APPENDIX D

Traffic Impact Study (Draft Report)

GRIFFIN
transportation group inc.
traffic engineering | transportation planning

Route 133 Campground Development

Dept. of Transportation & Infrastructure

Traffic Impact Study

Draft Final Report

Prepared by:
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Prepared for:
Shediac Camping Resort

July 2016

July 7, 2016

Mr. Pierre Vautour
Shediac Camping Resort
1330 Amirault Street, Unit 32
Dieppe, NB E1A 8M7

Dear Mr. Vautour:

RE: Traffic Impact Study for a proposed campground development on Route 133

The GRIFFIN transportation group inc. is pleased to present the results of the enclosed traffic impact study carried out in support of the planning approval process for a proposed new campground development near the Route 133 / Euclide Leger Road intersection, east of the Town of Shediac.

The results flowing from the study analyses have identified that the addition of a southbound channelized right turn lane at the Route 133 / Euclide Leger Road intersection will improve minimum driver sight distances to the east along Route 133. With these minor infrastructure changes, the proposed campground development will have an acceptable level of impact on the study area roadways and intersections and improve driver sight distances for residents of Euclide Leger Road.

It has been a pleasure working with the project team in completing this study. Feel free to contact the undersigned anytime to further discuss the details of this project.

Yours truly,

James J. Copeland, P.Eng.
Managing Principal
GRIFFIN transportation group inc.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1 Background

The GRIFFIN transportation group has been retained by *Shediac Camping Resort* to carry out a traffic impact study (TIS) in support of the planning approval process associated with the proposed campground development on Euclide Leger Road that connects to Route 133 in West Boudreau, immediately east of the Town of Shediac. The proposed location for the new campground development is an approximate 24-acre parcel of land (PID #70429899) that is generally located in the northwest quadrant of the Route 133 / Euclide Leger Road intersection. A key map showing the general location of the site is shown in *Figure 1*.

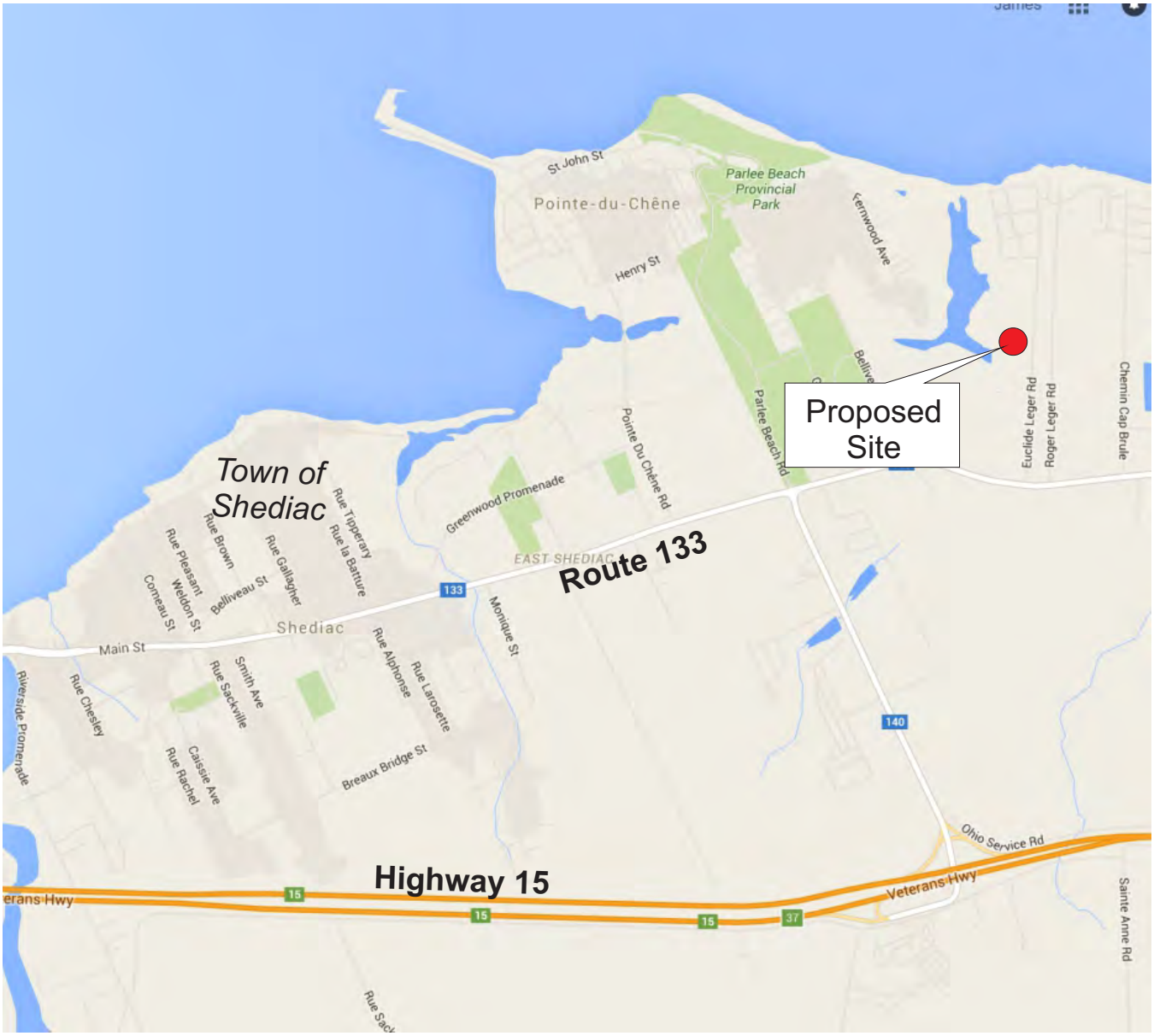
Euclide Leger Road serves about 70 residential cottage properties and it is understood that 12 cottages are occupied year-round while the other 58 properties are seasonal and predominantly occupied only during the summer months. Based on information provided by *Shediac Camping Resort*, Euclide Leger Road will be upgraded from a private to a public roadway from Route 133 to the north about 245m, at which point the new public roadway will terminate in a cul-de-sac. Individual accesses for the remaining portion of the private Euclide Leger Road and the new campground development will then connect to the cul-de-sac.

1.2 Context

It is understood that the approval agency for the traffic impact study process is the New Brunswick Department of Transportation and Infrastructure (DTI). As such, the general assumptions of the TIS process follows industry best practice and guidelines including the Institute of Transportation Engineers (ITE), the Nova Scotia Department of Transportation and Infrastructure Renewal, and the City of Moncton. The terms of reference for this impact study were developed based on the following:

- The City of Moncton's *Traffic Impact Study Guidelines* (2012)
- A site plan drawing prepared by *J.R. Daigle Engineering* dated January 2016.
- Site reviews carried out on Tuesday March 29th and Wednesday May 18th, 2016.

The approach and technical findings of this traffic impact study are discussed in the following sections of this report.



Source: Google Maps

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Key Map and Site Location

Figure 1

2. EXISTING CONDITIONS

This chapter describes the roadway network, traffic volumes, operational analysis results and other notable characteristics under the baseline conditions.

2.1 The Study Area Road Network

2.1.1 Overview

The proposed campground development is to be generally located in the northwest quadrant of the Route 133 / Euclide Leger Road intersection, immediately east of the Town of Shediac. The main access to the site will be via Euclide Leger Road which forms the north leg of an existing two-way stop-controlled t-intersection. A description of the study area roads is provided below.

