK	10
				Operational Factors Subtotal		**50**

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	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)		0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)		0			Use Y or N	
					OK	
				Collision History Subtotal		**Check Entry**

Check Intersection Signalization:
Intersection is not Signalized

LIGHTING IS NOT WARRANTED

SUMMARY	
Geometric Factors Subtotal	21
Operational Factor Subtotal	50
Environmental Factor Subtotal	0
Collision History Subtotal	Check Entry
TOTAL POINTS	**71**

GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
LIGHTING WARRANT SPREADSHEET

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Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Highway 16A	Main Road
Range Road 13	Minor Road
Parkland County	City/Town

Date May 22, 2012
Other 2013 Total

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	3		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)	100		5		OK	
Channelization Factor					OK	15
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	100				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =	B	0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
				Geometric Factors Subtotal		**21**

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)		0	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	0
AADT on Minor Road (2-way)		0	20		OK	0
Signalization Warrant	Descriptive	0	30		OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	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)	70	2	5	Refer to Table 1(B), note #3	OK	10
				Operational Factors Subtotal		**50**

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	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)		0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)		0			Use Y or N	
					OK	
				Collision History Subtotal		**Check Entry**

Check Intersection Signalization:
Intersection is not Signalized

LIGHTING IS NOT WARRANTED

SUMMARY	
Geometric Factors Subtotal	21
Operational Factor Subtotal	50
Environmental Factor Subtotal	0
Collision History Subtotal	Check Entry
TOTAL POINTS	**71**

GUIDE FOR THE DESIGN OF ROADWAY LIGHTING

LIGHTING WARRANT SPREADSHEET

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Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Highway 16A	Main Road
Range Road 13	Minor Road
Parkland County	City/Town

Date May 22, 2012

Other 2033 Background

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	3		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)	100		5		OK	
Channelization Factor					OK	15
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	100				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =	B	0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
				Geometric Factors Subtotal		**21**

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)		0	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	0
AADT on Minor Road (2-way)		0	20		OK	0
Signalization Warrant	Descriptive	1	30		OK	30
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	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)	70	2	5	Refer to Table 1(B), note #3	OK	10
				Operational Factors Subtotal		**80**

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	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)		0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)		0			Use Y or N	
					OK	
				Collision History Subtotal		**Check Entry**

Check Intersection Signalization:
Intersection is not Signalized

LIGHTING IS NOT WARRANTED

SUMMARY	
Geometric Factors Subtotal	21
Operational Factor Subtotal	80
Environmental Factor Subtotal	0
Collision History Subtotal	Check Entry
TOTAL POINTS	**101**

GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
LIGHTING WARRANT SPREADSHEET

This spreadsheet is to be used in conjunction with *Guide for the Design of Roadway Lighting* , Transportation Association of Canada, 2006 Edition.

Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Highway 16A	Main Road
Range Road 13	Minor Road
Parkland County	City/Town

Date May 22, 2012
Other 2033 Total

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	3		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)	100		5		OK	
Channelization Factor					OK	15
Approach Sight Distance on most constrained approach (%)	100	0	10	Relative to the recommended minimum sight distance	OK	0
Posted Speed limit (in 10's of km/h)	100				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =	B	0				
Posted Speed Category =		0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	0.0	0	3	Rounded to nearest tenth of a percent	OK	0
Number of Intersection Legs	4	2	3	Number of legs = 3 or more	OK	6
					Geometric Factors Subtotal	**21**

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)		0	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	0
AADT on Minor Road (2-way)		0	20		OK	0
Signalization Warrant	Descriptive	1	30		OK	30
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	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)	70	2	5	Refer to Table 1(B), note #3	OK	10
					Operational Factors Subtotal	**80**

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	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)		0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)		0			Use Y or N	
					OK	
					Collision History Subtotal	**Check Entry**

Check Intersection Signalization:
Intersection is not Signalized

LIGHTING IS NOT WARRANTED

SUMMARY	
Geometric Factors Subtotal	21
Operational Factor Subtotal	80
Environmental Factor Subtotal	0
Collision History Subtotal	Check Entry
TOTAL POINTS	**101**

GUIDE FOR THE DESIGN OF ROADWAY LIGHTING

LIGHTING WARRANT SPREADSHEET

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Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Range Road 13	Main Road
Site Access	Minor Road
Parkland County	City/Town

