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## **TRANSPORTATION IMPACT ANALYSIS**

**To**  
City of Manzanita

**For**  
Oregon Coast Development

**Dated**  
November 13, 2024

**Project Number**  
2160454.11



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## I. INTRODUCTION

This Transportation Impact Analysis (TIA) has been prepared in support of the proposed Manzanita Pines residential project in Manzanita, Oregon. Figure 1 in Appendix A presents a vicinity map indicating the project location.

### **Project Description**

The proposed Manzanita Pines residential project located on the proposed Loop Road connected to Necarney City Road in Manzanita, Oregon will include multiple phases of development. Phase 1 will include 60 residential units between one- and three-bedroom and 500-1,200 square feet (SF) in size. The project will also include a common building, plaza, and playground. The apartments are intended to be an affordable option for local residents.

### **Scope of Analysis**

This TIA has been prepared in accordance with the ODOT APM Version 2 and the scoping memo from Lancaster Mobley dated October 2, 2024. This TIA includes a summary of existing traffic conditions, proposed trip generation, trip distribution and assignment, crash review, an analysis of intersection operations, and queuing. The scoping letter is provided in Appendix B.

### ***Study Area***

This TIA includes a study of the following City of Manzanita intersections:

- Necarney City Road/Highway 101
- Necarney City Road/Loop Road

### ***Analysis Scenarios***

Analysis is provided for all study area intersections. Construction is anticipated at the end of 2025, so this study assumes full occupancy in 2026. This TIA addresses transportation conditions for the following analysis scenarios during the PM peak hours and Saturday peak hours:

- 2024 Existing
- 2026 Pre-Development without Manzanita Pines
- 2026 Post-Development with Manzanita Pines

## II. EXISTING CONDITIONS

The existing conditions analysis is based on a current year inventory of transportation facilities and traffic data collected on October 10 and 12, 2024.

### Site Conditions

The project site is located on the north side of Necarney City Road between Clipper Court and Pine Ridge Drive in Manzanita, Oregon. The site is zoned R2, Medium Density Residential. The site is currently vacant.

### Vehicular Transportation Facilities

The study area presented in this TIA includes roadways under City of Manzanita as well as ODOT jurisdiction. Figure 3 presents the existing lane configurations and traffic control devices for the study area intersections (Appendix A). Table 1 summarizes the characteristics of the study area roadways.

TABLE 1 – ROADWAY CHARACTERISTICS							
Roadway	Functional Classification	Posted Speed (mph)	Travel Lanes	Lane Width	Bike Lanes	On-Street Parking	Sidewalks
Necarney City Road	Minor Collector	35	2	12 feet	No	No	No
Highway 101	Principal Arterial/ Statewide Highway	40	2	12 feet	No	No	No
Loop Road	Local Street	25	2	10 feet	No	No	No

### Pedestrian and Bike Facilities

Bike lanes and sidewalks are not currently provided on any of the area roadways as noted above.

### Transit Facilities

The City of Manzanita is part of the NWConnector transit system. Route 3 provides service to Manzanita as it passes between Cannon Beach and Tillamook. The greater NWConnector transit system provides connections between Astoria to the north and Yachats to the south along Highway 101. It also provides connections to the east, from Kelso, Washington to the north to Albany, Oregon to the south, primarily along the I-5 corridor. A copy of the NWConnector Route 3 schedule and map have been provided in Appendix C.

### Existing Traffic Counts

Turning movement counts utilized in this study were collected on Thursday, October 10, 2024, and Saturday, October 12, 2024. Because the Loop Road intersection with Necarney City Road does not yet exist and to obtain data on residential trip distribution, we collected data at the intersection of Pine Ridge

and Necarney City Road. Figure 4 presents the existing PM peak hour and Saturday peak hour traffic volumes for all study area intersections (Appendix A). Raw traffic count summaries are provided in Appendix D.

### ***Seasonal Adjustment***

Seasonal adjustment factors were reviewed using ODOT's ATR Seasonal Trend Table for coastal destination with a count conducted on October 10 and 12. The calculated seasonal adjustment factor of 1.19 was applied to the 2024 existing traffic counts at all locations. Figure 5 presents the seasonally adjusted 2024 volumes (Appendix A).

### **Crash Analysis**

Historical crash data reported for the study area were evaluated for safety. Crash data for the 5-year period of 2018 through 2022 were obtained from ODOT and used to review crash patterns and estimate crash rates for the study area intersection of Necarney City Road with Highway 101 and along Necarney City Road between Highway 101 and Classic Street. Two crashes were noted at the intersection and four crashes along the approximately one-mile segment of Necarney City Road.

#### ***Intersection Crash Rates***

When evaluating the relative safety of an intersection, consideration is given not only to the total number and types of crashes occurring, but also to the number of vehicles entering the intersection. This concept, referred to as a "crash rate," is usually expressed in terms of the number of crashes occurring per one million entering vehicles (MEV) for the intersection per year. Intersections having a crash rate higher than 1.0 crashes/MEV should be reviewed for opportunities to improve safety.

The intersection crash rate is calculated by dividing the average number of crashes per year by the MEV per year. A daily traffic volume was estimated by dividing the PM peak hour volume at the intersection by a peak-to-daily factor, or k-factor. A k-factor of 0.144 from ODOT traffic data taken 0.1 miles east of Necarney City Road on Highway 101 was found on ODOT's TransGIS web portal was applied to the PM peak hour traffic volume collected on October 10, 2024, to estimate ADT.

Road segment crash rates are calculated similarly to intersections but are based on the vehicle miles traveled. The number of crashes is divided by the vehicle volume times the length of the segment and is expressed in crashes per million vehicle miles traveled (MVMT). The daily volume on Necarney City Road was estimated by applying the same k-factor to the PM peak hour volume just south of the intersection with Highway 101.

The raw crash data and calculations is provided in Appendix F.

#### ***Crash Data Summary***

There were two crashes reported at the intersection of Necarney City Road with Highway 101. One was a fixed-object crash in 2018 caused by an improper westbound left turning movement, resulting in a suspected minor injury (Injury Type B). The other was a crash with a cyclist caused by a failure to yield by the driver at fault, resulting in a suspected serious injury (Injury Type A). With an estimated daily volume of 5,000 vehicles, the resulting crash rate is 0.18 crashes per MEV. This is much less than ODOT's 90th Percentile rate of 0.475 for similar intersection types.

There were four crashes reported along Necarney City Road between Highway 101 and Classic Street. All four appear to be single-vehicle crashes caused by driver error (i.e., driving too fast for conditions, hitting a fixed object or deer/elk, etc.). None of the crashes occurred near the proposed Loop Road intersection. With an estimated daily volume 938 vehicles, the crash rate was calculated to be 2.34 crashes per MVMT.

Though the crash rate is high on the segment of Necarney City Road, it is generally the result of driver behavior such as driving too fast for conditions. None of the crashes were intersection-related and all involved a single vehicle. Therefore, we do not believe the added Loop Road intersection will have an impact on safety on the roadway. No further crash analysis is recommended.

### III. PRE-DEVELOPMENT CONDITIONS

The pre-development condition reflects a buildout year scenario without the proposed development. This scenario includes traffic from the 2024 existing condition, background traffic growth to the year 2026, and in-process traffic from other approved developments that have not been constructed.

#### Planned Transportation Improvements

None noted in the study area.

#### Background Traffic Growth

Based on data from ODOT's 2040 Future Volumes Table from 0.2 miles north of Manzanita and 0.2 miles south of Laneda, and recent studies prepared in Manzanita, a 1% growth rate per year was applied to the study area intersections.

Figure 6 presents the PM peak hour and Saturday peak hour background traffic growth volumes for all study area intersections (Appendix A).

