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2024

Northern Lights
Traffic Impact Study Addendum 2

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Traffic Impact Study Disclaimer

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TRAFFIC IMPACT ANALYSIS

Northern Lights Addendum 2

I. Executive Summary

A. Introduction

1. Background Information

The original Traffic Impact Analysis (TIS) for the Northern Lights development northwest of Tetonia, Idaho was prepared in accordance with the *Requirements for Transportation Impact Studies* which is a supplement to the Idaho Transportation Department Board Policy B-12-06. At the presentation of the project to the Teton County Board of County Commissioners (BOCC), the BOCC questioned some of the assumptions used in the original TIS, principally, the route motorists would likely use traveling to and from the development to Hwy. 33 and to the City of Driggs. Consequently, the development was denied, with one of the reasons for denial the perceived inadequacy of the county roads to provide for traffic from the proposed development. Various events have occurred since that original public hearing before the BOCC in August of 2023 which have led to circumstances wherein the project is being reconsidered by the BOCC. The BOCC reconsidered the preliminary plat submittal on February 26, 2024, and made a motion to continue the public hearing. The specific language of the motion as extracted from the approved meeting minutes states:

> *Continue the public hearing for Northern Lights Subdivision Preliminary Plat to May 6, 2024 at 1 PM in order to obtain a revised traffic study to evaluate traffic impacts with the actual primary route being Hatches Corner to 500 W to 6500 N from the applicant.*

As a result of the motion, the Applicant has revisited the assumptions used in the original TIS regarding the primary route traffic would likely utilize to access the proposed development from Hwy. 33. The Engineer visited with both the Teton County Engineer and the ITD Traffic Engineer regarding a reasonable approach to determining the allocation of traffic among the available routes to access Hwy 33. Consequently, the Engineer performed traffic counts during the P.M. Peak hour at the intersection of 1750 West and 6500 North on two separate occasions to ascertain the predilection of existing motorists regarding the preferred route to access Hwy 33. On neither occasion did any traffic north of the intersection utilize 6500 North to access Hwy 33, rather, all of the existing traffic generated or returning from destinations north the 1750 West/6500 North intersection used the 2000 West/Hwy 33 intersection.

a. Existing Traffic Patterns at the 1750 West/6500 North Intersection

Because the observed existing traffic patterns at the 1750 West/6500 North intersection used the 2000 West/Hwy 33 intersection to access Hwy 33, the assumptions in the original TIS are consistent with observed existing traffic. Generally, motorists prefer the most direct route when presented with alternatives to access roads with higher modality in a road network. Therefore, the Engineer prepared an

addendum (Addendum 1) to the original TIS updating the traffic counts for the intersections analyzed in the original TIS.

Because of the language in the motion to continue the public hearing, the Engineer also modeled the traffic generated by the proposed development as if all of the motorists selected the intersection referenced in the motion to access Hwy 33, namely the 500 West/Hwy 33 intersection which is known as Hatch's Corner. The modeling data and resulting analysis are presented as Addendum 2.

2. Addendum 2

Civilize, PLLC has been retained to update the 2022 Traffic Impact Study for the Northern Lights project in accordance with the requirements of Teton County.

Addendum 2 adds to the compendium of information developed germane to existing and proposed traffic patterns on the existing road network in the vicinity of the proposed development by modeling and analyzing the intersections of 500 West/6500 North and 500 West/Hwy 33. For Addendum 2, as with Addendum 1, the traffic counts have been updated to reflect 2024 values. For information regarding the proposed development, reference the original 2022 TIS for the project identification, location, applicable regulations, purpose of report and study objectives, proposed development characteristics, zoning, site plan, land use and intensity, site accessibility, access management, area transportation elements and roadway system, and accident history.

B. Development Description and Phasing

The projected land use for the build-out year of the proposed development is comprised of 17 main dwelling units and 17 accessory dwelling units (34 units total).

This traffic impact study evaluates the existing transportation conditions, the buildout condition, and a horizon year 20 years beyond the buildout year. The following analyses were performed:

- 2024 existing background traffic
- 2029 buildout year background traffic
- 2029 buildout year background plus site traffic
- 2049 horizon year background traffic
- 2049 buildout year background plus site traffic

C. Projected Traffic

The build-out conditions are expected to generate approximately 325 trips for the MADT and 26 trips during PM peak hour by the year 2027.

D. Conclusion

After evaluating the proposed development within the context of zoning; projected land use; existing transportation system; background traffic counts for the principal roadways within the study impact area; projected traffic for horizon years corresponding with project opening, project buildout, and a 20-year horizon year; the findings of the Traffic Impact Study are summarized below. In order to simplify the forecasted traffic conditions as they have progressed through this study, the following three (3) tables were produced. The first table shows the forecasted progression of the roadway segments, the second

table shows the intersections, and the third shows the left or right turn lanes. It should be noted by constructing the left turn lane or TWLTL at Intersection 5 for safety for the 2024 existing conditions, the LOS improved for the 2029 buildout year.

Table 1- Segment Traffic Conditions Progression Each Horizon Year

Segment 1	2024 (Existing)		2029 Buildout		2049 Horizon	
Hwy 33	Value	LOS	Value	LOS	Value	LOS
FFS (mph)	63.25	n/a	63.25	n/a	63.25	n/a
ATS (mph)	54.48	B	53.5	B	49.97	C
PTSF (%)	53.1%	B	57.2%	C	77.0%	D
v/c Ratio	0.2	B	0.24	C	0.41	D

Segment 2	2024 (Existing)		2029 Buildout		2049 Horizon	
2000S (from Hwy 33 to 5750N)	Value	LOS	Value	LOS	Value	LOS
FFS (mph)	40	n/a	40	n/a	40	n/a
PFFS (%)	97.1%	A	95.3%	A	92.4%	A
v/c Ratio	0.04	A	0.07	A	0.11	A

Table 2- Intersection Traffic Conditions Progression Each Horizon Year

Int 1: 6500N/1750W	Eastbound Max LOS	Westbound Max LOS	Northbound Max LOS	Southbound Max LOS
2024 Existing Traffic	n/a	A	A	A
2029 Background Traffic	n/a	A	A	A
2029 Background plus Site Traffic	n/a	A	A	A
2049 Background Traffic	n/a	A	A	A
2049 Background plus Site Traffic	n/a	A	A	A

Int 2: 6500N/500W	Eastbound Max LOS	Westbound Max LOS	Northbound Max LOS	Southbound Max LOS
2024 Existing Traffic	A	n/a	A	A
2029 Background Traffic	A	n/a	A	A
2029 Background plus Site Traffic	A	n/a	A	A
2049 Background Traffic	A	n/a	A	A
2049 Background plus Site Traffic	A	n/a	A	A

Int 3: 5750N/500W	Eastbound Max LOS	Westbound Max LOS	Northbound Max LOS	Southbound Max LOS
2024 Existing Traffic	A	A	A	A
2029 Background Traffic	A	A	A	A
2029 Background plus Site Traffic	A	A	A	A
2049 Background Traffic	A	A	A	A
2049 Background plus Site Traffic	A	A	A	A

Int 4: Hwy 33/5750N	Eastbound Max LOS	Westbound Max LOS	Northbound Max LOS	Southbound Max LOS
2024 Existing Traffic	A	A	n/a	B
2029 Background Traffic	A	A	n/a	B
2029 Background plus Site Traffic	A	A	n/a	B
2049 Background Traffic	A	A	n/a	C
2049 Background plus Site Traffic	A	A	n/a	C

Int 5: Hwy 33/500W	Eastbound Max LOS	Westbound Max LOS	Northbound Max LOS	Southbound Max LOS
2024 Existing Traffic	n/a	C	A	A
2029 Background Traffic	n/a	B	A	A
2029 Background plus Site Traffic	n/a	B	A	A
2049 Background Traffic	n/a	C	A	A
2049 Background plus Site Traffic	n/a	C	A	B

Table 3- Left and Right Turn Lane Progression Each Horizon Year

Int 4: Hwy 33/5750N	Left Turn Lane		Right Turn Lane	
	Eastbound	Westbound	Eastbound	Westbound
2024 Existing Traffic	Warranted	n/a	n/a	Not Warranted
2029 Background Traffic	Warranted	n/a	n/a	Not Warranted
2029 Background plus Site Traffic	Warranted	n/a	n/a	Not Warranted
2049 Background Traffic	Warranted	n/a	n/a	Not Warranted
2049 Background plus Site Traffic	Warranted	n/a	n/a	Not Warranted

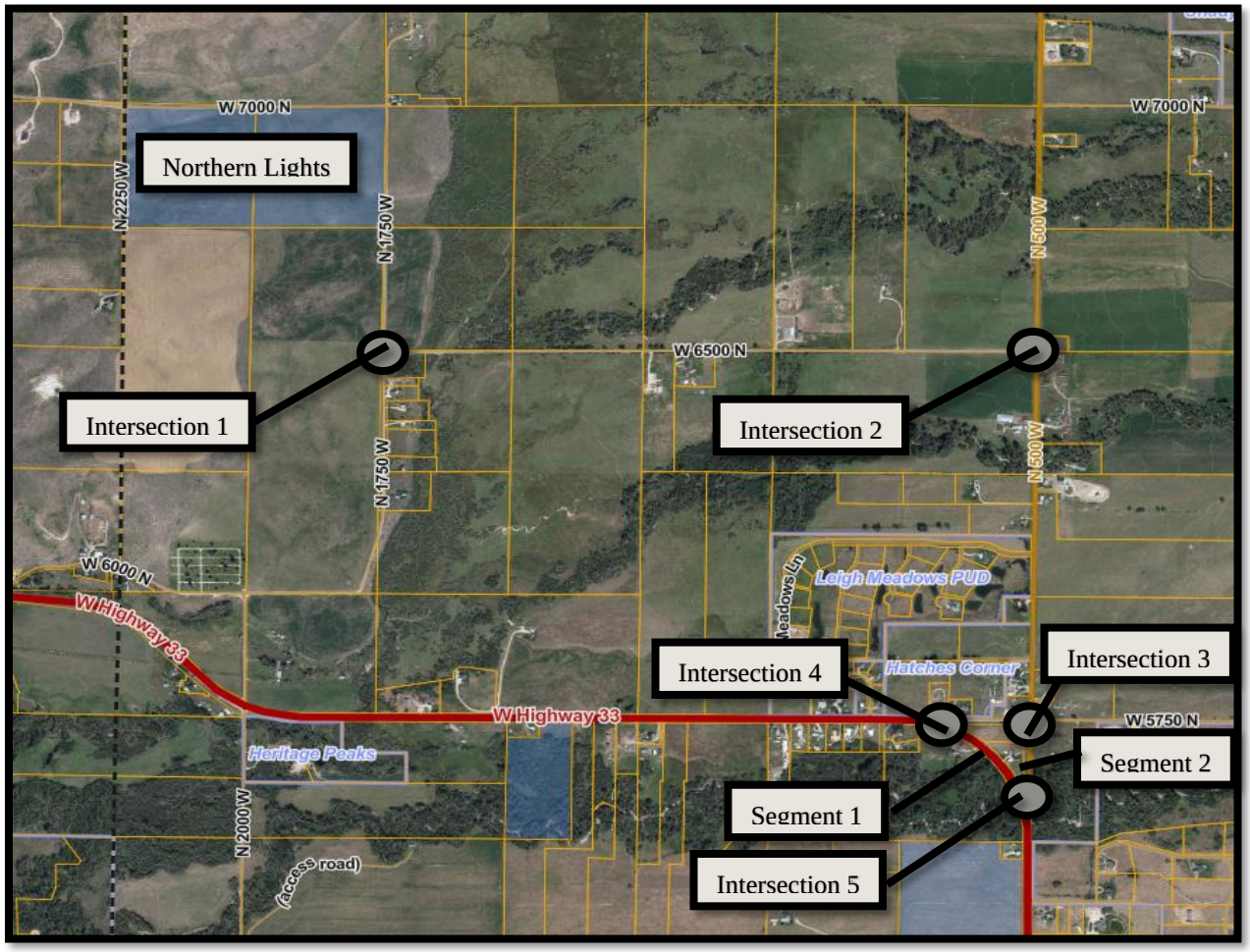
Int 5: Hwy 33/500N	Left Turn Lane		Right Turn Lane	
	Northbound	Southbound	Northbound	Southbound
2024 Existing Traffic	n/a	Warranted	Warranted	n/a
2029 Background Traffic	n/a	Warranted	Warranted	n/a
2029 Background plus Site Traffic	n/a	Warranted	Warranted	n/a
2049 Background Traffic	n/a	Warranted	Warranted	n/a
2049 Background plus Site Traffic	n/a	Warranted	Warranted	n/a

E. Existing Traffic Conditions (2024)

The existing traffic conditions were analyzed with the existing intersection control and lane configurations. For the existing traffic conditions, all the road segments and intersections are operating within minimum operational thresholds except:

- Int. 4 Hwy 33/5750W: Eastbound left-turning traffic exceeds the minimum safety levels
- Int. 5 Hwy 33/500W: Southbound left-turning traffic exceeds the minimum safety levels

- Int. 5 Hwy 33/500W: Northbound right-turning traffic exceeds the minimum safety levels



1. Existing 2024 Traffic Mitigating Measures

To mitigate for existing traffic conditions, the Hwy 33/500W intersection should be improved. It is recommended that a left turn lane or a two way left turn lane (TWLTL) be constructed on Hwy 33 at both intersections 4 and 5. Additionally, it is recommended that a right turn lane be constructed at Intersection 5 to accommodate the existing 2024 traffic safely.

F. 2029 Buildout Year Traffic Conditions Results

All segment capacity and intersection delay times/LOS are projected to operate within the minimum allowable operational thresholds for the 2029 buildout year.

1. 2029 Buildout Mitigating Measures

Assuming the responsible parties construct the recommended improvements to mitigate for existing condition, there are no additional deficiencies forecasted for the 2029 Buildout conditions, therefore no mitigation measures are recommended.

G. 2049 Horizon Year Traffic Conditions Results

All segment capacity and intersection delay times/LOS are projected to operate within the minimum allowable operational thresholds for the 2049 horizon year.

1. 2049 Horizon Year Mitigating Measures

For the 2049 planning horizon, the traffic for the proposed development becomes part of the background traffic. For the 2049 horizon year scenario no deficiencies were forecasted, therefore no mitigation measures are recommended.

H. Overall Study Summary

From the data and analysis presented above, the development is forecasted to have negligible impact to the traffic network within the study area. All segments are forecasted to operate below the allowable operation thresholds throughout the study time period. All intersections are forecasted to operate below the allowable operation thresholds throughout the study time period with or without the development.

Although the traffic is forecasted to operate at an acceptable level, in order to meet ITD's minimum safety guidelines on Hwy 33, left turns lanes or a two way left turn lane (TWLTL) for both intersections 4 and 5 along with a right turn lane at Intersection 5 is warranted with or without the development.

II. Addendum 2 Study Approach

Addendum 2 is a scenario where 100% of the traffic generated by the proposed development travels south on 1750 W to 6500N, turns left and travels east to 500W, and then travels south to Hwy 33.

A. Full TIS or Minor TIS

The scope of this TIS is based on ITD's *Requirements for Transportation Impact Studies* (Supplement to Board Policy B-12-06) as well as the guidance document titled *Transportation Impact Analyses for Site Development*. published by the Institute of Transportation Engineers (ITE). These requirements outline a full or minor TIS as:

- A full TIS shall be required for development that will generate more than 100 vph or 1000 vpd.
- A minor TIS is required for development that will generate up to 99 vph or 999 vpd.

This development is forecasted to generate less than 99 vph, and less than 999 vpd, thus a minor TIS will be performed. Since this is determined to be a minor TIS, only the pm peak hour will be analyzed as recommended by the Requirements for Transportation Impact Studies by ITD

B. Study Period

The following study periods were identified for analysis:

1. 2024 (Existing)
2. 2029 (Project Buildout)
3. 2049 (20-Year Horizon)

The following time intervals were identified for analysis:

1. Weekend PM peak hour

1. Phasing and Timing

a. Existing Conditions

The traffic counts were obtained in March of 2024. The existing condition year will be considered 2024.

b. Buildout Conditions

It is estimated that buildout will occur in five (5) years. The buildout conditions will be considered for 2029

c. 20-Year Horizon Year

The 20-year longer term traffic conditions occur 20 years after buildout. Therefore, the 20-year horizon year will be projected to year 2049. As mentioned earlier, this TIS will not consider additional traffic that may be generated from unknown development within the study area.

C. Segments and Intersections to be Studied

It has been identified that the following intersections will be evaluated for Addendum 2 with the most recent traffic counts:

1. Segment 1 – Hwy 33 (from Intersection 6, ½ mile each direction)
2. Segment 2 – 500W (from Hwy 33 to 5750N)
3. Intersection 1 – 6500N/1750W
4. Intersection 2 – 6500N/500W
5. Intersection 3 – 5750N/500W
6. Intersection 4 – Hwy 33/5750N
7. Intersection 5 – Hwy 33/500W

It should be noted that the intersections of Hwy 33/2000W, 7000N/1750W, and the two (2) entrances to the proposed subdivision were modeled in the original 2022 TIS and updated in Addendum 1.

D. Study Methodology, Limitations and Assumptions

1. Traffic Model

The data gathered will be entered into the Synchro Traffic Modeling Software Version 11. The traffic volumes (in vehicles per hour) during the pm peak hour will be entered into the traffic model. The following steps will be followed in this TIS:

1. PM peak traffic using Intersection 1, 6500N/1750W, will be visually counted
2. PM peak traffic using Intersection 2, 6500N/500W, will be visually counted
3. PM peak traffic using Intersection 3, 5750N/500W, will be visually counted
4. PM peak traffic using Intersection 2, Hwy 33/5750N, will be visually counted
5. PM peak traffic using Intersection 3, Hwy 33/500W, will be visually counted
6. Hwy 33 data will be obtained from ITD
7. Since the data was visually collected out of peak season, the visual data will be seasonally adjusted to the peak month to match the data from ITD
8. The adjusted volumes will be entered into a model for the 2024 existing conditions to establish a baseline
9. The proposed development will be analyzed to determine the projected generated traffic
10. A growth factor will be multiplied to the 2024 existing volumes to determine the forecasted 2029 traffic volumes and conditions **without** the development
11. The projected generated traffic from the development will be added to the 2029 forecasted traffic volumes to determine the forecasted 2029 traffic volumes and conditions **with** the development
12. The growth factor will be multiplied to the 2024 existing volumes to determine the forecasted 2049 (20-years after anticipated buildout) traffic volumes and conditions **without** the development
13. The projected generated traffic from the development will be added to the 2049 forecasted traffic volumes to determine the forecasted 2049 traffic volumes and conditions **with** the development
14. If a poor Level of Service (LOS) is determined, mitigation measure will be discussed to improve the LOS

Along with entering in the traffic volumes into the model, a peak hour factor, as recommended by the Highway Capacity Manual HCM for rural roadways, of 0.88 and a 5% heavy vehicle factor will be used.

2. Anticipated Annual Growth

The growth will be based on the historical increase in traffic that the ITD has collected. This data show that in 2002 the ADT was 1951 vpd and the in 2023 the ADT was 3405 vpd. Using the population growth formula of $P=P*(\exp(e^{rt}))$, we get an annual average increase of 2.78%. This increase will be used throughout this study.

3. Level of Service (LOS)

The LOS helps to determine when improvements are needed. The following sections discuss the difference between the segment and intersection LOS.

a. Segment LOS

The HCM defines the LOS as a quantitative stratification of a performance measure or measures representing the quality of service. The HCM defines six levels of service, ranging from A to F; LOS A represents the best operating conditions from the traveler's perspective, and LOS F is the most unfavorable. It is common practice to consider the LOS of A to D as acceptable with a LOS of E or F as unacceptable. For each rural roadway class (I, II, and III), the HCM measures for calculating the LOS are:

- Class I Roadway – Average Travel Speed (ATS) and Percent Time Spent Following (PTSF)
- Class II Roadway – Percent Time Spent Following (PTSF)
- Class III Roadway – Percent of Free Flow Speed (PFFS)

(1) Roadway Classification

Hwy 33 is considered a Class I two-lane highway and 500W is considered a Class III two-lane highway.

(2) Percent of free-flow speed (PFFS)

The PFFS represents the ability of vehicles to travel at or near the posted speed limit. The PFFS is a function of the Average Travel Speed (ATS), which is the average travel speed for vehicles to traverse the roadway during the analysis period, and the Free Flow Speed (FFS) which is the desired speed of drivers in low volume conditions and the absence of traffic control devices.

(3) Free Flow Speed (FFS)

The equation for the Free Flow Speed (FFS) is:

$$FFS = BFFS - F_{LS} - F_A$$ (Equation 15-2 in the HCM).

The variables in the equation are:

- BFFS - base free flow speed (the speed limit plus 10 mph)
- F_{LS} - adjusted lane and shoulder width (from the HCM Exhibit 15-7)
- F_A - adjustment for access point density (from the HCM Exhibit 15.8)

(4) Average Travel Speed (ATS)

The first step is to calculate the demand flow rate for both the analysis and the opposing direction. The equation used is Equation 15-3 from the HCM which is the following:

$$V_{i,ats} = \frac{V_i}{PHF * f_{g,ats} * f_{hv,ats}}$$ (Equation 15-3 in the HCM).

The variables in this equation are:

- V_i (demand volume)
- PHF (peak hour factor from HCM Exhibit 15-5)
- $F_{g,ats}$ (grade adjustment from HCM Exhibit 15-9)
- $F_{hv,ats}$ (heavy vehicle adjustment, using HCM Equation 15-4)

(5) PFFS Results

Lastly, the PFFS is calculated by dividing the ATS by the FFS.

$$PFFS = \frac{ATS}{FFS}$$

(6) LOS Results

The LOS correlation for the resulting Class III highway is shown in the following table which is from Exhibit 15-3 of the HCM.

Table 4 - LOS Criteria for General Two-Lane Highway Segments

Exhibit 15-3
Motorized Vehicle LOS for Two-Lane Highways

LOS	Class I Highways ATS (mi/h)	Class I Highways PTSF (%)	Class II Highways PTSF (%)	Class III Highways PFFS (%)
A	>55	≤35	≤40	>91.7
B	>50–55	>35–50	>40–55	>83.3–91.7
C	>45–50	>50–65	>55–70	>75.0–83.3
D	>40–45	>65–80	>70–85	>66.7–75.0
E	≤40	>80	>85	≤66.7
F	Demand exceeds capacity			

Note: For Class I highways, LOS is determined by the worse of ATS-based LOS and PTSF-based LOS.

(7) Volume-to-Capacity Ratio (v/c ratio)

In addition to the explanation above in regard to segment LOS, the v/c ratio is also a performance measure that can be used. In order to determine the v/c ratio, we divide the volume of the roadway by the capacity. According to the Highway Capacity Manual, the capacity of a two-lane highway is 1,700 vehicles per hour for each direction of travel. By dividing the peak hour by the peak hour capacity, we get a v/c ratio. The following table shows the correlation between the v/c ratio and the LOS.

Table 5 - LOS Criteria for General Two-Lane Highway Segments

Level of Service Criteria for General Two-Lane Highway Segments

		V/C Ratio[a]																						
		Level Terrain							Rolling Terrain							Mountainous Terrain								
			% No-Passing Zone							% No-Passing Zone							% No-Passing Zone							
LOS	% Time Delay	Avg.[b] Speed	0	20	40	60	80	100	Avg.[b] Speed	0	20	40	60	80	100	Avg.[b] Speed	0	20	40	60	80	100		
A	≤ 30	≥ 58	0.15	0.12	0.09	0.07	0.05	0.04	≥ 57	0.15	0.10	0.07	0.05	0.04	0.03	≥ 56	0.14	0.09	0.07	0.04	0.02	0.01		
B	≤ 45	≥ 55	0.27	0.24	0.21	0.19	0.17	0.16	≥ 54	0.26	0.23	0.19	0.17	0.15	0.13	≥ 54	0.25	0.20	0.16	0.13	0.12	0.10		
C	≤ 60	≥ 52	0.43	0.39	0.36	0.34	0.33	0.32	≥ 51	0.42	0.39	0.35	0.32	0.30	0.28	≥ 49	0.39	0.33	0.28	0.23	0.20	0.16		
D	≤ 75	≥ 50	0.64	0.62	0.60	0.59	0.58	0.57	≥ 49	0.62	0.57	0.52	0.48	0.46	0.43	≥ 45	0.58	0.50	0.45	0.40	0.37	0.33		
E	> 75	≥ 45	1.00	1.00	1.00	1.00	1.00	1.00	≥ 40	0.97	0.94	0.92	0.91	0.90	0.90	≥ 35	0.91	0.87	0.84	0.82	0.80	0.78		
F	100	< 45	--	--	--	--	--	--	< 40	--	--	--	--	--	--	< 35	--	--	--	--	--	--		

The following figure helps define each of the six (6) segment LOS levels. When a LOS decreases to a LOS of E, mitigation measures/improvements are recommended.

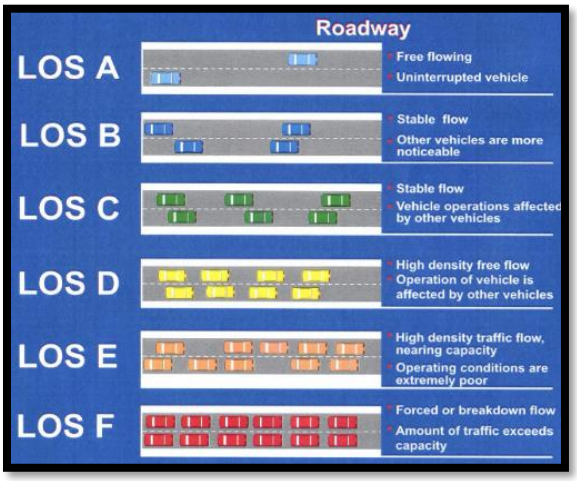


Figure 1 – Segment: Six (6) Levels of LOS

b. Intersection LOS

The LOS for an intersection is determined by the control delay per vehicle. The LOS is broken down into six (6) categories A through F; A being the best, F being the worst and E being the start of failure. In other words, when a LOS decreases from a D to an E, improvements are recommended. The following bulleted items and table break down the six (6) categories and show the correlation between the delay time and a LOS.

- LOS A: The intersection has no congestion, has less than a 10-second control delay per vehicle, and is operating below 55% capacity.
- LOS B: The intersection has very little congestion, has a control delay per vehicle between 10 and 15 seconds, and is operating between 55% and 64% capacity.
- LOS C: The intersection has no major congestion, has a control delay per vehicle between 15 and 25 seconds, and is operating between 64% and 73% capacity.

- LOS D: The intersection normally has no congestion, has a control delay per vehicle between 25 and 35 seconds, and is operating between 73% and 82% capacity.
- LOS E: The intersection is right on the verge of congested conditions, has a control delay per vehicle between 35 and 50 seconds, and is operating between 82% and 91% capacity.
- LOS F: The intersection is over capacity and experiences congestion, has a control delay per vehicle between 50 seconds or more, and is operating between 91% and 100% capacity.

Table 6 - Control Delay per Vehicle to LOS Correlation Table

Control Delay Per Vehicle (s)	LOS
≤10	A
10 to 15	B
15 to 25	C
25 to 35	D
35 to 50	E
>50	F

4. Left Turn and Right Turn Lane Warrant Analysis

The left-hand turn and right-hand turn lane warrants are analyzed following the guidance found in ITD's *Traffic Manual: Idaho's Supplementary Guide to the MUTCD*, which references *NCHRP Report 745 – Left-Turn Accommodations at Unsignalized Intersections.* In addition, the *NCHRP 457 – Evaluating Intersection Improvements: An Engineering Study Guide* was utilized for right-turn movements. The following figures show the left-turn and right-turn warrant charts for intersections on a two-lane rural highway.

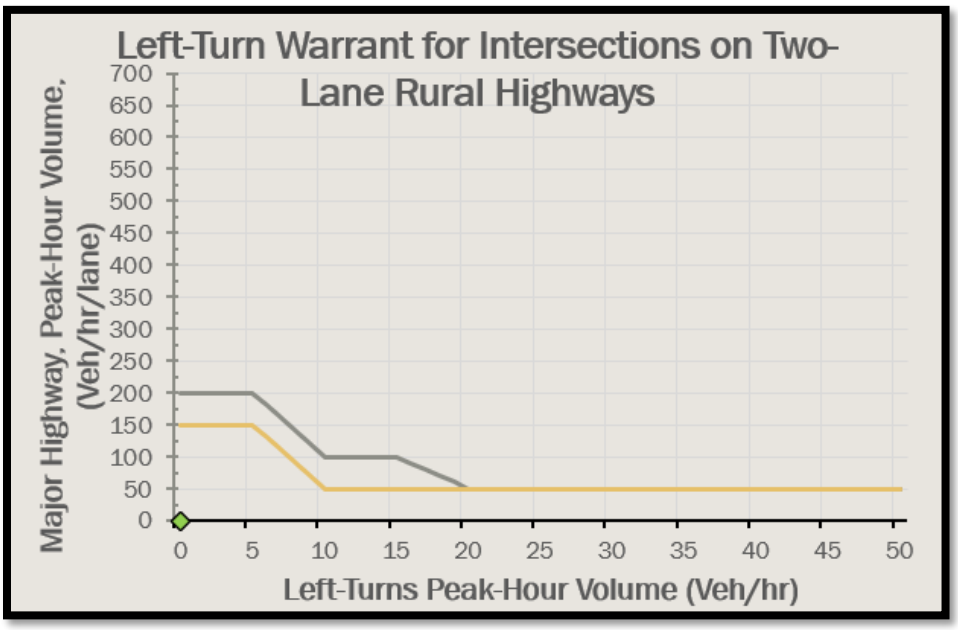


Figure 2 – Left-Turn Warrant Chart

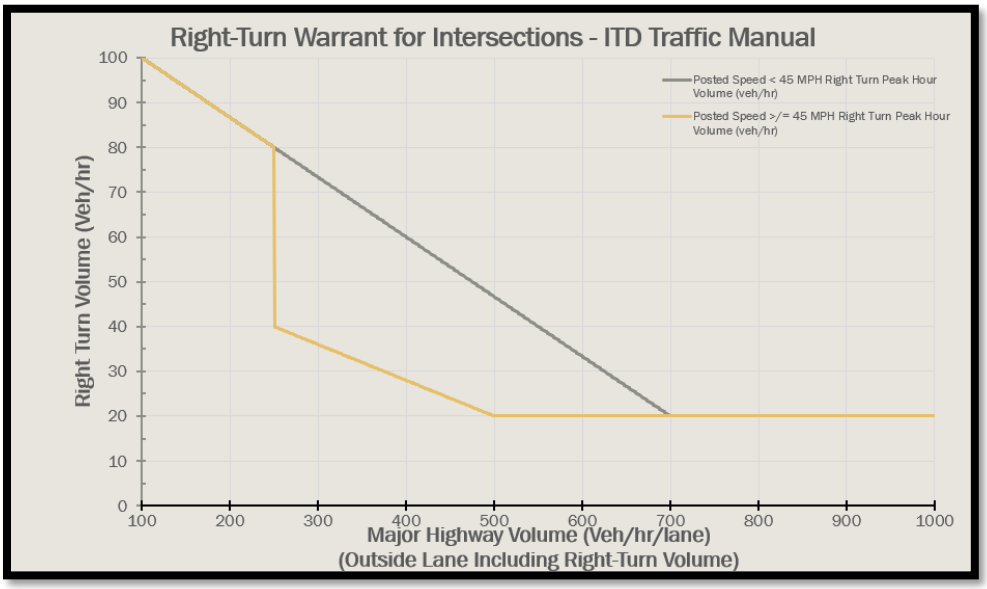


Figure 3 – Right-Turn Warrant Chart

III. Area Conditions

A. Study Area

1. Area of Influence and Significant Traffic Impact

The area of influence for this analysis includes the following roadway segments and intersections.