Date May 22, 2012

Other 2013 Total

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)			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)	70				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =		0				
Posted Speed Category =	C	0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	2.0	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	**3**

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)		0	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	0
AADT on Minor Road (2-way)		0	20		OK	0
Signalization Warrant	Descriptive	0	30		OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	0	5	Refer to Table 1(B) for ratings.	OK	0
Operating Speed or Posted Speed on Major Road (km/h)	70	2	5	Refer to Table 1(B), note #3	OK	10
Operating Speed on Minor Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
					Operational Factors Subtotal	**10**

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	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)		0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)		0			Use Y or N	
					OK	
					Collision History Subtotal	**Check Entry**

Check Intersection Signalization:
Intersection is not Signalized

LIGHTING IS NOT WARRANTED

SUMMARY	
Geometric Factors Subtotal	3
Operational Factor Subtotal	10
Environmental Factor Subtotal	0
Collision History Subtotal	Check Entry
TOTAL POINTS	**13**

GUIDE FOR THE DESIGN OF ROADWAY LIGHTING

LIGHTING WARRANT SPREADSHEET

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Please enter information in the cells with yellow background

INTERSECTION CHARACTERISTICS

Range Road 13	Main Road	**Date**	May 22, 2012
Site Access	Minor Road	**Other**	2033 Total
Parkland County	City/Town		

GEOMETRIC FACTORS

	Value	Rating	Weight	Comments	Check	Score
Channelization Rating	Descriptive	0		Refer to Table 1(A) to determine rating value	OK	
Presence of raised channelization? (Y / N)	n				OK	
Highest operating speed on raised, channelized approach (km/h)			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)	70				OK	
Radius of Horizontal Curve (m)	T			Enter "T" for tangent (no horizontal curve at the intersection)	OK	
Posted Speed Category =		0				
Posted Speed Category =		0				
Posted Speed Category =	C	0				
Posted Speed Category =		0				
Horizontal Curvature Factor		0	5		OK	0
Angle of Intersection (10's of Degrees)	90	0	5		OK	0
Downhill Approach Grade (x.x%)	2.0	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	**3**

OPERATIONAL FACTORS

Is the intersection signalized ? (Y/ N)	n			Calculate the Signalization Warrant Factor		
AADT on Major Road (2-way)		0	10	Either Use the two AADT inputs **OR** the Descriptive Signalization Warrant (Unused values should be set to Zero) Refer to Table 1(B) for description and rating values for signalization warrant.	OK	0
AADT on Minor Road (2-way)		0	20		OK	0
Signalization Warrant	Descriptive	0	30		OK	0
					OK	
Night-Time Hourly Pedestrian Volume	0	0	10	Refer to Table 1(B), note #2, to account for children and seniors	OK	0
Intersecting Roadway Classification	Descriptive	0	5	Refer to Table 1(B) for ratings.	OK	0
Operating Speed or Posted Speed on Major Road (km/h)	70	2	5	Refer to Table 1(B), note #3	OK	10
Operating Speed on Minor Road (km/h)	50	0	5	Refer to Table 1(B), note #3	OK	0
					Operational Factors Subtotal	**10**

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	Enter **either** the annual frequency (See Table 1(C), note #4)	OK	0
OR				**OR** the number of collisions / MEV		
Collision Rate over last 3 years, due to inadequate lighting (/MEV)		0	0	(Unused values should be set to Zero)	OK	0
Is the average ratio of **all** night to day collisions >= 1.5 (Y/N)		0			Use Y or N	
					OK	
					Collision History Subtotal	**Check Entry**