#### In-Process Traffic

In-process traffic volumes account for developments that have been approved or that are under construction at the time of the traffic counts. These traffic volumes account for trips that will be added to the external roadway network before build-out of the proposed development. Traffic volumes for the following developments were included in the analysis to account for in-process traffic:

- Manzanita Lofts
- Heron's Rest
- Nehalem Bay State Park Expansion

The detailed trip generation analysis for the Nehalem Bay State Park Expansion provided by ODOT via Lancaster Mobley listed zero trips on Saturday due to limited ITE data. The PM peak hour rate has been assumed for Saturday as a more appropriate estimate. Figure 7 presents the PM peak hour and Saturday peak hour in-process trips for the above project (Appendix A). Detailed information for the in-process projects is included in Appendix E.

#### Pre-Development Traffic

The 2026 pre-development analysis scenario is a combination of 2024 traffic volumes, a 1% annual background growth rate over two years, and in-process traffic. The pre-development traffic without the project trips will indicate if traffic issues are present before the addition of the proposed residential project.

Figure 8 presents the PM peak hour and Saturday peak hour 2026 pre-development traffic volumes (Appendix A).



#### IV. SITE DEVELOPMENT

The trip-making characteristics of the proposed development are described below.

##### Trip Generation

Trip generation estimates for the proposed project were developed using the Institute of Transportation Engineers' (ITE) *Trip Generation Manual*, 11th Edition. The ITE land uses that best match the proposed project is "Affordable Housing" (LUC 223). The data set for Saturday trip generation for "Affordable Housing" is limited, so the trip rates from "Multifamily Housing (Low-Rise)" (LUC 220) were used.

A trip generation summary is presented in Table 2.

TABLE 2 – TRIP GENERATION										
ITE Code	ITE Land Use	Size	Trip Type	PM Peak Hour			Saturday Peak Hour			Daily
				In	Out	Total	In	Out	Total	
223	Affordable Housing (Income Limit)	60	DU	15	13	28	15 <sup>1</sup>	10 <sup>1</sup>	25 <sup>1</sup>	289

<sup>1</sup>Trip rates from "Multifamily Housing (Low-Rise)" (LUC 220) used

As shown in Table 2, the affordable housing development is expected to generate 28 PM peak hour, 25 Saturday peak hour, and 289 weekday daily trips.

##### Trip Distribution and Assignment

Trip distribution for the proposed development was estimated using similar studies for residential development and review of existing traffic volumes at the study area intersections and to the intersection of Necarney City Road with Pine Ridge Lane. Because of the nature of residential developments in this area, trip patterns differ between weekday and the weekend. The following trip distribution was used for PM peak hour trips:

- 5% to/from Nehalem Bay State Park
- 35% to/from Central Manzanita
- 20% to/from the north on Highway 101 via Necarney City Road
- 40% to/from the south on Highway 101 via Necarney City Road

The following trip distribution was used for Saturday peak hour trips:

- 5% to/from Nehalem Bay State Park
- 45% to/from Central Manzanita
- 15% to/from the north on Highway 101 via Necarney City Road
- 35% to/from the south on Highway 101 via Necarney City Road

Figure 9 presents the PM peak hour and Saturday peak hour site trip distribution and volumes (Appendix A).

## **Post-Development Traffic**

Post-development traffic volumes are the sum of the site trips and the pre-development traffic volumes. Figure 10 presents the PM peak hour and Saturday peak hour 2024 post-development traffic volumes (Appendix A).

## V. SITE ACCESS, CIRCULATION, AND PARKING

The evaluation of site access and on-site circulation are presented below. This evaluation includes assessment of sight distance.

### Site Access and Circulation

The residential project will have access via two driveways on the proposed Loop Road. The southern driveway is proposed approximately 575 feet from Necarney City Road, and the second driveway is proposed 265 feet north of the first.

### Sight Distance Evaluation

Based on the proposed Loop Road and project site, the site driveways on Loop Road will meet minimum stopping sight distance (SSD) and intersection sight distance (ISD) requirements per AASHTO design guidelines.

TABLE 3 – SIGHT DISTANCE EVALUATION						
Access	Design Speed (MPH)	Design Vehicle	Recommended ISD (feet)	Required SSD (feet)	Available Sight Distance (feet)	
					To North	To South
South Access	25 MPH	Passenger Car	280	155	280	280
North Access	25 MPH	Passenger Car			N/A	280

The proposed intersection between Loop Road and Necarney City Road will address required sight distances through the design process.

## VI. OPERATIONS ANALYSIS

Two aspects of operation analysis were evaluated for the study area intersections: 1) intersection operation analysis, which evaluates how well an intersection processes traffic demand; and 2) queuing analysis, which compares intersection queues with available storage for different travel lanes.

### Intersection Operations Analysis

Intersection operations are generally measured by three mobility standards: volume-to-capacity (v/c) ratio, level-of-service (LOS), and delay (measured in seconds).

- V/C ratio is a measurement of capacity used by a given traffic movement or for an entire intersection. It is defined by the rate of traffic flow or traffic demand divided by the theoretical capacity calculated for the roadway geometry and traffic control.
- LOS is an expression of the average control delay (in seconds) experienced by drivers as described by a letter on the scale from A to F. LOS A represents optimum operating conditions and minimum delay, while LOS F indicates lengthy delays and often over-capacity conditions.
- Delay is a measurement of the average vehicle delay resulting from the type of traffic control and the conflicting traffic volumes. An average delay can be expressed for a certain movement, a specific lane, a single approach, or for an entire intersection.

### *Performance Measures*

The Oregon Highway Plan (OHP) designates Highway 101 as a statewide highway that is Non-MPO outside of a Special Transportation Area. With a posted speed of 40 mph Table 6 of the OHP states the mobility target for the Highway 101 and Necarney City Road intersection is a v/c ratio of 0.85 or less.

The City of Manzanita has no clear operational standards for City intersections. It is assumed a level of service "D" or better would be sufficient for City intersections.

### *Methodology*

Intersection operations were analyzed with the use of Synchro 11 software, which utilizes the Transportation Research Board's *Highway Capacity Manual* (HCM) 2000, HCM 2010, and HCM 7 methodologies. All the study area intersections are stop controlled.

### *Findings*

The operation results for the worst-operating movement at each intersection are presented in Table . HCM 2000 and seven reports have been made available in Appendix G.

TABLE 4 – PEAK HOUR INTERSECTION OPERATIONS				
Intersection (Control)	Peak Hour	Analysis Results (v/c-LOS-Delay in seconds)		
		2024 Existing	2026 Pre-Development	2026 Post-Development
Necarney City Road/Hwy 101 (Stop)	PM	0.19-B-13.3 (NB)	0.23-B-14.2 (NB)	0.24-B-14.2 (NB)
	SAT	0.30-C-16.1 (NB)	0.34-C-17.2 (NB)	0.36-C-17.6 (NB)
Necarney City Road/Loop Road (Stop)	PM	N/A	N/A	0.02-A-9.3 (SB)
	SAT	N/A	N/A	0.01-A-9.7 (SB)

As presented in Table 4, all study area intersections currently operate within ODOT and City standards and are projected to continue meeting standards under post-development conditions.

### Intersection Queuing Analysis

An intersection queuing analysis was conducted for the study area intersections during the PM peak hour and Saturday peak hours to identify vehicle queuing needs. The 95th percentile queues were estimated using SimTraffic software, with results rounded to the nearest 25 feet to represent average vehicle lengths.

Because queues are based on an average of five traffic simulations using random arrivals, some fluctuation in results can be anticipated, particularly for movements that are near or projected to be over capacity.

### Methodology

Available queue storage lengths were estimated using Google Earth Pro software and rounded to the nearest five feet. For turn lanes, two available storage values are stated: the first represents the striped storage; and the second is the effective storage, or the length physically available regardless of striping, such as a center turn lane upstream of a striped left-turn lane at an intersection. Although through lanes have no storage defined by striping, two values are reported for storage: the first is the distance to an upstream driveway; and the second is the distance to an upstream public street intersection.