1. Segment 1 – Hwy 33 (from Intersection 6, ½ mile each direction)
2. Segment 2 – 500W (from Hwy 33 to 5750N)
3. Intersection 1 – 6500N/1750W
4. Intersection 2 – 6500N/500W
5. Intersection 3 – 5750N/500W
6. Intersection 4 – Hwy 33/5750N
7. Intersection 5 – Hwy 33/500W

The area of influence is presented in the following figure.

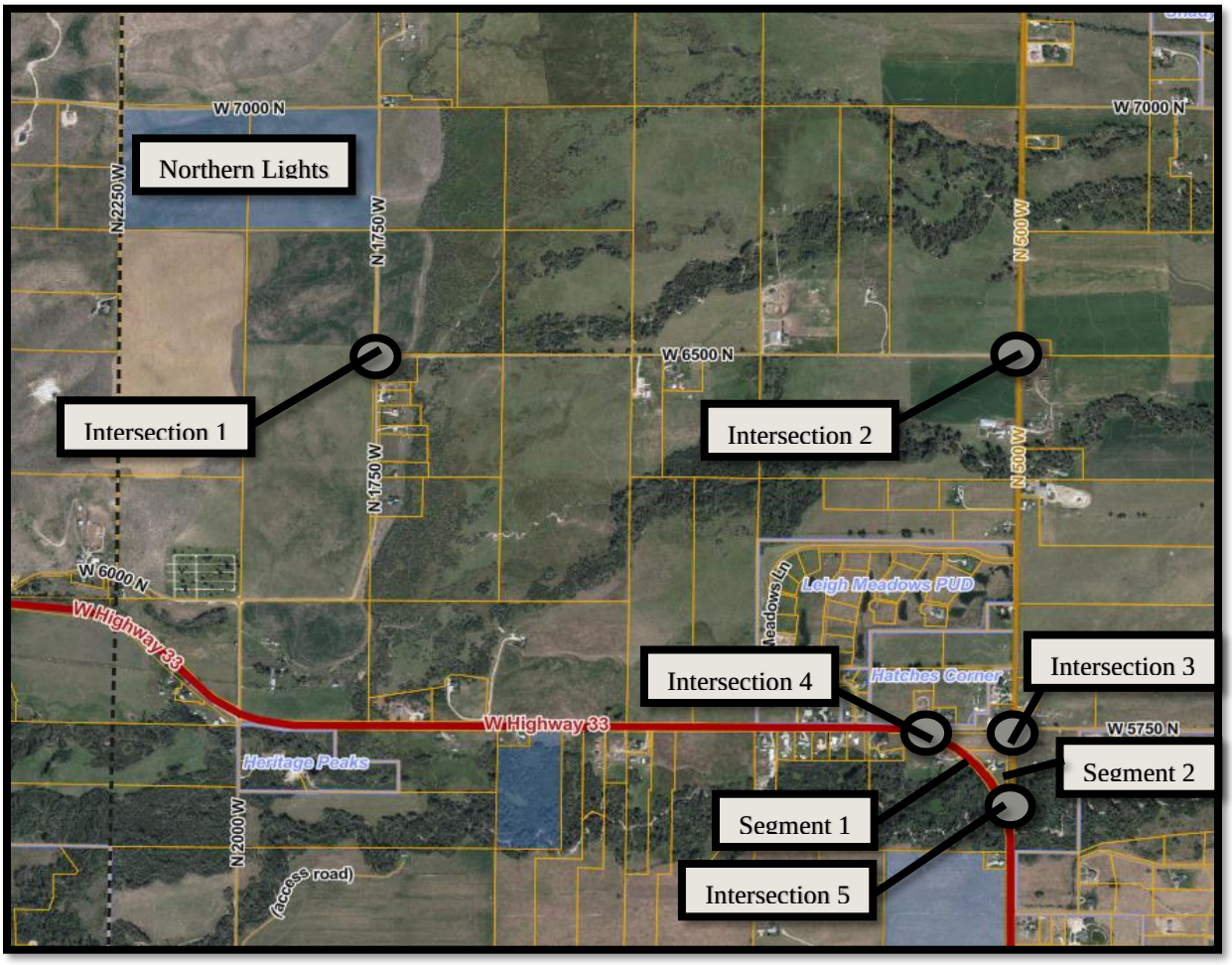


Figure 4 – Area of Influence

IV. Existing 2024 Traffic Volumes and Conditions

A. Traffic Forecasting

There are diverse ways to forecast future traffic flow and patterns. A common forecasting method is to take the historic population and forecast the traffic from those values. However, in this situation, recreation and tourism is a major factor, therefore using traffic data trends from ITD traffic counts will provide more satisfactory results from which to draw conclusions and make recommendations for mitigation. This study will use traffic data obtained from the ITD to determine traffic conditions for the 2024 (existing), 2029 (Project buildout), and the 2049 (20-year after buildout) horizon years.

B. Roadway Network

Within the area of influence there will be two (2) roadway segments and five (5) existing intersections that will be studied. The segments and the intersections that will analyzed are:

1. Segment 1 – Hwy 33 (from Intersection 6, ½ mile each direction)
2. Segment 2 – 500W (from Hwy 33 to 5750N)
3. Intersection 1 – 6500N/1750W
4. Intersection 2 – 6500N/500W
5. Intersection 3 – 5750N/500W
6. Intersection 4 – Hwy 33/5750N
7. Intersection 5 – Hwy 33/500W

C. Seasonal Adjustment

As a recreational destination, the traffic volumes fluctuate throughout the year with the summer months exhibiting the highest ADT. It has been determined that the peak month in 2023 was July with an ADT of 4,447 vpd. The visual counts for county roads were performed in March. The ITD data for March of 2023 shows that there was an ADT of 2,645 vpd. This indicated that the seasonal difference between when the visual counts were performed (March) and the peak month (July) is a multiplier of 1.68. Throughout this study, all visual counts in March will be multiplied by 1.68 to help represent the traffic in July.

D. Existing 2024 Segment PM Peak Traffic Volumes

1. Seg 1 - Hwy 33 Existing 2024 Peak Hr Flow

The traffic volumes for Hwy 33 were obtained from the ITD. The ITD website for Road Data features an interactive map that allows a query by road milepost for Average Annual Daily Traffic (AADT), which is the total volume of traffic on a road for a year divided by the number of days (365) in a year. However, these values are annual averages rather than peak days that reflect summertime travel. ITD also maintains Automatic Traffic Recorders (ATRs) throughout the state including District 6, two (2) of these ATRs are located on Hwy 33; ATR 59 east of Newdale and ATR 239 south of Driggs. The ATR most relevant to this project is ATR #59 near Newdale which records the traffic on Hwy 33. The monthly AADT for ATR #59 in 2023 ranged from a low in February of 2,565 vpd to a high in July of 4,447 vpd. This study will

focus on the July MADT or peak season and not the ADT. The following figure shows the locations of the ATRs in the area.

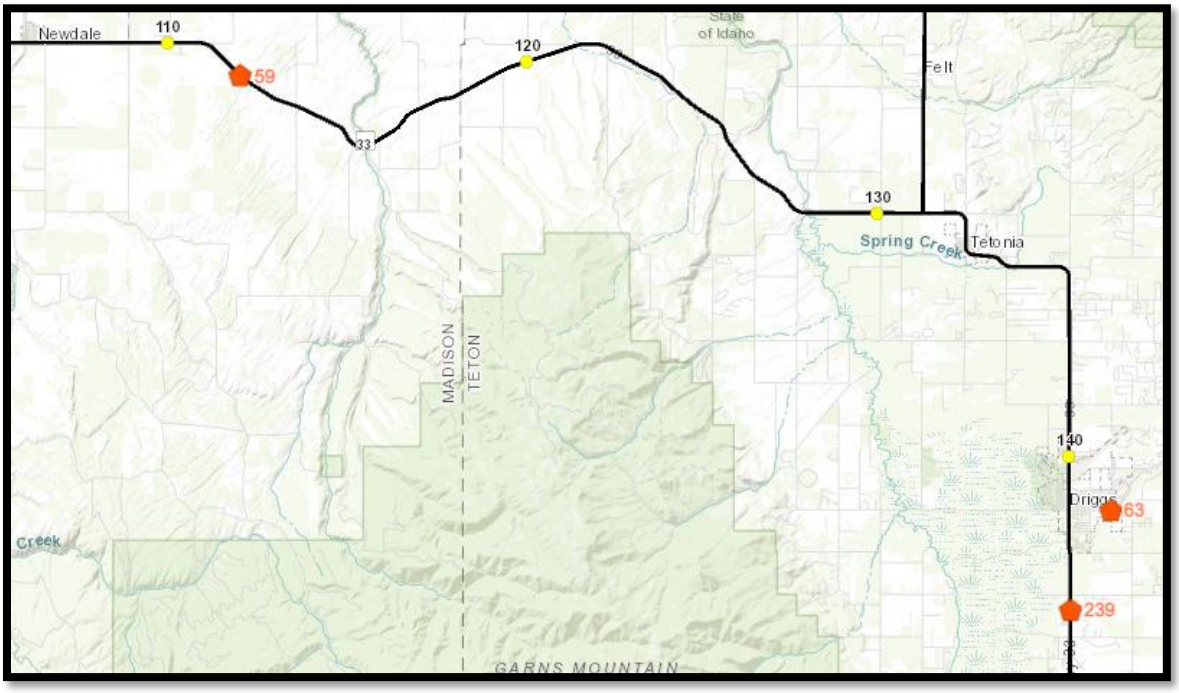


Figure 5: Hwy 33 ATR Locations

Furthermore, an adjustment needs to be made due to the fact that ATR 59 is 24 miles away from the study area. The ITD does have a database that has the ADT for each milepost along Hwy 33. In order to make these adjustments, the ADT difference between ATR 59 (Milepost 113) and the study area (Milepost 132 and Milepost 136) will be used. The following figure shows the mileposts along Hwy 33.

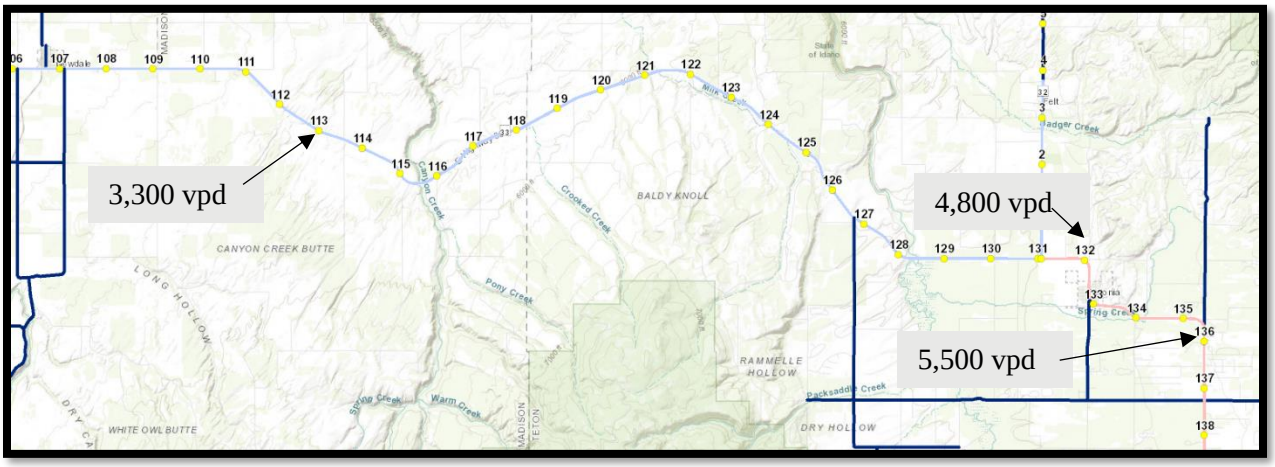


Figure 6: Hwy 33 Mileposts and ADT

The ITD website shows that the ADT at Milepost 113 to Milepost 130 is 3,300 vpd, at Milepost 132 is 4,800 vpd, and at Milepost 136 is 5,500 vpd. It is calculated that there is an increase in traffic of 45.5% between Milepost 113 and Milepost 132 and an increase of 14.6% between mileposts 132 and 136.

Data retrieved at ATR 59 shows that the in July, the highest traffic day is Friday. Furthermore, the highest pm peak hour traffic occurs between 5:00 pm and 6:00 pm on Fridays with a monthly average pm peak of 388 vph with 180 vph traveling east and 208 vph traveling west.

The last step is to take the pm peak hour traffic and adjust them proportionately to the by the calculated increase; an increase of 45.5% from Milepost 113 to Milepost 132 and an increase of 14.6% from Milepost 132 to Milepost 136. The following table shows the calculated PM peak hour volumes that will be used in this study. These volumes will be used in analyzing the intersections.

Table 7 Existing Segment ADT, Peak Hour, and Trip Distribution Volumes

Milepost	Year	ADT	July PM Peak	PM Peak Eastbound	PM Peak Westbound
113	2024	3300	388	180	208
132	2024	4800	564	262	303
136	2024	5500	647	300	347

2. Seg. 2 - 500W Existing 2024 PM Peak Hr Flow

The results of the visual count show that there were 44 vph headed north and 18 vph headed south during pm peak hour. Increasing these counts by the 1.68 seasonal adjustment multiplier, it is calculated that there are 74 vph headed north and 31 vph headed south.

E. Existing 2024 PM Peak Intersection Traffic Volumes

The traffic volumes at the five (5) existing intersections were visually counted twice in March of 2024. The higher of these volumes counted will be used for the analysis. Additionally, for intersections 4 and 5 that includes Hwy 33, traffic data was obtained from the ITD for the Hwy 33 through movements.

1. Int. 1 – 6500N/1750WPeak Hr Volume

The turning movements that were visually counted in March of 2024 were seasonally adjusted to July and were added to the collected July traffic counts provided by the ITD. The results are shown in the following figure. You will notice that the westbound traffic has a turning movement of one (1) vph for both right and left turns. For both the traffic counts these turning movements had zero (0) vehicles. For modeling purposes, counts were added to represent at least one (1) vehicle per turning movement.

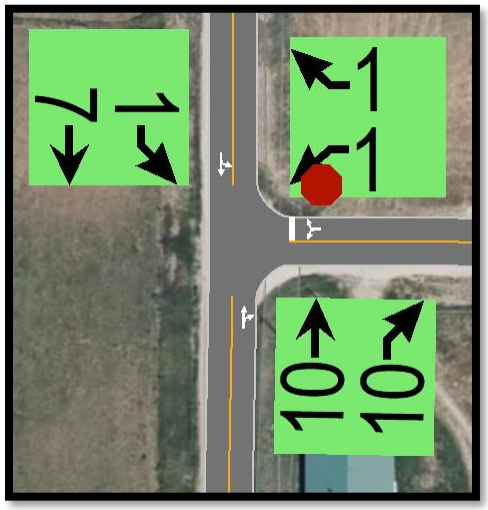


Figure 7: Existing 2024 Conditions 6500N/1750WPM Peak Hr Volume

2. Int. 2 – 6500N/500W Peak Hr Volume

The turning movements that were visually counted in March of 2024 were seasonally adjusted to July and were added to the collected July traffic counts provided by the ITD. The results are shown in the following figure. You will notice that the northbound left turning and southbound right traffic has a turning movement of one (1) vph. During the traffic counts, these turning movements had zero (0) vehicles. For modeling purposes, counts were added to represent at least one (1) vehicle per turning movement.

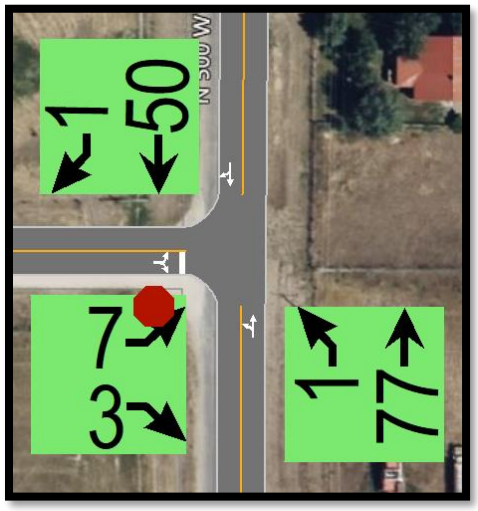


Figure 8: Existing 2024 Conditions 6500N/500W PM Peak Hr Volume

3. Int. 3 – 5750N/500W Peak Hr Volume

The turning movements that were visually counted in March of 2024 were seasonally adjusted to July and were added to the collected July traffic counts provided by the ITD. The results are shown in the following figure.

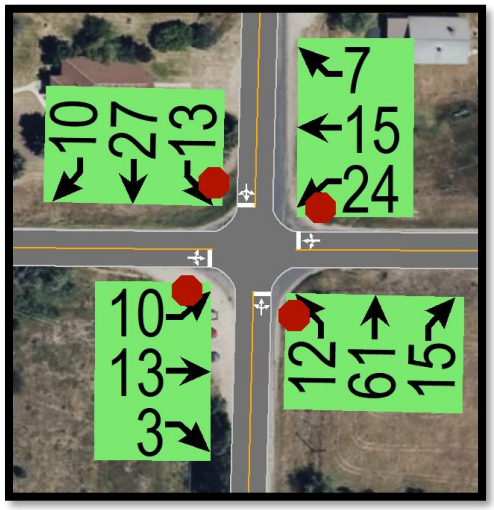


Figure 9: Existing 2024 Conditions 5750N/500W PM Peak Hr Volume

4. Int. 4 – Hwy 33/5750N Peak Hr Volume

The turning movements that were visually counted in March of 2024 were seasonally adjusted to July and were added to the collected July traffic counts provided by the ITD. The results are shown in the following figure. You will notice that the westbound right turning and southbound left turning traffic has a turning movement of one (1) vph. During the traffic counts, these turning movements had zero (0) vehicles. For modeling purposes, counts were added to represent at least one (1) vehicle per turning movement.

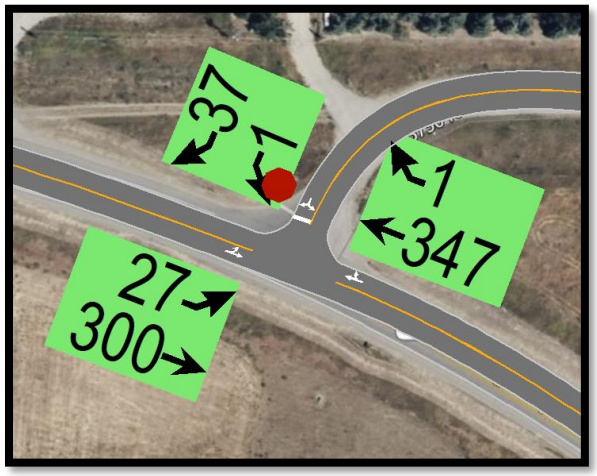


Figure 10: Existing 2024 Conditions Hwy 33/5750N PM Peak Hr Volume

5. Int. 5 – Hwy 33/500W Peak Hr Volume

The turning movements that were visually counted in March of 2024 were seasonally adjusted to July and were added to the collected July traffic counts provided by the ITD. The results are shown in the following figure. You will notice that the westbound right turning and southbound left turning traffic has a turning movement of one (1) vph. During the traffic counts, these turning movements had zero (0) vehicles. For modeling purposes, counts were added to represent at least one (1) vehicle per turning movement.

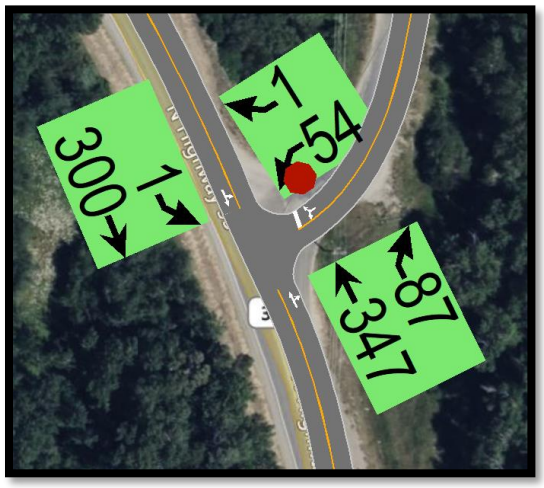


Figure 11: Existing 2024 Conditions Hwy 33/500W PM Peak Hr Volume

F. Existing 2024 Segment PM Peak Traffic Conditions

The methods discussed in Chapter 2 will be used to calculate the FFS, PTSF, PFFS, v/c ratio, and LOS. The following table is a result of these calculations. For a more in-depth look at these calculations, reference Appendix H.

Table 8 –Existing 2024 Segments PM Traffic LOS

Segment 1	2024 (Existing)	
Hwy 33	Value	LOS
FFS (mph)	63.25	n/a
ATS (mph)	54.48	B
PTSF (%)	53.1%	B
v/c Ratio	0.2	B

Segment 2	2024 (Existing)	
2000S (from Hwy 33 to 5750N)	Value	LOS
FFS (mph)	40	n/a
PFFS (%)	97.1%	A
v/c Ratio	0.04	A

G. Existing 2024 Intersection PM Peak Hr Traffic Conditions

In order to determine how well an intersection is functioning, the intersection's Measures of Effectiveness (MOEs) for the peak hour is analyzed. The MOEs include:

1. Level of Service (LOS)
2. Control Delay
3. Volume/Capacity Ratio (V/C Ratio)
4. 95th Percentile Queue

Using the traffic volumes and turning movements shown previously, the 2024 existing MOEs for the intersections can be determined.

1. Int. 1 – 6500N/1750WExisting 2024 PM Peak Hr Traffic Conditions

The traffic volumes, identified at the beginning of this chapter, were entered into the computer modeling software Synchro. The results from the model for Intersection 1 are shown in the following figure.

Table 9 –Int. 1 – Existing (2024) Peak Hr MOEs

HCM 2000 SIGNING SETTINGS	WBL	WBR	NBT	NBR	SBL	SBT
Lanes and Sharing (#RL)						
Traffic Volume (vph)	1	1	10	10	1	7
Future Volume (vph)	1	1	10	10	1	7
Sign Control	Stop	—	Free	—	—	Free
Median Width (ft)	12	—	0	—	—	0
TWLTL Median	☐	—	☐	—	—	☐
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	6.4	6.2	—	—	4.1	—
Follow Up Time, tF (s)	3.5	3.3	—	—	2.2	—
Volume to Capacity Ratio	0.00	0.00	0.01	0.01	0.00	0.00
Control Delay (s)	8.6	8.6	0.0	0.0	0.0	0.8
Level of Service	A	A	A	A	A	A
Queue Length 95th (ft)	0	0	0	0	0	0
Approach Delay (s)	8.6	—	0.0	—	—	0.8

2. Int. 2 – 6500N/500W Existing 2024 PM Peak Hr Traffic Conditions

The traffic volumes, identified at the beginning of this chapter, were entered into the computer modeling software Synchro. The results from the model for Intersection 2 are shown in the following figure.

Table 10 –Int. 2 - Existing (2024) Peak Hr MOEs

HCM 2000 SIGNING SETTINGS	EBL	EBR	NBL	NBT	SBT	SBR
Lanes and Sharing (#RL)						
Traffic Volume (vph)	7	3	1	77	50	1
Future Volume (vph)	7	3	1	77	50	1
Sign Control	Stop	—	—	Free	Free	—
Median Width (ft)	12	—	—	0	0	—
TWLTL Median	☐	—	—	☐	☐	—
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	6.4	6.2	4.1	—	—	—
Follow Up Time, tF (s)	3.5	3.3	2.2	—	—	—
Volume to Capacity Ratio	0.01	0.01	0.00	0.00	0.03	0.03
Control Delay (s)	9.2	9.2	0.0	0.1	0.0	0.0
Level of Service	A	A	A	A	A	A
Queue Length 95th (ft)	1	1	0	0	0	0
Approach Delay (s)	9.2	—	—	0.1	0.0	—

3. Int. 3 – 5750N/500W Existing 2024 PM Peak Hr Traffic Conditions

The traffic volumes, identified at the beginning of this chapter, were entered into the computer modeling software Synchro. The results from the model for Intersection 3 are shown in the following figure.

Table 11 –Int. 3 - Existing (2024) Peak Hr MOEs

HCM 2000 SIGNING SETTINGS	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lanes and Sharing (#RL)												
Traffic Volume (vph)	10	13	3	24	15	7	12	61	15	13	27	10
Future Volume (vph)	10	13	3	24	15	7	12	61	15	13	27	10
Sign Control	—	Stop	—	—	Stop	—	—	Stop	—	—	Stop	—
Median Width (ft)	—	0	—	—	0	—	—	0	—	—	0	—
TWLTL Median	—	☐	—	—	☐	—	—	☐	—	—	☐	—
Right Turn Channelized	—	—	None	—	—	None	—	—	None	—	—	None
Critical Gap, tC (s)	—	—	—	—	—	—	—	—	—	—	—	—
Follow Up Time, tF (s)	—	—	—	—	—	—	—	—	—	—	—	—
Volume to Capacity Ratio	0.04	0.04	0.04	0.06	0.06	0.06	0.12	0.12	0.12	0.07	0.07	0.07
Control Delay (s)	7.6	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.5	7.5	7.5
Level of Service	A	A	A	A	A	A	A	A	A	A	A	A
Queue Length 95th (ft)	—	—	—	—	—	—	—	—	—	—	—	—
Approach Delay (s)	—	7.6	—	—	7.7	—	—	7.7	—	—	7.5	—

4. Int. 4 – Hwy 33/5750W Existing 2024 PM Peak Hr Traffic Conditions

The traffic volumes, identified at the beginning of this chapter, were entered into the computer modeling software Synchro. The results from the model for Intersection 4 are shown in the following figure.

Table 12 –Int. 4 - Existing (2024) Peak Hr MOEs

HCM 2000 SIGNING SETTINGS	EBL	EBT	WBT	WBR	SBL	SBR
Lanes and Sharing (#RL)						
Traffic Volume (vph)	27	300	347	1	1	37
Future Volume (vph)	27	300	347	1	1	37
Sign Control	—	Free	Free	—	Stop	—
Median Width (ft)	—	0	0	—	12	—
TWLTL Median	—	☐	☐	—	☐	—
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	4.1	—	—	—	6.4	6.2
Follow Up Time, tF (s)	2.2	—	—	—	3.5	3.3
Volume to Capacity Ratio	0.03	0.03	0.23	0.23	0.07	0.07
Control Delay (s)	0.3	0.9	0.0	0.0	11.1	11.1
Level of Service	A	A	A	A	B	B
Queue Length 95th (ft)	2	2	0	0	5	5
Approach Delay (s)	—	0.9	0.0	—	11.1	—

5. Int. 5 – Hwy 33/500W Existing 2024 PM Peak Hr Traffic Conditions

The traffic volumes, identified at the beginning of this chapter, were entered into the computer modeling software Synchro. The results from the model for Intersection 5 are shown in the following figure.

Table 13 –Int. 5 - Existing (2024) Peak Hr MOEs

HCM 2000 SIGNING SETTINGS	WBL	WBR	NBT	NBR	SBL	SBT
Lanes and Sharing (#RL)						
Traffic Volume (vph)	54	1	347	87	1	300
Future Volume (vph)	54	1	347	87	1	300
Sign Control	Stop	—	Free	—	—	Free
Median Width (ft)	12	—	0	—	—	0
TWLTL Median	☐	—	☐	—	—	☐
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	6.4	6.2	—	—	4.1	—
Follow Up Time, tF (s)	3.5	3.3	—	—	2.2	—
Volume to Capacity Ratio	0.17	0.17	0.29	0.29	0.00	0.00
Control Delay (s)	17.1	17.1	0.0	0.0	0.0	0.0
Level of Service	C	C	A	A	A	A
Queue Length 95th (ft)	15	15	0	0	0	0
Approach Delay (s)	17.1	—	0.0	—	—	0.0

H. Turn Lane Warrants Based on Safety Analysis of Intersections

1. Existing Conditions Left Turn Lane Analysis

Using the guidelines and procedures for left turn lane analysis, we learn that if a three-leg intersection has directional traffic higher than 200 vph per lane on the major roadway and more than 150 vph per lane on a four-leg intersection, a left turn is warranted. The intersections that qualify are Int. 4 Hwy 33/5750W and Int. 5 Hwy 33/500W. An analysis will be performed for both the directions (see Appendix F for the left-turn worksheets).

The following left turn lanes are warranted for the existing 2024 traffic.

- Int. 4 Hwy 33/5750W: Eastbound traffic
- Int. 5 Hwy 33/500W: Southbound traffic

2. Existing Conditions Right Turn Lane Analysis

Based on the guidelines and procedures for right turn lane analysis, the following right turn lanes are warranted for the existing 2024 traffic (see Appendix G for the right-turn worksheet).

- Int. 5 Hwy 33/500W: Northbound traffic

I. Analysis of Existing 2024 PM Peak Hr Traffic Conditions Summary

This chapter has identified the following:

1. Segments

The following table is a summary of each segment's LOS.

Table 14 –Existing 2024 Segments Traffic Condition Summary

Segment 1	2024 (Existing)	
Hwy 33	Value	LOS
FFS (mph)	63.25	n/a
ATS (mph)	54.48	B
PTSF (%)	53.1%	B
v/c Ratio	0.2	B

Segment 2	2024 (Existing)	
2000S (from Hwy 33 to 5750N)	Value	LOS
FFS (mph)	40	n/a
PFFS (%)	97.1%	A
v/c Ratio	0.04	A

a. Segment Summary

As can be seen in the above table, each segment is operating at an acceptable level.

2. Intersections

The following tables show each intersection's LOS for the 2024 existing conditions.

Table 15 –Int. 1 Existing 2024 Intersections Traffic Condition Summary

Int 1 - 6500N/1750W - Build LOS and Delay Times without the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2024 Traffic	n/a	n/a	n/a	1	n/a	1	n/a	10	10	1	7	n/a
LOS	n/a	n/a	n/a	A	n/a	A	n/a	A	A	A	A	n/a
Delay	n/a	n/a	n/a	8.6	n/a	8.6	n/a	0	0	0	0.8	n/a

Table 16 –Int. 2 Existing 2024 Intersections Traffic Condition Summary

Int 2 - 6500N/500W - Build LOS and Delay Times without the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2024 Traffic	7	n/a	3	n/a	n/a	n/a	1	77	n/a	n/a	50	1
LOS	A	n/a	A	n/a	n/a	n/a	A	A	n/a	n/a	A	A
Delay	9.2	n/a	9.2	n/a	n/a	n/a	0	0.1	n/a	n/a	0	0

Table 17 –Int. 3 Existing 2024 Intersections Traffic Condition Summary

Int 3 - 5750N/500W - Build LOS and Delay Times without the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2024 Traffic	10	13	3	24	15	7	12	61	15	13	27	10
LOS	A	A	A	A	A	A	A	A	A	A	A	A
Delay	7.6	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.5	7.5	7.5

Table 18 –Int. 4 Existing 2024 Intersections Traffic Condition Summary

Int 4 - Hwy 33/5750W - Build LOS and Delay Times without the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2024 Traffic	27	300	n/a	n/a	347	1	n/a	n/a	n/a	1	n/a	37
LOS	A	A	n/a	n/a	A	A	n/a	n/a	n/a	B	n/a	B
Delay	0.3	0.9	n/a	n/a	0	0	n/a	n/a	n/a	11.1	n/a	11.1

Table 19 –Int. 5 Existing 2024 Intersections Traffic Condition Summary

Int 5 - Hwy 33/500W - Build LOS and Delay Times without the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2024 Traffic	n/a	n/a	n/a	54	n/a	1	n/a	347	87	1	300	n/a
LOS	n/a	n/a	n/a	C	n/a	C	n/a	A	A	A	A	n/a
Delay	n/a	n/a	n/a	17.1	n/a	17.1	n/a	0	0	0	0	n/a

a. Intersection Summary

As can be seen in the above tables, each intersection is currently operating at an acceptable level.