2.1.2 Route 133

Route 133 is generally aligned in an east-west direction and in the vicinity of the proposed campground development appears to function as a suburban collector roadway. It has a rural open-ditch cross-section with a two-lane, two-way paved surface. There are two 3.7m travel lanes. The south shoulder is comprised of a 1.5m wide gravel surface plus a 0.5m rounding. The north shoulder is comprised of a 1.0m paved surface plus a 1.0m gravel surface plus a 0.5m rounding. It should be noted there are no exclusive auxiliary turn lanes at the Euclide Leger Road unsignalized t-intersection.

The regulatory posted speed limit along this section of Route 133 is 70 km/h. The intersection of Euclide Leger Road is located in a transition area between the rural high-speed environment to the east and the urban low-speed environment to the west. About 375m to the west of Euclide Leger Road the speed limit is reduced from 70 km/h to 60 km/h. A speed survey was carried out during the March 2016 site visit to record the free-flow operating speeds along Route 133. It was determined from this data that the 85th percentile operating speeds were 82 km/h and 80 km/h in the westbound and eastbound direction, respectively.

2.1.3 Euclide Leger Road

Euclide Leger Road is generally aligned in a north-south direction and appears to function as a rural local residential street. Currently it is a private roadway that serves about 70 cottages – 12 of which are occupied year-round. Following Transportation Association of Canada (TAC) guidelines, this private roadway is considered to be a low volume road and represents conditions where the vehicle demand is considerably below the actual capacity resulting in no operational issues. Given the low volume conditions it has a relatively narrow width (6.5m) with a gravel-surfaced travel way and open ditches. The majority of inbound and outbound traffic using Euclide Leger Road is turning to / from the west due to the proximity of the services offered in the Town of Shediac.

2.2 Traffic Data

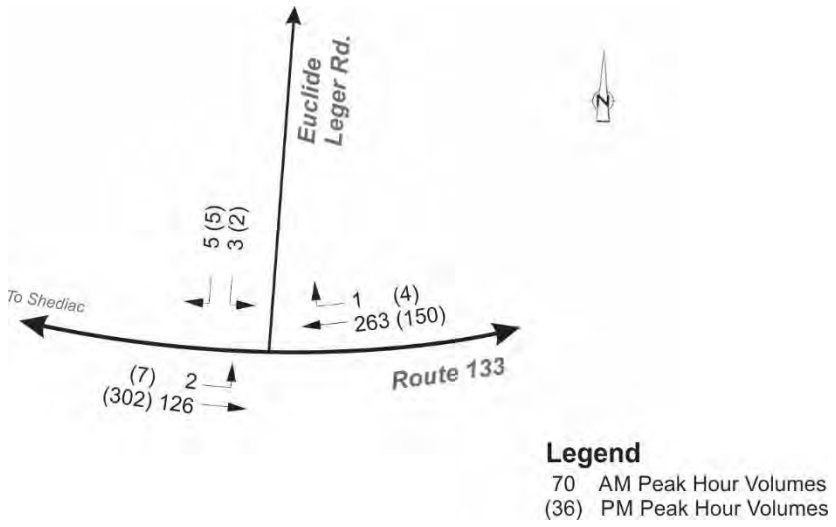
In order to facilitate an assessment of the existing and future traffic operations there was a need to develop a set of baseline traffic volumes. The GRIFFIN transportation group collected traffic data on Route 133 immediately east of Euclide Leger Road on Tuesday March 29th, 2016. The data collection spanned the weekday morning, mid-day and afternoon peak periods.

Following industry best practices, specific hours that experience the highest traffic volumes on the roadway are used for analysis in the traffic impact study process in order to identify the necessary capacity to accommodate peak vehicle demands. Ideally the peak hours for this analysis would occur during the peak travel times along Route 133 combined with the peak time for the proposed campground development. As such, it was determined that the combined peak would occur on a Friday afternoon when the Route 133 corridor serves commuter, commercial retail and recreational traffic as well as campground patrons arriving for the weekend. For analysis purposes, the weekday AM and PM peak periods were selected for this study.

As discussed above, the traffic data along Route 133 was collected in March 2016. However, due to the recreational amenities in the Shediac area traffic volumes increase substantially during the peak summer season. Therefore, a seasonal adjustment factor was applied to the March 2016 peak hour traffic volumes to obtain representative peak summer season volumes that could be applied to the analysis. Based on earlier traffic analyses conducted by the GRIFFIN transportation group in nearby Cap-Pele it was determined that a 30% increase in traffic would be appropriate.

A summary of the baseline Existing Summer 2016 peak hour traffic volumes applied to the study analyses are illustrated in *Figure 2*.

Figure 2: Existing 2015 Peak Hour Volumes



2.3 Existing Summer Conditions Operational Analysis

A capacity analysis process was carried out using the Existing Summer 2016 traffic volumes as well as the existing lane configurations and traffic control at the study area intersection. The analysis process used the industry accepted Trafficware's *Synchro 8* software tool – founded in the methodologies contained in the Transportation Research Board's (TRB) Highway Capacity Manual. The results of the existing summer conditions peak hour analysis are provided in *Table 1* below. Following TIS guidelines, the measures of effectiveness used to describe the operational performance included the average vehicle delay, volume-to-capacity ratio (v/c ratio) and 95th percentile queue length (metres) for all vehicle movements at each of the study area intersections.

Table 1: Existing Summer 2016 Operational Analysis Results

Route 133 / Euclide Leger Road (unsignalized)						
	AM Peak Hour			**PM Peak Hour**		
	Move: LOS (Delay)	**V/C**	**Queue[A]**	**Move: LOS (Delay)**	**V/C**	**Queue[A]**
Existing 2016[B]	EB Th-Lt: **A** (7.8s)	<0.01	0m	EB Th-Lt: **A** (7.6s)	0.01	0m
	WB Th-Rt: **A** (0.0s)	<0.01	0m	WB Th-Rt: **A** (0.0s)	<0.01	0m
	SB Lt-Rt: **B** (10.4s)	0.01	<10m	SB Lt-Rt: **B** (10.0s)	0.01	<10m

A – Queue represents the calculated vehicle queue length in metres occurring 95% of the time (95th percentile).

B – Based on the observed signal timing, a 100 second cycle length with semi-actuation (maximum recall) was used.

The capacity analysis results in *Table 1* indicate that all movements through the subject intersection operate with acceptable performance measures. The critical southbound shared left-right turn movement operates at v/c ratios of 0.01 and levels of service (LOS) B. The results of the operational analysis are consistent with the vehicle delays and queues observed during the field review and indicates there is a considerable amount of residual capacity at this intersection under existing summer peak hour conditions. Detailed summaries of the Existing 2016 operational analysis results are provided in *Appendix I*.

2.4 Driver Sight Lines

The driver sight line review was carried out based on information gathered by the GRIFFIN transportation group as well as survey and plan / profile drawings prepared by J.R. Daigle Engineering. The review was comprised of a two-step process that followed the Transportation Association of Canada's (TAC) guidelines[1] as well as the criteria established by NBDTI. The TAC guidelines use vehicle operating speed to determine criteria such as minimum stopping sight distance (SSD). While the NBDTI has established their minimum sight distance requirements based on posted speed limits.

[1] Geometric Design Guide for Canadian Roads. Transportation Association of Canada. 1999 Edition, Updated December 2011.

Available driver sight lines to the west (towards Shediac) measured from the proposed stop-bar location on Euclide Leger Road were determined to be more than acceptable and exceeded 180m and so the review focused on the critical direction to the east. The available driver sight lines to the east were measured in the field as being 144m and the measurement procedures followed TAC guidelines. The sightlines to the east are limited by a combination horizontal-vertical curve and utility poles located in the right-of-way (i.e. between the ditch-line and the property line) on the inside of the horizontal curve.