### Findings

The PM peak hour and Saturday 95th percentile queues are presented in Table . Bold text indicates the calculated queue exceeds the storage for the travel lane. SimTraffic output sheets are provided in Appendix I.

TABLE 5 – 95TH PERCENTILE QUEUING ANALYSIS					
Intersection (Control)	Approach/ Movement	Available/ Effective Storage (feet)	PM/Saturday Queue (feet)		
			2024 Existing	2026 Pre- Development	2026 Post- Development
Necarney City Road/ Hwy 101 (Stop)	WBL	375/500	50/75	50/75	50/75
	NB L+R	40/135	75/100	75/125	100/100
Necarney City Road/ Loop Road (Stop)	EB L+R	765/765	N/A	N/A	25/25
	SB L+R	TBD	N/A	N/A	25/25

As presented in Table 5, all existing and future conditions queues are expected to be accommodated by available storage. No queues will exceed available storage distances.

## **VII. MITIGATION AND RECOMMENDATIONS**

All study area intersections are expected to operate at acceptable levels per ODOT and City standards with the addition of site trips, and vehicle queues will not exceed available storage.

The minimum required intersection sight distance of 280 feet is available from the driveways on Loop Road. The proposed intersection between Loop Road and Nekarney City Road will address required sight distances through the design process.

Therefore, we do not recommend any mitigation measures for Nekarney City Road or Loop Road.

## **VIII. APPENDIX**

- Appendix A. Figures
- Appendix B. Scoping Material
- Appendix C. Transit Information
- Appendix D. Traffic Count Summaries
- Appendix E. Seasonal Adjustment Calculations
- Appendix F. In-Process Trips and Vicinity Map
- Appendix G. Crash Data
- Appendix H. Operations Calculations
- Appendix I. Queuing Analysis



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APPENDIX A.  
**FIGURES**



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VICINITY MAP

MANZANITA PINES  
MANZANITA, OREGON

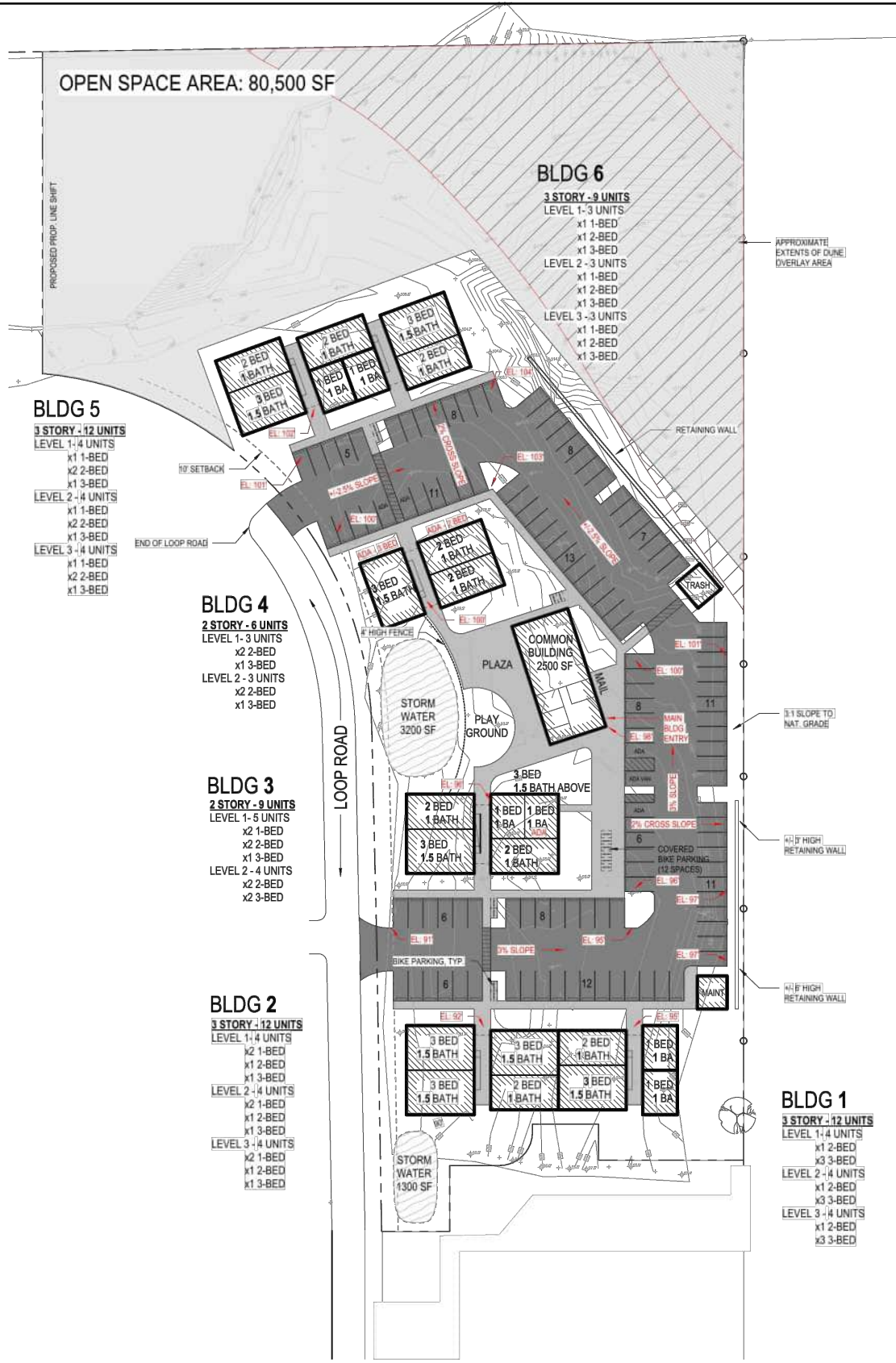
FIGURE

1



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OPEN SPACE AREA: 80,500 SF



**BLDG 5**

- 3 STORY - 12 UNITS**
- LEVEL 1-4 UNITS
- x1 1-BED
- x2 2-BED
- x1 3-BED
- LEVEL 2 -4 UNITS
- x1 1-BED
- x2 2-BED
- x1 3-BED
- LEVEL 3 -4 UNITS
- x1 1-BED
- x2 2-BED
- x1 3-BED

**BLDG 4**

- 2 STORY - 6 UNITS**
- LEVEL 1-3 UNITS
- x2 2-BED
- x1 3-BED
- LEVEL 2 - 3 UNITS
- x2 2-BED
- x1 3-BED

**BLDG 3**

- 2 STORY - 9 UNITS**
- LEVEL 1-5 UNITS
- x2 1-BED
- x2 2-BED
- x1 3-BED
- LEVEL 2 - 4 UNITS
- x2 2-BED
- x2 3-BED

**BLDG 2**

- 3 STORY - 12 UNITS**
- LEVEL 1-4 UNITS
- x2 1-BED
- x1 2-BED
- x1 3-BED
- LEVEL 2 -4 UNITS
- x2 1-BED
- x1 2-BED
- x1 3-BED
- LEVEL 3 -4 UNITS
- x2 1-BED
- x1 2-BED
- x1 3-BED

**BLDG 6**

- 3 STORY - 9 UNITS**
- LEVEL 1-3 UNITS
- x1 1-BED
- x1 2-BED
- x1 3-BED
- LEVEL 2 - 3 UNITS
- x1 1-BED
- x1 2-BED
- x1 3-BED
- LEVEL 3 - 3 UNITS
- x1 1-BED
- x1 2-BED
- x1 3-BED

**BLDG 1**

- 3 STORY - 12 UNITS**
- LEVEL 1-4 UNITS
- x1 2-BED
- x3 3-BED
- LEVEL 2 -4 UNITS
- x1 2-BED
- x3 3-BED
- LEVEL 3 -4 UNITS
- x1 2-BED
- x3 3-BED