3. Turn Lane Analysis

a. Left Turn Lane Analysis

The following left turn lanes are warranted for the existing 2024 traffic.

- Int. 4 Hwy 33/5750W: Eastbound traffic
- Int. 5 Hwy 33/500W: Southbound traffic

b. Right Turn Lane Analysis

The following right turn lanes are warranted for the existing 2024 traffic.

- Int. 5 Hwy 33/500W: Northbound traffic

4. Overall Summary for 2024

a. 2024 Existing Conditions Review

In summary, the following was determined to be operating at an unacceptable level for the 2024 existing conditions:

- Int. 4 Hwy 33/5750W: Eastbound left-turning traffic exceeds the minimum safety levels
- Int. 5 Hwy 33/500W: Southbound left-turning traffic exceeds the minimum safety levels
- Int. 5 Hwy 33/500W: Northbound right-turning traffic exceeds the minimum safety levels

b. Mitigation Measures for the 2024 Existing Conditions

It is recommended that a left turn lane or a two way left turn lane (TWLTL) be constructed on Hwy 33 at both intersections 4 and 5. Additionally, it is recommended that a right turn lane be constructed at Intersection 5 to accommodate the 2024 traffic safely.

V. Projected Traffic

A. Site Traffic

It is anticipated that buildout of the development will be complete by 2029.

1. Trip Generation

In order to determine the trips generated by the proposed development, the ITE Trip Generation 10th Edition Manual was used. This study will use traffic data obtained from the ITD to determine traffic conditions for the 2024 (existing), 2029 (Project buildout), and the 2049 (Future) horizon years.

a. Buildout (2029)

The following two (2) tables show the land use and trip generation for the ADT and the peak hour.

Table 20- Land Use and Trip Generation (ADT) for Buildout (2029)

Land Use Category	ITE Code	Size	Units	Trip Generation per unit	Total Trips	Internal Capture Trips		Pass-by Trips		Primary Trips Total
Weekday Trips										
Single-Family Detached Housing (Main)	210	17	Dwelling Untis	9.57	163	0%	0	-	-	163
Single-Family Detached Housing (Accessory)	210	17	Dwelling Untis	9.57	163	0%	0	-	-	163
Total					**325**		**0**		**0**	**325**

Table 21- Land Use and Trip Generation (Peak Hour) for Buildout (2029)

Land Use Category	ITE Code	Size	Units	Trip Generation per unit	Total Trips	Internal Capture Trips		Pass-by Trips		Primary Trips Total
Weekday Peak Hour										
Single-Family Detached Housing (Main)	210	17	Dwelling Untis	0.76	13	0%	0	-	-	13
Single-Family Detached Housing (Accessory)	210	17	Dwelling Untis	0.76	13	0%	0	-	-	13
Total					**26**		**0**		**0**	**26**

2. Trip Distribution

Trip distribution is a percentage indicating what percentage of traffic is entering or exiting the study area. The ITE Trip Generation Handbook outlines the trip distribution for each land use. The following two (2) tables show the land use, trip generation, and trip distribution for the ADT and the peak hour.

Table 22- Trip Distribution (ADT) for Buildout (2029)

Land Use Category	ITE Code	Size	Units	Trip Generation per unit	Total Trips	Internal Capture Trips		Pass-by Trips		Primary Trips Total	Primary Trips Entering		Primary Trips Exiting	
Weekday Trips														
Single-Family Detached Housing (Main)	210	17	Dwelling Untis	9.57	163	0%	0	-	-	163	50%	81	50%	81
Single-Family Detached Housing (Accessory)	210	17	Dwelling Untis	9.57	163	0%	0	-	-	163	50%	81	50%	81
Total					**325**		**0**		**0**	**325**		**163**		**163**

Table 23- Trip Distribution (Peak Hour) for Buildout (2029)

Land Use Category	ITE Code	Size	Units	Trip Generation per unit	Total Trips	Internal Capture Trips		Pass-by Trips		Primary Trips Total	Primary Trips Entering		Primary Trips Exiting	
Weekday Peak Hour														
Single-Family Detached Housing (Main)	210	17	Dwelling Untis	0.76	13	0%	0	-	-	13	64%	8	36%	5
Single-Family Detached Housing (Accessory)	210	17	Dwelling Untis	0.76	13	0%	0	-	-	13	64%	8	36%	5
Total					**26**		**0**		**0**	**26**		**17**		**9**

3. Modal Split

Modal split is the determination of different travel modes (automobile, heavy vehicles, walk, etc.) from an origin to a given destination. Analyzing the pedestrian traffic is outside the scope of this study and it is assumed that no heavy vehicles will be generated from the development. A standard 5% heavy vehicle percentage will be applied to this study.

4. Trip Assignment

Addendum 2 is a scenario where 100% of the traffic generated by the proposed development travels south on 1750 W to 6500N, turns left and travels east to 500W, and then travels south to Hwy 33. It should be noted that when the traffic reaches Intersection 3 (5750N/500W) it is assumed that the generated traffic will follow the same traffic patterns where 20% turn right towards Intersection 4 and the remaining 80% travels through the intersection towards Intersection 5.

B. Through Traffic (Non-Site Traffic)

1. Non-Site Traffic for anticipated Development in Study Area

a. Method of Projections

Pass-by trips are made as intermediate stops on the way from an origin to a destination without a route diversion. In other words, a pass-by trip is when the traffic on an adjacent roadway is attracted to a certain land use in a development as non-site traffic. The trip generally goes from origin to generator and then returns to the origin. The proposed development does not have any land uses that would be considered pass-by trips.

b. Trip Distribution

This section is not applicable due to the fact that single-family detached housing is not considered a non-site traffic generator.

c. Modal Split

This section is not applicable due to the fact that single-family detached housing is not considered a non-site traffic generator.

d. Trip Assignment

This section is not applicable due to the fact that single-family detached housing is not considered a non-site traffic generator.

C. Total Traffic

The total trips generated by the development and the impact to each intersection for the 2029 Buildout are shown in the following figures.

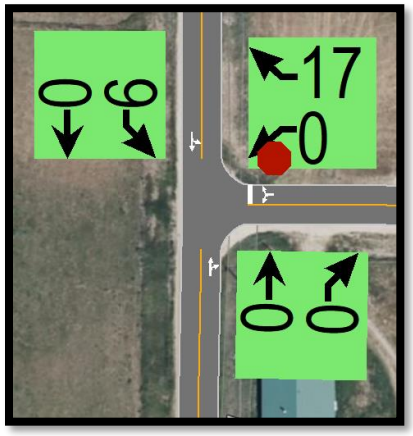


Figure 12- Intersection 1 6500N/1750WPM Peak Generated Traffic

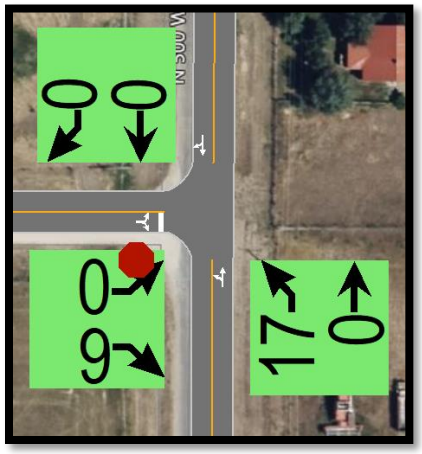


Figure 13- Intersection 2 6500N/500W PM Peak Generated Traffic

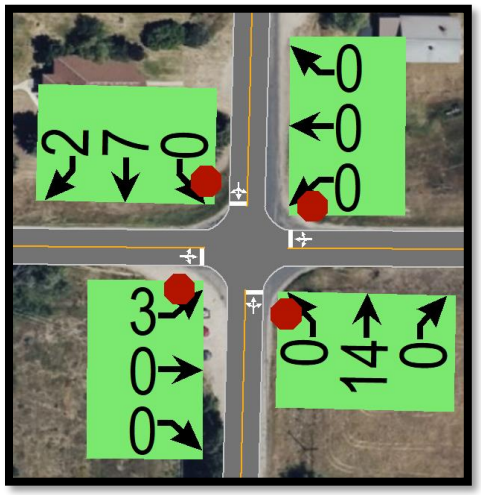


Figure 14- Intersection 3 5750N/500W PM Peak Generated Traffic

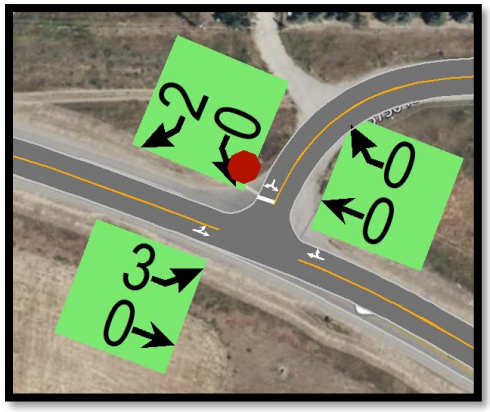


Figure 15- Intersection 4 Hwy 33/5750N PM Peak Generated Traffic

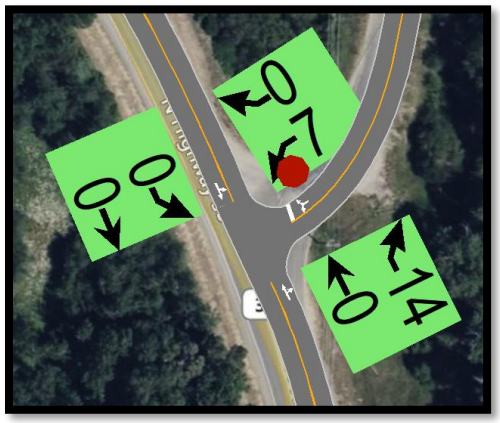


Figure 16- Intersection 5 Hwy 33/500W PM Peak Generated Traffic

VI. 2029 Horizon Year Traffic Analysis (Buildout)

A. On-Site Development

Buildout is assumed to be complete by the year 2029.

B. Traffic Forecasting

The traffic counts from the 2024 existing year were increased by the annual growth rate percentages to establish the background traffic. This chapter will analyze two (2) scenarios for each segment and intersection; 2029 background traffic (without the development) and 2029 background plus site traffic (with the development).

C. Roadway Network

Within the area of influence there will be two (2) roadway segments and five (5) existing intersections that will be studied. The segments and the intersections that will analyzed are:

1. Segment 1 – Hwy 33 (from Intersection 6, ½ mile each direction)
2. Segment 2 – 500W (from Hwy 33 to 5750N)
3. Intersection 1 – 6500N/1750W
4. Intersection 2 – 6500N/500W
5. Intersection 3 – 5750N/500W
6. Intersection 4 – Hwy 33/5750N
7. Intersection 5 – Hwy 33/500W

Additionally, it was determined in the 2024 existing conditions analysis, that left turn lanes for both intersections 4 and 5 and a right turn lane for Intersection 5 are warranted to meet safety guidelines. For the 2029 analysis, the addition of the left and right turn lanes will be added to the model.

D. 2029 Buildout Segment PM Peak Traffic Volumes

This section discusses the ADT, the peak hour flows, and the trip distribution for the 2029 Buildout Year traffic.

1. Segment 1: Hwy 33 2029 Buildout PM Peak Hr Flow

a. Average Daily Traffic (ADT) and Monthly Average Daily Traffic (MADT)

The following tables show both 2024 MADT and 2029 MADT with the peak hour of the peak month without and with the development.

Table 24 – Seg 1: 2029 Segment MADT, Peak Hour, and Trip Distribution Volumes without the development

Segment 1: Hwy 33	Units	Year	Traffic Volume	Eastbound	Westbound
Max. Month ADT (MADT)	VPD	2024	5500	2750	2750
Max. Month Peak Hour Ave. (PH)	VPH	2024	647	300	347
Max. Month ADT (MADT)	VPD	2029	6322	3161	3161
Max. Month Peak Hour Ave. (PH)	VPH	2029	743	345	398

Table 25 – Seg 1: 2029 Segment MADT, Peak Hour, and Trip Distribution Volumes with the development

Segment 1: Hwy 33	Units	Year	Traffic Volume	Eastbound	Westbound
Max. Month ADT (MADT)	VPD	2024	5500	2750	2750
Max. Month Peak Hour Ave. (PH)	VPH	2024	647	300	347
Max. Month ADT (MADT)	VPD	2029	6647	3324	3324
Max. Month Peak Hour Ave. (PH)	VPH	2029	769	348	400

2. Segment 2: 500W (from Hwy 33 to 5750N)

The following tables show both 2024 MADT and 2029 MADT with the peak hour of the peak month without and with the development.

Table 26 – Seg 2: 2029 Segment MADT, Peak Hour, and Trip Distribution Volumes without the development

Segment 2: 500W (from Hwy 33 to 5750N)	Units	Year	Traffic Volume	Northbound	Southbound
Max. Month ADT (MADT)	VPD	2024	893	447	447
Max. Month Peak Hour Ave. (PH)	VPH	2024	105	74	31
Max. Month ADT (MADT)	VPD	2029	1026	513	513
Max. Month Peak Hour Ave. (PH)	VPH	2029	121	85	36

Table 27 – Seg 2: 2029 Segment MADT, Peak Hour, and Trip Distribution Volumes with the development

Segment 2: 500W (from Hwy 33 to 5750N)	Units	Year	Traffic Volume	Northbound	Southbound
Max. Month ADT (MADT)	VPD	2024	1153	577	577
Max. Month Peak Hour Ave. (PH)	VPH	2024	126	88	38
Max. Month ADT (MADT)	VPD	2029	1286	643	643
Max. Month Peak Hour Ave. (PH)	VPH	2029	142	99	43

3. Intersection 1 – 6500N/1750WPeak Hr Volume

The turning movements used for the 2024 existing conditions were adjusted to 2029 using the annual growth rate to analyze the intersection without and with the traffic from the development. The results are shown in the following figure.

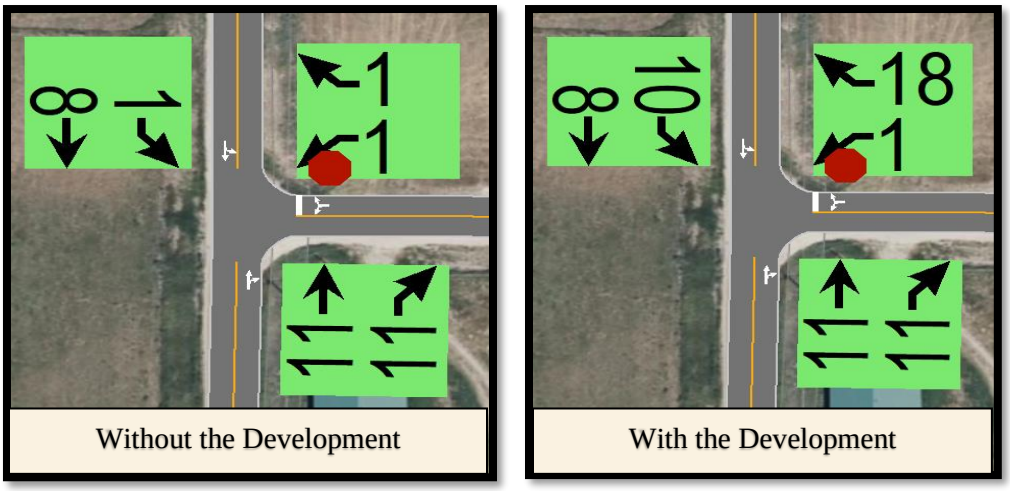


Figure 17: 6500N/1750W2029 Traffic Volumes without and with the Development

4. Intersection 2 – 6500N/500W Peak Hr Volume

The turning movements used for the 2024 existing conditions were adjusted to 2029 using the annual growth rate to analyze the intersection without and with the traffic from the development. The results are shown in the following figure.

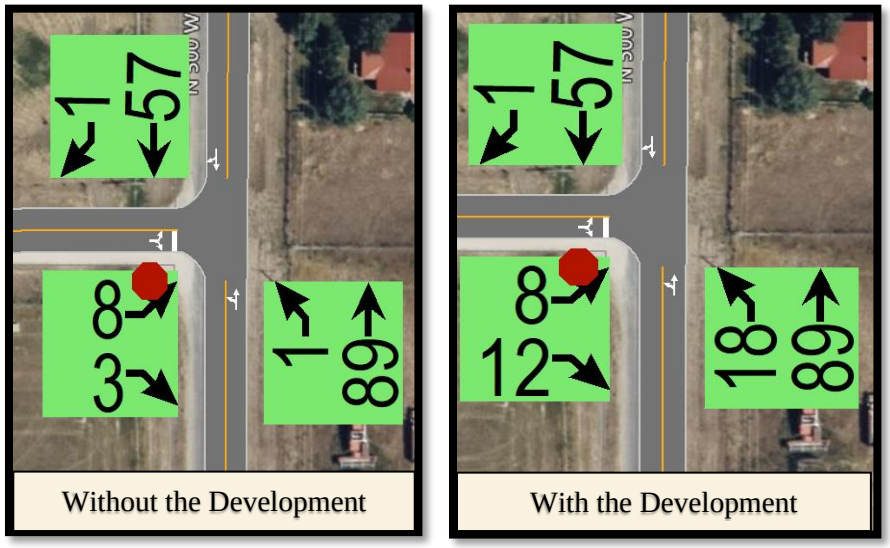


Figure 18: 6500N/500W 2029 Traffic Volumes without and with the Development

5. Intersection 3 – 5750N/500W Peak Hr Volume

The turning movements used for the 2024 existing conditions were adjusted to 2029 using the annual growth rate to analyze the intersection without and with the traffic from the development. The results are shown in the following figure.

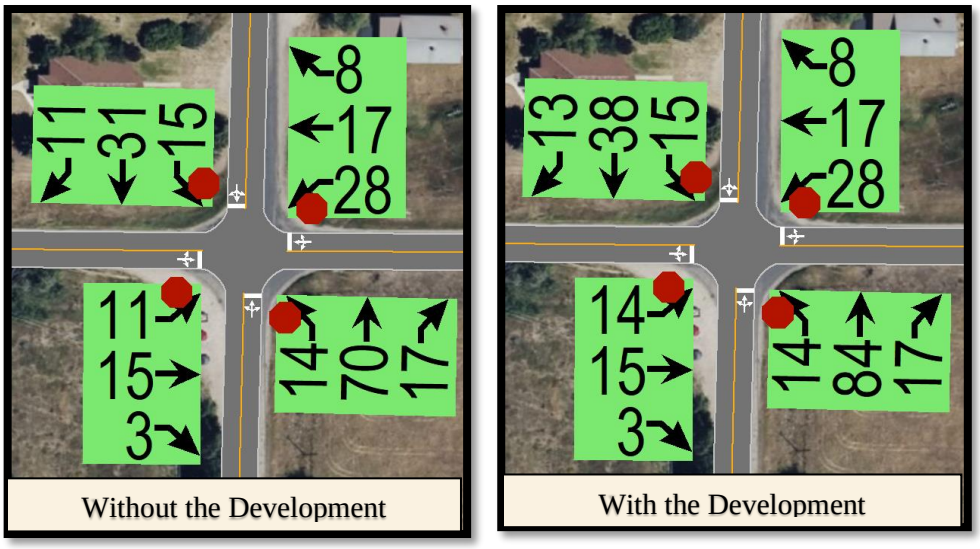


Figure 19: 5750N/500W 2029 Traffic Volumes without and with the Development

6. Intersection 4 – Hwy 33/5750N Peak Hr Volume

The turning movements used for the 2024 existing conditions were adjusted to 2029 using the annual growth rate to analyze the intersection without and with the traffic from the development. The results are shown in the following figure. It should be noted that the recommended turn lanes for the 2024 existing year were added to the model.

Figure 20: Hwy 33/5750N 2029 Traffic Volumes without and with the Development

7. Intersection 5 – Hwy 33/500W Peak Hr Volume

The turning movements used for the 2024 existing conditions were adjusted to 2029 using the annual growth rate to analyze the intersection without and with the traffic from the development. The results are shown in the following figure. It should be noted that the recommended turn lanes for the 2024 existing year were added to the model.

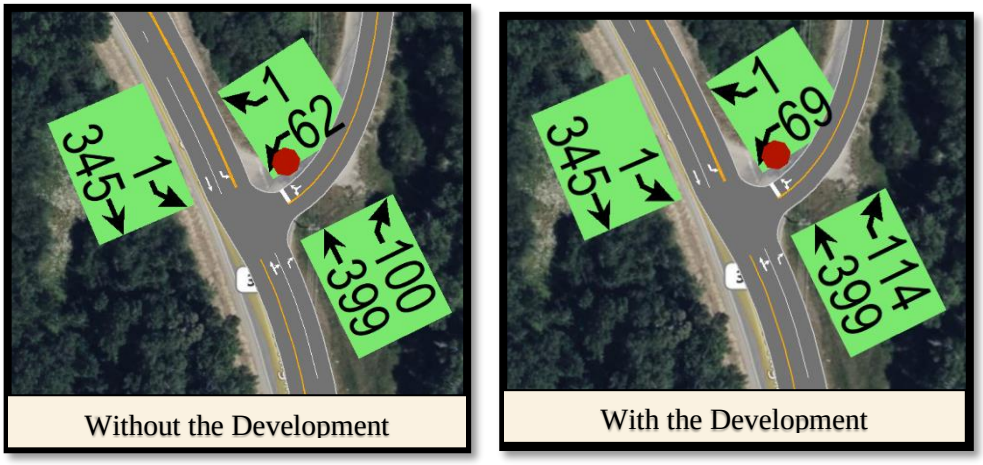


Figure 21: Hwy 33/500W 2029 Traffic Volumes without and with the Development

E. 2029 Buildout Segment PM Peak Traffic Conditions

The methods discussed in Chapter 2 will be used to calculate the FFS, PTSF, PFFS, v/c ratio, and LOS. The following table is a result of these calculations. For a more in-depth look at these calculations, reference Appendix H.

Table 28 –2029 Buildout Segments PM Traffic LOS

Segment 1	2024 (Existing)		2029 Buildout	
Hwy 33	Value	LOS	Value	LOS
FFS (mph)	63.25	n/a	63.25	n/a
ATS (mph)	54.48	B	53.47	B
PTSF (%)	53.1%	B	57.2%	C
v/c Ratio	0.2	B	0.24	C

Segment 2	2024 (Existing)		2029 Buildout	
2000S (from Hwy 33 to 5750N)	Value	LOS	Value	LOS
FFS (mph)	40	n/a	40	n/a
PFFS (%)	97.1%	A	95.3%	A
v/c Ratio	0.04	A	0.07	A

F. 2029 Buildout Intersection PM Peak Hr Traffic Conditions

In order to determine how well an intersection is functioning, the intersection's Measures of Effectiveness (MOEs) for the peak hour is analyzed. The MOEs include:

1. Level of Service (LOS)
2. Control Delay
3. Volume/Capacity Ratio (v/c Ratio)
4. 95th Percentile Queue

Using the traffic volumes and turning movements shown previously, the 2029 Buildout MOEs for the intersections can be determined.

1. Int. 1 – 6500N/1750W 2029 Buildout PM Peak Hr Traffic Conditions

The traffic volumes, identified at the beginning of this chapter, were entered into the computer modeling software Synchro. The results from the model for Intersection 1, without and with the development, are shown in the following table.

Table 29 –Int. 1 – 2029 Buildout Peak Hr MOEs Without the Development

HCM 2000 SIGNING SETTINGS	WBL	WBR	NBT	NBR	SBL	SBT
Lanes and Sharing (#RL)						
Traffic Volume (vph)	1	1	11	11	1	8
Future Volume (vph)	1	1	11	11	1	8
Sign Control	Stop	—	Free	—	—	Free
Median Width (ft)	12	—	0	—	—	0
TWLTL Median	☐	—	☐	—	—	☐
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	6.4	6.2	—	—	4.1	—
Follow Up Time, tF (s)	3.5	3.3	—	—	2.2	—
Volume to Capacity Ratio	0.00	0.00	0.01	0.01	0.00	0.00
Control Delay (s)	8.6	8.6	0.0	0.0	0.0	0.7
Level of Service	A	A	A	A	A	A
Queue Length 95th (ft)	0	0	0	0	0	0
Approach Delay (s)	8.6	—	0.0	—	—	0.7

Table 30 –Int. 1 – 2029 Buildout Peak Hr MOEs With the Development

HCM 2000 SIGNING SETTINGS	WBL	WBR	NBT	NBR	SBL	SBT
Lanes and Sharing (#RL)						
Traffic Volume (vph)	1	18	11	11	10	8
Future Volume (vph)	1	18	11	11	10	8
Sign Control	Stop	—	Free	—	—	Free
Median Width (ft)	12	—	0	—	—	0
TWLTL Median		—		—	—	
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	6.4	6.2	—	—	4.1	—
Follow Up Time, tF (s)	3.5	3.3	—	—	2.2	—
Volume to Capacity Ratio	0.02	0.02	0.01	0.01	0.01	0.01
Control Delay (s)	8.5	8.5	0.0	0.0	0.1	4.0
Level of Service	A	A	A	A	A	A
Queue Length 95th (ft)	2	2	0	0	1	1
Approach Delay (s)	8.5	—	0.0	—	—	4.0

2. Int. 2 – 6500N/500W 2029 Buildout PM Peak Hr Traffic Conditions

The traffic volumes, identified at the beginning of this chapter, were entered into the computer modeling software Synchro. The results from the model for Intersection 2, without and with the development, are shown in the following table.

Table 31 –Int. 2 – 2029 Buildout Peak Hr MOEs Without the Development

HCM 2000 SIGNING SETTINGS	EBL	EBR	NBL	NBT	SBT	SBR
Lanes and Sharing (#RL)						
Traffic Volume (vph)	8	3	1	89	57	1
Future Volume (vph)	8	3	1	89	57	1
Sign Control	Stop	—	—	Free	Free	—
Median Width (ft)	12	—	—	0	0	—
TWLTL Median		—	—			—
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	6.4	6.2	4.1	—	—	—
Follow Up Time, tF (s)	3.5	3.3	2.2	—	—	—
Volume to Capacity Ratio	0.01	0.01	0.00	0.00	0.04	0.04
Control Delay (s)	9.3	9.3	0.0	0.1	0.0	0.0
Level of Service	A	A	A	A	A	A
Queue Length 95th (ft)	1	1	0	0	0	0
Approach Delay (s)	9.3	—	—	0.1	0.0	—

Table 32 –Int. 2 – 2029 Buildout Peak Hr MOEs With the Development

HCM 2000 SIGNING SETTINGS	EBL	EBR	NBL	NBT	SBT	SBR
Lanes and Sharing (#RL)						
Traffic Volume (vph)	8	12	18	89	57	1
Future Volume (vph)	8	12	18	89	57	1
Sign Control	Stop	—	—	Free	Free	—
Median Width (ft)	12	—	—	0	0	—
TWLTL Median		—	—			—
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	6.4	6.2	4.1	—	—	—
Follow Up Time, tF (s)	3.5	3.3	2.2	—	—	—
Volume to Capacity Ratio	0.03	0.03	0.01	0.01	0.04	0.04
Control Delay (s)	9.2	9.2	0.1	1.3	0.0	0.0
Level of Service	A	A	A	A	A	A
Queue Length 95th (ft)	2	2	1	1	0	0
Approach Delay (s)	9.2	—	—	1.3	0.0	—

3. Int. 3 – 5750N/500W 2029 Buildout PM Peak Hr Traffic Conditions

The traffic volumes, identified at the beginning of this chapter, were entered into the computer modeling software Synchro. The results from the model for Intersection 3, without and with the development, are shown in the following table.

Table 33 –Int. 3 – 2029 Buildout Peak Hr MOEs Without the Development

HCM 2000 SIGNING SETTINGS	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lanes and Sharing (#RL)												
Traffic Volume (vph)	11	15	3	28	17	8	14	70	17	15	31	11
Future Volume (vph)	11	15	3	28	17	8	14	70	17	15	31	11
Sign Control	—	Stop	—	—	Stop	—	—	Stop	—	—	Stop	—
Median Width (ft)	—	0	—	—	0	—	—	0	—	—	0	—
TWLTL Median	—		—	—		—	—		—	—		—
Right Turn Channelized	—	—	None	—	—	None	—	—	None	—	—	None
Critical Gap, tC (s)	—	—	—	—	—	—	—	—	—	—	—	—
Follow Up Time, tF (s)	—	—	—	—	—	—	—	—	—	—	—	—
Volume to Capacity Ratio	0.04	0.04	0.04	0.07	0.07	0.07	0.13	0.13	0.13	0.08	0.08	0.08
Control Delay (s)	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.6	7.6	7.6
Level of Service	A	A	A	A	A	A	A	A	A	A	A	A
Queue Length 95th (ft)	—	—	—	—	—	—	—	—	—	—	—	—
Approach Delay (s)	—	7.7	—	—	7.8	—	—	7.8	—	—	7.6	—

Table 34 –Int. 3 – 2029 Buildout Peak Hr MOEs With the Development

HCM 2000 SIGNING SETTINGS	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lanes and Sharing (#RL)												
Traffic Volume (vph)	14	15	3	28	17	8	14	84	17	15	38	13
Future Volume (vph)	14	15	3	28	17	8	14	84	17	15	38	13
Sign Control	—	Stop	—	—	Stop	—	—	Stop	—	—	Stop	—
Median Width (ft)	—	0	—	—	0	—	—	0	—	—	0	—
TWLTL Median	—	☐	—	—	☐	—	—	☐	—	—	☐	—
Right Turn Channelized	—	—	None	—	—	None	—	—	None	—	—	None
Critical Gap, tC (s)	—	—	—	—	—	—	—	—	—	—	—	—
Follow Up Time, tF (s)	—	—	—	—	—	—	—	—	—	—	—	—
Volume to Capacity Ratio	0.05	0.05	0.05	0.08	0.08	0.08	0.15	0.15	0.15	0.09	0.09	0.09
Control Delay (s)	7.8	7.8	7.8	7.9	7.9	7.9	8.0	8.0	8.0	7.7	7.7	7.7
Level of Service	A	A	A	A	A	A	A	A	A	A	A	A
Queue Length 95th (ft)	—	—	—	—	—	—	—	—	—	—	—	—
Approach Delay (s)	—	7.8	—	—	7.9	—	—	8.0	—	—	7.7	—

4. Int. 4 – Hwy 33/5750N 2029 Buildout PM Peak Hr Traffic Conditions

The traffic volumes, identified at the beginning of this chapter, were entered into the computer modeling software Synchro. The results from the model for Intersection 4, without and with the development, are shown in the following table. It should be noted that the recommended turn lanes for the 2024 existing year were added to the model.