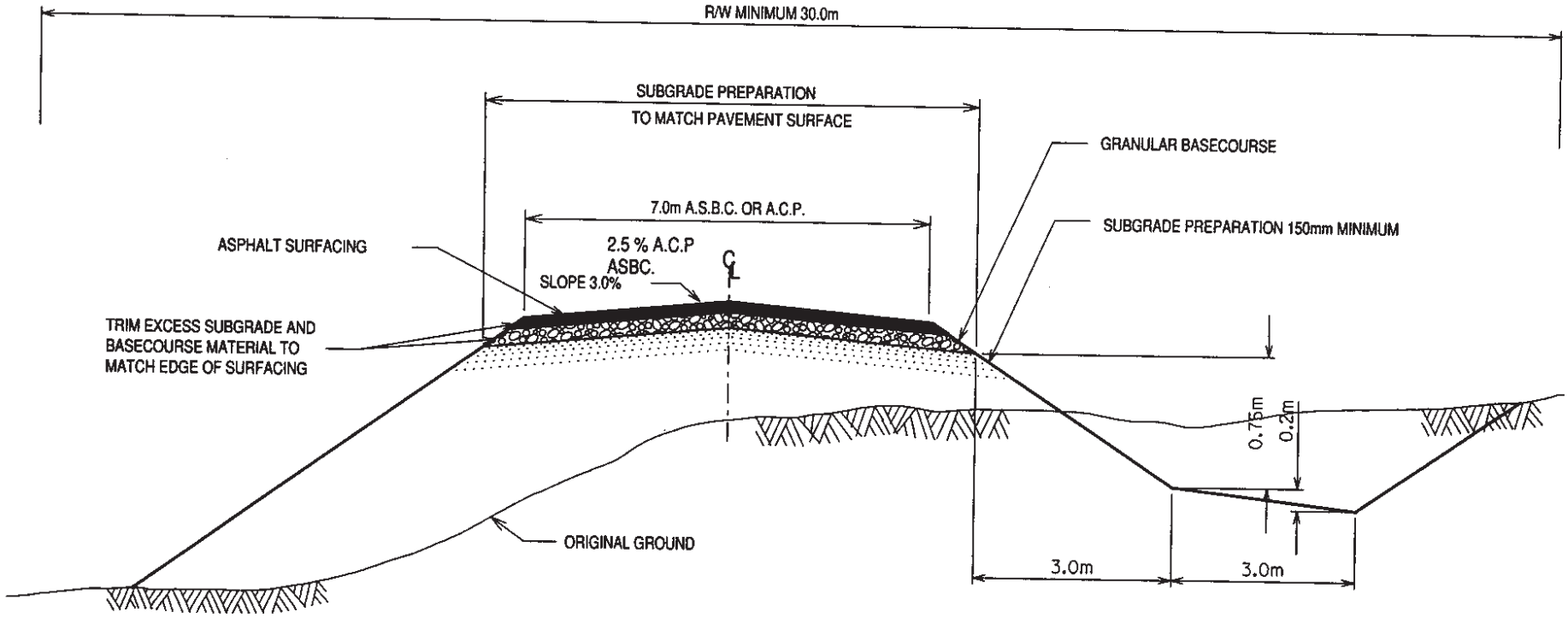
Check Intersection Signalization:
Intersection is not Signalized

LIGHTING IS NOT WARRANTED

SUMMARY	
Geometric Factors Subtotal	3
Operational Factor Subtotal	10
Environmental Factor Subtotal	0
Collision History Subtotal	Check Entry
TOTAL POINTS	**13**

APPENDIX F

County Standard Drawings



NOTE: ALL BACK SLOPES 3 : 1 UNLESS NOTED OTHERWISE
ALL DIMENSIONS ARE IN METERS

FILL SLOPE TABLE

DEPTH of FILL	SLOPE
0 - 1.5m	4 : 1
1.5 - 3.5m	3 : 1
3.5 - 4.5m	2 1/2 : 1
> - 4.5m	2 : 1

NOTE:

2 : 1 SLOPE REQUIRES 1m SHOULDER WIDENING
& GUARDRAIL INSTALLATION

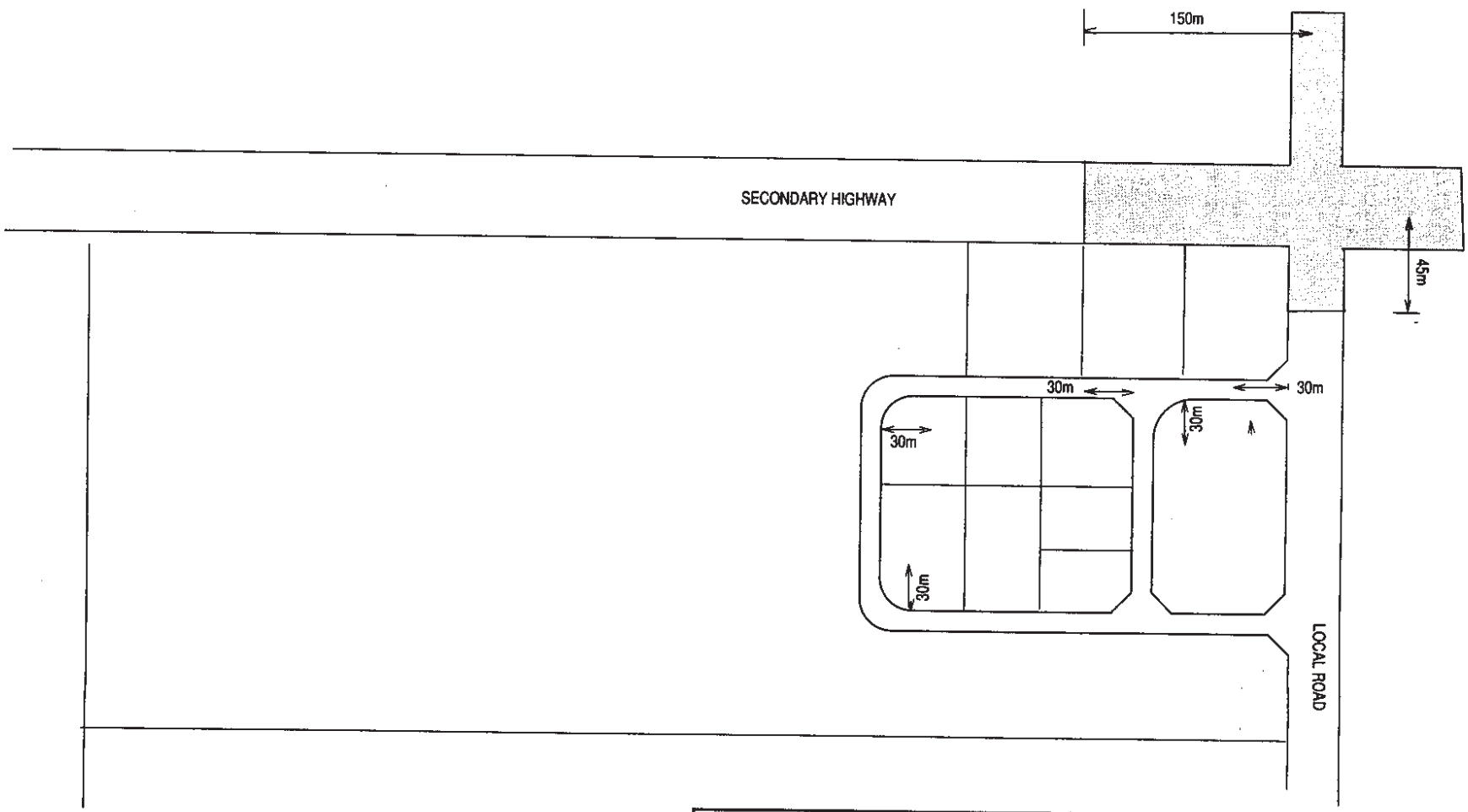
DIMENSIONS SHOWN IN METRES
g:\dgn\typxsec\dgn

PARKLAND COUNTY

TRANSPORTATION AND UTILITIES

TYPICAL CROSS-SECTION
RESIDENTIAL ACCESS AND LOCAL ROAD

DATE	FEB.,1999	DRAWN BY	W.T.	DRAWING 7.1
SCALE	N.T.S.	CHECKED BY	W.S.S..	APPROVED



DIMENSIONS INDICATE WHERE ROAD APPROACHES SHALL NOT BE CONSTRUCTED UNLESS NO REASONABLE ALTERNATIVE EXISTS.

ALL LOT ACCESS WITHIN SUBDIVISIONS SHALL BE OFF OF INTERNAL SUBDIVISION ROADS

DIMENSIONS SHOWN IN METRES

g:\dgn\typsec.dgn

PARKLAND COUNTY

TRANSPORTATION AND UTILITIES

TYPICAL APPROACH LOCATIONS

DATE	FEB,1999	DRAWN BY	N.ACKMAN	DRAWING 7.11
SCALE	N.T.S.	CHECKED BY	W.S.S	APPROVED