SD07  
**1** PROPOSED SITE PLAN\_05-13-2024  
SCALE: 1" = 40'-0"



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**SITE PLAN**

MANZANITA PINES  
MANZANITA, OREGON

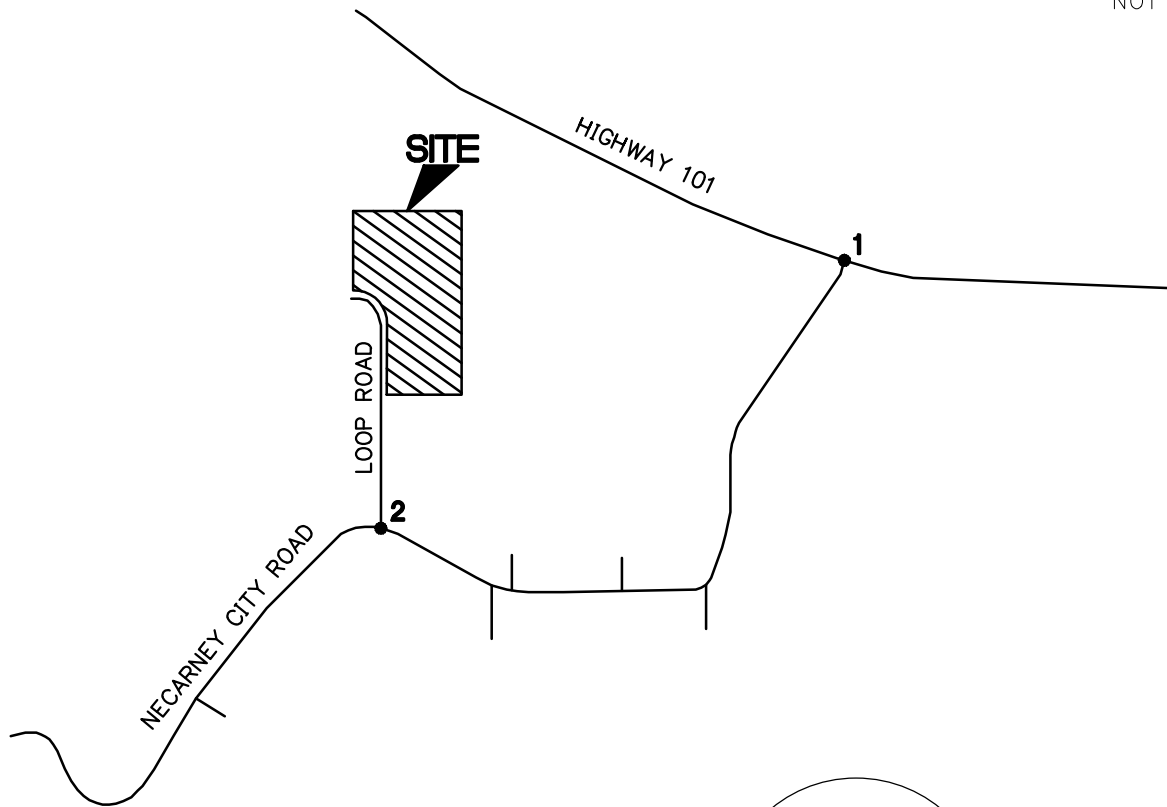
FIGURE

2

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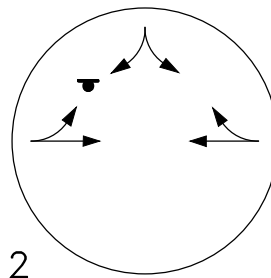
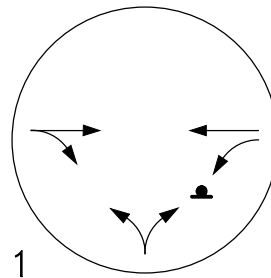


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EXISTING + PLANNED  
 TRAFFIC CONTROL DEVICES  
 + LANE CONFIGURATIONS

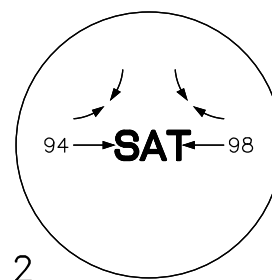
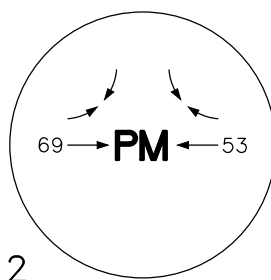
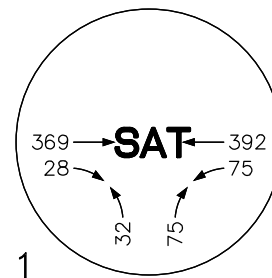
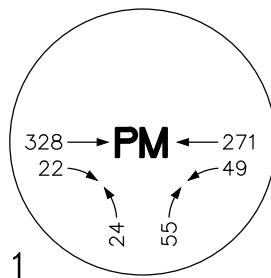
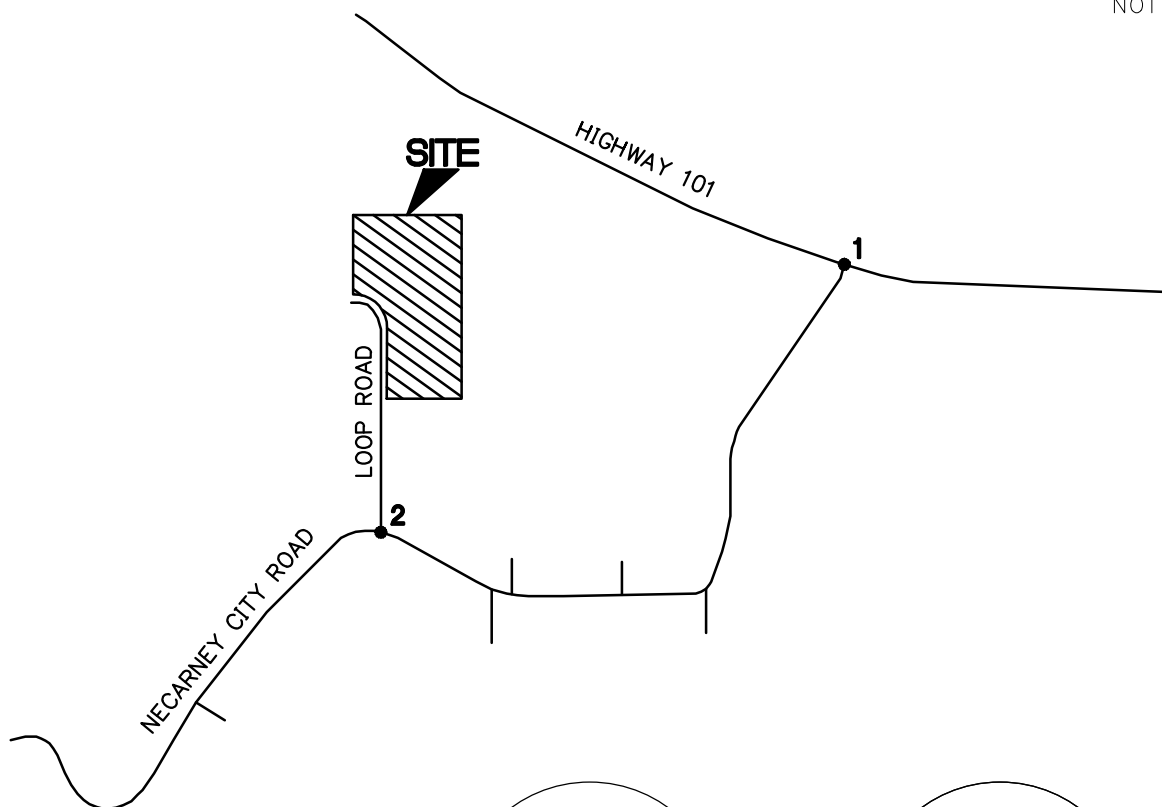
MANZANITA PINES  
 MANZANITA, OREGON