Table 35 –Int. 4 – 2029 Buildout Peak Hr MOEs Without the Development

HCM 2000 SIGNING SETTINGS	EBL	EBT	WBT	WBR	SBL	SBR
Lanes and Sharing (#RL)						
Traffic Volume (vph)	31	345	399	1	1	43
Future Volume (vph)	31	345	399	1	1	43
Sign Control	—	Free	Free	—	Stop	—
Median Width (ft)	—	12	12	—	12	—
TWLTL Median	—	☑	☑	—	☐	—
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	4.1	—	—	—	6.4	6.2
Follow Up Time, tF (s)	2.2	—	—	—	3.5	3.3
Volume to Capacity Ratio	0.03	0.23	0.27	0.27	0.08	0.08
Control Delay (s)	8.4	0.0	0.0	0.0	11.6	11.6
Level of Service	A	A	A	A	B	B
Queue Length 95th (ft)	2	0	0	0	7	7
Approach Delay (s)	—	0.7	0.0	—	11.6	—

Table 36 –Int. 4 – 2029 Buildout Peak Hr MOEs With the Development

HCM 2000 SIGNING SETTINGS	EBL	EBT	WBT	WBR	SBL	SBR
Lanes and Sharing (#RL)						
Traffic Volume (vph)	33	345	399	1	1	45
Future Volume (vph)	33	345	399	1	1	45
Sign Control	—	Free	Free	—	Stop	—
Median Width (ft)	—	12	12	—	12	—
TWLTL Median	—	☑	☑	—	☐	—
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	4.1	—	—	—	6.4	6.2
Follow Up Time, tF (s)	2.2	—	—	—	3.5	3.3
Volume to Capacity Ratio	0.03	0.23	0.27	0.27	0.09	0.09
Control Delay (s)	8.4	0.0	0.0	0.0	11.6	11.6
Level of Service	A	A	A	A	B	B
Queue Length 95th (ft)	3	0	0	0	7	7
Approach Delay (s)	—	0.7	0.0	—	11.6	—

5. Int. 5 – Hwy 33/500W 2029 Buildout PM Peak Hr Traffic Conditions

The traffic volumes, identified at the beginning of this chapter, were entered into the computer modeling software Synchro. The results from the model for Intersection 5, without and with the development, are shown in the following table. It should be noted that the recommended turn lanes for the 2024 existing year were added to the model.

Table 37 –Int. 5 – 2029 Buildout Peak Hr MOEs Without the Development

HCM 2000 SIGNING SETTINGS	WBL	WBR	NBT	NBR	SBL	SBT
Lanes and Sharing (#RL)						
Traffic Volume (vph)	62	1	399	100	1	345
Future Volume (vph)	62	1	399	100	1	345
Sign Control	Stop	—	Free	—	—	Free
Median Width (ft)	12	—	0	—	—	12
TWLTL Median	☐	—	☐	—	—	☑
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	6.4	6.2	—	—	4.1	—
Follow Up Time, tF (s)	3.5	3.3	—	—	2.2	—
Volume to Capacity Ratio	0.13	0.13	0.29	0.29	0.00	0.23
Control Delay (s)	12.8	12.8	0.0	0.0	8.6	0.0
Level of Service	B	B	A	A	A	A
Queue Length 95th (ft)	11	11	0	0	0	0
Approach Delay (s)	12.8	—	0.0	—	—	0.0

Table 38 –Int. 5 – 2029 Buildout Peak Hr MOEs With the Development

HCM 2000 SIGNING SETTINGS	WBL	WBR	NBT	NBR	SBL	SBT
Lanes and Sharing (#RL)						
Traffic Volume (vph)	69	1	399	114	1	345
Future Volume (vph)	69	1	399	114	1	345
Sign Control	Stop	—	Free	—	—	Free
Median Width (ft)	12	—	0	—	—	12
TWLTL Median	☐	—	☐	—	—	☑
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	6.4	6.2	—	—	4.1	—
Follow Up Time, tF (s)	3.5	3.3	—	—	2.2	—
Volume to Capacity Ratio	0.15	0.15	0.29	0.29	0.00	0.23
Control Delay (s)	12.9	12.9	0.0	0.0	8.7	0.0
Level of Service	B	B	A	A	A	A
Queue Length 95th (ft)	13	13	0	0	0	0
Approach Delay (s)	12.9	—	0.0	—	—	0.0

G. Turn Lane Warrants Based on Safety Analysis of Intersections

1. 2029 Buildout Conditions Left Turn Lane Analysis

It was identified that left turn lanes were warranted for the 2024 existing conditions for both intersection 4 and 5. No new turn lanes are warranted between the 2024 existing conditions and the 2029 buildout conditions; see Appendix F for the left-turn worksheets.

2. 2029 Buildout Conditions Right Turn Lane Analysis

It was identified that a right turn lane was warranted for the 2024 existing conditions for Intersection 5. No new turn lanes are warranted between the 2024 existing conditions and the 2029 buildout conditions; see Appendix G for the right-turn worksheets.

H. Analysis of 2029 Buildout PM Peak Hr Traffic Conditions Summary

This chapter has identified the following:

1. Segments

The following table is a summary of each segment's LOS

Table 39 –2029 Buildout Segments Traffic Condition Summary

Segment 1	2024 (Existing)		2029 Buildout	
Hwy 33	Value	LOS	Value	LOS
FFS (mph)	63.25	n/a	63.25	n/a
ATS (mph)	54.48	B	53.47	B
PTSF (%)	53.1%	B	57.2%	C
v/c Ratio	0.2	B	0.24	C

Segment 2	2024 (Existing)		2029 Buildout	
2000S (from Hwy 33 to 5750N)	Value	LOS	Value	LOS
FFS (mph)	40	n/a	40	n/a
PFFS (%)	97.1%	A	95.3%	A
v/c Ratio	0.04	A	0.07	A

a. Segment Summary

As can be seen in the above table, each segment is forecasted to operate at an acceptable level.

2. Intersections

The following tables show each intersection's LOS for the 2029 buildout conditions.

Table 40 –Int. 1 2029 Buildout Intersection Traffic Condition Summary without and with the development

Int 1 - 6500N/1750W - Build LOS and Delay Times without the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2029 Traffic	n/a	n/a	n/a	1	n/a	1	n/a	11	11	1	8	n/a
LOS	n/a	n/a	n/a	A	n/a	A	n/a	A	A	A	A	n/a
Delay	n/a	n/a	n/a	8.6	n/a	8.6	n/a	0	0	0	0.7	n/a

Int 1 - 6500N/1750W - Build LOS and Delay Times with the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2029 Traffic	n/a	n/a	n/a	1	n/a	18	n/a	11	11	10	8	n/a
LOS	n/a	n/a	n/a	A	n/a	A	n/a	A	A	A	A	n/a
Delay	n/a	n/a	n/a	8.5	n/a	8.5	n/a	0	0	0.1	4	n/a

Table 41 –Int. 2 2029 Buildout Intersection Traffic Condition Summary without and with the development

Int 2 - 6500N/500W - Build LOS and Delay Times without the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2029 Traffic	8	n/a	3	n/a	n/a	n/a	1	89	n/a	n/a	57	1
LOS	A	n/a	A	n/a	n/a	n/a	A	A	n/a	n/a	A	A
Delay	9.3	n/a	9.3	n/a	n/a	n/a	0	0.1	n/a	n/a	0	0

Int 2 - 6500N/500W - Build LOS and Delay Times with the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2029 Traffic	8	n/a	12	n/a	n/a	n/a	18	89	n/a	n/a	57	1
LOS	A	n/a	A	n/a	n/a	n/a	A	A	n/a	n/a	A	A
Delay	9.2	n/a	9.2	n/a	n/a	n/a	0.1	1.3	n/a	n/a	0	0

Table 42 –Int. 3 2029 Buildout Intersection Traffic Condition Summary without and with the development

Int 3 - 5750N/500W - Build LOS and Delay Times without the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2029 Traffic	11	15	3	28	17	8	14	70	17	15	31	11
LOS	A	A	A	A	A	A	A	A	A	A	A	A
Delay	7.7	7.7	7.7	7.8	7.8	7.8	7.8	7.8	7.8	7.6	7.6	7.6

Int 3 - 5750N/500W - Build LOS and Delay Times with the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2029 Traffic	14	15	3	28	17	8	14	84	17	15	38	13
LOS	A	A	A	A	A	A	A	A	A	A	A	A
Delay	7.8	7.8	7.8	7.9	7.9	7.9	8	8	8	7.7	7.7	7.7

Table 43 –Int. 4 2029 Buildout Intersection Traffic Condition Summary without and with the development

Int 4 - Hwy 33/5750W - Build LOS and Delay Times without the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2029 Traffic	31	345	n/a	n/a	399	1	n/a	n/a	n/a	1	n/a	43
LOS	A	A	n/a	n/a	A	A	n/a	n/a	n/a	B	n/a	B
Delay	8.4	0	n/a	n/a	0	0	n/a	n/a	n/a	11.6	n/a	11.6

Int 4 - Hwy 33/5750W - Build LOS and Delay Times with the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2029 Traffic	33	345	n/a	n/a	399	1	n/a	n/a	n/a	1	n/a	45
LOS	A	A	n/a	n/a	A	A	n/a	n/a	n/a	B	n/a	B
Delay	8.4	0	n/a	n/a	0	0	n/a	n/a	n/a	11.6	n/a	11.6

Table 44 –Int. 5 2029 Buildout Intersection Traffic Condition Summary without and with the development

Int 5 - Hwy 33/500W - Build LOS and Delay Times without the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2029 Traffic	n/a	n/a	n/a	62	n/a	1	n/a	399	100	1	345	n/a
LOS	n/a	n/a	n/a	B	n/a	B	n/a	A	A	A	A	n/a
Delay	n/a	n/a	n/a	12.8	n/a	12.8	n/a	0	0	8.6	0	n/a

Int 5 - Hwy 33/500W - Build LOS and Delay Times with the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2029 Traffic	n/a	n/a	n/a	69	n/a	1	n/a	399	114	1	345	n/a
LOS	n/a	n/a	n/a	B	n/a	B	n/a	A	A	A	A	n/a
Delay	n/a	n/a	n/a	12.9	n/a	12.9	n/a	0	0	8.7	0	n/a

a. Intersection Summary

As can be seen in the above tables, all five (5) intersections are forecasted to operate at an acceptable level for the 2029 buildout year.

3. Turn Lane Analysis

a. Left Turn Lane Analysis

The following left turn lane(s) are warranted for the 2029 buildout traffic.

- None

b. Right Turn Lane Analysis

The following right turn lane(s) are warranted for the 2029 buildout traffic (between 2024 and 2029).

- None

4. Review of the 2024 Existing Conditions

a. 2024 Existing Conditions Review

This section is a review from Chapter 4. The following was determined to be operating at an unacceptable level for the 2024 existing conditions:

- Int. 4 Hwy 33/5750W: Eastbound left-turning traffic exceeds the minimum safety levels
- Int. 5 Hwy 33/500W: Southbound left-turning traffic exceeds the minimum safety levels
- Int. 5 Hwy 33/500W: Northbound right-turning traffic exceeds the minimum safety levels

b. Mitigation Measures for the 2024 Existing Conditions

It is recommended that a left turn lane or a two way left turn lane (TWLTL) be constructed on Hwy 33 at both intersections 4 and 5. Additionally, it is recommended that a right turn lane be constructed at Intersection 5 for the 2024 existing conditions.

5. Overall Summary for the 2029 Buildout Conditions

a. 2029 Existing Conditions Review

The following was forecasted to be operating at an unacceptable level for the 2029 existing conditions:

- None

b. Mitigation Measures for the 2029 Buildout Conditions

No mitigation measures are warranted for the 2029 buildout conditions.

VII. 2049 Horizon Year Traffic Analysis

A. On-Site Development

Buildout is assumed to be complete by the year 2029. This chapter will analyze the forecasted conditions for the 20-years after buildout.

B. Traffic Forecasting

The traffic counts from the 2029 buildout year were increased by the annual growth rate percentages to establish the 2049 background traffic. This chapter will analyze two (2) scenarios for each segment and intersection; 2049 background traffic (without the development) and 2049 background plus site traffic (with the development).

C. Roadway Network

Within the area of influence there will be two (2) roadway segments and five (5) existing intersections that will be studied. The segments and the intersections that will analyzed are:

1. Segment 1 – Hwy 33 (from Intersection 6, ½ mile each direction)
2. Segment 2 – 500W (from Hwy 33 to 5750N)
3. Intersection 1 – 6500N/1750W
4. Intersection 2 – 6500N/500W
5. Intersection 3 – 5750N/500W
6. Intersection 4 – Hwy 33/5750N
7. Intersection 5 – Hwy 33/500W

Additionally, it was determined in the 2024 existing conditions analysis, that left turn lanes for both intersections 4 and 5 and a right turn lane for Intersection 5 are warranted to meet safety guidelines; no improvements were warranted for the 2029 horizon year. For the 2049 analysis, the addition of the left and right turn lanes will be added to the model.

D. 2049 Horizon Year Segment PM Peak Traffic Volumes

This section discusses the ADT, the peak hour flows, and the trip distribution for the 2049 Buildout Year traffic.

1. Segment 1: Hwy 33 2049 Horizon Year PM Peak Hr Flow

a. Average Daily Traffic (ADT) and Monthly Average Daily Traffic (MADT)

The following tables show the 2024 MADT, 2029 MADT, and the 2049 MADT along with the peak hour of the peak month, without and with the development.

Table 45 – Seg 1: 2049 Segment MADT, Peak Hour, and Trip Distribution Volumes without the development

Segment 1: Hwy 33	Units	Year	Traffic Volume	Eastbound	Westbound
Max. Month ADT (MADT)	VPD	2024	5500	2750	2750
Max. Month Peak Hour Ave. (PH)	VPH	2024	647	300	347
Max. Month ADT (MADT)	VPD	2029	6322	3161	3161
Max. Month Peak Hour Ave. (PH)	VPH	2029	743	345	398
Max. Month ADT (MADT)	VPD	2049	11033	5516	5516
Max. Month Peak Hour Ave. (PH)	VPH	2049	1297	602	695

Table 46 – Seg 1: 2049 Segment MADT, Peak Hour, and Trip Distribution Volumes with the development

Segment 1: Hwy 33	Units	Year	Traffic Volume	Eastbound	Westbound
Max. Month ADT (MADT)	VPD	2024	5500	2750	2750
Max. Month Peak Hour Ave. (PH)	VPH	2024	647	300	347
Max. Month ADT (MADT)	VPD	2029	6647	3324	3324
Max. Month Peak Hour Ave. (PH)	VPH	2029	769	348	400
Max. Month ADT (MADT)	VPD	2049	11358	5679	5679
Max. Month Peak Hour Ave. (PH)	VPH	2049	1323	611	703

2. Segment 2: 500W (from Hwy 33 to 5750N)

The following tables show the 2024 MADT, 2029 MADT, and the 2049 MADT along with the peak hour of the peak month, without and with the development.

Table 47 – Seg 2: 2049 Segment MADT, Peak Hour, and Trip Distribution Volumes without the development

Segment 2: 500W (from Hwy 33 to 5750N)	Units	Year	Traffic Volume	Northbound	Southbound
Max. Month ADT (MADT)	VPD	2024	893	447	447
Max. Month Peak Hour Ave. (PH)	VPH	2024	105	74	31
Max. Month ADT (MADT)	VPD	2029	1026	513	513
Max. Month Peak Hour Ave. (PH)	VPH	2029	121	85	36
Max. Month ADT (MADT)	VPD	2049	1791	896	896
Max. Month Peak Hour Ave. (PH)	VPH	2049	211	148	62

Table 48 – Seg 2: 2049 Segment MADT, Peak Hour, and Trip Distribution Volumes with the development

Segment 2: 500W (from Hwy 33 to 5750N)	Units	Year	Traffic Volume	Northbound	Southbound
Max. Month ADT (MADT)	VPD	2024	1153	577	577
Max. Month Peak Hour Ave. (PH)	VPH	2024	126	88	38
Max. Month ADT (MADT)	VPD	2029	1286	643	643
Max. Month Peak Hour Ave. (PH)	VPH	2029	142	99	43
Max. Month ADT (MADT)	VPD	2049	2051	1026	1026
Max. Month Peak Hour Ave. (PH)	VPH	2049	232	162	69

3. Intersection 1 – 6500N/1750WPeak Hr Volume

The turning movements used for the 2024 existing conditions were adjusted to 2049 using the annual growth rate to analyze the intersection without and with the traffic from the development. The results are shown in the following figure.

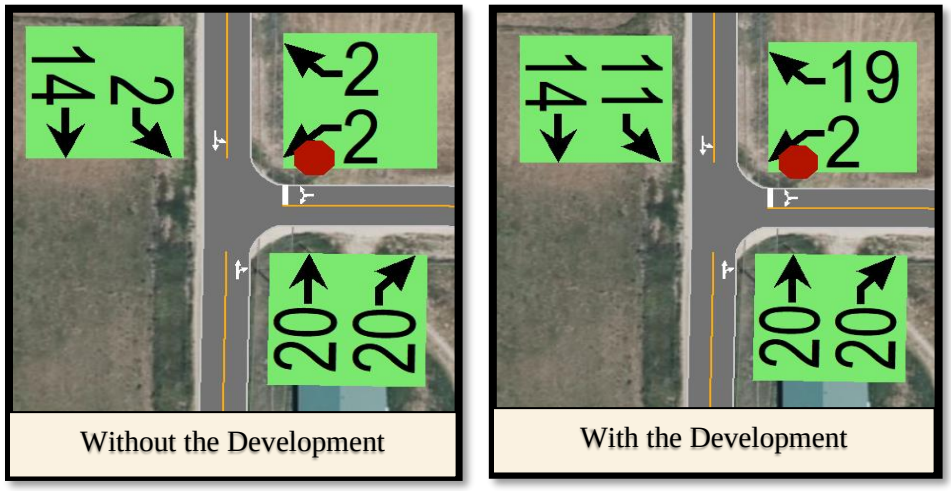


Figure 22: 6500N/1750W 2049 Traffic Volumes without and with the Development

4. Intersection 2 – 6500N/500W Peak Hr Volume

The turning movements used for the 2024 existing conditions were adjusted to 2049 using the annual growth rate to analyze the intersection without and with the traffic from the development. The results are shown in the following figure.

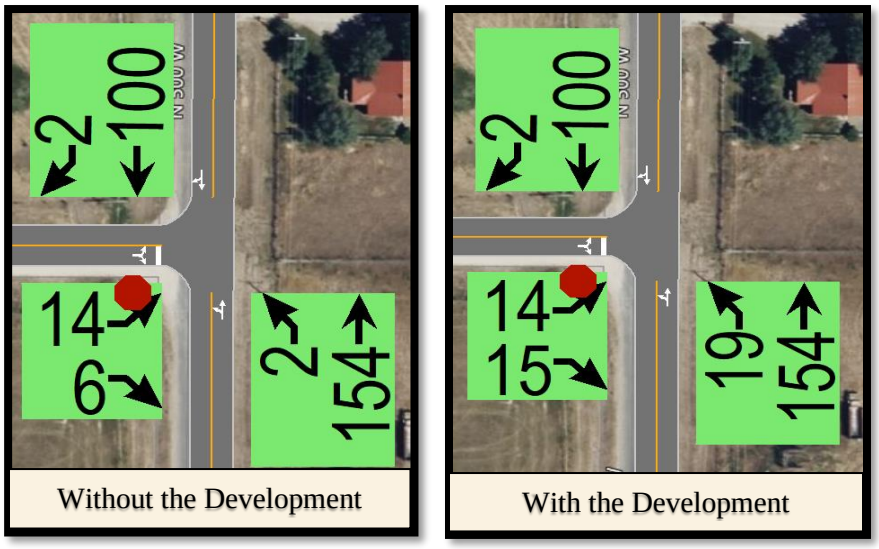


Figure 23: 6500N/500W 2049 Traffic Volumes without and with the Development

5. Intersection 3 – 5750N/500W Peak Hr Volume

The turning movements used for the 2024 existing conditions were adjusted to 2049 using the annual growth rate to analyze the intersection without and with the traffic from the development. The results are shown in the following figure.

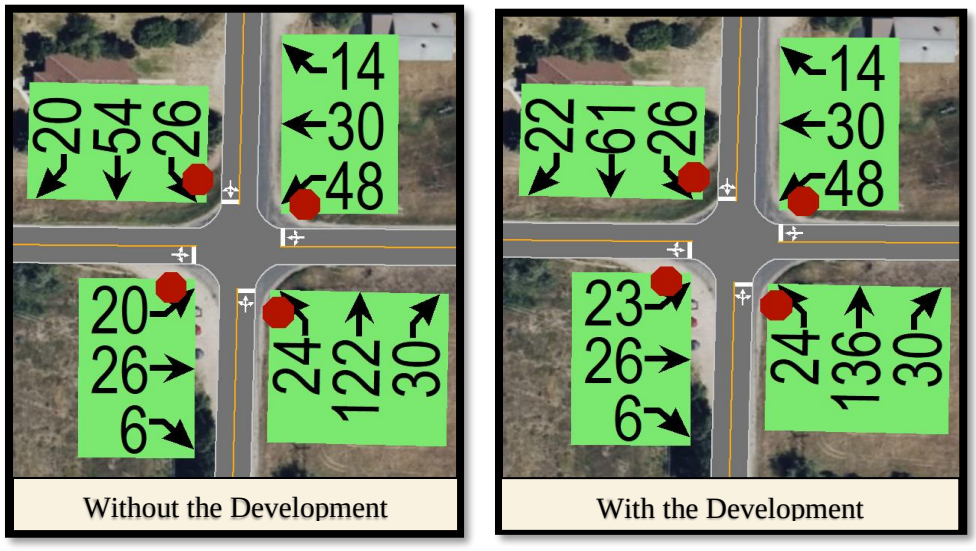


Figure 24: 5750N/500W 2049 Traffic Volumes without and with the Development

6. Intersection 4 – Hwy 33/5750N Peak Hr Volume

The turning movements used for the 2024 existing conditions were adjusted to 2049 using the annual growth rate to analyze the intersection without and with the traffic from the development. The results are shown in the following figure. It should be noted that the recommended turn lanes for the 2024 existing year were added to the model.

Figure 25: Hwy 33/5750N 2049 Traffic Volumes without and with the Development

7. Intersection 5 – Hwy 33/500W Peak Hr Volume

The turning movements used for the 2024 existing conditions were adjusted to 2049 using the annual growth rate to analyze the intersection without and with the traffic from the development. The results are shown in the following figure. It should be noted that the recommended turn lanes for the 2024 existing year were added to the model.

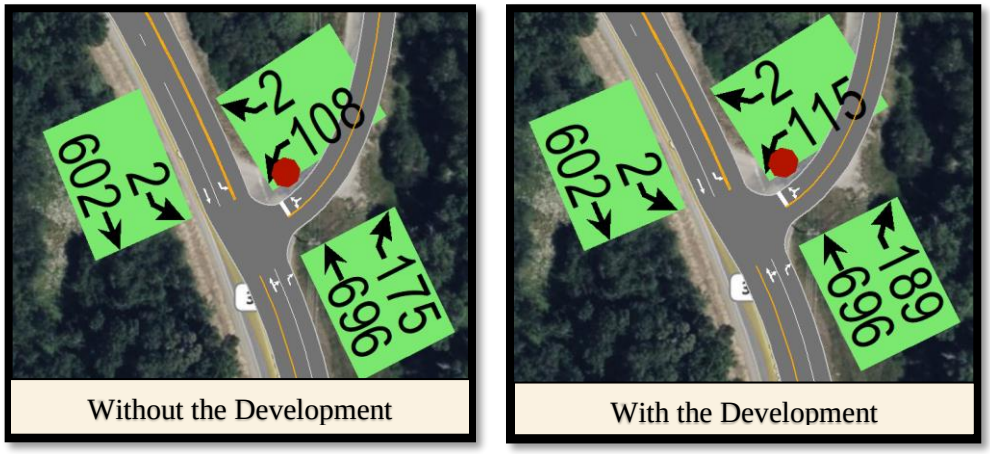


Figure 26: Hwy 33/500W 2049 Traffic Volumes without and with the Development

E. 2049 Horizon Year Segment PM Peak Traffic Conditions

The methods discussed in Chapter 2 will be used to calculate the FFS, PTSF, PFFS, v/c ratio, and LOS. The following table is a result of these calculations. For a more in-depth look at these calculations, reference Appendix H.

Table 49 –2049 Horizon Year Segments PM Traffic LOS

Segment 1	2024 (Existing)		2029 Buildout		2049 Horizon	
Hwy 33	Value	LOS	Value	LOS	Value	LOS
FFS (mph)	63.25	n/a	63.25	n/a	63.25	n/a
ATS (mph)	54.48	B	53.47	B	49.97	C
PTSF (%)	53.1%	B	57.2%	C	77.0%	D
v/c Ratio	0.2	B	0.24	C	0.41	D
Segment 2	2024 (Existing)		2029 Buildout		2049 Horizon	
2000S (from Hwy 33 to 5750N)	Value	LOS	Value	LOS	Value	LOS
FFS (mph)	40	n/a	40	n/a	40	n/a
PFFS (%)	97.1%	A	95.3%	A	92.4%	A
v/c Ratio	0.04	A	0.07	A	0.11	A

F. 2049 Horizon Year Intersection PM Peak Hr Traffic Conditions

In order to determine how well an intersection is functioning, the intersection's Measures of Effectiveness (MOEs) for the peak hour is analyzed. The MOEs include:

1. Level of Service (LOS)
2. Control Delay
3. Volume/Capacity Ratio (v/c Ratio)
4. 95th Percentile Queue

Using the traffic volumes and turning movements shown previously, the 2049 Buildout MOEs for the intersections can be determined.

1. Int. 1 – 6500N/1750W 2049 Horizon Year PM Peak Hr Traffic Conditions

The traffic volumes, identified at the beginning of this chapter, were entered into the computer modeling software Synchro. The results from the model for Intersection 1, without and with the development, are shown in the following table.

Table 50 –Int. 1 – 2049 Horizon Year Peak Hr MOEs Without the Development

HCM 2000 SIGNING SETTINGS	WBL	WBR	NBT	NBR	SBL	SBT
Lanes and Sharing (#RL)						
Traffic Volume (vph)	2	2	20	20	2	14
Future Volume (vph)	2	2	20	20	2	14
Sign Control	Stop	—	Free	—	—	Free
Median Width (ft)	12	—	0	—	—	0
TWLTL Median	☐	—	☐	—	—	☐
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	6.4	6.2	—	—	4.1	—
Follow Up Time, tF (s)	3.5	3.3	—	—	2.2	—
Volume to Capacity Ratio	0.00	0.00	0.03	0.03	0.00	0.00
Control Delay (s)	8.7	8.7	0.0	0.0	0.0	0.8
Level of Service	A	A	A	A	A	A
Queue Length 95th (ft)	0	0	0	0	0	0
Approach Delay (s)	8.7	—	0.0	—	—	0.8

Table 51 –Int. 1 – 2049 Horizon Year Peak Hr MOEs With the Development

HCM 2000 SIGNING SETTINGS	WBL	WBR	NBT	NBR	SBL	SBT
Lanes and Sharing (#RL)						
Traffic Volume (vph)	2	19	20	20	11	14
Future Volume (vph)	2	19	20	20	11	14
Sign Control	Stop	—	Free	—	—	Free
Median Width (ft)	12	—	0	—	—	0
TWLTL Median	☐	—	☐	—	—	☐
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	6.4	6.2	—	—	4.1	—
Follow Up Time, tF (s)	3.5	3.3	—	—	2.2	—
Volume to Capacity Ratio	0.02	0.02	0.03	0.03	0.01	0.01
Control Delay (s)	8.6	8.6	0.0	0.0	0.1	3.2
Level of Service	A	A	A	A	A	A
Queue Length 95th (ft)	2	2	0	0	1	1
Approach Delay (s)	8.6	—	0.0	—	—	3.2

2. Int. 2 – 6500N/500W 2049 Horizon Year PM Peak Hr Traffic Conditions

The traffic volumes, identified at the beginning of this chapter, were entered into the computer modeling software Synchro. The results from the model for Intersection 2, without and with the development, are shown in the following table.

Table 52 –Int. 2 – 2049 Horizon Year Peak Hr MOEs Without the Development

HCM 2000 SIGNING SETTINGS	EBL	EBR	NBL	NBT	SBT	SBR
Lanes and Sharing (#RL)						
Traffic Volume (vph)	14	6	2	154	100	2
Future Volume (vph)	14	6	2	154	100	2
Sign Control	Stop	—	—	Free	Free	—
Median Width (ft)	12	—	—	0	0	—
TWLTL Median	☐	—	—	☐	☐	—
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	6.4	6.2	4.1	—	—	—
Follow Up Time, tF (s)	3.5	3.3	2.2	—	—	—
Volume to Capacity Ratio	0.03	0.03	0.00	0.00	0.07	0.07
Control Delay (s)	10.0	10.0	0.0	0.1	0.0	0.0
Level of Service	A	A	A	A	A	A
Queue Length 95th (ft)	2	2	0	0	0	0
Approach Delay (s)	10.0	—	—	0.1	0.0	—

Table 53 –Int. 2 – 2049 Horizon Year Peak Hr MOEs With the Development

HCM 2000 SIGNING SETTINGS	EBL	EBR	NBL	NBT	SBT	SBR
Lanes and Sharing (#RL)						
Traffic Volume (vph)	14	15	19	154	100	2
Future Volume (vph)	14	15	19	154	100	2
Sign Control	Stop	—	—	Free	Free	—
Median Width (ft)	12	—	—	0	0	—
TWLTL Median	☐	—	—	☐	☐	—
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	6.4	6.2	4.1	—	—	—
Follow Up Time, tF (s)	3.5	3.3	2.2	—	—	—
Volume to Capacity Ratio	0.04	0.04	0.02	0.02	0.07	0.07
Control Delay (s)	9.9	9.9	0.1	1.0	0.0	0.0
Level of Service	A	A	A	A	A	A
Queue Length 95th (ft)	3	3	1	1	0	0
Approach Delay (s)	9.9	—	—	1.0	0.0	—

3. Int. 3 – 5750N/500W 2049 Horizon Year PM Peak Hr Traffic Conditions

The traffic volumes, identified at the beginning of this chapter, were entered into the computer modeling software Synchro. The results from the model for Intersection 3, without and with the development, are shown in the following table.