Following TAC guidelines, one of the key factors in determining required driver sight distance is to measure vehicle operating speeds on the main roadway. As discussed in *Section 2.1.2* the calculated 85th percentile operating speeds were 80 km/h and 82 km/h for the eastbound and westbound directions, respectively. As such, an 80 km/h operating speed was used in the analysis of current conditions. However, it should be noted that over the medium to long term Shediac's urban boundary will continue to move eastward and its expected the existing 60 km/h speed zone will eventually extend beyond the current location of Euclide Leger Road. This means that the sight line criteria will eventually be reduced relative to current conditions. Nonetheless, the analysis was based on current conditions and the results are summarized in *Table 2*.

Table 2: Driver Sight Line Results for an 80 km/h Operating Speed

	TAC Guidelines	NBDTI Criteria[A]
Minimum Stopping Sight Distance (SSD)	140m[B]	110m
Available Sight Lines	144m	144m
Does Available Meet Minimum Requirements?	**Yes**	**Yes**

A – NBDTI Figure 4.7a (2002), Table 1 criteria for a posted speed limit of 70 km/h

B – Change in elevation results in downgrade of less than 1.5%, therefore no effect of grade included in analysis.

In summary, under current operating conditions the available sight lines for the proposed Euclide Leger Road intersection meet minimum TAC guidelines for an 80 km/h operating speed and exceed minimum NBDTI criteria for a posted speed limit of 70 km/h. Since the sight lines to the east are at the minimum TAC guideline it should be noted that although acceptable, there are increased road safety risks associated with minimum design values. Therefore, modifications to the intersection lane configuration will be discussed later in this report in an attempt to reduce the road safety risks in this location and improve upon the available driver sight lines that exist at the Euclide Leger Road intersection.

3. FUTURE BACKGROUND CONDITIONS

This chapter summarizes the assumptions used to develop future year traffic volumes for the background traffic scenario, the operational analysis results and associated impacts to the transportation infrastructure.

3.1 Overview

The future planning horizon chosen for a traffic impact study represents a milestone in the development process. It is assumed that the future planning horizon year used in the analysis for this type of development will occur 5 years beyond the full build-out/occupancy of the site. It is expected that the planning, design and construction of the proposed development will likely be complete by the end of 2017. Based on this information, the future horizon year selected for this study was 2022.

Developing the future background traffic volumes excludes the forecast traffic explicitly associated with the proposed development under study but considers other contributing factors to traffic volume increases including:

- General traffic growth that is typically associated with population and employment increases in the area;
- Traffic volumes explicitly associated with any adjacent planned developments; and
- Traffic volume and travel pattern changes associated with any planned roadway network changes in the vicinity of the study area.

Each of these contributing factors is discussed in the following Sections.

3.2 Traffic Growth Assumptions

The development of a background traffic growth rate accounts for general population and employment increases in the area of the proposed development. One indicator of growth is the increase of traffic volumes over time. As there were no historical traffic counts available for the study area roadways an assumed 2% yearly increase (compounding) was applied to the analysis. This follows industry-accepted guidelines and is representative of typical yearly traffic volume increases for a growing urban area such as Shediac.

3.3 Future Adjacent Development

It is understood that there are no major planned or approved developments in the immediately vicinity of the proposed development. Therefore, no additional traffic was added to the analysis process to explicitly account for these developments. However, there may be future changes to individual parcels of land and these may have small impacts on traffic volume growth. This study assumes that these small changes would be included in the 2% background traffic growth rate assumption, discussed above.

3.4 Planned Road Network Changes

It is understood from discussions with *Shediac Camping Resort* that a 245m length of Euclide Leger Road will be upgraded from a private roadway to a public roadway. This change will occur from Route 133 northward for 245m and the public roadway will terminate in a cul-de-sac. Since this change is not expected to change driver route choice no changes in traffic pattern flow were assumed as part of this study.

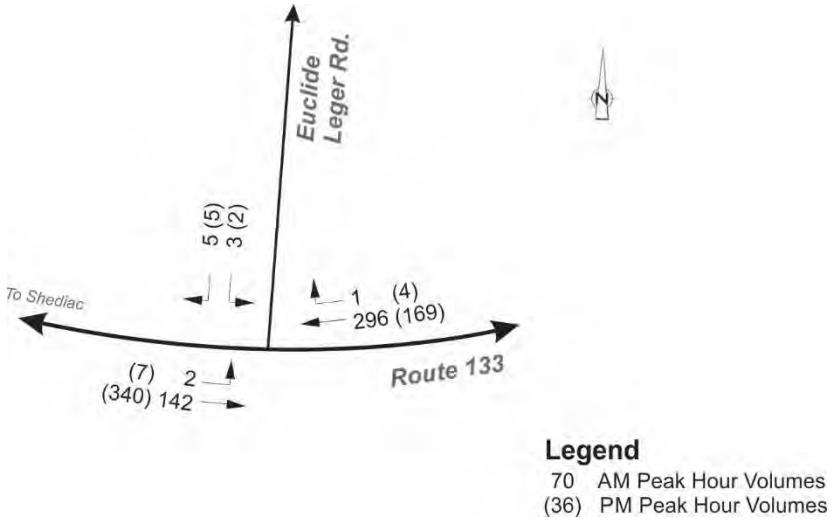
3.5 Summary of Future Background Volumes

The information presented in the previous Sections was used to develop a set of peak hour traffic volumes for the future Background Summer 2022 planning horizon. The development of these volumes was comprised of the following:

- 2016 summer weekday peak hour traffic volumes (*Figure 2*); plus
- A 2.0% per year background traffic growth factor (1.126) to account for population and employment increases in the vicinity of the study area out to the 2022 planning horizon.

A summary of the future Background Summer 2022 peak hour traffic volumes used in the analysis are illustrated in *Figure 3*.

Figure 3: Future Background Summer 2022 Peak Hour Volumes



3.6 Future Background Summer 2022 Operational Analysis

A capacity analysis effort was carried out for the study area intersection using the future Background Summer 2022 forecast traffic volumes and the existing intersection lane configuration. The analysis process used Trafficware's *Synchro 8* software tool. The results for the critical movements at the study area intersections are contained in *Table 3*.

Table 3: Future Background Summer 2022 Operational Analysis Results

Route 133 / Euclide Leger Road (unsignalized)						
	AM Peak Hour			PM Peak Hour		
	Move: LOS (Delay)	V/C	Queue[A]	Move: LOS (Delay)	V/C	Queue[A]
Existing 2016	EB Th-Lt: **A** (7.8s)	<0.01	0m	EB Th-Lt: **A** (7.6s)	0.01	0m
	WB Th-Rt: **A** (0.0s)	<0.01	0m	WB Th-Rt: **A** (0.0s)	<0.01	0m
	SB Lt-Rt: **B** (10.4s)	0.01	<10m	SB Lt-Rt: **B** (10.0s)	0.01	<10m
Background 2022	EB Th-Lt: **A** (7.9s)	<0.01	0m	EB Th-Lt: **A** (7.6s)	0.01	0m
	WB Th-Rt: **A** (0.0s)	<0.01	0m	WB Th-Rt: **A** (0.0s)	<0.01	0m
	SB Lt-Rt: **B** (10.7s)	0.01	<10m	SB Lt-Rt: **B** (10.2s)	0.01	<10m

A – Queue represents the calculated vehicle queue length in metres occurring 95% of the time (95th percentile).