FIGURE

3



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2024 EXISTING  
 TRAFFIC VOLUMES -  
 PM + SATURDAY PEAK HOUR

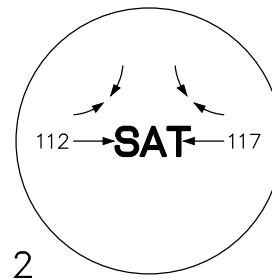
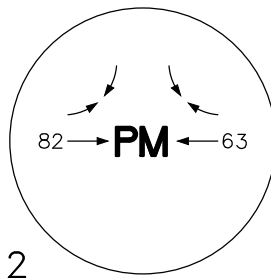
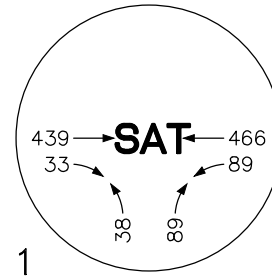
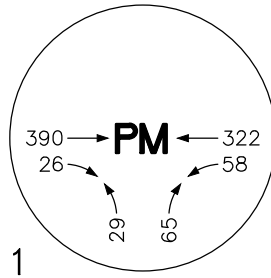
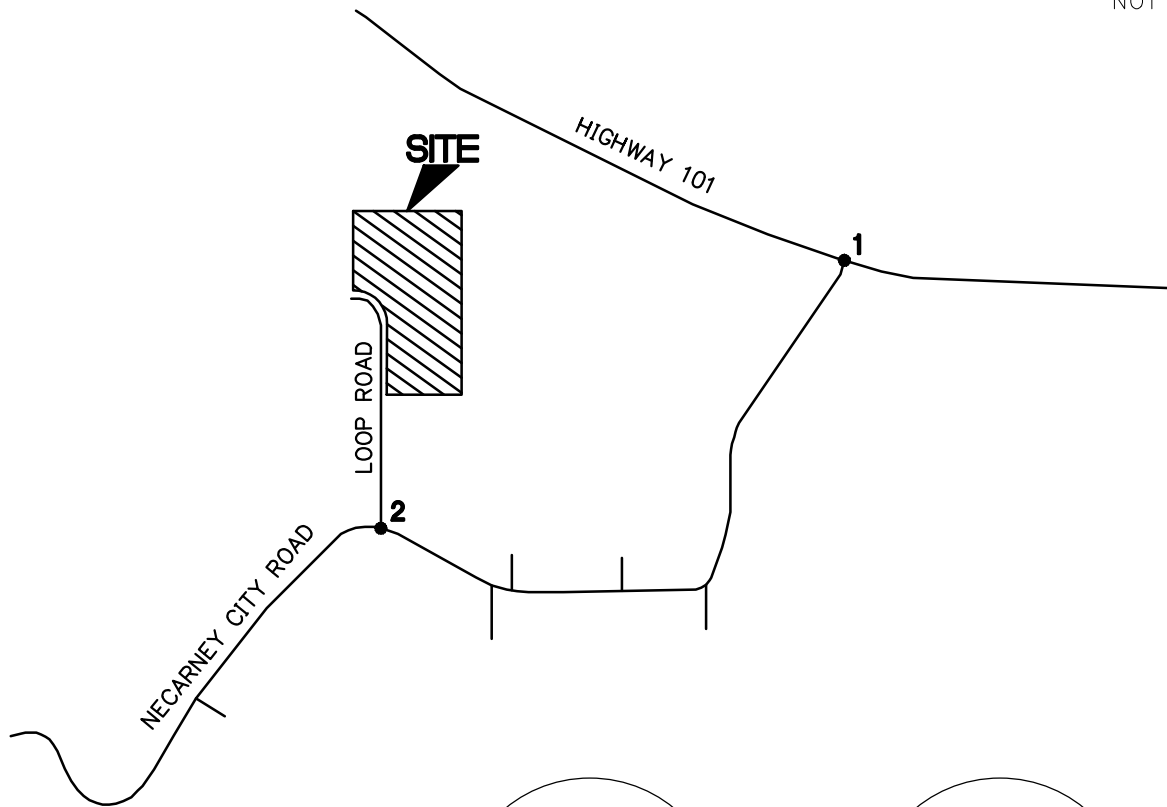
MANZANITA PINES  
 MANZANITA, OREGON

FIGURE

4



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2024 SEASONALLY ADJUSTED  
 TRAFFIC VOLUMES -  
 PM + SATURDAY PEAK HOUR