Table 54 –Int. 3 – 2049 Horizon Year Peak Hr MOEs Without the Development

HCM 2000 SIGNING SETTINGS	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lanes and Sharing (#RL)												
Traffic Volume (vph)	20	26	6	48	30	14	24	122	30	26	54	20
Future Volume (vph)	20	26	6	48	30	14	24	122	30	26	54	20
Sign Control	—	Stop	—	—	Stop	—	—	Stop	—	—	Stop	—
Median Width (ft)	—	0	—	—	0	—	—	0	—	—	0	—
TWLTL Median	—		—	—		—	—		—	—		—
Right Turn Channelized	—	—	None	—	—	None	—	—	None	—	—	None
Critical Gap, tC (s)	—	—	—	—	—	—	—	—	—	—	—	—
Follow Up Time, tF (s)	—	—	—	—	—	—	—	—	—	—	—	—
Volume to Capacity Ratio	0.08	0.08	0.08	0.14	0.14	0.14	0.25	0.25	0.25	0.14	0.14	0.14
Control Delay (s)	8.3	8.3	8.3	8.6	8.6	8.6	8.9	8.9	8.9	8.3	8.3	8.3
Level of Service	A	A	A	A	A	A	A	A	A	A	A	A
Queue Length 95th (ft)	—	—	—	—	—	—	—	—	—	—	—	—
Approach Delay (s)	—	8.3	—	—	8.6	—	—	8.9	—	—	8.3	—

Table 55 –Int. 3 – 2049 Horizon Year Peak Hr MOEs With the Development

HCM 2000 SIGNING SETTINGS	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lanes and Sharing (#RL)												
Traffic Volume (vph)	23	26	6	48	30	14	24	136	30	26	61	22
Future Volume (vph)	23	26	6	48	30	14	24	136	30	26	61	22
Sign Control	—	Stop	—	—	Stop	—	—	Stop	—	—	Stop	—
Median Width (ft)	—	0	—	—	0	—	—	0	—	—	0	—
TWLTL Median	—		—	—		—	—		—	—		—
Right Turn Channelized	—	—	None	—	—	None	—	—	None	—	—	None
Critical Gap, tC (s)	—	—	—	—	—	—	—	—	—	—	—	—
Follow Up Time, tF (s)	—	—	—	—	—	—	—	—	—	—	—	—
Volume to Capacity Ratio	0.09	0.09	0.09	0.14	0.14	0.14	0.27	0.27	0.27	0.16	0.16	0.16
Control Delay (s)	8.4	8.4	8.4	8.7	8.7	8.7	9.1	9.1	9.1	8.5	8.5	8.5
Level of Service	A	A	A	A	A	A	A	A	A	A	A	A
Queue Length 95th (ft)	—	—	—	—	—	—	—	—	—	—	—	—
Approach Delay (s)	—	8.4	—	—	8.7	—	—	9.1	—	—	8.5	—

4. Int. 4 – Hwy 33/5750N 2049 Horizon Year PM Peak Hr Traffic Conditions

The traffic volumes, identified at the beginning of this chapter, were entered into the computer modeling software Synchro. The results from the model for Intersection 4, without and with the development, are shown in the following table. It should be noted that the recommended turn lanes for the 2024 existing year were added to the model.

Table 56 –Int. 4 – 2049 Horizon Year Peak Hr MOEs Without the Development

HCM 2000 SIGNING SETTINGS	EBL	EBT	WBT	WBR	SBL	SBR
Lanes and Sharing (#RL)						
Traffic Volume (vph)	54	602	696	2	2	74
Future Volume (vph)	54	602	696	2	2	74
Sign Control	—	Free	Free	—	Stop	—
Median Width (ft)	—	12	12	—	12	—
TWLTL Median	—	☑	☑	—	☐	—
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	4.1	—	—	—	6.4	6.2
Follow Up Time, tF (s)	2.2	—	—	—	3.5	3.3
Volume to Capacity Ratio	0.07	0.40	0.47	0.47	0.23	0.23
Control Delay (s)	9.8	0.0	0.0	0.0	17.1	17.1
Level of Service	A	A	A	A	C	C
Queue Length 95th (ft)	6	0	0	0	21	21
Approach Delay (s)	—	0.8	0.0	—	17.1	—

Table 57 –Int. 4 – 2049 Horizon Year Peak Hr MOEs With the Development

HCM 2000 SIGNING SETTINGS	EBL	EBT	WBT	WBR	SBL	SBR
Lanes and Sharing (#RL)						
Traffic Volume (vph)	57	602	696	2	2	76
Future Volume (vph)	57	602	696	2	2	76
Sign Control	—	Free	Free	—	Stop	—
Median Width (ft)	—	12	12	—	12	—
TWLTL Median	—	☑	☑	—	☐	—
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	4.1	—	—	—	6.4	6.2
Follow Up Time, tF (s)	2.2	—	—	—	3.5	3.3
Volume to Capacity Ratio	0.08	0.40	0.47	0.47	0.23	0.23
Control Delay (s)	9.8	0.0	0.0	0.0	17.2	17.2
Level of Service	A	A	A	A	C	C
Queue Length 95th (ft)	6	0	0	0	22	22
Approach Delay (s)	—	0.9	0.0	—	17.2	—

5. Int. 5 – Hwy 33/500W 2049 Horizon Year PM Peak Hr Traffic Conditions

The traffic volumes, identified at the beginning of this chapter, were entered into the computer modeling software Synchro. The results from the model for Intersection 5, without and with the development, are shown in the following table. It should be noted that the recommended turn lanes for the 2024 existing year were added to the model.

Table 58 –Int. 5 – 2049 Horizon Year Peak Hr MOEs Without the Development

HCM 2000 SIGNING SETTINGS	WBL	WBR	NBT	NBR	SBL	SBT
Lanes and Sharing (#RL)						
Traffic Volume (vph)	108	2	696	175	2	602
Future Volume (vph)	108	2	696	175	2	602
Sign Control	Stop	—	Free	—	—	Free
Median Width (ft)	12	—	0	—	—	12
TWLTL Median	☐	—	☐	—	—	☑
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	6.4	6.2	—	—	4.1	—
Follow Up Time, tF (s)	3.5	3.3	—	—	2.2	—
Volume to Capacity Ratio	0.36	0.36	0.50	0.50	0.00	0.40
Control Delay (s)	21.1	21.1	0.0	0.0	10.3	0.0
Level of Service	C	C	A	A	B	A
Queue Length 95th (ft)	40	40	0	0	0	0
Approach Delay (s)	21.1	—	0.0	—	—	0.0

Table 59 –Int. 5 – 2049 Horizon Year Peak Hr MOEs With the Development

HCM 2000 SIGNING SETTINGS	WBL	WBR	NBT	NBR	SBL	SBT
Lanes and Sharing (#RL)						
Traffic Volume (vph)	115	2	696	189	2	602
Future Volume (vph)	115	2	696	189	2	602
Sign Control	Stop	—	Free	—	—	Free
Median Width (ft)	12	—	0	—	—	12
TWLTL Median	☐	—	☐	—	—	☑
Right Turn Channelized	—	None	—	None	—	None
Critical Gap, tC (s)	6.4	6.2	—	—	4.1	—
Follow Up Time, tF (s)	3.5	3.3	—	—	2.2	—
Volume to Capacity Ratio	0.38	0.38	0.51	0.51	0.00	0.40
Control Delay (s)	21.7	21.7	0.0	0.0	10.3	0.0
Level of Service	C	C	A	A	B	A
Queue Length 95th (ft)	44	44	0	0	0	0
Approach Delay (s)	21.7	—	0.0	—	—	0.0

G. Turn Lane Warrants Based on Safety Analysis of Intersections

1. 2049 Horizon Year Conditions Left Turn Lane Analysis

It was identified that left turn lanes were warranted for the 2024 existing conditions for both intersection 4 and 5. No new turn lanes are warranted between the 2024 existing conditions and the 2049 buildout conditions; see Appendix F for the left-turn worksheets.

2. 2049 Horizon Year Conditions Right Turn Lane Analysis

It was identified that a right turn lane was warranted for the 2024 existing conditions for Intersection 5. No new turn lanes are warranted between the 2024 existing conditions and the 2049 buildout conditions; see Appendix G for the right-turn worksheets.

H. Analysis of 2049 Horizon Year PM Peak Hr Traffic Conditions Summary

This chapter has identified the following:

1. Segments

The following table is a summary of each segment's LOS

Table 60 – 2049 Horizon Year Segments Traffic Condition Summary

Segment 1	2024 (Existing)		2029 Buildout		2049 Horizon	
Hwy 33	Value	LOS	Value	LOS	Value	LOS
FFS (mph)	63.25	n/a	63.25	n/a	63.25	n/a
ATS (mph)	54.48	B	53.47	B	49.97	C
PTSF (%)	53.1%	B	57.2%	C	77.0%	D
v/c Ratio	0.2	B	0.24	C	0.41	D

Segment 2	2024 (Existing)		2029 Buildout		2049 Horizon	
2000S (from Hwy 33 to 5750N)	Value	LOS	Value	LOS	Value	LOS
FFS (mph)	40	n/a	40	n/a	40	n/a
PFFS (%)	97.1%	A	95.3%	A	92.4%	A
v/c Ratio	0.04	A	0.07	A	0.11	A

a. Segment Summary

As can be seen in the above table, each segment is forecasted to operate at an acceptable level.

2. Intersections

The following tables show each intersection's LOS for the 2049 horizon year conditions.

Table 61 –Int. 1 2049 Horizon Year Intersection Traffic Condition Summary without and with the development

Int 1 - 6500N/1750W - Build LOS and Delay Times without the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2049 Traffic	n/a	n/a	n/a	2	n/a	2	n/a	20	20	2	14	n/a
LOS	n/a	n/a	n/a	A	n/a	A	n/a	A	A	A	A	n/a
Delay	n/a	n/a	n/a	8.7	n/a	8.7	n/a	0	0	0	0.8	n/a

Int 1 - 6500N/1750W - Build LOS and Delay Times with the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2049 Traffic	n/a	n/a	n/a	2	n/a	19	n/a	20	20	11	14	n/a
LOS	n/a	n/a	n/a	A	n/a	A	n/a	A	A	A	A	n/a
Delay	n/a	n/a	n/a	8.6	n/a	8.6	n/a	0	0	0.1	3.2	n/a

Table 62 –Int. 2 2049 Horizon Year Intersection Traffic Condition Summary without and with the development

Int 2 - 6500N/500W - Build LOS and Delay Times without the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2049 Traffic	14	n/a	6	n/a	n/a	n/a	2	154	n/a	n/a	100	2
LOS	A	n/a	A	n/a	n/a	n/a	A	A	n/a	n/a	A	A
Delay	10	n/a	10	n/a	n/a	n/a	0	0.1	n/a	n/a	0	0

Int 2 - 6500N/500W - Build LOS and Delay Times with the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2049 Traffic	14	n/a	15	n/a	n/a	n/a	19	154	n/a	n/a	100	2
LOS	A	n/a	A	n/a	n/a	n/a	A	A	n/a	n/a	A	A
Delay	9.9	n/a	9.9	n/a	n/a	n/a	0.1	1	n/a	n/a	0	0

Table 63 –Int. 3 2049 Horizon Year Intersection Traffic Condition Summary without and with the development

Int 3 - 5750N/500W - Build LOS and Delay Times without the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2049 Traffic	20	26	6	48	30	14	24	122	30	26	54	20
LOS	A	A	A	A	A	A	A	A	A	A	A	A
Delay	8.3	8.3	8.3	8.6	8.6	8.6	8.9	8.9	8.9	8.3	8.3	8.3

Int 3 - 5750N/500W - Build LOS and Delay Times with the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2049 Traffic	23	26	6	48	30	14	24	136	30	26	61	22
LOS	A	A	A	A	A	A	A	A	A	A	A	A
Delay	8.4	8.4	8.4	8.7	8.7	8.7	9.1	9.1	9.1	8.5	8.5	8.5

Table 64 –Int. 4 2049 Horizon Year Intersection Traffic Condition Summary without and with the development

Int 4 - Hwy 33/5750W - Build LOS and Delay Times without the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2049 Traffic	54	602	n/a	n/a	696	2	n/a	n/a	n/a	2	n/a	74
LOS	A	A	n/a	n/a	A	A	n/a	n/a	n/a	C	n/a	C
Delay	9.8	0	n/a	n/a	0	0	n/a	n/a	n/a	17.1	n/a	17.1

Int 4 - Hwy 33/5750W - Build LOS and Delay Times with the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2049 Traffic	57	602	n/a	n/a	696	2	n/a	n/a	n/a	2	n/a	76
LOS	A	A	n/a	n/a	A	A	n/a	n/a	n/a	C	n/a	C
Delay	9.8	0	n/a	n/a	0	0	n/a	n/a	n/a	17.2	n/a	17.2

Table 65 –Int. 5 2049 Horizon Year Intersection Traffic Condition Summary without and with the development

Int 5 - Hwy 33/500W - Build LOS and Delay Times without the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2049 Traffic	n/a	n/a	n/a	108	n/a	2	n/a	696	175	2	602	n/a
LOS	n/a	n/a	n/a	C	n/a	C	n/a	A	A	V	A	n/a
Delay	n/a	n/a	n/a	21.1	n/a	21.1	n/a	0	0	10.3	0	n/a

Int 5 - Hwy 33/500W - Build LOS and Delay Times with the Development												
	Eastbound			Westbound			Northbound			Southbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
2049 Traffic	n/a	n/a	n/a	115	n/a	2	n/a	696	189	2	602	n/a
LOS	n/a	n/a	n/a	C	n/a	C	n/a	A	A	B	A	n/a
Delay	n/a	n/a	n/a	21.7	n/a	21.7	n/a	0	0	10.3	0	n/a

a. Intersection Summary

As can be seen in the above tables, all five (5) intersections are forecasted to operate at an acceptable level for the 2049 horizon year.

3. Turn Lane Analysis

a. Left Turn Lane Analysis

The following left turn lane(s) are warranted for the 2049 horizon year traffic (between 2029 and 2049).

- None

b. Right Turn Lane Analysis

The following right turn lane(s) are warranted for the 2049 horizon year traffic (between 2029 and 2049).

- None

4. Review of the 2024 Existing Conditions

a. 2024 Existing Conditions Review

This section is a review from Chapter 4. The following was determined to be operating at an unacceptable level for the 2024 existing conditions:

- Int. 4 Hwy 33/5750W: Eastbound left-turning traffic exceeds the minimum safety levels
- Int. 5 Hwy 33/500W: Southbound left-turning traffic exceeds the minimum safety levels
- Int. 5 Hwy 33/500W: Northbound right-turning traffic exceeds the minimum safety levels

b. Mitigation Measures for the 2024 Existing Conditions

It is recommended that a left turn lane or a two way left turn lane (TWLTL) be constructed on Hwy 33 at both intersections 4 and 5. Additionally, it is recommended that a right turn lane be constructed at Intersection 5 for the current 2024 existing conditions.

5. Review of the 2029 Buildout Conditions

a. 2029 Existing Conditions Review

This section is a review from Chapter 6. The following was forecasted to be operating at an unacceptable level for the 2029 buildout conditions:

- None

b. Mitigation Measures for the 2029 Buildout Conditions

No mitigation measures are warranted for the 2029 buildout conditions.

6. Overall Summary for the 2049 Horizon Year Conditions

a. 2049 Horizon Year Conditions Review

The following was forecasted to be operating at an unacceptable level for the 2049 horizon year conditions:

- None

b. Mitigation Measures for the 2049 Horizon Year Conditions

No mitigation measures are warranted for the 2049 horizon year conditions.

VIII. Conclusions.

After evaluating the proposed development within the context of zoning; projected land use; existing transportation system; background traffic counts for the principal roadways within the study impact area; projected traffic for horizon years corresponding with project opening, project buildout, and a 20-year horizon year; the findings of the Traffic Impact Study are summarized below. In order to simplify the forecasted traffic conditions as they have progressed through this study, the following three (3) tables were produced. The first table shows the forecasted progression of the roadway segments, the second table shows the intersections, and the third shows the left or right turn lanes. It should be noted by constructing the left turn lane or TWLTL at Intersection 5 for safety for the 2024 existing conditions, the LOS improved for the 2029 buildout year (this is highlighted in orange in Table 67).

Table 66- Segment Traffic Conditions Progression Each Horizon Year

Segment 1	2024 (Existing)		2029 Buildout		2049 Horizon	
Hwy 33	Value	LOS	Value	LOS	Value	LOS
FFS (mph)	63.25	n/a	63.25	n/a	63.25	n/a
ATS (mph)	54.48	B	53.5	B	49.97	C
PTSF (%)	53.1%	B	57.2%	C	77.0%	D
v/c Ratio	0.2	B	0.24	C	0.41	D

Segment 2	2024 (Existing)		2029 Buildout		2049 Horizon	
2000S (from Hwy 33 to 5750N)	Value	LOS	Value	LOS	Value	LOS
FFS (mph)	40	n/a	40	n/a	40	n/a
PFFS (%)	97.1%	A	95.3%	A	92.4%	A
v/c Ratio	0.04	A	0.07	A	0.11	A

Table 67- Intersection Traffic Conditions Progression Each Horizon Year

Int 1: 6500N/1750W	Eastbound Max LOS	Westbound Max LOS	Northbound Max LOS	Southbound Max LOS
2024 Existing Traffic	n/a	A	A	A
2029 Background Traffic	n/a	A	A	A
2029 Background plus Site Traffic	n/a	A	A	A
2049 Background Traffic	n/a	A	A	A
2049 Background plus Site Traffic	n/a	A	A	A

Int 2: 6500N/500W	Eastbound Max LOS	Westbound Max LOS	Northbound Max LOS	Southbound Max LOS
2024 Existing Traffic	A	n/a	A	A
2029 Background Traffic	A	n/a	A	A
2029 Background plus Site Traffic	A	n/a	A	A
2049 Background Traffic	A	n/a	A	A
2049 Background plus Site Traffic	A	n/a	A	A

Int 3: 5750N/500W	Eastbound Max LOS	Westbound Max LOS	Northbound Max LOS	Southbound Max LOS
2024 Existing Traffic	A	A	A	A
2029 Background Traffic	A	A	A	A
2029 Background plus Site Traffic	A	A	A	A
2049 Background Traffic	A	A	A	A
2049 Background plus Site Traffic	A	A	A	A

Int 4: Hwy 33/5750N	Eastbound Max LOS	Westbound Max LOS	Northbound Max LOS	Southbound Max LOS
2024 Existing Traffic	A	A	n/a	B
2029 Background Traffic	A	A	n/a	B
2029 Background plus Site Traffic	A	A	n/a	B
2049 Background Traffic	A	A	n/a	C
2049 Background plus Site Traffic	A	A	n/a	C

Int 5: Hwy 33/500W	Eastbound Max LOS	Westbound Max LOS	Northbound Max LOS	Southbound Max LOS
2024 Existing Traffic	n/a	C	A	A
2029 Background Traffic	n/a	B	A	A
2029 Background plus Site Traffic	n/a	B	A	A
2049 Background Traffic	n/a	C	A	A
2049 Background plus Site Traffic	n/a	C	A	B

Table 68- Left and Right Turn Lane Progression Each Horizon Year

Int 4: Hwy 33/5750N	Left Turn Lane		Right Turn Lane	
	Eastbound	Westbound	Eastbound	Westbound
2024 Existing Traffic	Warranted	n/a	n/a	Not Warranted
2029 Background Traffic	Warranted	n/a	n/a	Not Warranted
2029 Background plus Site Traffic	Warranted	n/a	n/a	Not Warranted
2049 Background Traffic	Warranted	n/a	n/a	Not Warranted
2049 Background plus Site Traffic	Warranted	n/a	n/a	Not Warranted

Int 5: Hwy 33/500N	Left Turn Lane		Right Turn Lane	
	Northbound	Southbound	Northbound	Southbound
2024 Existing Traffic	n/a	Warranted	Warranted	n/a
2029 Background Traffic	n/a	Warranted	Warranted	n/a
2029 Background plus Site Traffic	n/a	Warranted	Warranted	n/a
2049 Background Traffic	n/a	Warranted	Warranted	n/a
2049 Background plus Site Traffic	n/a	Warranted	Warranted	n/a

A. Existing Traffic Conditions (2024)

The existing traffic conditions were analyzed with the existing intersection control and lane configurations, all the road segments and intersections are operating within minimum operational thresholds except:

- Int. 4 Hwy 33/5750W: Eastbound left-turning traffic exceeds the minimum safety levels
- Int. 5 Hwy 33/500W: Southbound left-turning traffic exceeds the minimum safety levels
- Int. 5 Hwy 33/500W: Northbound right-turning traffic exceeds the minimum safety levels

1. Existing 2024 Traffic Mitigating Measures

It is recommended that a left turn lane or a two way left turn lane (TWLTL) be constructed on Hwy 33 at both intersections 4 and 5. Additionally, it is recommended that a right turn lane be constructed at Intersection 5 to accommodate the existing 2024 traffic safely.

B. 2029 Buildout Year Traffic Conditions Results

All segment capacity and intersection delay times/LOS are projected to operate within the minimum allowable operational thresholds for the 2029 buildout year.

1. 2029 Buildout Mitigating Measures

For the 2029 buildout scenario no deficiencies were forecasted, therefore no mitigation measures are recommended.

C. 2049 Horizon Year Traffic Conditions Results

All segment capacity and intersection delay times/LOS are projected to operate within the minimum allowable operational thresholds for the 2049 horizon year.

1. 2049 Horizon Year Mitigating Measures

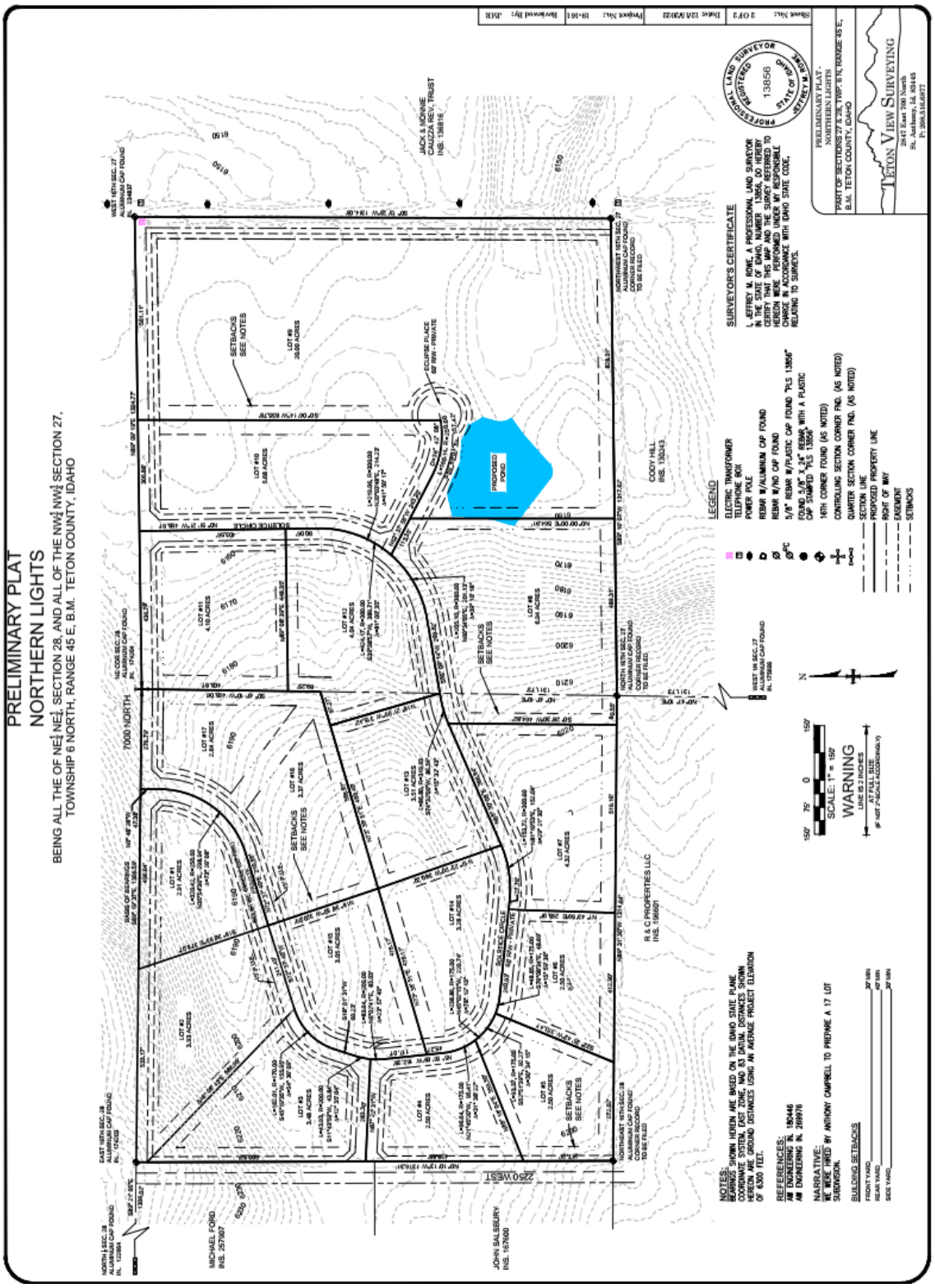
For the 2049 horizon year scenario no deficiencies were forecasted, therefore no mitigation measures are recommended.

D. Overall Study Summary

As can be seen from the tables in this chapter, the development is forecasted to have minimal impact to the traffic network within the study area. All segments are forecasted to operate below the allowable operation thresholds throughout the study time period. All intersections are forecasted to operate below the allowable operation thresholds throughout the study time period.

Although the traffic is forecasted to operate at an acceptable level, in order to meet ITD's minimum safety guidelines on Hwy 33, left turns lanes or a two way left turn lane (TWLTL) for both intersections 4 and 5 along with a right turn lane at Intersection 5 is warranted with or without the development.

IX. Appendix A: Site Master Plan



X. Appendix B: Traffic Counts

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Project Analysis Worksheet
Tranportation Engineering
Traffic Volume Count
Intersection Tally Sheet - One Hour

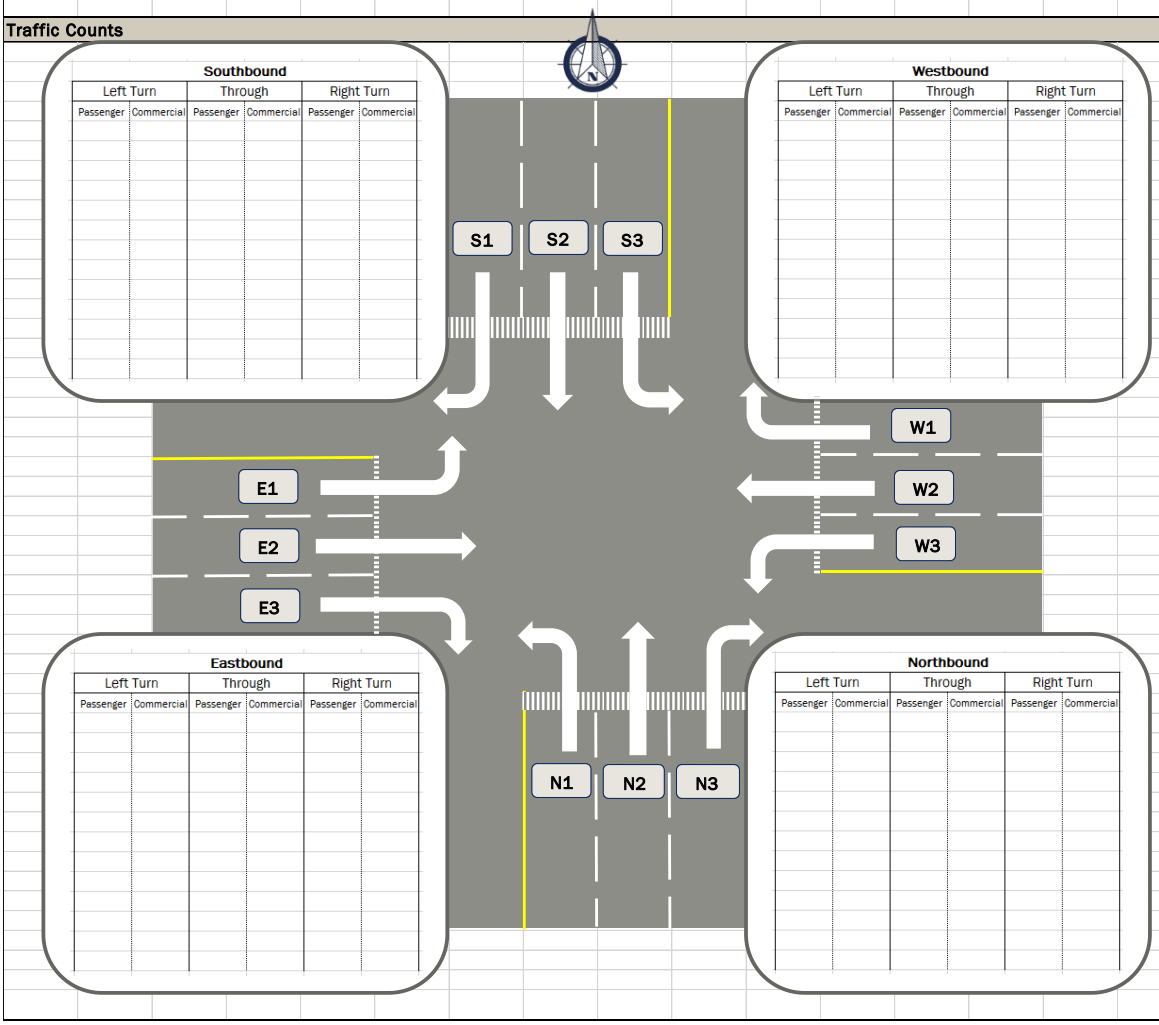
Client:
Project: Northern Lights Addendum 2
Project No.:

DESIGNED
CHECKED
DATE:

Project Information

					TOTAL COUNTS		
1	State:		Idaho	ID	Passenger		**Total**
2	County:		Teton	N1			0
3	North-South Roadway		1750W	N2	6		6
4	East-West Roadway		6500N	N3	6		6
5	Type of Intersection:		Three Way	S1			0
6	Date Data Collected:		29-Mar-24	S2	5		5
7	Time Period Analyzed:		5:00 P.M.	S3	0		0
8		until	6:00 P.M.	E1			0
9				E2			0
10				E3			0
11				W1	0		0
12				W2			0
13				W3	0		0
14				Total			17

Traffic Counts



Civilize, PLLC
Management and Engineering

Project Analysis Worksheet
Tranportation Engineering
Traffic Volume Count
Intersection Tally Sheet - One Hour

Client:
Project: Northern Lights Addendum 2
Project No.:

DESIGNED
CHECKED
DATE:

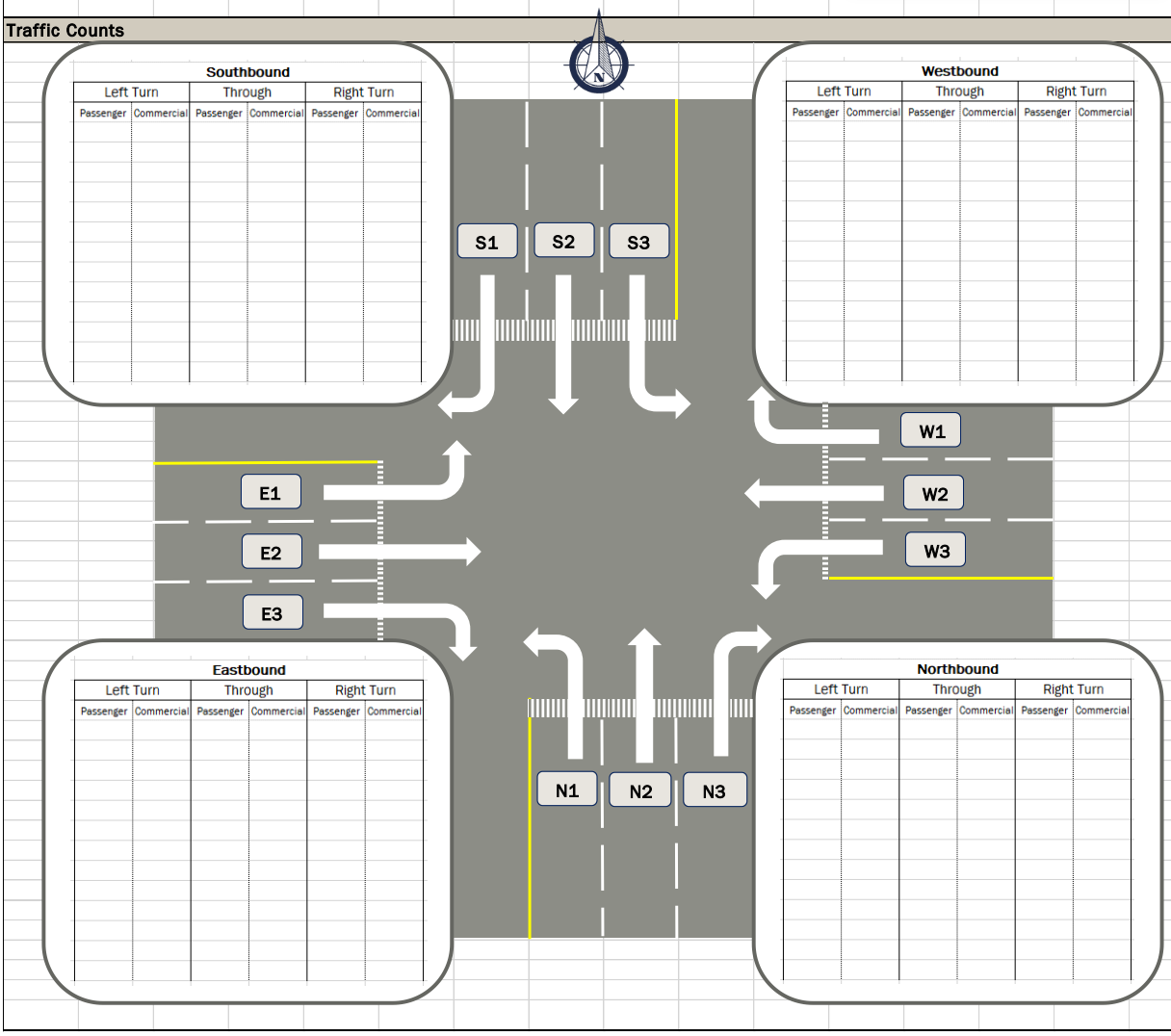
Project Information

1	State:	Idaho		
2	County:	Teton		
3	North-South Roadway	500W		
4	East-West Roadway	6500N		
5	Type of Intersection:	Three Way		
6	Date Data Collected:	29-Mar-24		
7	Time Period Analyzed:	5:00	P.M.	
8	until	6:00	P.M.	
9				
10				
11				
12				
13				
14				

TOTAL COUNTS

ID	Passenger	Total
N1	0	0
N2	46	46
N3		0
S1	0	0
S2	30	30
S3		0
E1	4	4
E2		0
E3	2	2
W1		0
W2		0
W3		0
Total		82

Traffic Counts



Civilize, PLLC
Management and Engineering

Project Analysis Worksheet
Tranportation Engineering
Traffic Volume Count
Intersection Tally Sheet - One Hour

Client:
Project: Northern Lights Addendum 2
Project No.:

DESIGNED
CHECKED
DATE:

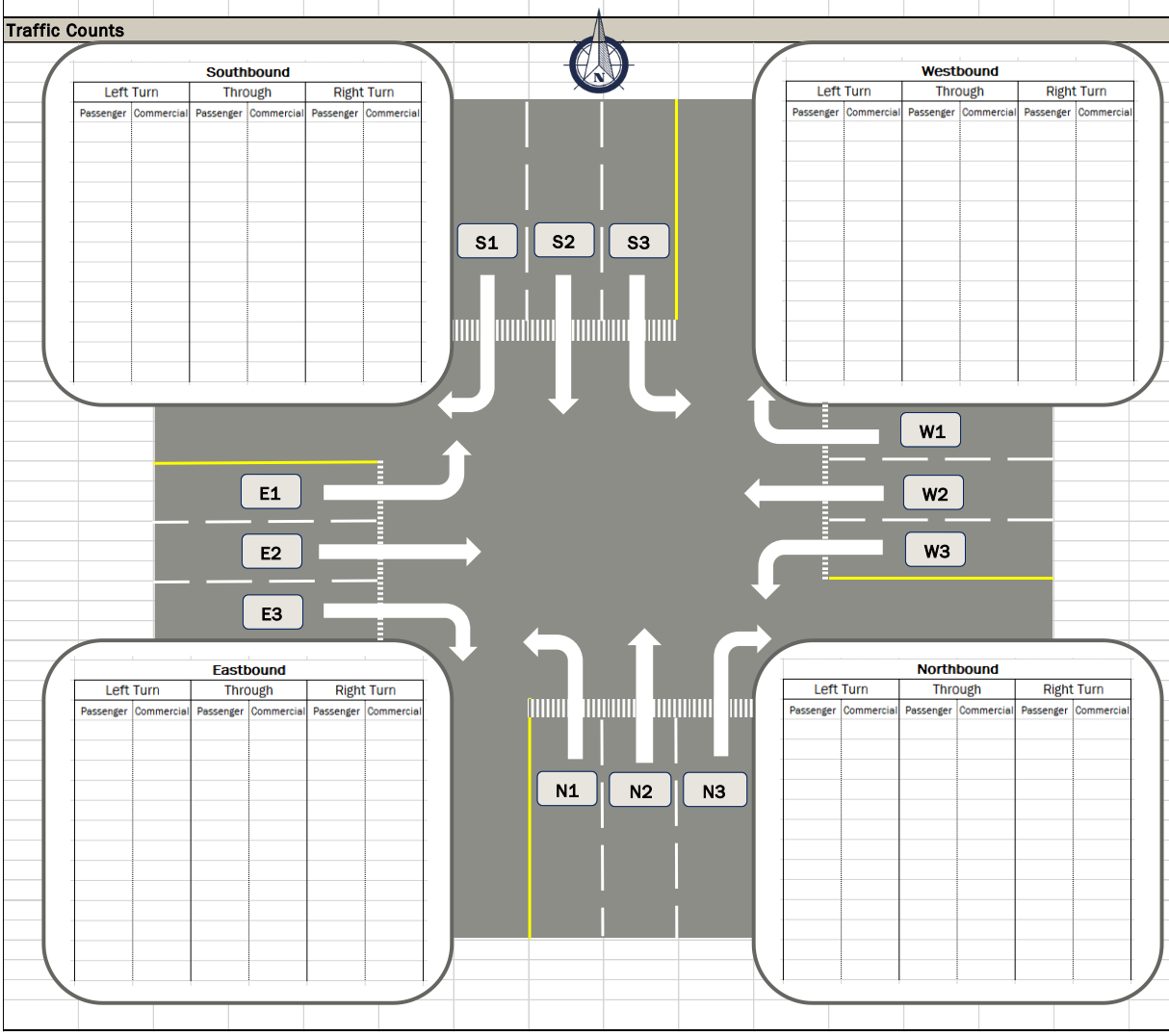
Project Information

1	State:	Idaho		
2	County:	Teton		
3	North-South Roadway	500W		
4	East-West Roadway	5750N		
5	Type of Intersection:	Four		
6	Date Data Collected:	29-Mar-24		
7	Time Period Analyzed:	5:00	P.M.	
8	until	6:00	P.M.	
9				
10				
11				
12				
13				
14				

TOTAL COUNTS

ID	Passenger	Total
N1	7	7
N2	36	36
N3	9	9
S1	6	6
S2	16	16
S3	8	8
E1	6	6
E2	8	8
E3	2	2
W1	4	4
W2	9	9
W3	14	14
Total		125

Traffic Counts



Civilize, PLLC
Management and Engineering

Project Analysis Worksheet
Tranportation Engineering
Traffic Volume Count
Intersection Tally Sheet - One Hour

Client:
Project: Northern Lights Addendum 2
Project No.:

DESIGNED
CHECKED
DATE:

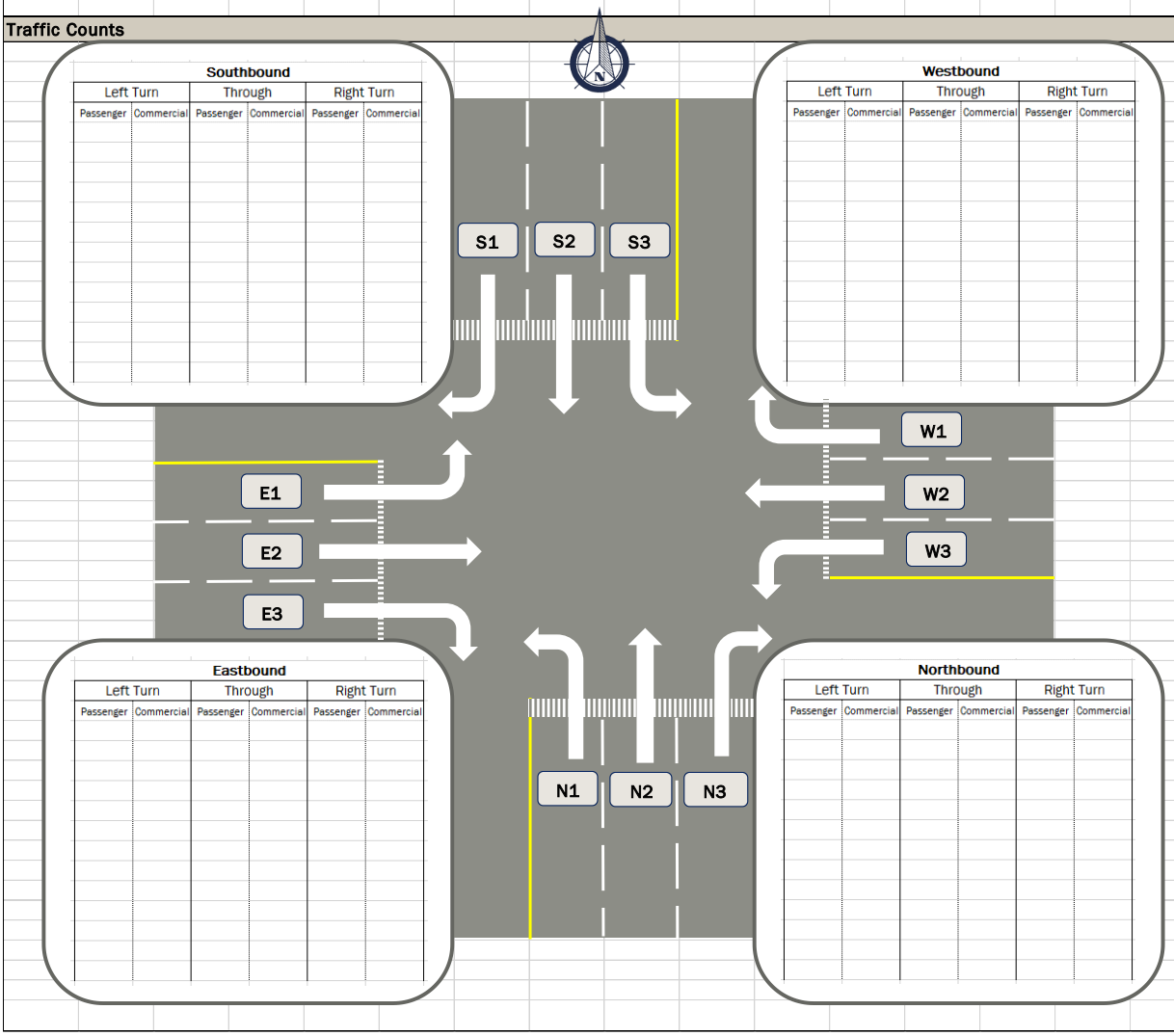
Project Information

1	State:	Idaho		
2	County:	Teton		
3	North-South Roadway	5750N		
4	East-West Roadway	Hwy 33		
5	Type of Intersection:	Three		
6	Date Data Collected:	29-Mar-24		
7	Time Period Analyzed:	5:00	P.M.	
8	until	6:00	P.M.	
9				
10				
11				
12				
13				
14				

TOTAL COUNTS

ID	Passenger	Total
N1		0
N2		0
N3		0
S1	22	22
S2		0
S3	0	0
E1	16	16
E2		0
E3		0
W1		0
W2		0
W3	0	0
Total		38

Traffic Counts



Civilize, PLLC
Management and Engineering

Project Analysis Worksheet
Tranportation Engineering
Traffic Volume Count
Intersection Tally Sheet - One Hour

Client:
Project: Northern Lights Addendum 2
Project No.:

DESIGNED
CHECKED
DATE:

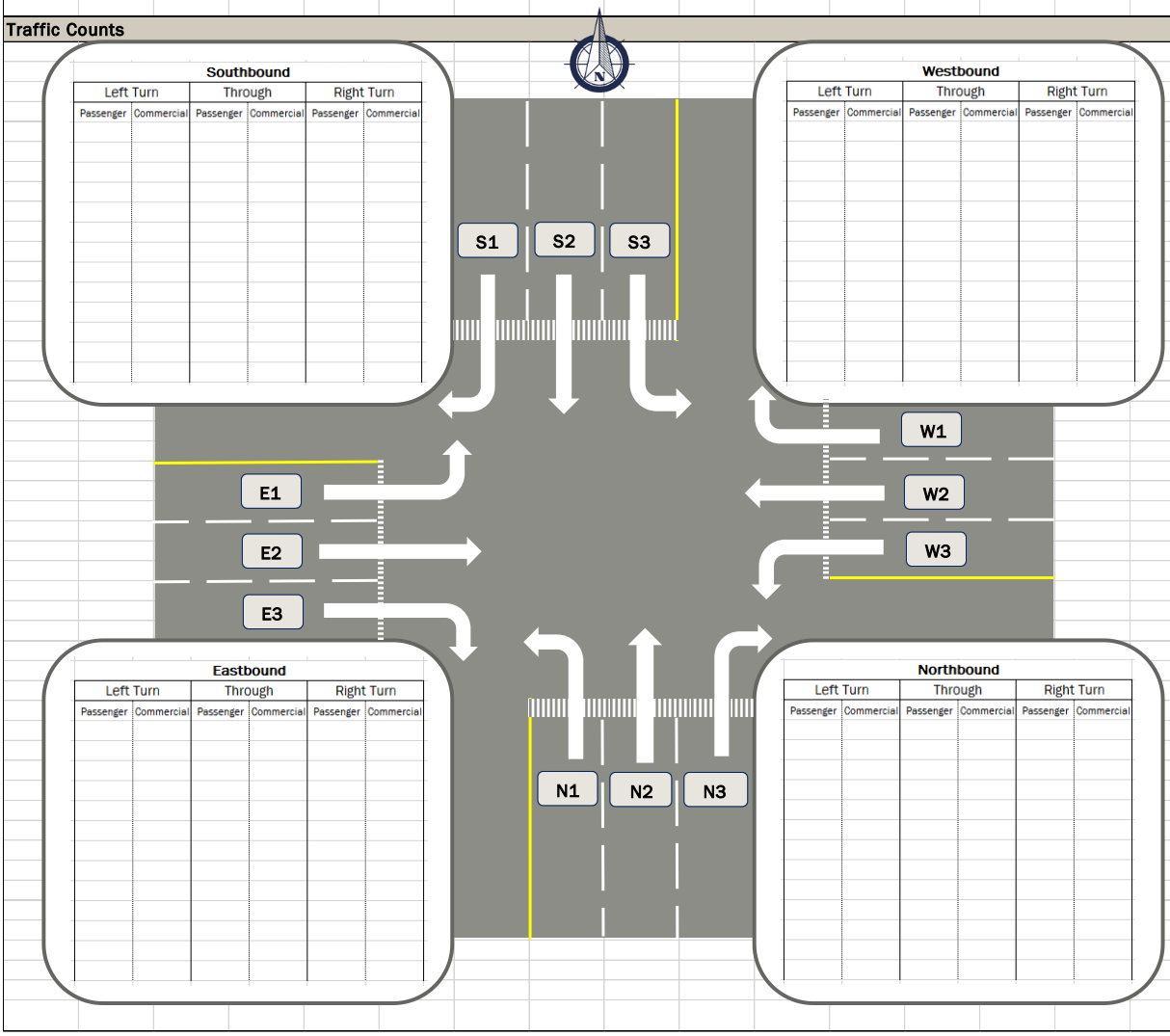
Project Information

1	State:	Idaho		
2	County:	Teton		
3	North-South Roadway	5750N		
4	East-West Roadway	Hwy 33		
5	Type of Intersection:	Three		
6	Date Data Collected:	29-Mar-24		
7	Time Period Analyzed:	5:00	P.M.	
8	until	6:00	P.M.	
9				
10				
11				
12				
13				
14				

TOTAL COUNTS

ID	Passenger	Total
N1		0
N2		0
N3	52	52
S1		0
S2		0
S3	0	0
E1		0
E2		0
E3		0
W1	0	0
W2		0
W3	32	32
Total		84

Traffic Counts



#059 - Newdale - ATR | Average Daily Traffic | Published Reports

Automatic Counter Volumes

Report Types

Year	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	24-Hour	Annual	Avg.
1990	835	895	1230	1375	1428	1505	1876	1777	1389	1396	1091	1047	1324		
1991	859	1021	1069	1327	1461	1616	1820	1799	1521	1580	1066	1061	1352		
1992	1029	1131	1242	1557	1635	1761	2079	1877	1696	1348	1149	905	1455		
1993	835	915	1208	1463	1669	1706	2053	1838	1724	1550	1168	1159	1444		
1994	1145	1138	1415	1729	1674	1842	2147	2032	1762	1579	1234	1172	1575		
1995	1211	1245	1660	1919	2157	1883	2208	2143	1922	1788	1407	1409	1746		
1996	1025	1282	1528	1739	1765	1886	2188	2071	1814	1653	1273	1049	1606		
1997	1072	1230	1329	1639	1893	1997	2297	2194	1936	1704	1427	1399	1676		
1998	1141	1280	1479	1678	1860	1901	2201	2176	1935	1786	1466	1353	1688		
1999	1331	1302	1604	1764	1896	2084	2479	2392	2124	1651	1473	1433	1794		
2000	1120	1310	1578	1763	1824	2038	2352	2349	1983	1825	1506	1484	1761		
2001	1451	1516	1695	1906	1999	2122	2379	2336	2155	1893	1662	1571	1890		
2002	1305	1480	1786	1819	2048	2152	2574	2451	2258	2065	1752	1723	1951		
2003	1635	1637	1737	1899	2103	2202	2438	2393	2121	1955	1642	1627	1949		
2004	1371	1596	1785	1949	2031	2170	2614	2380	2227	1955	1813	1816	1976		
2005	1584	1746	1846	1992	2190	2363	2600	2395	2108	2085	1762	1822	2041		
2006	1611	1734	1870	2011	2294	2507	2706	2766	2500	2370	1978	2079	2202		
2007	1967	2179	2321	2417	2666	2980	3089	3314	2977	2726	2351	2173	2597		
2008	1806	1703	2170	2158	2306	2533	2714	2538	2341	2222	1846	1632	2164		
2009	1660	1721	1768	1911	2180	2483	2625	2411	2414	2062	1704	1700	2053		
2010	1659	1712	1793	1814	2036	2360	2668	2321	2263	2024	1585	1518	1979		
2011	1519	1505	1667	1679	1887	2097	2482	2234	2180	1909	1505	1535	1850		
2012	1461	1566	1615	1802	1844	2155	2352	2212	2044	1747	1518	1567	1824		
2013	1416	1530	1604	1741	1894	2306	2410	2107	1976	1874	1622	1612	1841		
2014	1562	1556	1805	1907	1995	2440	2480	2293	2217	2018	1701	1730	1975		
2015	1732	1833	1920	2084	2089	2508	2879	2688	2522	2255	1957	1861	2194		
2016	1826	2000	2147	2219	2367	2744	3115	2954	2655	2293	2011	1838	2347		
2017	1804	1918	2154	2322	2529	2991	3293	3402	2880	2633	2264	2251	2537		
2018	2191	2152	2246	2444	2733	3146	3470	3164	3126	2853	2296	2169	2666		
2019	2139	1706		2604	2764	3189	3526	3434	3084	2666	2395	2318	2697		
2020	2157	2257	1971	1920	2651	3078	3430	3565	3461	3015	2454	2460	2701		
2021	2519	2129	2702	2809	3276	3948	4073	3529	3045	2528	2349	2287	2933		
2022	2357	2547	2730	2777	3242	3791	4219	4145	4135	3685	2869	2533	3253		
2023	2692	2565	2645	2918	3496	4022	4447	4139	4122	3764	3172	2874	3405		
2024	2676	2897													

Idaho Transportation Department

Monthly Hourly Day of Week Summary for July 2023

Site names: 00059
County: Madison
Funct Class: R Minor Arterial - Other
Location: SH-33 5.3 Mi. E of Main St

Seasonal Factor Grp: 4
Daily Factor Grp: 3
Axle Factor Grp: All_Class_Sites
Growth Factor Grp: 7

	SUN			MON			TUE			WED			THU			FRI			SAT		
	Road	E	W	Road	E	W	Road	E	W	Road	E	W	Road	E	W	Road	E	W	Road	E	W
00:00	32	17	15	19	10	9	13	6	7	25	12	13	16	11	6	21	11	10	46	15	31
01:00	18	11	7	10	5	5	9	3	6	10	6	4	10	6	5	9	6	4	19	11	8
02:00	10	4	6	6	4	2	8	4	4	5	2	2	5	3	2	6	4	2	11	7	4
03:00	8	4	4	6	3	2	8	5	2	9	6	3	11	7	4	8	5	3	13	10	3
04:00	15	11	4	28	20	9	30	25	5	26	20	7	33	27	6	29	23	6	28	22	6
05:00	27	19	8	123	113	10	120	112	9	132	120	12	137	123	14	109	96	13	60	45	15
06:00	42	27	15	238	211	26	218	195	23	256	227	29	243	220	24	216	183	33	119	85	34
07:00	74	40	34	263	195	67	255	189	66	279	206	73	287	220	67	263	192	71	181	121	60
08:00	131	64	67	282	181	101	279	174	106	301	193	109	310	206	104	287	180	107	216	123	93
09:00	181	80	102	300	163	137	283	181	102	310	172	138	300	166	134	321	165	157	282	144	138
10:00	210	81	128	298	148	150	257	126	131	278	135	143	303	150	153	304	143	161	318	148	170
11:00	226	93	133	282	127	155	242	109	133	288	137	151	285	140	145	312	143	170	291	138	153
12:00	230	91	139	264	118	145	242	107	135	270	119	150	272	132	141	302	124	177	295	135	160
13:00	240	108	132	272	134	138	245	116	129	272	126	145	257	120	137	322	138	184	276	129	147
14:00	225	105	120	273	136	137	266	133	133	288	141	147	287	131	156	344	153	191	288	137	152
15:00	238	123	115	292	138	155	274	119	155	308	130	178	318	145	173	353	154	199	335	150	185
16:00	235	134	102	307	131	176	299	122	177	349	142	208	347	136	212	387	180	208	296	137	159
17:00	224	118	106	374	127	247	347	114	233	384	130	253	395	144	252	373	158	215	262	117	145
18:00	209	116	93	315	101	213	315	100	215	366	114	252	343	121	222	351	163	187	259	115	144
19:00	174	90	84	213	81	132	214	79	135	231	78	153	233	86	147	279	138	142	207	90	117
20:00	144	67	77	148	62	86	143	55	89	148	60	88	158	61	97	203	94	108	176	77	99
21:00	121	59	62	119	53	66	111	46	64	136	63	73	142	61	81	161	75	85	146	64	82
22:00	73	35	38	66	31	35	92	40	52	87	42	45	96	40	56	130	61	69	126	57	68
23:00	45	24	21	35	20	16	73	29	44	35	20	14	56	23	33	93	41	53	66	32	35
MADW	3,131	1,519	1,612	4,531	2,312	2,219	4,338	2,185	2,153	4,788	2,400	2,388	4,841	2,475	2,366	5,182	2,628	2,554	4,316	2,107	2,209
N Days	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5

Idaho Transportation Department

Monthly Hourly Day of Week Summary for March 2023

Site names: 00059
County: Madison
Funct Class: R Minor Arterial - Other
Location: SH-33 5.3 Mi. E of Main St

Seasonal Factor Grp: 4
Daily Factor Grp: 3
Axle Factor Grp: All_Class_Sites
Growth Factor Grp: 7

	SUN			MON			TUE			WED			THU			FRI			SAT		
	Road	E	W	Road	E	W	Road	E	W	Road	E	W	Road	E	W	Road	E	W	Road	E	W
00:00	10	7	3	7	3	4	7	5	3	6	3	3	8	5	3	10	6	4	13	9	5
01:00	9	6	3	4	2	2	3	1	3	2	2	0	3	3	1	4	2	2	6	3	3
02:00	3	1	2	5	4	1	3	2	1	3	2	1	3	1	1	3	1	2	5	4	2
03:00	6	3	3	8	5	3	5	3	2	4	2	2	8	6	3	6	3	2	5	2	3
04:00	8	5	4	11	8	4	14	10	3	6	5	1	14	10	4	8	5	3	12	8	4
05:00	13	7	6	75	67	8	79	74	5	64	58	6	86	75	10	55	46	10	17	12	5
06:00	27	19	9	133	120	13	138	120	18	118	103	14	137	119	19	101	87	14	50	39	11
07:00	62	46	16	194	146	48	207	156	51	175	128	47	210	164	47	186	145	41	118	91	27
08:00	96	43	53	209	148	60	224	161	63	166	124	42	231	164	68	207	140	67	123	78	45
09:00	117	39	78	206	123	84	230	137	93	183	102	81	231	136	95	198	107	90	146	70	76
10:00	159	43	116	187	91	96	199	101	98	176	90	86	198	100	98	167	78	89	161	66	95
11:00	147	47	100	178	82	95	178	85	93	167	72	95	174	83	91	160	71	89	161	70	91
12:00	144	56	87	171	80	91	174	75	99	144	60	84	178	80	98	163	67	96	136	60	76
13:00	132	51	81	162	73	90	180	79	101	142	63	79	186	81	104	159	60	99	159	73	87
14:00	149	63	86	180	74	106	189	76	113	148	62	86	187	80	108	158	62	96	153	66	88
15:00	180	87	93	205	79	126	205	75	129	177	77	99	237	92	145	155	58	97	186	81	106
16:00	179	81	99	247	89	158	242	85	157	219	83	136	273	94	179	193	73	120	189	78	111
17:00	156	66	89	278	72	206	303	94	209	257	78	180	269	86	183	156	62	94	187	81	106
18:00	114	65	50	204	70	135	220	74	147	182	61	121	208	73	135	109	46	63	130	66	64
19:00	83	47	36	124	48	77	119	43	76	113	46	67	143	58	85	81	42	39	97	52	45
20:00	61	36	25	72	34	38	87	40	47	67	34	32	80	45	35	61	33	28	81	42	39
21:00	43	26	17	55	28	27	51	27	24	48	34	14	60	40	20	53	29	24	78	45	34
22:00	24	18	7	26	17	10	31	16	14	26	17	9	34	21	13	34	26	8	50	25	25
23:00	14	8	5	15	8	7	16	7	9	15	9	6	22	15	6	26	20	7	30	18	12
MADW	1,936	868	1,068	2,954	1,467	1,486	3,099	1,544	1,555	2,607	1,315	1,292	3,180	1,631	1,549	2,451	1,269	1,182	2,290	1,136	1,155
N Days	3	3	3	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	4	4	4

XI. Appendix C: 2024 Existing Conditions Traffic Model Results

Northern Lights Addendum 2 - 2024 Existing Conditions - Intersection 1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	1	10	10	1	7
Future Volume (Veh/h)	1	1	10	10	1	7
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	1	1	11	11	1	8
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	26	16			22	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	26	16			22	
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	100			100	
cM capacity (veh/h)	980	1054			1574	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	2	22	9
Volume Left	1	0	1
Volume Right	1	11	0
cSH	1016	1700	1574
Volume to Capacity	0.00	0.01	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	8.6	0.0	0.8
Lane LOS	A		A
Approach Delay (s)	8.6	0.0	0.8
Approach LOS	A		

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Northern Lights Addendum 2 - 2024 Existing Conditions - Intersection 2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	3	1	77	50	1
Future Volume (Veh/h)	7	3	1	77	50	1
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	8	3	1	88	57	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	148	58	58			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	148	58	58			
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	100			
cM capacity (veh/h)	837	1000	1527			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	11	89	58
Volume Left	8	1	0
Volume Right	3	0	1
cSH	876	1527	1700
Volume to Capacity	0.01	0.00	0.03
Queue Length 95th (ft)	1	0	0
Control Delay (s)	9.2	0.1	0.0
Lane LOS	A	A	
Approach Delay (s)	9.2	0.1	0.0
Approach LOS	A		

Intersection Summary				
Average Delay		0.7		
Intersection Capacity Utilization		15.4%	ICU Level of Service	A
Analysis Period (min)		15		

Northern Lights Addendum 2 - 2024 Existing Conditions - Intersection 3

Intersection	
Intersection Delay, s/veh	7.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	13	3	24	15	7	12	61	15	13	27	10
Future Vol, veh/h	10	13	3	24	15	7	12	61	15	13	27	10
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	11	15	3	27	17	8	14	69	17	15	31	11
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.6	7.7	7.7	7.5
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	14%	38%	52%	26%
Vol Thru, %	69%	50%	33%	54%
Vol Right, %	17%	12%	15%	20%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	88	26	46	50
LT Vol	12	10	24	13
Through Vol	61	13	15	27
RT Vol	15	3	7	10
Lane Flow Rate	100	30	52	57
Geometry Grp	1	1	1	1
Degree of Util (X)	0.114	0.035	0.062	0.065
Departure Headway (Hd)	4.094	4.306	4.293	4.134
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	868	819	823	857
Service Time	2.156	2.396	2.376	2.206
HCM Lane V/C Ratio	0.115	0.037	0.063	0.067
HCM Control Delay	7.7	7.6	7.7	7.5
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.4	0.1	0.2	0.2

Northern Lights Addendum 2 - 2024 Existing Conditions - Intersection 4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	27	300	347	1	1	37
Future Volume (Veh/h)	27	300	347	1	1	37
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	31	341	394	1	1	42
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	395				798	394
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	395				798	394
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				100	94
cM capacity (veh/h)	1147				342	648

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	372	395	43
Volume Left	31	0	1
Volume Right	0	1	42
cSH	1147	1700	635
Volume to Capacity	0.03	0.23	0.07
Queue Length 95th (ft)	2	0	5
Control Delay (s)	0.9	0.0	11.1
Lane LOS	A		B
Approach Delay (s)	0.9	0.0	11.1
Approach LOS			B

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	52.6%	ICU Level of Service	A
Analysis Period (min)	15		