The capacity analysis results for the future Background Summer 2022 conditions indicate that the individual vehicle movements through the subject intersection will continue to operate with acceptable performance measures. The southbound shared left-right turn movement will continue to be the critical movement and is forecast to operate with v/c ratios of 0.01 and LOS B or better. These results suggest that a general traffic growth rate of 2% per year between the 2016 and 2022 planning horizons will have a marginal impact on the performance of this intersection and will have a substantial amount of residual capacity to accommodate traffic growth well beyond the 2022 planning horizon. Detailed summaries of the future Background Summer 2022 operational analysis results are provided in *Appendix I*.

4. THE PROPOSED DEVELOPMENT

This chapter describes the existing site, proposed changes to the buildings/operations, and the development of the site generated traffic.

4.1 Proposed Campground Development

It is understood that *Shediac Camping Resort* is the current property owner of PID #70429899 that measures about 24-acres in size. The property is currently undeveloped and is bounded by existing recreational properties to the north, Euclide Leger Road to the east, Route 133 to the south and water to the west.

The proposed campground layout is shown in the site plan drawing contained in *Figure 4*. There will be a variety of camp site offerings including the following:

- Standard camp sites = 114
- Premium camp sites = 100
- Pull-through camp sites = 15
- Tent-only camp sites = 10
- Rental cottages = 10
- Total sites = 249

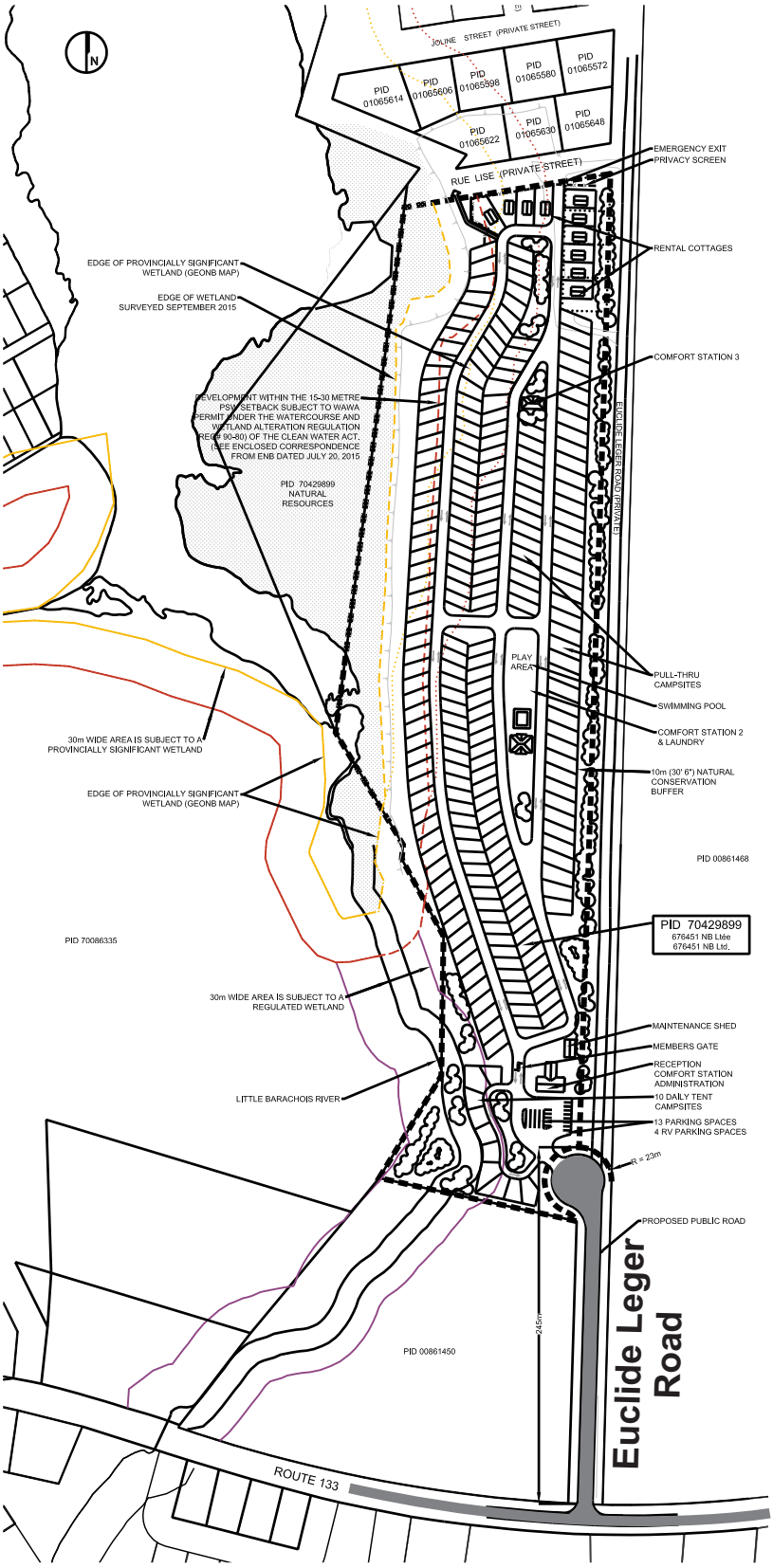
It is assumed that the tent-only camp sites and rental cottages will have similar trip-generating characteristics as the recreational vehicle camp sites and were therefore included in the total number of camp sites for analysis purposes.

4.2 Site Trip Generation

The trip generation calculation process is carried out to identify the number of new vehicles that will be added to the study area roads and intersections as a direct result of a new development. Typically traffic engineers use vehicle generation rates that are published by the Institute of Transportation Engineers (ITE), if deemed appropriate and suitable. Since there is a related land use type contained in the ITE's *Trip Generation, 9th Edition* document – Campground/Recreational Vehicle Park (Code 416) – these published trip rates were applied to this analysis. The volume of site-generated trips has been calculated based on the number of camp sites contained within the development and it was assumed that all 249 sites are occupied - a worst case scenario.

A summary of the AM and PM peak hour site trip generation results associated with a new 24-acre, 249-site campground development is provided in *Table 4*. The total forecast site-generated trips for each peak hour are as follows:

- *AM Peak:* Forecast new trips comprised of 43 two-way trips, including 15 inbound and 28 outbound from the site.
- *PM Peak:* Forecast new trips comprised of 50 two-way trips, including 33 inbound and 17 outbound from the site.



Source: J.R. Daigle Engineering

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Proposed Site Plan

Figure 4

Table 4: Peak Hour Site-Generated Trips (vph)

Peak	Land Use Type	Trip Rate (/ site)	Total Trips (In / Out)	Pass-by Trips (Rate)	New Trips (vph)
AM Peak Hour	Campground/RV Park (249 sites) ITE Code 416	0.17	43 (36%/64%)	0 (0%)	43 (15 in, 28 out)
PM Peak Hour	Campground/RV Park (249 sites) ITE Code 416	0.20	50 (65%/35%)	0 (0%)	50 (33 in, 17 out)

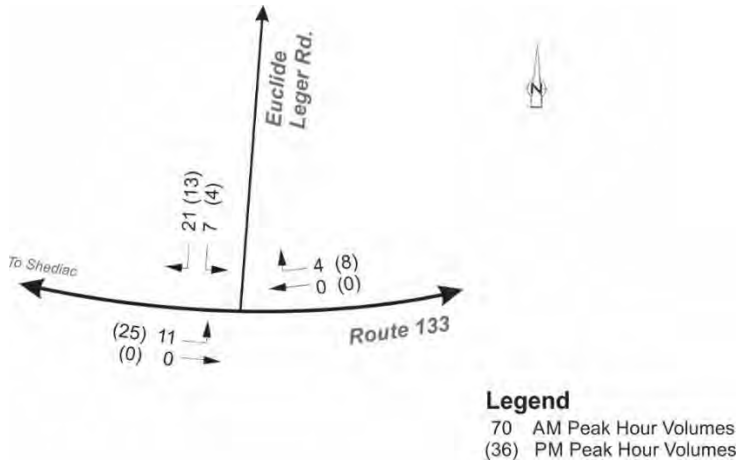
In order to remain conservative in the trip generation estimates, it was assumed there would be no reduction in the total vehicle trips associated with pass-by trips and interaction with on-site services.