MANZANITA PINES  
 MANZANITA, OREGON

FIGURE

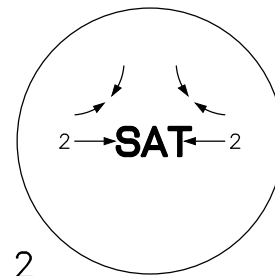
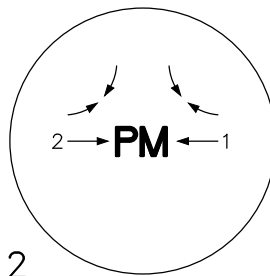
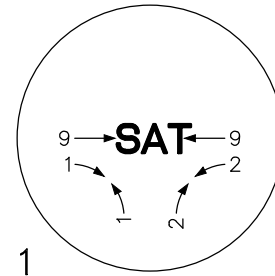
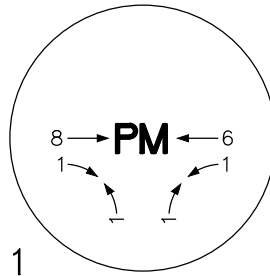
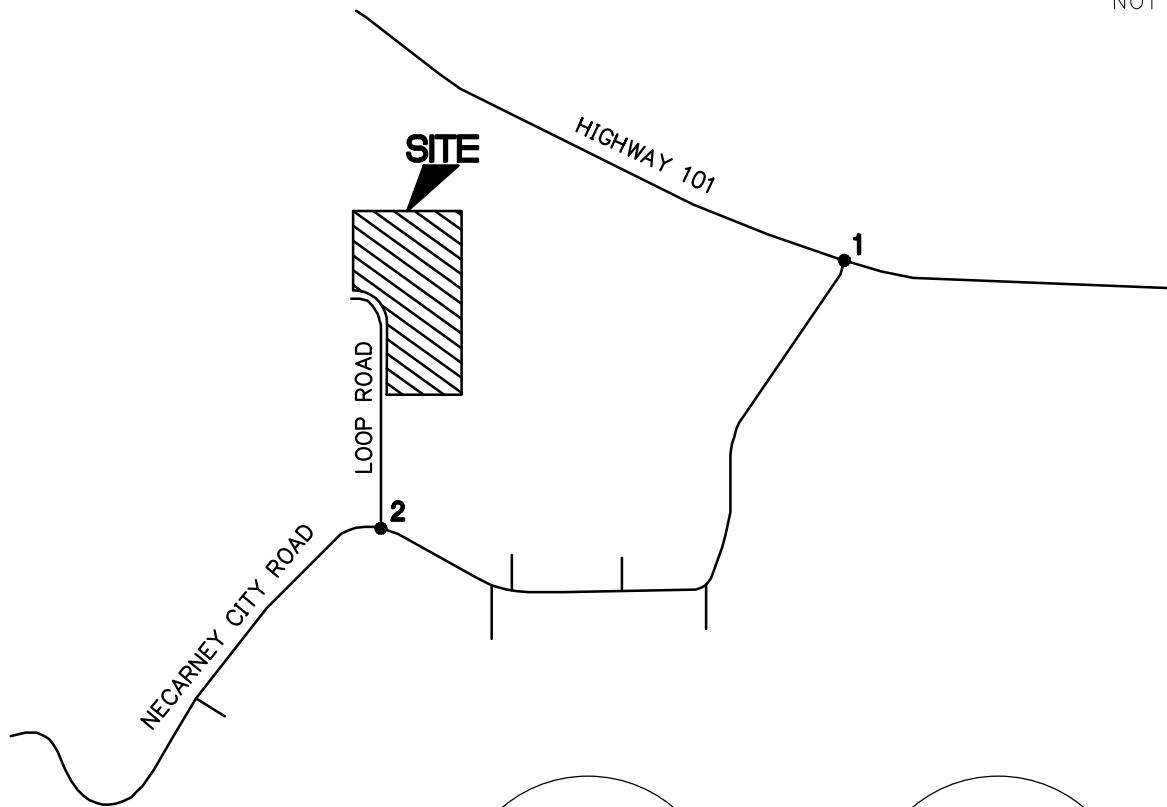
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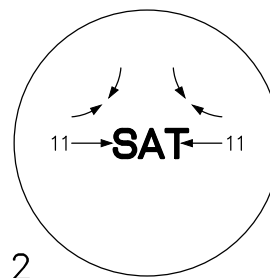
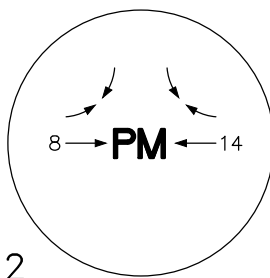
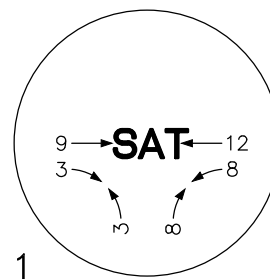
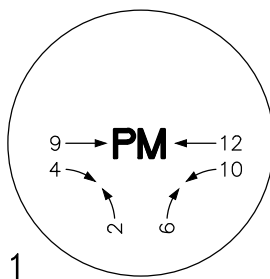
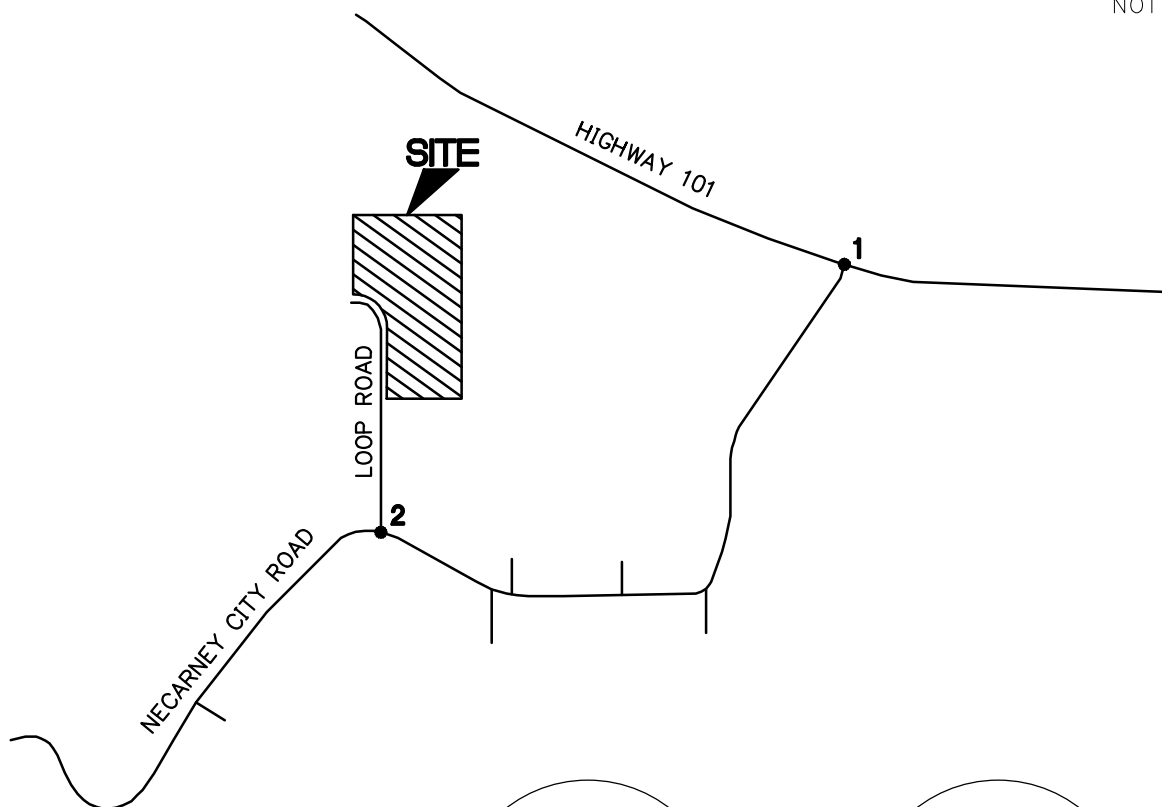
BACKGROUND TRAFFIC GROWTH, FIGURE  
 2 YEARS AT 1.0% PER YEAR -  
 PM + SATURDAY PEAK HOUR

MANZANITA PINES  
 MANZANITA, OREGON

6



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IN-PROCESS  
 TRAFFIC VOLUMES -  
 PM + SATURDAY PEAK HOUR

MANZANITA PINES  
 MANZANITA, OREGON

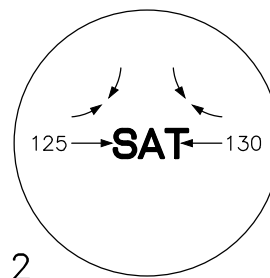
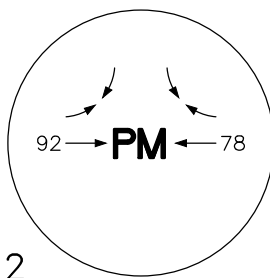
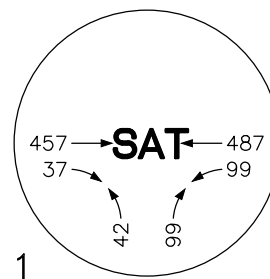
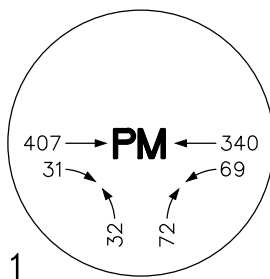
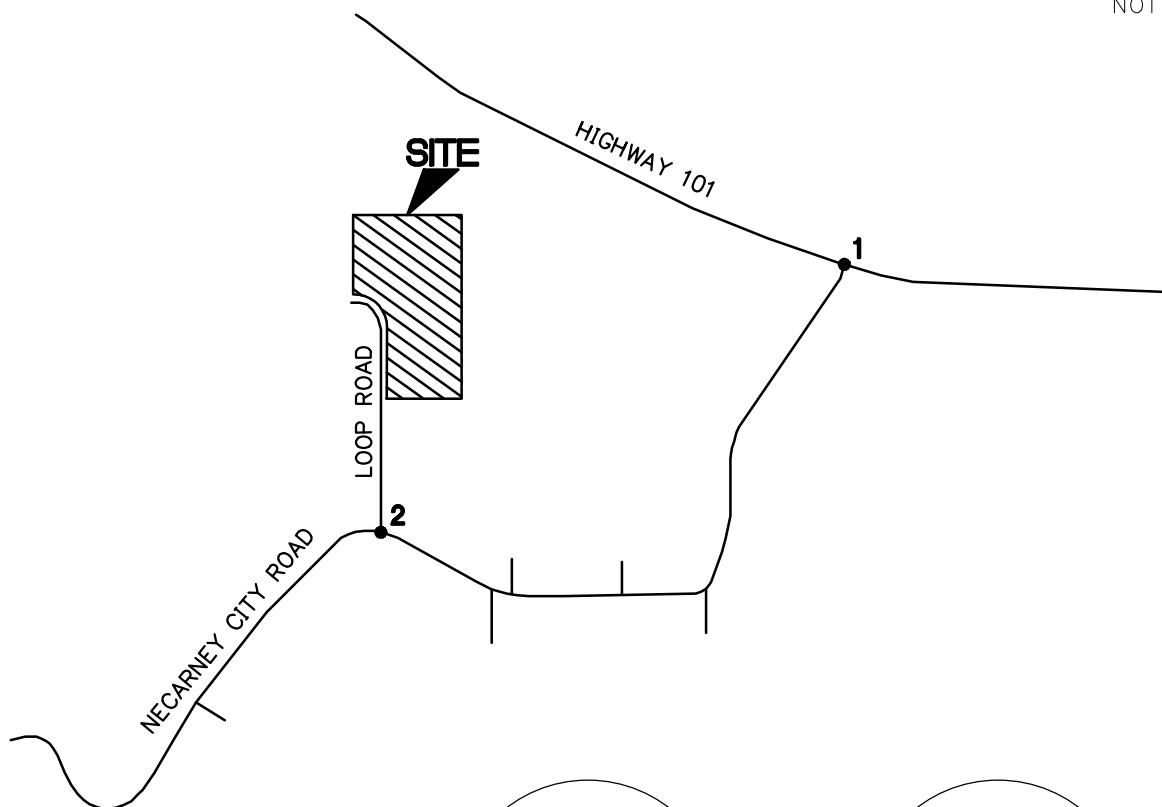
FIGURE