Northern Lights Addendum 2 - 2024 Existing Conditions - Intersection 5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	54	1	347	87	1	300
Future Volume (Veh/h)	54	1	347	87	1	300
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	61	1	394	99	1	341
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	786	444			493	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	786	444			493	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	83	100			100	
cM capacity (veh/h)	356	608			1055	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	62	493	342
Volume Left	61	0	1
Volume Right	1	99	0
cSH	359	1700	1055
Volume to Capacity	0.17	0.29	0.00
Queue Length 95th (ft)	15	0	0
Control Delay (s)	17.1	0.0	0.0
Lane LOS	C		A
Approach Delay (s)	17.1	0.0	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	36.4%	ICU Level of Service	A
Analysis Period (min)	15		

XII. Appendix D: 2029 Buildout Traffic Model Results

Without the Development

Northern Lights Addendum 2 - 2029 Without the Development - Intersection 1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	1	11	11	1	8
Future Volume (Veh/h)	1	1	11	11	1	8
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	1	1	12	12	1	9
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	29	18			24	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	29	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 %	100	100			100	
cM capacity (veh/h)	977	1052			1572	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	2	24	10
Volume Left	1	0	1
Volume Right	1	12	0
cSH	1013	1700	1572
Volume to Capacity	0.00	0.01	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	8.6	0.0	0.7
Lane LOS	A		A
Approach Delay (s)	8.6	0.0	0.7
Approach LOS	A		

Intersection Summary			
Average Delay		0.7	
Intersection Capacity Utilization		13.3%	ICU Level of Service A
Analysis Period (min)		15	

With the Development

Northern Lights Addendum 2 - 2029 With the Development - Intersection 1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	18	11	11	10	8
Future Volume (Veh/h)	1	18	11	11	10	8
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	1	20	12	12	11	9
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	49	18			24	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	49	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 %	100	98			99	
cM capacity (veh/h)	946	1052			1572	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	21	24	20
Volume Left	1	0	11
Volume Right	20	12	0
cSH	1046	1700	1572
Volume to Capacity	0.02	0.01	0.01
Queue Length 95th (ft)	2	0	1
Control Delay (s)	8.5	0.0	4.0
Lane LOS	A		A
Approach Delay (s)	8.5	0.0	4.0
Approach LOS	A		

Intersection Summary			
Average Delay		4.0	
Intersection Capacity Utilization		17.8%	ICU Level of Service A
Analysis Period (min)		15	

Without the Development

Northern Lights Addendum 2 - 2029 Without the Development - Intersection 2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	8	3	1	89	57	1
Future Volume (Veh/h)	8	3	1	89	57	1
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	9	3	1	101	65	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	168	66	66			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	168	66	66			
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	100			
cM capacity (veh/h)	814	990	1517			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	12	102	66
Volume Left	9	1	0
Volume Right	3	0	1
cSH	852	1517	1700
Volume to Capacity	0.01	0.00	0.04
Queue Length 95th (ft)	1	0	0
Control Delay (s)	9.3	0.1	0.0
Lane LOS	A	A	
Approach Delay (s)	9.3	0.1	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	16.1%	ICU Level of Service	A
Analysis Period (min)	15		

With the Development

Northern Lights Addendum 2 - 2029 With the Development - Intersection 2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	8	12	18	89	57	1
Future Volume (Veh/h)	8	12	18	89	57	1
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	9	14	20	101	65	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	206	66	66			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	206	66	66			
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	99	99			
cM capacity (veh/h)	765	990	1517			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	23	121	66
Volume Left	9	20	0
Volume Right	14	0	1
cSH	888	1517	1700
Volume to Capacity	0.03	0.01	0.04
Queue Length 95th (ft)	2	1	0
Control Delay (s)	9.2	1.3	0.0
Lane LOS	A	A	
Approach Delay (s)	9.2	1.3	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	23.0%	ICU Level of Service	A
Analysis Period (min)	15		

Without the Development

Northern Lights Addendum 2 - 2029 Without the Development - Intersection 3

Intersection	
Intersection Delay, s/veh	7.7
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	15	3	28	17	8	14	70	17	15	31	11
Future Vol, veh/h	11	15	3	28	17	8	14	70	17	15	31	11
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	13	17	3	32	19	9	16	80	19	17	35	13
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.7	7.8	7.8	7.6
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	14%	38%	53%	26%
Vol Thru, %	69%	52%	32%	54%
Vol Right, %	17%	10%	15%	19%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	101	29	53	57
LT Vol	14	11	28	15
Through Vol	70	15	17	31
RT Vol	17	3	8	11
Lane Flow Rate	115	33	60	65
Geometry Grp	1	1	1	1
Degree of Util (X)	0.131	0.041	0.073	0.075
Departure Headway (Hd)	4.124	4.464	4.336	4.172
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	858	807	812	846
Service Time	2.2	2.464	2.436	2.259
HCM Lane V/C Ratio	0.134	0.041	0.074	0.077
HCM Control Delay	7.8	7.7	7.8	7.6
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.5	0.1	0.2	0.2

With the Development

Northern Lights Addendum 2 - 2029 With the Development - Intersection 3

Intersection	
Intersection Delay, s/veh	7.9
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	14	15	3	28	17	8	14	84	17	15	38	13
Future Vol, veh/h	14	15	3	28	17	8	14	84	17	15	38	13
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	16	17	3	32	19	9	16	95	19	17	43	15
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.8	7.9	8	7.7
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	12%	44%	53%	23%
Vol Thru, %	73%	47%	32%	58%
Vol Right, %	15%	9%	15%	20%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	115	32	53	66
LT Vol	14	14	28	15
Through Vol	84	15	17	38
RT Vol	17	3	8	13
Lane Flow Rate	131	36	60	75
Geometry Grp	1	1	1	1
Degree of Util (X)	0.151	0.046	0.075	0.087
Departure Headway (Hd)	4.146	4.543	4.501	4.181
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	852	793	800	842
Service Time	2.233	2.545	2.502	2.281
HCM Lane V/C Ratio	0.154	0.045	0.075	0.089
HCM Control Delay	8	7.8	7.9	7.7
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.5	0.1	0.2	0.3

Without the Development

Northern Lights Addendum 2 - 2029 Without the Development - Intersection 4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	31	345	399	1	1	43
Future Volume (Veh/h)	31	345	399	1	1	43
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	35	392	453	1	1	49
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	454				916	454
vC1, stage 1 conf vol					454	
vC2, stage 2 conf vol					462	
vCu, unblocked vol	454				916	454
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	97				100	92
cM capacity (veh/h)	1091				498	600

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	35	392	454	50
Volume Left	35	0	0	1
Volume Right	0	0	1	49
cSH	1091	1700	1700	598
Volume to Capacity	0.03	0.23	0.27	0.08
Queue Length 95th (ft)	2	0	0	7
Control Delay (s)	8.4	0.0	0.0	11.6
Lane LOS	A			B
Approach Delay (s)	0.7		0.0	11.6
Approach LOS				B

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	38.8%	ICU Level of Service	A
Analysis Period (min)	15		

With the Development

Northern Lights Addendum 2 - 2029 With the Development - Intersection 4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	33	345	399	1	1	45
Future Volume (Veh/h)	33	345	399	1	1	45
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	38	392	453	1	1	51
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	454				922	454
vC1, stage 1 conf vol					454	
vC2, stage 2 conf vol					468	
vCu, unblocked vol	454				922	454
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	97				100	92
cM capacity (veh/h)	1091				495	600

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	38	392	454	52
Volume Left	38	0	0	1
Volume Right	0	0	1	51
cSH	1091	1700	1700	598
Volume to Capacity	0.03	0.23	0.27	0.09
Queue Length 95th (ft)	3	0	0	7
Control Delay (s)	8.4	0.0	0.0	11.6
Lane LOS	A			B
Approach Delay (s)	0.7		0.0	11.6
Approach LOS				B

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	40.2%	ICU Level of Service	A
Analysis Period (min)	15		

Without the Development

Northern Lights Addendum 2 - 2029 Without the Development - Intersection 5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	62	1	399	100	1	345
Future Volume (Veh/h)	62	1	399	100	1	345
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	70	1	453	114	1	392
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			TWLTL
Median storage veh)						2
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	847	453			567	
vC1, stage 1 conf vol	453					
vC2, stage 2 conf vol	394					
vCu, unblocked vol	847	453			567	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	87	100			100	
cM capacity (veh/h)	531	601			990	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	71	491	76	1	392
Volume Left	70	0	0	1	0
Volume Right	1	38	76	0	0
cSH	532	1700	1700	990	1700
Volume to Capacity	0.13	0.29	0.04	0.00	0.23
Queue Length 95th (ft)	11	0	0	0	0
Control Delay (s)	12.8	0.0	0.0	8.6	0.0
Lane LOS	B			A	
Approach Delay (s)	12.8	0.0		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	36.3%	ICU Level of Service	A
Analysis Period (min)	15		

With the Development

Northern Lights Addendum 2 - 2029 With the Development - Intersection 5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	69	1	399	114	1	345
Future Volume (Veh/h)	69	1	399	114	1	345
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	78	1	453	130	1	392
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			TWLTL
Median storage veh)						2
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	847	453			583	
vC1, stage 1 conf vol	453					
vC2, stage 2 conf vol	394					
vCu, unblocked vol	847	453			583	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	85	100			100	
cM capacity (veh/h)	531	601			977	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	79	496	87	1	392
Volume Left	78	0	0	1	0
Volume Right	1	43	87	0	0
cSH	532	1700	1700	977	1700
Volume to Capacity	0.15	0.29	0.05	0.00	0.23
Queue Length 95th (ft)	13	0	0	0	0
Control Delay (s)	12.9	0.0	0.0	8.7	0.0
Lane LOS	B			A	
Approach Delay (s)	12.9	0.0		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		37.1%	ICU Level of Service	A
Analysis Period (min)		15		

XIII. Appendix E: 2049 Horizon Year Traffic Analysis

Without the Development

Northern Lights Addendum 2 - 2029 Without the Development - Intersection 1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	2	20	20	2	14
Future Volume (Veh/h)	2	2	20	20	2	14
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	2	2	23	23	2	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	54	34			46	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	54	34			46	
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	100			100	
cM capacity (veh/h)	945	1030			1543	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	4	46	18
Volume Left	2	0	2
Volume Right	2	23	0
cSH	986	1700	1543
Volume to Capacity	0.00	0.03	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	8.7	0.0	0.8
Lane LOS	A		A
Approach Delay (s)	8.7	0.0	0.8
Approach LOS	A		

Intersection Summary			
Average Delay		0.7	
Intersection Capacity Utilization		13.3%	ICU Level of Service A
Analysis Period (min)		15	

With the Development

Northern Lights Addendum 2 - 2029 With the Development - Intersection 1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	19	20	20	11	14
Future Volume (Veh/h)	2	19	20	20	11	14
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	2	22	23	23	12	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	74	34			46	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	74	34			46	
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	98			99	
cM capacity (veh/h)	914	1030			1543	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	24	46	28
Volume Left	2	0	12
Volume Right	22	23	0
cSH	1019	1700	1543
Volume to Capacity	0.02	0.03	0.01
Queue Length 95th (ft)	2	0	1
Control Delay (s)	8.6	0.0	3.2
Lane LOS	A		A
Approach Delay (s)	8.6	0.0	3.2
Approach LOS	A		

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	18.2%	ICU Level of Service	A
Analysis Period (min)	15		

Without the Development

Northern Lights Addendum 2 - 2029 Without the Development - Intersection 2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	14	6	2	154	100	2
Future Volume (Veh/h)	14	6	2	154	100	2
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	16	7	2	175	114	2
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	294	115	116			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	294	115	116			
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	100			
cM capacity (veh/h)	690	929	1454			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	23	177	116
Volume Left	16	2	0
Volume Right	7	0	2
cSH	748	1454	1700
Volume to Capacity	0.03	0.00	0.07
Queue Length 95th (ft)	2	0	0
Control Delay (s)	10.0	0.1	0.0
Lane LOS	A	A	
Approach Delay (s)	10.0	0.1	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	20.8%	ICU Level of Service	A
Analysis Period (min)	15		

With the Development

Northern Lights Addendum 2 - 2029 With the Development - Intersection 2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	14	15	19	154	100	2
Future Volume (Veh/h)	14	15	19	154	100	2
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	16	17	22	175	114	2
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	334	115	116			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	334	115	116			
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	98	98			
cM capacity (veh/h)	645	929	1454			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	33	197	116
Volume Left	16	22	0
Volume Right	17	0	2
cSH	766	1454	1700
Volume to Capacity	0.04	0.02	0.07
Queue Length 95th (ft)	3	1	0
Control Delay (s)	9.9	1.0	0.0
Lane LOS	A	A	
Approach Delay (s)	9.9	1.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	26.9%	ICU Level of Service	A
Analysis Period (min)	15		

Without the Development

Northern Lights Addendum 2 - 2029 Without the Development - Intersection 3

Intersection	
Intersection Delay, s/veh	8.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	26	6	48	30	14	24	122	30	26	54	20
Future Vol, veh/h	20	26	6	48	30	14	24	122	30	26	54	20
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	23	30	7	55	34	16	27	139	34	30	61	23
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.3	8.6	8.9	8.3
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	14%	38%	52%	26%
Vol Thru, %	69%	50%	33%	54%
Vol Right, %	17%	12%	15%	20%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	176	52	92	100
LT Vol	24	20	48	26
Through Vol	122	26	30	54
RT Vol	30	6	14	20
Lane Flow Rate	200	59	105	114
Geometry Grp	1	1	1	1
Degree of Util (X)	0.247	0.08	0.139	0.143
Departure Headway (Hd)	4.442	4.844	4.791	4.542
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	810	739	749	790
Service Time	2.466	2.878	2.822	2.571
HCM Lane V/C Ratio	0.247	0.08	0.14	0.144
HCM Control Delay	8.9	8.3	8.6	8.3
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1	0.3	0.5	0.5

With the Development

Northern Lights Addendum 2 - 2029 With the Development - Intersection 3

Intersection	
Intersection Delay, s/veh	8.8
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	23	26	6	48	30	14	24	136	30	26	61	22
Future Vol, veh/h	23	26	6	48	30	14	24	136	30	26	61	22
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	5	5	5	5	5	5	5	5	5	5	5	5
Mvmt Flow	26	30	7	55	34	16	27	155	34	30	69	25
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.4	8.7	9.1	8.5
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	13%	42%	52%	24%
Vol Thru, %	72%	47%	33%	56%
Vol Right, %	16%	11%	15%	20%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	190	55	92	109
LT Vol	24	23	48	26
Through Vol	136	26	30	61
RT Vol	30	6	14	22
Lane Flow Rate	216	63	105	124
Geometry Grp	1	1	1	1
Degree of Util (X)	0.268	0.085	0.141	0.157
Departure Headway (Hd)	4.47	4.917	4.857	4.567
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	803	727	737	784
Service Time	2.498	2.957	2.893	2.599
HCM Lane V/C Ratio	0.269	0.087	0.142	0.158
HCM Control Delay	9.1	8.4	8.7	8.5
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1.1	0.3	0.5	0.6

Without the Development

Northern Lights Addendum 2 - 2029 Without the Development - Intersection 4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	54	602	696	2	2	74
Future Volume (Veh/h)	54	602	696	2	2	74
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	61	684	791	2	2	84
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	793				1598	792
vC1, stage 1 conf vol					792	
vC2, stage 2 conf vol					806	
vCu, unblocked vol	793				1598	792
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	93				99	78
cM capacity (veh/h)	815				308	384

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	61	684	793	86
Volume Left	61	0	0	2
Volume Right	0	0	2	84
cSH	815	1700	1700	382
Volume to Capacity	0.07	0.40	0.47	0.23
Queue Length 95th (ft)	6	0	0	21
Control Delay (s)	9.8	0.0	0.0	17.1
Lane LOS	A			C
Approach Delay (s)	0.8		0.0	17.1
Approach LOS				C

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		

With the Development

Northern Lights Addendum 2 - 2029 With the Development - Intersection 4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	57	602	696	2	2	76
Future Volume (Veh/h)	57	602	696	2	2	76
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	65	684	791	2	2	86
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	793				1606	792
vC1, stage 1 conf vol					792	
vC2, stage 2 conf vol					814	
vCu, unblocked vol	793				1606	792
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	92				99	78
cM capacity (veh/h)	815				305	384

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	65	684	793	88
Volume Left	65	0	0	2
Volume Right	0	0	2	86
cSH	815	1700	1700	382
Volume to Capacity	0.08	0.40	0.47	0.23
Queue Length 95th (ft)	6	0	0	22
Control Delay (s)	9.8	0.0	0.0	17.2
Lane LOS	A			C
Approach Delay (s)	0.9		0.0	17.2
Approach LOS				C

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	60.0%	ICU Level of Service	B
Analysis Period (min)	15		

Without the Development

Northern Lights Addendum 2 - 2029 Without the Development - Intersection 5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	108	2	696	175	2	602
Future Volume (Veh/h)	108	2	696	175	2	602
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	123	2	791	199	2	684
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			TWLTL
Median storage veh)						2
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1479	791			990	
vC1, stage 1 conf vol	791					
vC2, stage 2 conf vol	688					
vCu, unblocked vol	1479	791			990	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	64	99			100	
cM capacity (veh/h)	346	385			686	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	125	857	133	2	684
Volume Left	123	0	0	2	0
Volume Right	2	66	133	0	0
cSH	347	1700	1700	686	1700
Volume to Capacity	0.36	0.50	0.08	0.00	0.40
Queue Length 95th (ft)	40	0	0	0	0
Control Delay (s)	21.1	0.0	0.0	10.3	0.0
Lane LOS	C			B	
Approach Delay (s)	21.1	0.0		0.0	
Approach LOS	C				

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	58.4%	ICU Level of Service	B
Analysis Period (min)	15		

With the Development

Northern Lights Addendum 2 - 2029 With the Development - Intersection 5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	115	2	696	189	2	602
Future Volume (Veh/h)	115	2	696	189	2	602
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	131	2	791	215	2	684
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			TWLTL
Median storage veh)						2
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1479	791			1006	
vC1, stage 1 conf vol	791					
vC2, stage 2 conf vol	688					
vCu, unblocked vol	1479	791			1006	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3			2.2	
p0 queue free %	62	99			100	
cM capacity (veh/h)	346	385			677	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	133	863	143	2	684
Volume Left	131	0	0	2	0
Volume Right	2	72	143	0	0
cSH	347	1700	1700	677	1700
Volume to Capacity	0.38	0.51	0.08	0.00	0.40
Queue Length 95th (ft)	44	0	0	0	0
Control Delay (s)	21.7	0.0	0.0	10.3	0.0
Lane LOS	C			B	
Approach Delay (s)	21.7	0.0		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay	1.6			
Intersection Capacity Utilization	59.1%	ICU Level of Service		B
Analysis Period (min)	15			

XIV. Appendix F: Left Turn Lane Warrant Analyses

Civilize, PLLC
Management and Engineering

Project Analysis Worksheet
Tranportation Engineering
Left Hand Turn Analysis/Warrant at Unsignalized Intersections
Based on ITD Traffic Manual / NCHRP Report 745

Client:
Project: **Northern Lights Addendum 2**
Project No.:

DESIGNED BLH
CHECKED BLH
DATE:

Description: Eastbound Traffic at Intersection 1 **Horizon Years:** 2024, 2029, 2049

ITD Traffic Manual, Section 3B.04 White Lane Line Pavement Markings and Warrants
Warrants for left-turn lanes on uncontrolled highways can be found in "NCHRP Report 745 – Left-Turn Accommodations at Unsignalized Intersections."

NCHRP Report 745 - Left-Turn Accommodations at Unsignalized Intersections
Before installing a left-turn lane (or any other roadway improvement), it is necessary to consider the characteristics of the location where it would be installed. These characteristics guide the practitioner's decisions about whether to install the lane and what specific design criteria need to be emphasized to optimize the operation of the lane at that location.

The basic geometry of the intersection needed for use with the warrants is the number of lanes on the major roadway and the number of approaches to the intersection. The number of approaches and the development type (rural or urban/ suburban) are included in the warrants because the crash prediction methodology used to develop the warrants varied by these features. Rural crash prediction equations vary by number of lanes on the major roadway, so the warrants for rural highways also vary by number of lanes.

Technical warrants are an important element of the decision-making process; however, other factors should also be considered when deciding whether to install a left-turn lane, including:
• Sight distance relative to the position of the driver and
• Design consistency within the corridor.
These factors should be considered in conjunction with the numerical warrants.

DESIGN CRITERIA (Input the following based on observation, historical data, and/or results of a site specific study)

1	Jurisdiction	ITD	Horizon or Planning Year	2024	2029	2049	
2	Subdivision or Development Name	Northern Lights	Development Type	Rural	Rural	Rural	
3	Name of Major Roadway	US Hwy. 33	No. of lanes on the major	Two	Two	Two	
4	Name of Minor Roadway/Approach	5750W	Number of Legs	Four	Four	Four	
5	Peak Hour	PM	Peak-hr, left-turn lane vol	27	31	54	(vehicles per hour)
6	Posted Speed Limit (MPH)	55	Major Roadway Peak-hr vc	300	345	602	(veh/hour/lane).

Analysis - Table and graph reproduced from NCHRP Report 745 (Axes on the graph are reversed from source)

Intersection Eastbound Traffic at Intersection 1 **Horizon Years** 2024, 2029, 2049

1 Consult chart below and evaluate the type of intersection and the left-turn, peak-hour volume

Left Turn Peak Hour Volume (Veh/hr)	Three Leg Intersection, Major Two-Lane Highway Peak-Hour Volume that Warrants a Left-Turn Lane (Veh/hr/lane)	Four Leg Intersection, Major Two-Lane Highway Peak-Hour Volume that Warrants a Left-Turn Lane (Veh/hr/lane)	Three Leg Intersection, Major Four-Lane Highway Peak-Hour Volume that Warrants a Left-Turn Lane (Veh/hr/lane)	Four Leg Intersection, Major Four-Lane Highway Peak-Hour Volume that Warrants a Left-Turn Lane (Veh/hr/lane)	Three Leg Intersection, Major Four-Lane Highway Peak-Hour Volume that Warrants a Left-Turn Lane (Veh/hr/lane)	Four Leg Intersection, Major Four-Lane Highway Peak-Hour Volume that Warrants a Left-Turn Lane (Veh/hr/lane)
5	200	150	75	50	450	50
10	100	50	75	25	300	50
15	100	50	50	25	250	50
20	50	<50	50	25	200	50
25	50	<50	50	<25	200	50
30	50	<50	50	<25	150	50
35	50	<50	50	<25	150	50
40	50	<50	50	<25	150	50
45	50	<50	50	<25	150	<50
50	50	<50	50	<25	100	<50

2 Check the plotted point(s) on the chart below against the anticpated intersection of major-road volume and peak-hour left-turn volume in the volume advancing.

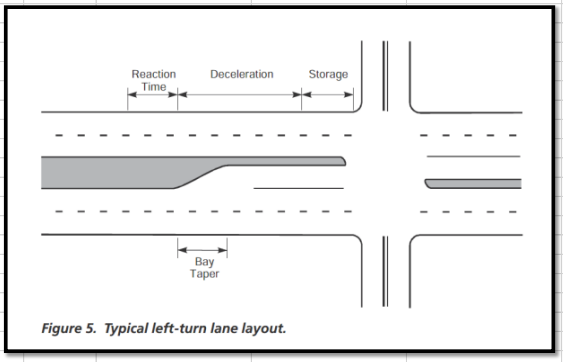
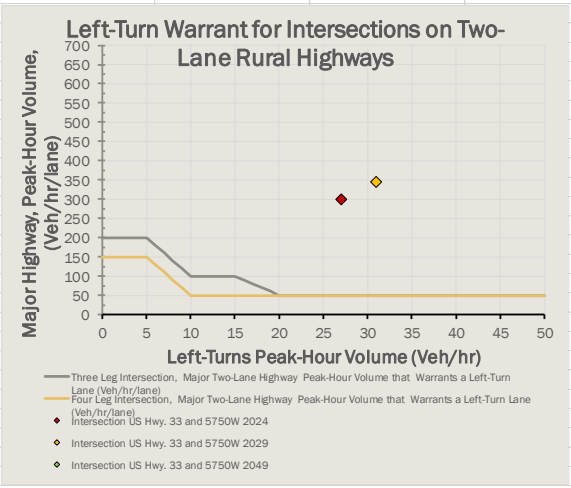


Figure 5. Typical left-turn lane layout.



Civilize, PLLC
Management and Engineering

Project Analysis Worksheet
Tranportation Engineering
Left Hand Turn Analysis/Warrant at Unsignalized Intersections
Based on ITD Traffic Manual / NCHRP Report 745

Client:
Project: **Northern Lights Addendum 2**
Project No.:

DESIGNED BLH
CHECKED BLH
DATE:

Description: Westbound Traffic at Intersection 1 **Horizon Years:** 2024, 2029, 2049

ITD Traffic Manual, Section 3B.04 White Lane Line Pavement Markings and Warrants
Warrants for left-turn lanes on uncontrolled highways can be found in "NCHRP Report 745 – Left-Turn Accommodations at Unsignalized Intersections."

NCHRP Report 745- Left-Turn Accommodations at Unsignalized Intersections
Before installing a left-turn lane (or any other roadway improvement), it is necessary to consider the characteristics of the location where it would be installed. These characteristics guide the practitioner's decisions about whether to install the lane and what specific design criteria need to be emphasized to optimize the operation of the lane at that location.

The basic geometry of the intersection needed for use with the warrants is the number of lanes on the major roadway and the number of approaches to the intersection. The number of approaches and the development type (rural or urban/ suburban) are included in the warrants because the crash prediction methodology used to develop the warrants varied by these features. Rural crash prediction equations vary by number of lanes on the major roadway, so the warrants for rural highways also vary by number of lanes.

Technical warrants are an important element of the decision-making process; however, other factors should also be considered when deciding whether to install a left-turn lane, including:
• Sight distance relative to the position of the driver and
• Design consistency within the corridor.
These factors should be considered in conjunction with the numerical warrants.

DESIGN CRITERIA (Input the following based on observation, historical data, and/or results of a site specific study)

1	Jurisdiction	ITD	Horizon or Planning Year	2024	2029	2049	
2	Subdivision or Development Name	Northern Lights	Development Type	Rural	Rural	Rural	
3	Name of Major Roadway	US Hwy. 33	No. of lanes on the major	Two	Two	Two	
4	Name of Minor Roadway/Approach	500W	Number of Legs	Four	Four	Four	
5	Peak Hour	PM	Peak-hr, left-turn lane vol	1	1	2	(vehicles per hour)
6	Posted Speed Limit (MPH)	55	Major Roadway Peak-hr vc	300	345	602	(veh/hour/lane).

Analysis - Table and graph reproduced from NCHRP Report 745 (Axes on the graph are reversed from source)

Intersection Westbound Traffic at Intersection 1 **Horizon Years** 2024, 2029, 2049

1 Consult chart below and evaluate the type of intersection and the left-turn, peak-hour volume

Left Turn Peak Hour Volume (Veh/hr)	Three Leg Intersection, Major Two-Lane Highway Peak-Hour Volume that Warrants a Left-Turn Lane (Veh/hr/lane)	Four Leg Intersection, Major Two-Lane Highway Peak-Hour Volume that Warrants a Left-Turn Lane (Veh/hr/lane)	Three Leg Intersection, Major Four-Lane Highway Peak-Hour Volume that Warrants a Left-Turn Lane (Veh/hr/lane)	Four Leg Intersection, Major Four-Lane Highway Peak-Hour Volume that Warrants a Left-Turn Lane (Veh/hr/lane)	Three Leg Intersection, Major Four-Lane Highway Peak-Hour Volume that Warrants a Left-Turn Lane (Veh/hr/lane)	Four Leg Intersection, Major Four-Lane Highway Peak-Hour Volume that Warrants a Left-Turn Lane (Veh/hr/lane)
5	200	150	75	50	450	50
10	100	50	75	25	300	50
15	100	50	50	25	250	50
20	50	<50	50	25	200	50
25	50	<50	50	<25	200	50
30	50	<50	50	<25	150	50
35	50	<50	50	<25	150	50
40	50	<50	50	<25	150	50
45	50	<50	50	<25	150	<50
50	50	<50	50	<25	100	<50

2 Check the plotted point(s) on the chart below against the anticpated intersection of major-road volume and peak-hour left-turn volume in the volume advancing.

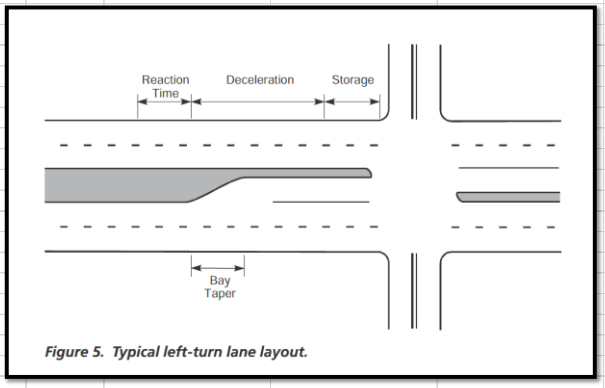
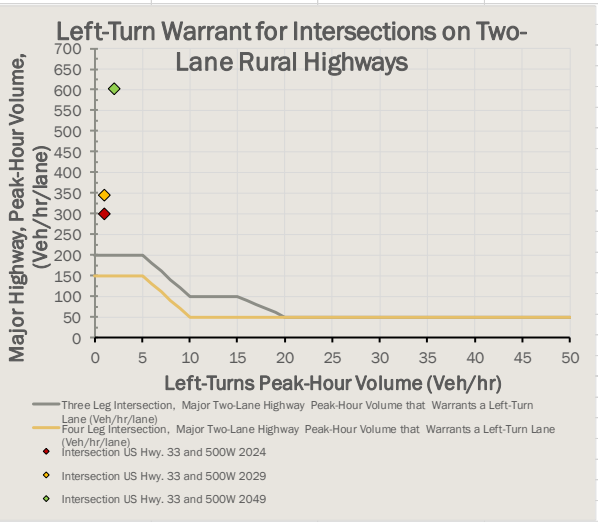


Figure 5. Typical left-turn lane layout.



XV. Appendix G: Right Turn Lane Warrant Analyses

Civilize, PLLC
Management and Engineering

Project Analysis Worksheet
Tranportation Engineering
Right-Hand Turn Analysis/Warrant for Uncontrolled Roads Intersecting with Public Highways/Approaches
Based on ITD Traffic Manual

Client:
Project: **Northern Lights Addendum 2**
Project No.:

DESIGNED BLH
CHECKED BLH
DATE:

Description: Westbound on Highway 33 at Intersection 1 **Horizon Years:** 2024, 2029, 2049

ITD Traffic Manual, Section 3B.04 White Lane Line Pavement Markings and Warrants
A right-turn lane warrant is shown in Figure 3B-1 that can be used for uncontrolled highways intersecting with public roads or approaches. Right-turn lanes can be further analyzed using the economic analysis procedure for right-turn deceleration lanes described in the article "Operational and Safety Effects of Right-Turn Deceleration Lanes on Urban and Suburban Arterials" that was published in the "Transportation Research Record, Volume 2023." The methodology can be used for rural highways in addition to urban and suburban arterials

DESIGN CRITERIA (Input the following based on observation, historical data, and/or results of a site specific study)

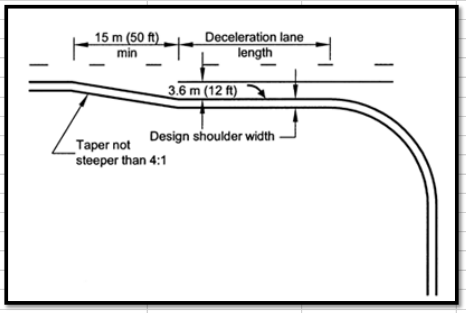
1	Jurisdiction	ITD	Horizon or Planning Year	2024	2029	2049	
2	Subdivision or Development Name	Northern Lights	Development Type	Rural	Rural	Rural	
3	Name of Major Roadway	US Hwy. 33	No. of lanes on the major	Two	Two	Two	
4	Name of Minor Roadway/Approach	5750W	Number of legs	Four	Four	Four	
5	Peak Hour	PM	Major roadway volume	347	399	696	(veh/hour/lane).
6	Posted Speed Limit (MPH)	55	Right-Turn, Peak Hour Vol	1	1	2	(veh/hour).