4.3 Distribution of Site-Generated Trips

Typically, the distribution of site-generated trips are based on the trip purpose and reason for the trip being made. In the case of the proposed campground it was assumed that the majority of trips would be comprised of either arriving/departing patrons moving to/from Highway 15 and patrons using the commercial amenities in the urban area of Shediac. As such, it was assumed the majority of these two trip types would be moving to/from the west of Euclide Leger Road, along Route 133.

Therefore, it appeared reasonable to assume that 75% of site-generated trips would move to/from the west and the other 25% would move to/from the east along Route 133. This generally followed the same travel patterns that exist today along Route 133. A summary of the site-generated trips assigned to the study area road network is illustrated in *Figure 5*.

Figure 5: Site-Generated Peak Hour Volumes



5. FUTURE TOTAL CONDITIONS

This chapter summarizes the assumptions used to develop future year traffic volumes for the total traffic scenario, the operational analysis results and associated impacts to the transportation infrastructure.

5.1 Overview

The future total traffic conditions represent a combination of general traffic growth out to the 2022 planning horizon and the new traffic associated with the full build-out of the proposed campground development. The assembly of the future total traffic conditions and the analysis process used to identify any future roadway infrastructure changes is discussed in the following Sections.

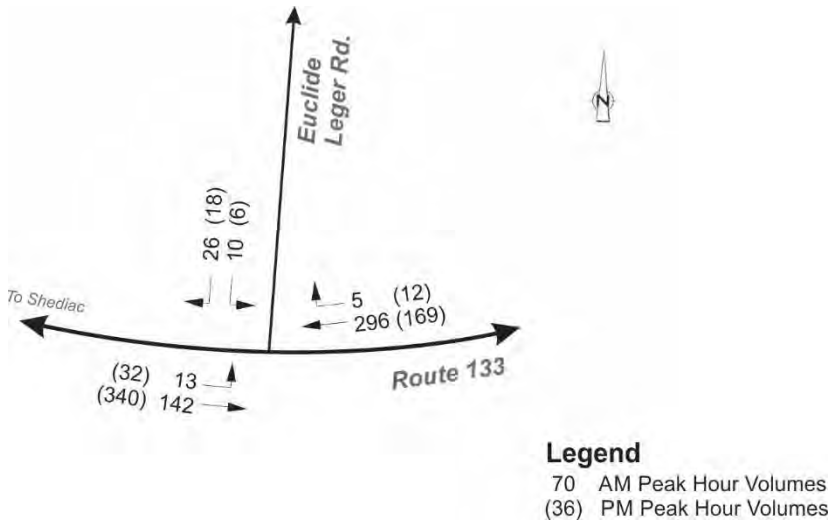
5.2 Future Total 2022 Traffic Scenario

Under the future total summer traffic scenario, the proposed campground development is expected to be fully constructed and campsites occupied. The assembly of future Total Summer 2022 AM and PM peak hour traffic volumes was based on the following:

- 2016 weekday peak hour summer traffic volumes (Figure 2); plus
- A 2.0% per year background traffic growth factor (1.126) to account for population and employment increases in the vicinity of the study area out to the 2022 planning horizon.
- Site-generated traffic associated with the proposed development (Figure 5).

The set of future year traffic volumes for the 2022 planning horizon used in the analyses are illustrated in *Figure 6*.

Figure 6: Future Total Summer 2022 Peak Hour Volumes



5.3 Route 133 Auxiliary Lane Warrant Analyses

Once the set of future Total 2022 peak hour traffic volumes were established an analysis was carried out to determine if there was a need to provide exclusive right and left turning lanes at the Route 133 / Euclide Leger Road intersection. The left turn lane warrant review was undertaken following Ministry of Transportation of Ontario (MTO) procedures. The right turn lane warrant review followed the Ohio Department of Transportation (ODOT) methodology. A summary of the auxiliary turn lane assessment results are provided in *Table 5*.

Table 5: Summary of Auxiliary Turn Lane Assessment at Euclide Leger Road

Scenario	Turn Lane Location	Warrant?
Total 2022 Peak Hour	Westbound Right Turn Lane	Warrant not met
	Eastbound Left Turn Lane	Warrant not met

The results of the auxiliary turn lane assessment indicate that under forecast Total 2022 traffic conditions the warrant criteria are not met and it was determined that exclusive right turn and left turn lanes are not required on Route 133 for vehicles turning onto Euclide Leger Road. These findings are consistent with the intersection capacity results contained in *Table 6,* below. The warrant calculation results are provided in *Appendix II*.

5.4 Total Summer 2022 Operational Analysis Results

A capacity analysis procedure was carried out for the future Total 2022 traffic conditions and used Trafficware's *Synchro 8* software tool following the Transportation Research Board's *Highway Capacity Manual* (HCM) methodology. The operational analysis results for the intersection movements are contained in *Table 6*.

As shown in *Table 6*, two sets of analyses were carried out for the Total 2022 horizon. Using the peak hour volumes contained in *Figure 6*, one analysis was carried out for the existing lane configuration and another that included a southbound channelized right turn on Euclide Leger Road. Since only minimum driver sight lines are available to/from the east from Euclide Leger Road a southbound channelized right turn lane was also included in the analysis to better accommodate slow-moving recreational vehicles and trailers. The channelizing right turn lane shifts these vehicles further to the west – adding more sight distance – and allows them to make the right turn movement under a yield condition as opposed to a stop condition.

A comparison of levels of service and v/c ratios between the Background 2022 and Total 2022 shows that the additional site-generated trips will only slightly increase delay times and reduce residual capacity at the intersection. As such, the results show that the substantial residual capacity that exists at the intersection can accommodate the new campground traffic as well as additional traffic growth beyond the future 2022 planning horizon.

Table 6: Future Total Summer 2022 Operational Analysis Results

Route 133 / Euclide Leger Road (unsignalized)						
	AM Peak Hour			PM Peak Hour		
	Move: LOS (Delay)	V/C	Queue[A]	Move: LOS (Delay)	V/C	Queue[A]
Existing 2016[B]	EB Th-Lt: **A** (7.8s)	<0.01	0m	EB Th-Lt: **A** (7.6s)	0.01	0m
	WB Th-Rt: **A** (0.0s)	<0.01	0m	WB Th-Rt: **A** (0.0s)	<0.01	0m
	SB Lt-Rt: **B** (10.4s)	0.01	<10m	SB Lt-Rt: **B** (10.0s)	0.01	<10m
Background 2022[B]	EB Th-Lt: **A** (7.9s)	<0.01	0m	EB Th-Lt: **A** (7.6s)	0.01	0m
	WB Th-Rt: **A** (0.0s)	<0.01	0m	WB Th-Rt: **A** (0.0s)	<0.01	0m
	SB Lt-Rt: **B** (10.7s)	0.01	<10m	SB Lt-Rt: **B** (10.2s)	0.01	<10m
Total 2022[B]	EB Th-Lt: **A** (8.0s)	0.01	0m	EB Th-Lt: **A** (7.7s)	0.03	<10m
	WB Th-Rt: **A** (0.0s)	<0.01	0m	WB Th-Rt: **A** (0.0s)	<0.01	0m
	SB Lt-Rt: **B** (10.9s)	0.06	<10m	SB Lt-Rt: **B** (10.5s)	0.04	<10m
Total 2022[C]	EB Th-Lt: **A** (8.0s)	0.01	0m	EB Th-Lt: **A** (7.7s)	0.01	0m
	WB Th-Rt: **A** (0.0s)	<0.01	0m	WB Th-Rt: **A** (0.0s)	<0.01	0m
	SB Left: **B** (12.1s)	0.02	<10m	SB Left: **B** (13.5s)	0.02	<10m
	SB Right: **B** (10.2s)	0.04	<10m	SB Right: **A** (9.3s)	0.02	<10m

A – Queue represents the calculated vehicle queue length in metres occurring 95% of the time (95th percentile).