7





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2026 PRE-DEVELOPMENT  
 TRAFFIC VOLUMES -  
 PM + SATURDAY PEAK HOUR

MANZANITA PINES  
 MANZANITA, OREGON

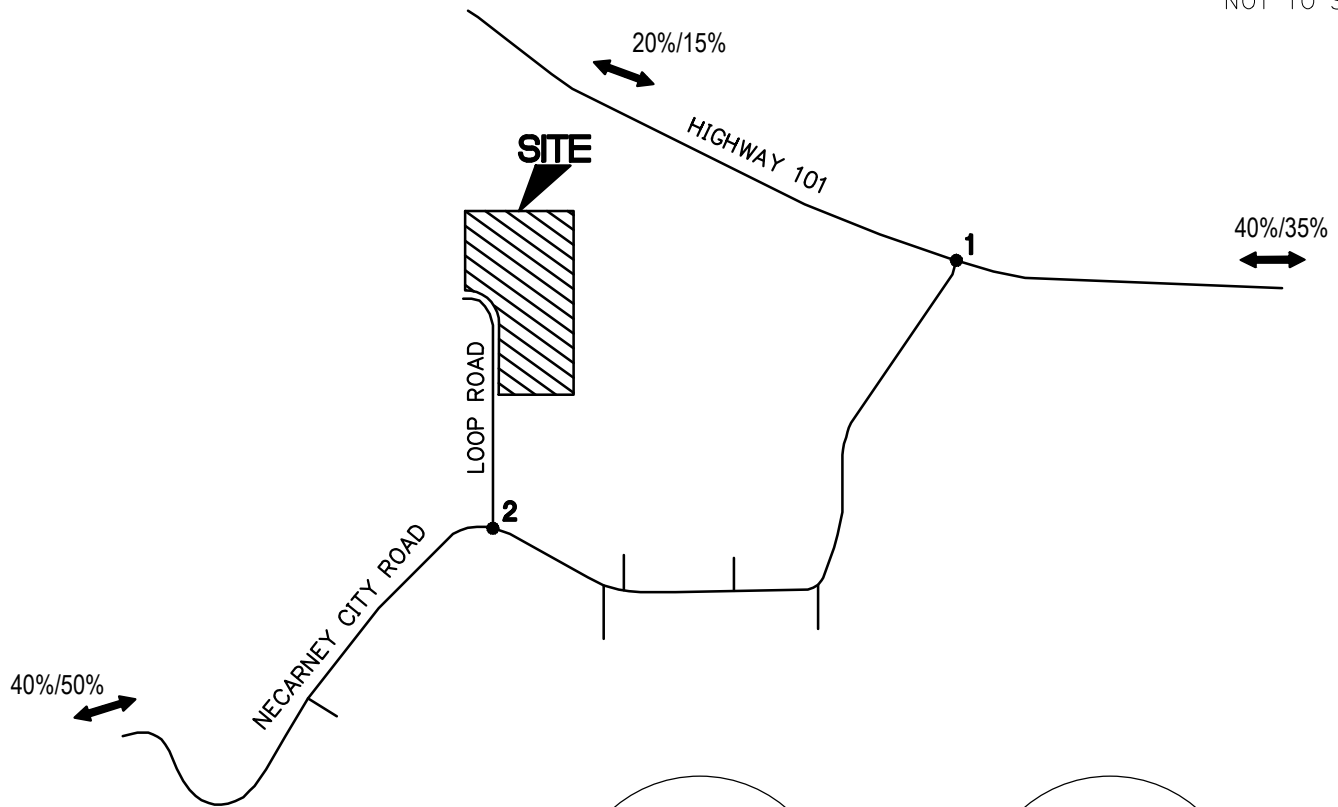
FIGURE

8

PM %/SAT %

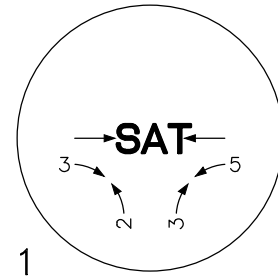
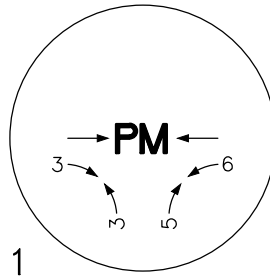


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PM PEAK HOUR

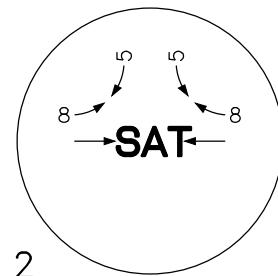
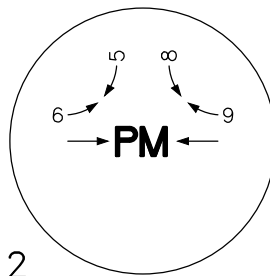
Enter - 15  
 Exit - 13  
 Total - 28



SATURDAY

PEAK HOUR

Enter - 15  
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PRIMARY TRIP DISTRIBUTION +  
 TRAFFIC ASSIGNMENT -  
 PM + SATURDAY PEAK HOUR