Analysis - Table and graph reproduced from NCHRP Report 745 (Axes on the graph are reversed from source)

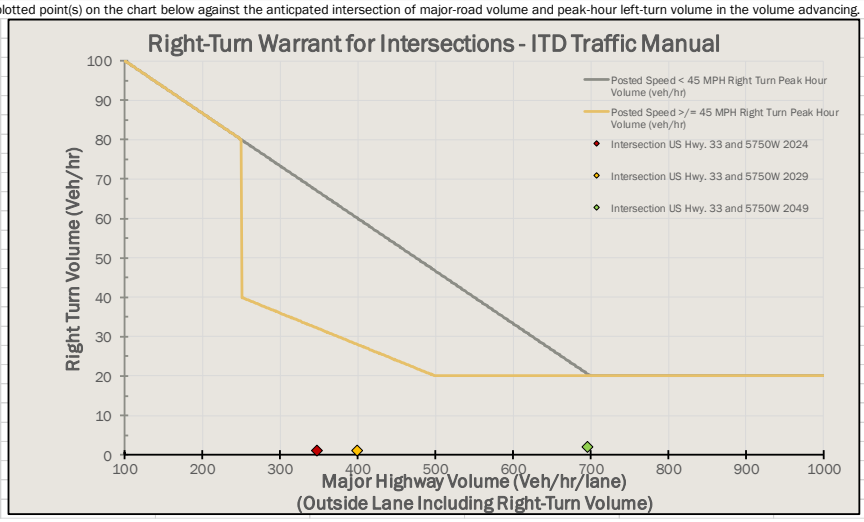
Intersection Westbound on Highway 33 at Intersection 1 **Horizon Years** 2024, 2029, 2049

1 Consult chart below and evaluate the type of intersection and the left-turn, peak-hour volume

Posted Speed < 45 MPH Highway Volume Outside Lane Only Including R-T Volume (Veh/hr/lane)	Posted Speed < 45 MPH Right Turn Peak Hour Volume (veh/hr)	Posted Speed >/= 45 MPH Right Turn Peak Hour Volume (veh/hr)
0	100	100
100	100	100
200	87	87
300	73	35
400	60	25
500	47	20
600	33	<20
700	20	<20
800	<20	<20
900	<20	<20
1000	<20	<20



2 Check the plotted point(s) on the chart below against the anticpated intersection of major-road volume and peak-hour left-turn volume in the volume advancing.



Civilize, PLLC
Management and Engineering

Project Analysis Worksheet
Tranportation Engineering
Right-Hand Turn Analysis/Warrant for Uncontrolled Roads Intersecting with Public Highways/Approaches
Based on ITD Traffic Manual

Client:
Project: **Northern Lights Addendum 2**
Project No.:

DESIGNED BLH
CHECKED BLH
DATE:

Description: Northbound on Highway 33 at Intersection 1 **Horizon Years:** 2024, 2029, 2049

ITD Traffic Manual, Section 3B.04 White Lane Line Pavement Markings and Warrants
A right-turn lane warrant is shown in Figure 3B-1 that can be used for uncontrolled highways intersecting with public roads or approaches. Right-turn lanes can be further analyzed using the economic analysis procedure for right-turn deceleration lanes described in the article "Operational and Safety Effects of Right-Turn Deceleration Lanes on Urban and Suburban Arterials" that was published in the "Transportation Research Record, Volume 2023." The methodology can be used for rural highways in addition to urban and suburban arterials

DESIGN CRITERIA (Input the following based on observation, historical data, and/or results of a site specific study)

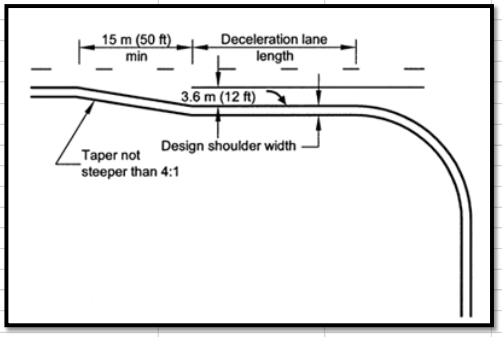
				2024	2029	2049	
1	Jurisdiction	ITD	Horizon or Planning Year	2024	2029	2049	
2	Subdivision or Development Name	Northern Lights	Development Type	Rural	Rural	Rural	
3	Name of Major Roadway	US Hwy. 33	No. of lanes on the major	Two	Two	Two	
4	Name of Minor Roadway/Approach	500W	Number of legs	Four	Four	Four	
5	Peak Hour	PM	Major roadway volume	347	399	696	(veh/hour/lane).
6	Posted Speed Limit (MPH)	55	Right-Turn, Peak Hour Vol	87	100	175	(veh/hour).

Analysis - Table and graph reproduced from NCHRP Report 745 (Axes on the graph are reversed from source)

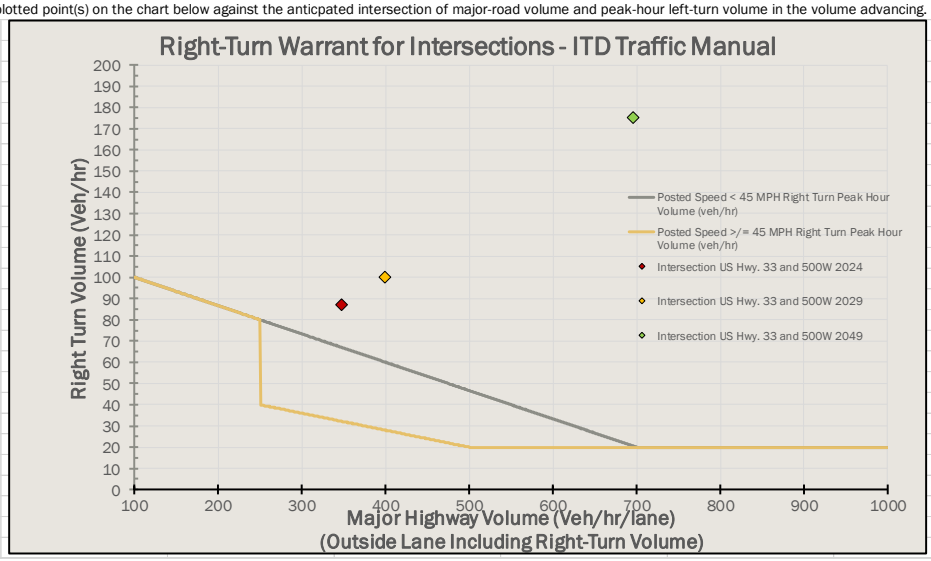
Intersection Northbound on Highway 33 at Intersection 1 **Horizon Years** 2024, 2029, 2049

1 Consult chart below and evaluate the type of intersection and the left-turn, peak-hour volume

Posted Speed < 45 MPH Highway Volume Outside Lane Only Including R-T Volume (Veh/hr/lane)	Posted Speed < 45 MPH Right Turn Peak Hour Volume (veh/hr)	Posted Speed >/= 45 MPH Right Turn Peak Hour Volume (veh/hr)
0	100	100
100	100	100
200	87	87
300	73	35
400	60	25
500	47	20
600	33	<20
700	20	<20
800	<20	<20
900	<20	<20
1000	<20	<20



2 Check the plotted point(s) on the chart below against the anticpated intersection of major-road volume and peak-hour left-turn volume in the volume advancing.



XVI. Appendix H: Segment LOS Calculations

2024 – Seg 1 – Hwy 33

Civilize, PLLC
Management and Engineering

Project Analysis Worksheet
Tranportation Engineering
Segment LOS for Class I Two-Lane Rural Highway

Client:		DESIGNED	BLH
Project:	Northern Lights Addendum 2	CHECKED	BLH
Project No.:		DATE:	

Input Data (Step #1)

Input Cell

Road Name	Hwy 33	
Lane Width	12	ft
Shoulder Width	6	ft
Total Accesses	7	Accesses
Segment Length	1	miles
Speed Limit	55	mph
PHF	0.88	HCM Ex. 15-5
Truck %	6%	
RV %	5%	
Grade %	0%	
No Passing %	0%	

Free Flow Speed (FFS) Calcs (Step #2)

Calc Cell / Input Cell

FFS=BFFS-f_{LS}-f_A	63.25	mph	HCM Eq. 15-2
Base Free Flow Speed (BFFS)	65	mph	From HCM: BFFS = Speed Limit + 10
Lane/Shoulder Width Adj. F_{LS}	0		From HCM Ex. 15-7
Accesses/mile	7.00	Accesses	
Round down nearest 10	0.00		Auto roundown to nearest 10
Rounded down FFS reduction	0	mph	From HCM Ex. 15-8
Round down value	7.00		Difference for interpolation
Interpolated FFS reduction	1.75	mph	Every 10 access/mile = 2.5 reduction
Access Density Reduction f_a	1.75	mph	From HCM Ex. 15-8

Demand Flow Rate (Step #3)

Calc Cell / Input Cell

Direction 1 Volume	300	vph	
Direction 2 Volume	347	vph	
Equvalent Trucks E_t	1.2		From HCM Ex. 15-18
Equvalent RV E_R	1		From HCM Ex. 15-18
Heavy Veh Adj. f_{hv}	0.99		From HCM Eq. 15-8
Grade Adj. f_g	1		From HCM Ex. 15-16
Demand Flow Eq.	$v_{i,ats} = \frac{V_i}{PHF * f_{g,ats} * f_{hv,ats}}$		From HCM Eq. 15-3
Direction 1 Demand Flow (v	345	vph	
Direction 2 Demand Flow (v	399	vph	

Average Travel Speed (ATS) (Step #4)

Calc Cell / Input Cell

ATS = FFS – 0.00776(v_1,ats + v_2,ats) – f_{np},ats — From HCM Eq. 15-6

No Pass Adj Factor f_{np}	3	From HCM Ex. 15-15
ATS	54.48	mph

v/c ratio (Step #5)

Calc Cell / Input Cell

Capacity	1700	vph
Direction 1	300	vph
v/c ratio	0.18	
LOS	B	
Direction 2	347	vph
v/c ratio	0.20	
LOS	B	

Percent Time Spent Following (PTSF) (Step 6)

Exhibit 15-3
Motorized Vehicle LOS for Two-Lane Highways

LOS	Class I Highways ATS (mi/h)	Class I Highways PTSF (%)	Class II Highways PTSF (%)	Class III Highways PFFS (%)
A	>55	≤35	≤40	>91.7
B	>50–55	>35–50	>40–55	>83.3–91.7
C	>45–50	>50–65	>55–70	>75.0–83.3
D	>40–45	>65–80	>70–85	>66.7–75.0
E	≤40	>80	>85	≤66.7
F	Demand exceeds capacity			

Note: For Class I highways, LOS is determined by the worse of ATS-based LOS and PTSF-based LOS.

Percent Time Spent Following (PTSF) $PTSF_d = BPTSF_d + f_{np,PTSF}\left(\frac{v_{d,PTSF}}{v_{d,PTSF} + v_{o,PTSF}}\right)$ From HCM Eq. 15-9

Base Percent Time Spent Following ($BPTSF_d$) $BPTSF_d = 100[1 - \exp(av_d^b)]$ From HCM Eq. 15-10

Coefficient a	-0.0018	From HCM Ex. 15-20
Coefficient b	0.923	From HCM Ex. 15-20
$BPTSF_d$	29.39	
No pass zone adj.	51.2	From HCM Ex. 15-21
PTSF	53.13	

Level of Service (LOS) (Step 7)

ATS LOS	B	From HCM Ex. 15-3
PTSF LOS	B	From HCM Ex. 15-4
v/c Ratio LOS	B	

2024 – Seg 2 – 500W

Civilize, PLLC
Management and Engineering

Project Analysis Worksheet
Tranportation Engineering
Segment LOS for Class III Two-Lane Rural Highway

Client:		DESIGNED	BLH
Project:	Northern Lights Addendum 2	CHECKED	BLH
Project No.:		DATE:	

Input Data (Step #1)

Input Cell

Road Name	500W	
Lane Width	12	ft
Shoulder Width	3	ft
Total Accesses	2	Accesses
Segment Length	0.25	miles
Speed Limit	35	mph
PHF	0.88	HCM Ex. 15-5
Truck %	5%	
RV %	5%	
Grade %	0%	
No Passing %	0%	

Free Flow Speed (FFS) Calcs (Step #2)

Calc Cell / Input Cell

FFS=BFFS-f_{LS}-f_A	40.00	mph	HCM Eq. 15-2
Base Free Flow Speed (BFFS)	45	mph	From HCM: BFFS = Speed Limit + 10
Lane/Shoulder Width Adj. F_{LS}	3		From HCM Ex. 15-7
Accesses/mile	8.00	Accesses	
Round down nearest 10	0.00		Auto roundown to nearest 10
Rounded down FFS reduction	0	mph	From HCM Ex. 15-8
Round down value	8.00		Difference for interpolation
Interpolated FFS reduction	2.00	mph	Every 10 access/mile = 2.5 reduction
Access Density Reduction f_a	2.00	mph	From HCM Ex. 15-8

Demand Flow Rate (Step #3)

Calc Cell / Input Cell

Direction 1 Volume	74	vph	
Direction 2 Volume	31	vph	
Equvalent Trucks E_t	1.9		From HCM Ex. 15-11
Equvalent RV E_R	1		From HCM Ex. 15-11
Heavy Veh Adj. f_{hv}	0.96		From HCM Eq. 15-5
Grade Adj. f_g	1		From HCM Ex. 15-9
Demand Flow Eq.	$v_{i,ats} = \frac{V_i}{PHF * f_{g,ats} * f_{hv,ats}}$		From HCM Eq. 15-3
Direction 1 Demand Flow (v	88	vph	
Direction 2 Demand Flow (v	37	vph	

Average Travel Speed (ATS) (Step #4)

Calc Cell / Input Cell

ATS = FFS – 0.00776(v_1,ats + v_2,ats) – f_{np},ats — From HCM Eq. 15-6

No Pass Adj Factor f_{np}	0.2		From HCM Ex. 15-15
ATS	38.83	mph	

v/c ratio (Step #5)

Calc Cell / Input Cell

Capacity	1700	vph
Direction 1	74	vph
v/c ratio	0.04	
LOS	A	
Direction 2	31	vph
v/c ratio	0.0182	
LOS	A	

Percent of Free Flow Speed (PFFS)

Exhibit 15-3
Motorized Vehicle LOS for Two-Lane Highways

LOS	Class I Highways ATS (mi/h)	Class I Highways PTSF (%)	Class II Highways PTSF (%)	Class III Highways PFFS (%)
A	>55	≤35	≤40	>91.7
B	>50–55	>35–50	>40–55	>83.3–91.7
C	>45–50	>50–65	>55–70	>75.0–83.3
D	>40–45	>65–80	>70–85	>66.7–75.0
E	≤40	>80	>85	≤66.7
F	Demand exceeds capacity			

Note: For Class I highways, LOS is determined by the worse of ATS-based LOS and PTSF-based LOS.

Percent of Free Flow Speed (PFFS)

PFFS = ATS/FFS	97.1%	
ATS	38.83	mph
FFS	40.00	mph

Level of Service (LOS)

PFFS LOS	A
v/c ratio LOS	A

2029 – Seg 1 – Hwy 33

Civilize, PLLC
Management and Engineering

Project Analysis Worksheet
Tranportation Engineering
Segment LOS for Class I Two-Lane Rural Highway

Client:		DESIGNED	BLH
Project:	Northern Lights Addendum 2	CHECKED	BLH
Project No.:		DATE:	

Input Data (Step #1)

Input Cell

Road Name	Hwy 33	
Lane Width	12	ft
Shoulder Width	6	ft
Total Accesses	7	Accesses
Segment Length	1	miles
Speed Limit	55	mph
PHF	0.88	HCM Ex. 15-5
Truck %	6%	
RV %	5%	
Grade %	0%	
No Passing %	0%	

Free Flow Speed (FFS) Calcs (Step #2)

Calc Cell / Input Cell

FFS=BFFS-f_{LS}-f_A	63.25	mph	HCM Eq. 15-2
Base Free Flow Speed (BFFS)	65	mph	From HCM: BFFS = Speed Limit + 10
Lane/Shoulder Width Adj. F_{LS}	0		From HCM Ex. 15-7
Accesses/mile	7.00	Accesses	
Round down nearest 10	0.00		Auto roundown to nearest 10
Rounded down FFS reduction	0	mph	From HCM Ex. 15-8
Round down value	7.00		Difference for interpolation
Interpolated FFS reduction	1.75	mph	Every 10 access/mile = 2.5 reduction
Access Density Reduction f_a	1.75	mph	From HCM Ex. 15-8

Demand Flow Rate (Step #3)

Calc Cell / Input Cell

Direction 1 Volume	354	vph	
Direction 2 Volume	406	vph	
Equvalent Trucks E_t	1.2		From HCM Ex. 15-18
Equvalent RV E_R	1		From HCM Ex. 15-18
Heavy Veh Adj. f_{hv}	0.99		From HCM Eq. 15-8
Grade Adj. f_g	1		From HCM Ex. 15-16
Demand Flow Eq.	$v_{i,ats} = \frac{V_i}{PHF * f_{g,ats} * f_{hv,ats}}$		From HCM Eq. 15-3
Direction 1 Demand Flow (v	407	vph	
Direction 2 Demand Flow (v	467	vph	

Average Travel Speed (ATS) (Step #4)

Calc Cell / Input Cell

ATS = FFS – 0.00776(v_1,ats + v_2,ats) – f_{np},ats — From HCM Eq. 15-6

No Pass Adj Factor f_{np}	3		From HCM Ex. 15-15
ATS	53.47	mph	

v/c ratio (Step #5)

Calc Cell / Input Cell

Capacity	1700	vph
Direction 1	354	vph
v/c ratio	0.21	
LOS	C	
Direction 2	406	vph
v/c ratio	0.24	
LOS	C	

Percent Time Spent Following (PTSF) (Step 6)

Exhibit 15-3
Motorized Vehicle LOS for Two-Lane Highways

LOS	Class I Highways ATS (mi/h)	Class I Highways PTSF (%)	Class II Highways PTSF (%)	Class III Highways PFFS (%)
A	>55	≤35	≤40	>91.7
B	>50–55	>35–50	>40–55	>83.3–91.7
C	>45–50	>50–65	>55–70	>75.0–83.3
D	>40–45	>65–80	>70–85	>66.7–75.0
E	≤40	>80	>85	≤66.7
F	Demand exceeds capacity			

Note: For Class I highways, LOS is determined by the worse of ATS-based LOS and PTSF-based LOS.

Percent Time Spent Following (PTSF) $PTSF_d = BPTSF_d + f_{np,PTSF}\left(\frac{v_{d,PTSF}}{v_{d,PTSF} + v_{o,PTSF}}\right)$ From HCM Eq. 15-9

Base Percent Time Spent Following ($BPTSF_d$) $BPTSF_d = 100[1 - \exp(av_d^b)]$ From HCM Eq. 15-10

Coefficient a	-0.0018	From HCM Ex. 15-20
Coefficient b	0.923	From HCM Ex. 15-20
$BPTSF_d$	33.34	
No pass zone adj.	51.2	From HCM Ex. 15-21
PTSF	57.18	

Level of Service (LOS) (Step 7)

ATS LOS	B	From HCM Ex. 15-3
PTSF LOS	C	From HCM Ex. 15-4
v/c Ratio LOS	C	

2029 – Seg 2 – 500W

Civilize, PLLC
Management and Engineering

Project Analysis Worksheet
Tranportation Engineering
Segment LOS for Class III Two-Lane Rural Highway

Client:		DESIGNED	BLH
Project:	Northern Lights Addendum 2	CHECKED	BLH
Project No.:		DATE:	

Input Data (Step #1)

Input Cell

Road Name	500W	
Lane Width	12	ft
Shoulder Width	3	ft
Total Accesses	2	Accesses
Segment Length	0.25	miles
Speed Limit	35	mph
PHF	0.88	HCM Ex. 15-5
Truck %	5%	
RV %	5%	
Grade %	0%	
No Passing %	0%	

Free Flow Speed (FFS) Calcs (Step #2)

Calc Cell / Input Cell

FFS=BFFS-f_{LS}-f_A	40.00	mph	HCM Eq. 15-2
Base Free Flow Speed (BFFS)	45	mph	From HCM: BFFS = Speed Limit + 10
Lane/Shoulder Width Adj. F_{LS}	3		From HCM Ex. 15-7
Accesses/mile	8.00	Accesses	
Round down nearest 10	0.00		Auto roundown to nearest 10
Rounded down FFS reduction	0	mph	From HCM Ex. 15-8
Round down value	8.00		Difference for interpolation
Interpolated FFS reduction	2.00	mph	Every 10 access/mile = 2.5 reduction
Access Density Reduction f_a	2.00	mph	From HCM Ex. 15-8

Demand Flow Rate (Step #3)

Calc Cell / Input Cell

Direction 1 Volume	114	vph	
Direction 2 Volume	70	vph	
Equvalent Trucks E_t	1.9		From HCM Ex. 15-11
Equvalent RV E_R	1		From HCM Ex. 15-11
Heavy Veh Adj. f_{hv}	0.96		From HCM Eq. 15-5
Grade Adj. f_g	1		From HCM Ex. 15-9
Demand Flow Eq.	$v_{i,ats} = \frac{V_i}{PHF * f_{g,ats} * f_{hv,ats}}$		From HCM Eq. 15-3
Direction 1 Demand Flow (v	135	vph	
Direction 2 Demand Flow (v	83	vph	

Average Travel Speed (ATS) (Step #4)

Calc Cell / Input Cell

ATS = FFS – 0.00776(v_1,ats + v_2,ats) – f_{np},ats — From HCM Eq. 15-6

No Pass Adj Factor f_{np}	0.2		From HCM Ex. 15-15
ATS	38.10	mph	

v/c ratio (Step #5)

Calc Cell / Input Cell

Capacity	1700	vph
Direction 1	114	vph
v/c ratio	0.07	
LOS	A	
Direction 2	70	vph
v/c ratio	0.0412	
LOS	A	

Percent of Free Flow Speed (PFFS)

Exhibit 15-3
Motorized Vehicle LOS for Two-Lane Highways

LOS	Class I Highways ATS (mi/h)	Class I Highways PTSF (%)	Class II Highways PTSF (%)	Class III Highways PFFS (%)
A	>55	≤35	≤40	>91.7
B	>50–55	>35–50	>40–55	>83.3–91.7
C	>45–50	>50–65	>55–70	>75.0–83.3
D	>40–45	>65–80	>70–85	>66.7–75.0
E	≤40	>80	>85	≤66.7
F	Demand exceeds capacity			

Note: For Class I highways, LOS is determined by the worse of ATS-based LOS and PTSF-based LOS.

Percent of Free Flow Speed (PFFS)

PFFS = ATS/FFS	95.3%	
ATS	38.10	mph
FFS	40.00	mph

Level of Service (LOS)

PFFS LOS	A
v/c ratio LOS	A

2049 – Seg 1 – Hwy 33

Civilize, PLLC
Management and Engineering

Project Analysis Worksheet
Tranportation Engineering
Segment LOS for Class I Two-Lane Rural Highway

Client:		DESIGNED	BLH
Project:	Northern lights Addendum 2	CHECKED	BLH
Project No.:		DATE:	

Input Data (Step #1)

Input Cell

Road Name	Hwy 33	
Lane Width	12	ft
Shoulder Width	6	ft
Total Accesses	7	Accesses
Segment Length	1	miles
Speed Limit	55	mph
PHF	0.88	HCM Ex. 15-5
Truck %	6%	
RV %	5%	
Grade %	0%	
No Passing %	0%	

Free Flow Speed (FFS) Calcs (Step #2)

Calc Cell / Input Cell

FFS=BFFS-f_{LS}-f_A	63.25	mph	HCM Eq. 15-2
Base Free Flow Speed (BFFS)	65	mph	From HCM: BFFS = Speed Limit + 10
Lane/Shoulder Width Adj. F_{LS}	0		From HCM Ex. 15-7
Accesses/mile	7.00	Accesses	
Round down nearest 10	0.00		Auto roundown to nearest 10
Rounded down FFS reduction	0	mph	From HCM Ex. 15-8
Round down value	7.00		Difference for interpolation
Interpolated FFS reduction	1.75	mph	Every 10 access/mile = 2.5 reduction
Access Density Reduction f_a	1.75	mph	From HCM Ex. 15-8

Demand Flow Rate (Step #3)

Calc Cell / Input Cell

Direction 1 Volume	602	vph	
Direction 2 Volume	696	vph	
Equvalent Trucks E_t	1.2		From HCM Ex. 15-18
Equvalent RV E_R	1		From HCM Ex. 15-18
Heavy Veh Adj. f_{hv}	0.99		From HCM Eq. 15-8
Grade Adj. f_g	1		From HCM Ex. 15-16
Demand Flow Eq.	$v_{i,ats} = \frac{V_i}{PHF * f_{g,ats} * f_{hv,ats}}$		From HCM Eq. 15-3
Direction 1 Demand Flow (v	692	vph	
Direction 2 Demand Flow (v	800	vph	

Average Travel Speed (ATS) (Step #4)

Calc Cell / Input Cell

ATS = FFS – 0.00776(v_1,ats + v_2,ats) – f_{np},ats — From HCM Eq. 15-6

No Pass Adj Factor f_{np}	1.7		From HCM Ex. 15-15
ATS	49.97	mph	

v/c ratio (Step #5)

Calc Cell / Input Cell

Capacity	1700	vph
Direction 1	602	vph
v/c ratio	0.35	
LOS	C	
Direction 2	696	vph
v/c ratio	0.41	
LOS	C	

Percent Time Spent Following (PTSF) (Step 6)

Exhibit 15-3
Motorized Vehicle LOS for Two-Lane Highways

LOS	Class I Highways ATS (mi/h)	Class I Highways PTSF (%)	Class II Highways PTSF (%)	Class III Highways PFFS (%)
A	>55	≤35	≤40	>91.7
B	>50–55	>35–50	>40–55	>83.3–91.7
C	>45–50	>50–65	>55–70	>75.0–83.3
D	>40–45	>65–80	>70–85	>66.7–75.0
E	≤40	>80	>85	≤66.7
F	Demand exceeds capacity			

Note: For Class I highways, LOS is determined by the worse of ATS-based LOS and PTSF-based LOS.

Percent Time Spent Following (PTSF) $PTSF_d = BPTSF_d + f_{np,PTSF}\left(\frac{v_{d,PTSF}}{v_{d,PTSF} + v_{o,PTSF}}\right)$ From HCM Eq. 15-9

Base Percent Time Spent Following (BPTSF$_d$) $BPTSF_d = 100[1 - \exp(av_d^b)]$ From HCM Eq. 15-10

Coefficient a	-0.0038	From HCM Ex. 15-20
Coefficient b	0.84	From HCM Ex. 15-20
BPTSF$_d$	56.03	
No pass zone adj.	45.2	From HCM Ex. 15-21
PTSF	76.99	

Level of Service (LOS) (Step 7)

ATS LOS	C	From HCM Ex. 15-3
PTSF LOS	D	From HCM Ex. 15-4
v/c Ratio LOS	C	

2049 – Seg 2 – 500W

Civilize, PLLC
Management and Engineering

Project Analysis Worksheet
Tranportation Engineering
Segment LOS for Class III Two-Lane Rural Highway

Client:		DESIGNED	BLH
Project:	Northern lights Addendum 2	CHECKED	BLH
Project No.:		DATE:	

Input Data (Step #1)

Input Cell

Road Name	500W	
Lane Width	12	ft
Shoulder Width	3	ft
Total Accesses	2	Accesses
Segment Length	0.25	miles
Speed Limit	35	mph
PHF	0.88	HCM Ex. 15-5
Truck %	5%	
RV %	5%	
Grade %	0%	
No Passing %	0%	

Free Flow Speed (FFS) Calcs (Step #2)

Calc Cell / Input Cell

FFS=BFFS-f_{LS}-f_A	40.00	mph	HCM Eq. 15-2
Base Free Flow Speed (BFFS)	45	mph	From HCM: BFFS = Speed Limit + 10
Lane/Shoulder Width Adj. F_{LS}	3		From HCM Ex. 15-7
Accesses/mile	8.00	Accesses	
Round down nearest 10	0.00		Auto roundown to nearest 10
Rounded down FFS reduction	0	mph	From HCM Ex. 15-8
Round down value	8.00		Difference for interpolation
Interpolated FFS reduction	2.00	mph	Every 10 access/mile = 2.5 reduction
Access Density Reduction f_a	2.00	mph	From HCM Ex. 15-8

Demand Flow Rate (Step #3)

Calc Cell / Input Cell

Direction 1 Volume	191	vph	
Direction 2 Volume	117	vph	
Equvalent Trucks E_t	1.9		From HCM Ex. 15-11
Equvalent RV E_R	1		From HCM Ex. 15-11
Heavy Veh Adj. f_{hv}	0.96		From HCM Eq. 15-5
Grade Adj. f_g	1		From HCM Ex. 15-9
Demand Flow Eq.	$v_{i,ats} = \frac{V_i}{PHF * f_{g,ats} * f_{hv,ats}}$		From HCM Eq. 15-3
Direction 1 Demand Flow (v	227	vph	
Direction 2 Demand Flow (v	139	vph	

Average Travel Speed (ATS) (Step #4)

Calc Cell / Input Cell

ATS = FFS – 0.00776(v_1,ats + v_2,ats) – f_{np},ats — From HCM Eq. 15-6

No Pass Adj Factor f_{np}	0.2	From HCM Ex. 15-15
ATS	36.96	mph

v/c ratio (Step #5)

Calc Cell / Input Cell

Capacity	1700	vph
Direction 1	191	vph
v/c ratio	0.11	
LOS	A	
Direction 2	117	vph
v/c ratio	0.0688	
LOS	A	

Percent of Free Flow Speed (PFFS)

Exhibit 15-3
Motorized Vehicle LOS for Two-Lane Highways

LOS	Class I Highways ATS (mi/h)	Class I Highways PTSF (%)	Class II Highways PTSF (%)	Class III Highways PFFS (%)
A	>55	≤35	≤40	>91.7
B	>50–55	>35–50	>40–55	>83.3–91.7
C	>45–50	>50–65	>55–70	>75.0–83.3
D	>40–45	>65–80	>70–85	>66.7–75.0
E	≤40	>80	>85	≤66.7
F	Demand exceeds capacity			

Note: For Class I highways, LOS is determined by the worse of ATS-based LOS and PTSF-based LOS.

Percent of Free Flow Speed (PFFS)

PFFS = ATS/FFS	92.4%	
ATS	36.96	mph
FFS	40.00	mph

Level of Service (LOS)

PFFS LOS	A
v/c ratio LOS	A