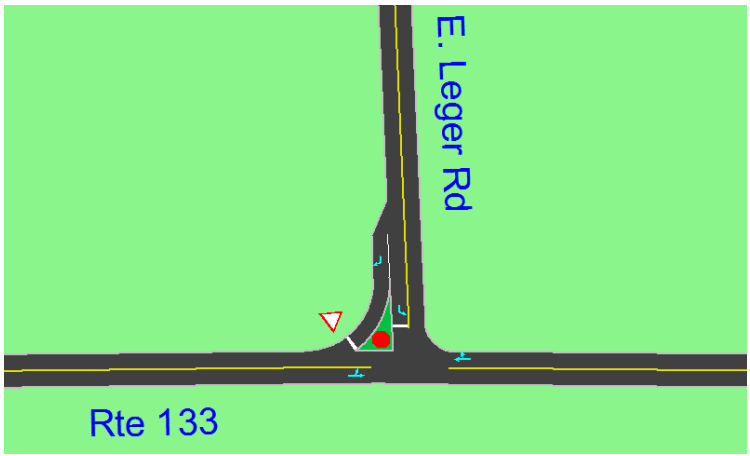
B – Existing lane configuration (i.e. no auxiliary turn lanes).

C – Lane configuration assumes an exclusive southbound channelized right turn lane.

5.4 Proposed Intersection Lane Configuration

A conceptual illustration of the proposed lane configuration at the Route 133 / Euclide Leger Road intersection is provided in *Figure 7*.

Figure 7: Proposed Intersection Lane Configuration



6. CONCLUSIONS AND RECOMMENDATIONS

This chapter summarizes the salient findings of the analysis and identifies any necessary changes to the transportation infrastructure.

6.1 Conclusions

The following conclusions were gleaned from the traffic impact assessment of the proposed development:

- The driver sight line review at the Euclide Leger Road intersection indicates that only minimum stopping sight distances are available to/from the east and are limited by the combined horizontal/vertical curve in the Route 133 alignment. Minimum design values are associated with increases in road safety risk.
- The capacity analysis results for the future Background Summer 2022 conditions at the Euclide Leger Road intersection suggests that individual vehicle movements through the subject intersection will continue to operate with acceptable performance measures. The southbound shared left-right turn movement will continue to operate with v/c ratios of 0.01 and LOS B or better. These results suggest that a general traffic growth rate of 2% per year between the 2016 and 2022 planning horizons will have a marginal impact on the performance of this intersection and it will have a substantial amount of residual capacity to accommodate traffic growth well beyond the 2022 planning horizon.
- The proposed 249 camp site campground development is expected to generate new traffic in the Route 133 corridor that includes:
    - Weekday AM peak hour: 43 two-way trips, including 15 inbound and 28 outbound from the site.
    - Weekday PM peak hour: 50 two-way trips, including 33 inbound and 17 outbound from the site.
- The operational analysis of the subject intersection under future Total 2022 traffic conditions - including the site-generated traffic – is expected to operate at acceptable levels of service and v/c ratios with the existing lane configuration and stop control. Since only minimum driver sight lines are available to/from the east from Euclide Leger Road a southbound channelized right turn lane was also included in the analysis to better accommodate slow-moving recreational vehicles and trailers. The channelizing right turn lane shifts these vehicles further to the west – adding more sight distance – and allows them to make the right turn movement under a yield condition as opposed to a stop condition.

Overall, the traffic study analysis results suggest that an upgraded Euclide Leger Road intersection will provide improved driver sight distance and reduced road safety risk. In addition, the new traffic associated with the campground development will have an acceptable level of impact on the Route 133 corridor under future Total 2022 traffic conditions.

6.2 Recommendations

The following recommendations are required to accommodate future traffic pattern changes associated with the proposed campground development:

- That the new public portion of Euclide Leger Road and new intersection with Route 133 be designed following Department of Transportation and Infrastructure (DTI) and Transportation Association of Canada (TAC) geometric design guidelines. Appropriate design parameters for large recreational vehicles and expected operating speeds should be applied.
- Euclide Leger Road will function with adequate capacity with a two-lane-two-way cross-section and localized widening at the Route 133 intersection. This will include one inbound (northbound) lane, one outbound (southbound) left turn and one outbound (southbound) channelized right turn lane, as shown in *Figure 7*. The southbound channelized right turn lane is recommended to accommodate large recreational vehicles and trailers to provide additional driver sight distance to/from the east.
- That DTI give consideration to relocating the existing 60 km/h speed zone to a point east of Euclide Leger Road, beyond the area of increased driveway density that is typical of urban low-speed environments. This change along with the installation of Town of Shediac gateway signage is expected to better manage operating speeds along Route 133, particularly in the westbound direction.
- That all new signage and pavement markings associated with the necessary roadway upgrades to the Euclide Leger Road intersection – including intersection warning signs – be designed and installed in accordance with the most recent version of the *Manual of Uniform Traffic Control Devices of Canada* (MUTCDC).

APPENDIX I

Intersection operational analyses

DEFINITION OF LEVELS OF SERVICE
Automobile Mode

UNSIGNALIZED INTERSECTIONS

Analysis of the Level of Service for unsignalized intersections is based on the ***Highway Capacity Manual*** *(HCM 2010)* procedures using Trafficware's *Synchro 8* for unsignalized intersections. The Level of Service for intersections is based on *Control Delay*. At two way stop controlled intersections (TWSC) and All way stop controlled intersections (AWSC), *Control Delay* is the total elapsed time from a vehicle joining the queue until its departure from the stopped position at the head of the queue. The *Control Delay* also includes the time required to decelerate from a stop and to accelerate to the free-flow speed.

The analysis of individual movements at TWSC and AWSC intersections can also include the estimate of the ratio of volume or demand to available capacity for the movements. This is commonly known as the (v/c) ratio. The v/c ratio provides some indication of how well these individual intersection movements will function during peak hour periods.

Level of Service definitions for unsignalized intersections as defined by the ***Highway Capacity Manual*** are summarized in the table below.

Definition of Level of Service for Unsignalized Intersections
(see Exhibit 19-1, Highway Capacity Manual 2010)

Level of Service	Average Delay (seconds)
A	0 - 10
B	>10-15
C	>15-25
D	>25-35
E	>35-50
F	More than 50s and/or v/c > 1

Level of Service (LoS) for TWSC and AWSC intersections is determined by the computed or measured *Control Delay* and is defined for each minor movement at the intersection. LoS is not defined for the major street approaches or the intersection as a whole. LoS "F" is considered to be undesirable for design or planning purposes. However, many individual turning movements at TWSC and AWSC intersections and commercial entrances along urban arterial corridors operate at LoS "F" during peak hour periods.

Existing Conditions Results

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	2	126	263	1	3	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	2	137	286	1	3	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	287	0	-	0	427	286
Stage 1	-	-	-	-	286	-
Stage 2	-	-	-	-	141	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1269	-	-	-	583	751
Stage 1	-	-	-	-	760	-
Stage 2	-	-	-	-	883	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1269	-	-	-	582	751
Mov Cap-2 Maneuver	-	-	-	-	582	-
Stage 1	-	-	-	-	760	-
Stage 2	-	-	-	-	881	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	10.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1269	-	-	-	677
HCM Lane V/C Ratio	0.002	-	-	-	0.013
HCM Control Delay (s)	7.8	0	-	-	10.4
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	7	302	150	4	2	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	8	328	163	4	2	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	167	0	-	0	508	165
Stage 1	-	-	-	-	165	-
Stage 2	-	-	-	-	343	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1405	-	-	-	523	877
Stage 1	-	-	-	-	862	-
Stage 2	-	-	-	-	716	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1405	-	-	-	519	877
Mov Cap-2 Maneuver	-	-	-	-	519	-
Stage 1	-	-	-	-	862	-
Stage 2	-	-	-	-	711	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	10
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1405	-	-	-	733
HCM Lane V/C Ratio	0.005	-	-	-	0.01
HCM Control Delay (s)	7.6	0	-	-	10
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Background 2021 Results

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	2	142	296	1	3	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	2	154	322	1	3	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	323	0	-	0	481	322
Stage 1	-	-	-	-	322	-
Stage 2	-	-	-	-	159	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1231	-	-	-	542	717
Stage 1	-	-	-	-	732	-
Stage 2	-	-	-	-	867	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1231	-	-	-	541	717
Mov Cap-2 Maneuver	-	-	-	-	541	-
Stage 1	-	-	-	-	732	-
Stage 2	-	-	-	-	865	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	10.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1231	-	-	-	639
HCM Lane V/C Ratio	0.002	-	-	-	0.014
HCM Control Delay (s)	7.9	0	-	-	10.7
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	7	340	169	4	2	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	8	370	184	4	2	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	188	0	-	0	571	186
Stage 1	-	-	-	-	186	-
Stage 2	-	-	-	-	385	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1380	-	-	-	481	854
Stage 1	-	-	-	-	843	-
Stage 2	-	-	-	-	686	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1380	-	-	-	478	854
Mov Cap-2 Maneuver	-	-	-	-	478	-
Stage 1	-	-	-	-	843	-
Stage 2	-	-	-	-	681	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	10.2
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1380	-	-	-	697
HCM Lane V/C Ratio	0.006	-	-	-	0.011
HCM Control Delay (s)	7.6	0	-	-	10.2
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Total 2021 Results

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	13	142	296	5	10	26
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	14	154	322	5	11	28

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	327	0	-	0	507	324
Stage 1	-	-	-	-	324	-
Stage 2	-	-	-	-	183	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1227	-	-	-	524	715
Stage 1	-	-	-	-	731	-
Stage 2	-	-	-	-	846	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1227	-	-	-	518	715
Mov Cap-2 Maneuver	-	-	-	-	518	-
Stage 1	-	-	-	-	731	-
Stage 2	-	-	-	-	836	-

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	10.9
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1227	-	-	-	647
HCM Lane V/C Ratio	0.012	-	-	-	0.06
HCM Control Delay (s)	8	0	-	-	10.9
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	32	340	169	12	6	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	35	370	184	13	7	20

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	197	0	-	0	629	190
Stage 1	-	-	-	-	190	-
Stage 2	-	-	-	-	439	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1370	-	-	-	445	849
Stage 1	-	-	-	-	840	-
Stage 2	-	-	-	-	648	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1370	-	-	-	431	849
Mov Cap-2 Maneuver	-	-	-	-	431	-
Stage 1	-	-	-	-	840	-
Stage 2	-	-	-	-	627	-

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	10.5
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1370	-	-	-	683
HCM Lane V/C Ratio	0.025	-	-	-	0.038
HCM Control Delay (s)	7.7	0	-	-	10.5
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.1

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	13	142	296	5	10	26
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	-	-	-	0	200
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	14	154	322	5	11	28

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	327	0	-	0	507	324
Stage 1	-	-	-	-	324	-
Stage 2	-	-	-	-	183	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1227	-	-	-	524	715
Stage 1	-	-	-	-	731	-
Stage 2	-	-	-	-	846	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1227	-	-	-	518	715
Mov Cap-2 Maneuver	-	-	-	-	518	-
Stage 1	-	-	-	-	731	-
Stage 2	-	-	-	-	836	-

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	10.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1227	-	-	-	518	715
HCM Lane V/C Ratio	0.012	-	-	-	0.021	0.04
HCM Control Delay (s)	8	0	-	-	12.1	10.2
HCM Lane LOS	A	A	-	-	B	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1	0.1

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	32	340	169	12	6	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Yield
Storage Length	-	-	-	-	0	200
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	35	370	184	13	7	20

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	197	0	-	0	629	190
Stage 1	-	-	-	-	190	-
Stage 2	-	-	-	-	439	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1370	-	-	-	445	849
Stage 1	-	-	-	-	840	-
Stage 2	-	-	-	-	648	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1370	-	-	-	431	849
Mov Cap-2 Maneuver	-	-	-	-	431	-
Stage 1	-	-	-	-	840	-
Stage 2	-	-	-	-	627	-

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	10.4
HCM LOS			B

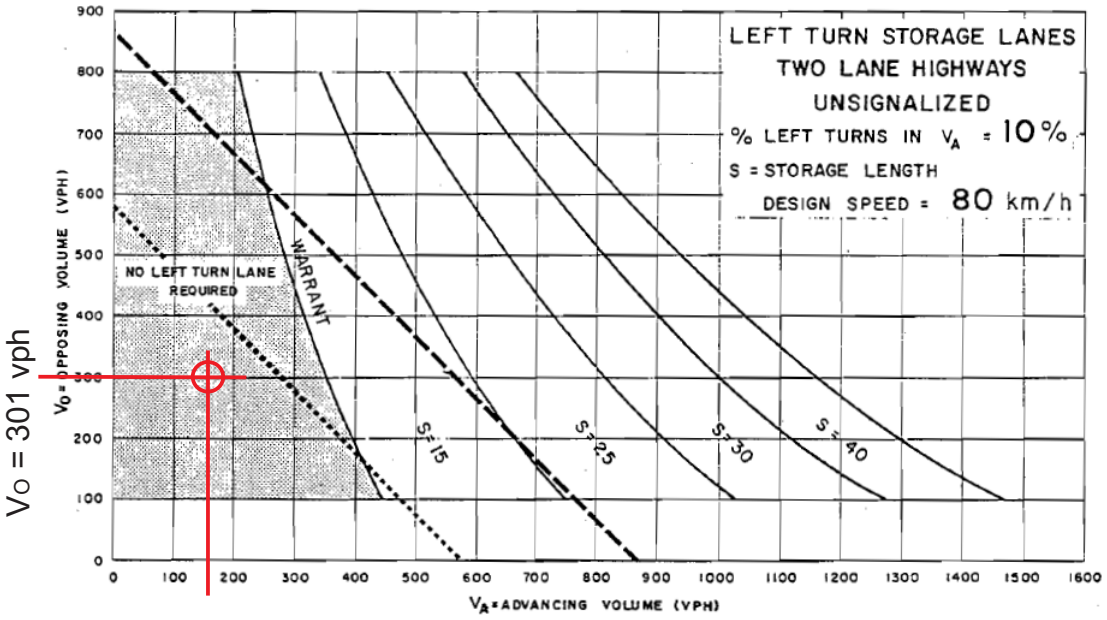
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1370	-	-	-	431	849
HCM Lane V/C Ratio	0.025	-	-	-	0.015	0.023
HCM Control Delay (s)	7.7	0	-	-	13.5	9.3
HCM Lane LOS	A	A	-	-	B	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0	0.1

APPENDIX II

Auxiliary Lane Warrant Results

Left Turn Lane Warrant Analysis
Total 2022 Summer Traffic Volumes
E. Leger Rd - Eastbound Left

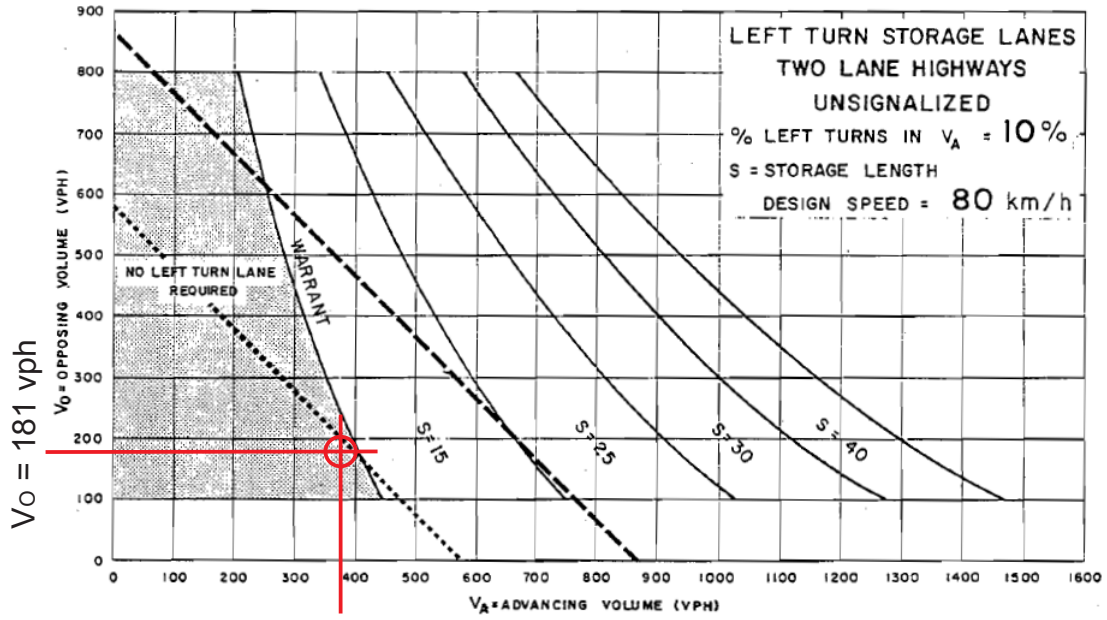
Weekday AM Peak Period - GDSOH Figure EA-14:



V_O = 301 vph

Advancing Traffic:
V_A = 155 vph
V_L = 13 vph
Left turns = 8.4%

Weekday PM Peak Period - GDSOH Figure EA-14:

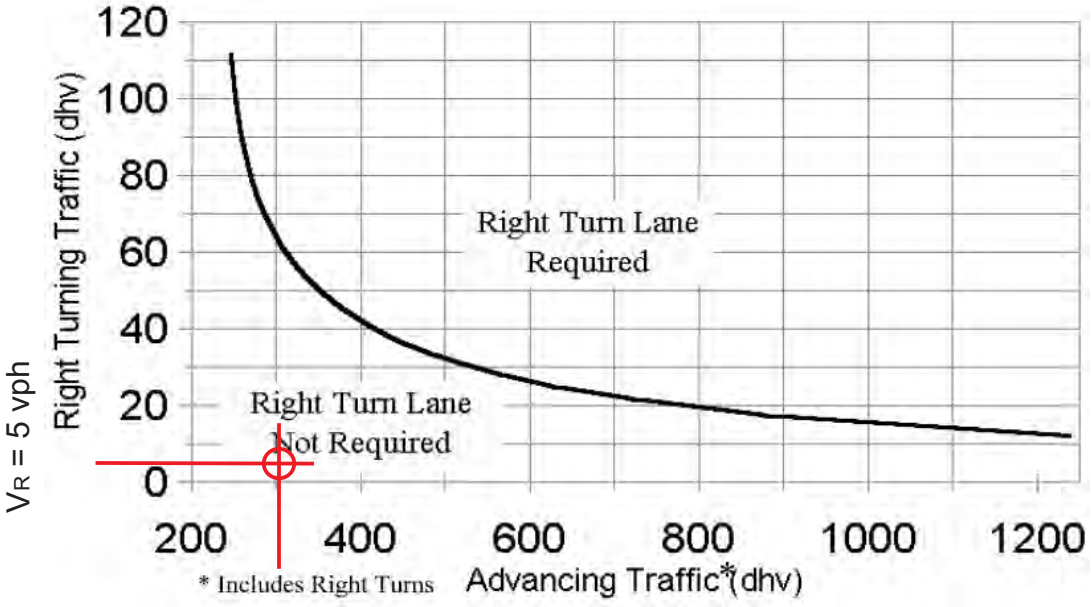


V_O = 181 vph

Advancing Traffic:
V_A = 372 vph
V_L = 32 vph
Left turns = 8.6%

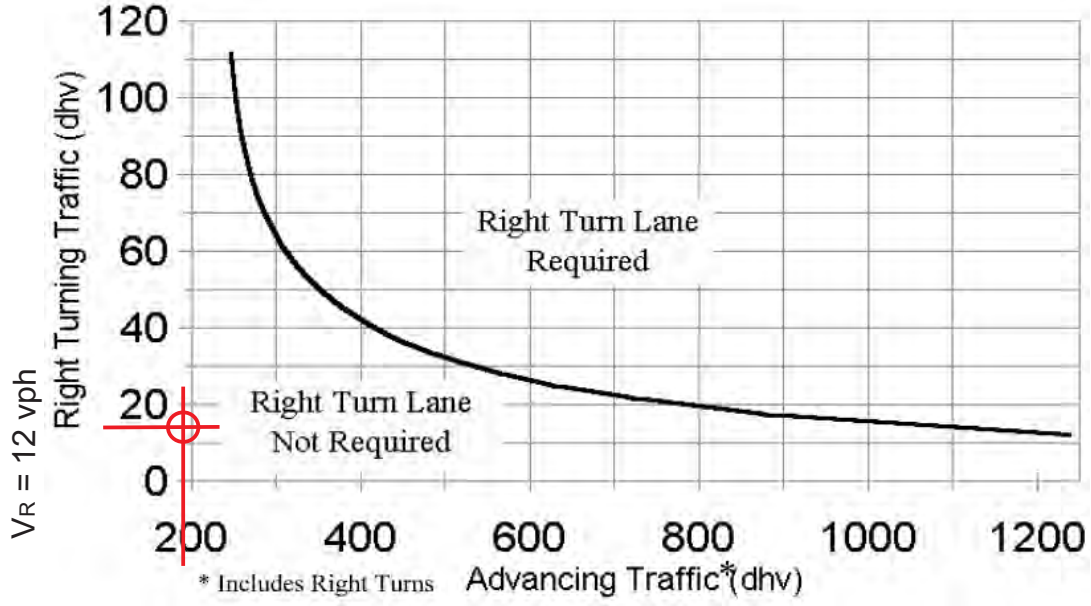
Right Turn Lane Warrant Analysis
Total 2022 Summer Traffic Volumes
E. Leger Rd - Westbound Right

Weekday AM Peak Period - ODOT SHAM (Page 45):



Advancing Traffic:
V_A = 301 vph

Weekday PM Peak Period - ODOT SHAM Manual (Page 45):



Advancing Traffic:
V_A = 181 vph