MANZANITA PINES  
 MANZANITA, OREGON

FIGURE

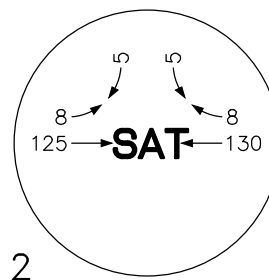
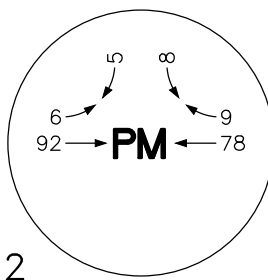
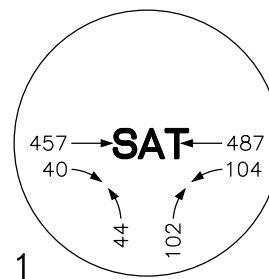
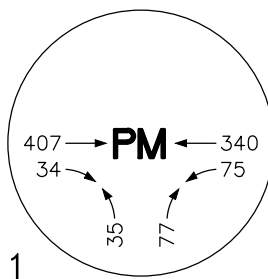
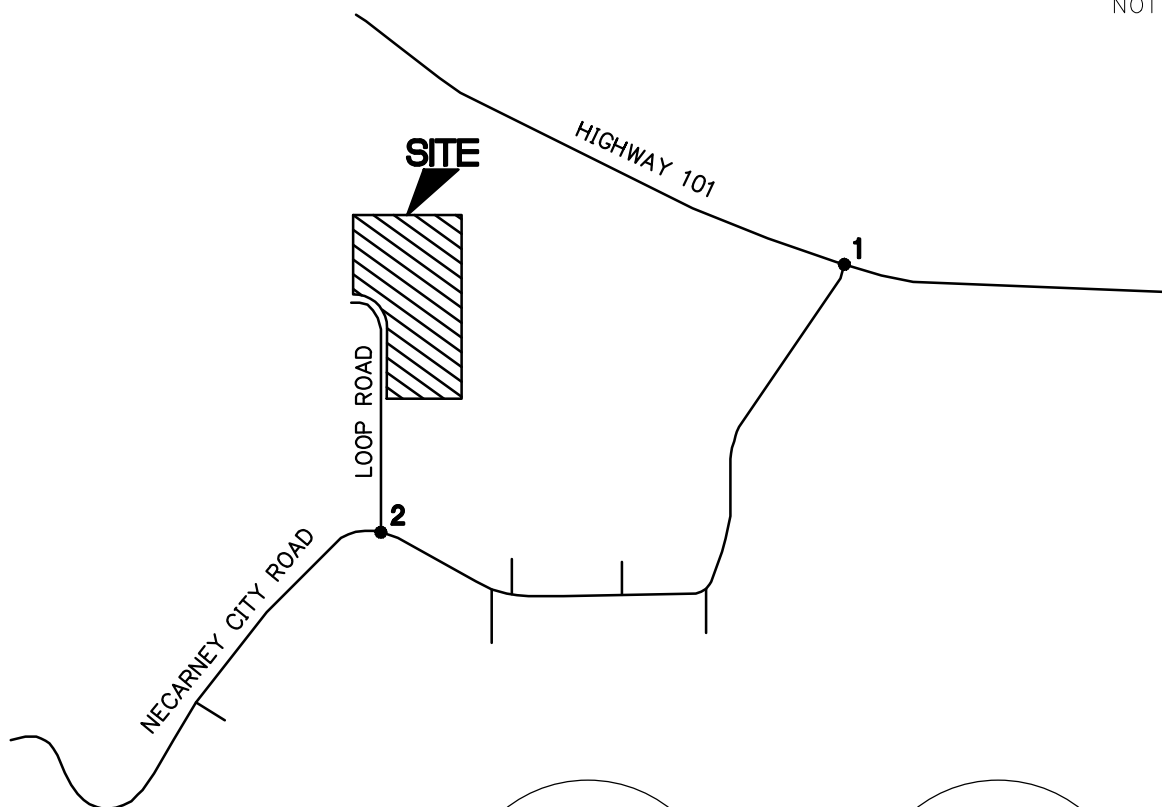
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2026 POST-DEVELOPMENT  
 TRAFFIC VOLUMES -  
 PM + SATURDAY PEAK HOUR

MANZANITA PINES  
 MANZANITA, OREGON

FIGURE

10

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APPENDIX B.  
**SCOPING MATERIAL**

August 12, 2024

City of Manzanita  
Attention: Walt Wendolowski  
167 S 5th Street  
Manzanita, OR 97130

Re: Oregon Coast Development Traffic Analysis  
*Traffic Impact Analysis Scope of Work*  
Project Number 2160454.11

Dear Mr. Wendolowski:

We have prepared this scoping assessment in response to your City Scoping letter dated May 23, 2024, for the affordable housing project to be constructed north of Necarney City Road along a new street, Loop Road. This proposed scope is more similar to recent traffic studies we prepared in the City.

## STUDY AREA

The study area should be based on the trip impact at each intersection. To assess what impact is expected, we have prepared this assessment of trip generation and distribution. In general, ODOT requires analysis when impacts are 50 peak hour trips or more at an intersection, and some jurisdictions require analysis with impacts of 10 or more peak hour trips, unless there are known safety or capacity concerns.

We are providing trip generation and distribution estimates to determine the expected impact at each intersection recommended in the letter to be included in the study area.

## Trip Generation

Trip estimates were developed based on the Institute of Transportation Engineer's Trip Generation Manual, 11th Edition for the affordable housing Land Use. Trip estimates for the proposed 60 units are 30 trips in the AM peak hour, 28 Trips in the weekday PM peak hour, and 289 daily as noted in Table 1.

Table 1 - Trip Generation										
ITE Code	Land Use	Size	AM Peak Hour			PM Peak Hour			Daily	
			In	Out	Total	In	Out	Total		
223	Affordable Housing (Income Limit)	60 DU	9	21	30	15	13	28	289	



**Trip Distribution**

The following distribution of trips to the roadway network is proposed, based on similar studies for residential development and review of existing traffic volume patterns.

- 5% to/from Nehalem Bay State Park
- 20% to/from Central Manzanita
- 25% to/from the north on Highway 101
- 50% to/from the south on Highway 101

**Trip Assignment**

Based on the above generation and distribution of the project trips, Table 2 presents the estimated peak hour assignment at each of the intersections noted in the City’s scoping letter.

Table 2 – Trip Assignment		
Intersection	Trip Distribution	Trip Assignment
Necarney City Road/Highway 101	75%	23
Necarney City Road/Loop Road	100%	30
Necarney City Road/Meadows Drive	25%	8
Necarney City Road/Classic Street	25%	8
Highland Drive/Classic Street	20%	6
Classic Street/Dorcas Lane	20%	6
Classic Street/Laneda Avenue	20%	6
Laneda Avenue/Highway101	25%	8

**Study Area Intersections**

The following intersections are recommended for study based on the impact of 10 or more peak hour trips as noted in Table 2.

- Highway 101/Necarney City Road
- Necarney City Road/Loop Road

The intersection of Necarney City Road/Meadows Drive will only see an increase of up to eight trips, and no trips are expected to turn to or from Meadows Drive – only through trips on Necarney City Road.

The intersections on Classic Street at Highland Drive, Dorcas Lane, Laneda Avenue have all been reviewed by recent traffic studies and found to operate at acceptable levels and the addition of less than 10 peak hour trips is not expected to result in a significant change in operation.

## **TRAFFIC ANALYSIS SCOPE**

The traffic analysis will follow City and ODOT standards and include the following elements.

### **Existing Traffic Counts**

New counts will be conducted or obtained at the recommended study areas for the Weekday PM Peak Hour. This will involve acquiring and/or collecting turning movement count data for passenger vehicles, heavy vehicles, pedestrians, and bicycles to accurately understand the existing conditions.

### **Seasonal Adjustment per ODOT standards for Hwy 101 intersections.**

A seasonal adjustment will be applied to traffic counts along Highway 101 as needed, depending on the date of the Counts. The ATR Characteristic Table Method and Seasonal Trend Method indicate that August is the peak time of the year for Highway 101.

### **Background Growth**

Similar to recent studies prepared in Manzanita, we propose to apply a 1% growth rate per year for the study area intersections. Data from ODOT's 2040 Future Volumes Table from 0.2 miles north of Manzanita and 0.2 miles south of Laneda show less than 1% of growth, so 1% is a conservative estimate.

### **In-Process Trips**

We are aware of the following projects which may need to be included as in-process with trips included in the pre-development traffic volume estimates at the study area intersections.

- Manzanita Lofts – 24 units off Dorcas Street
- Heron's Rest – 26 units on S 3rd Street
- Nehalem Bay State Park – expansion of existing facilities

Please confirm this list to be included and note if there are others recently approved.

### **Safety Review**

We will present an evaluation of crashes at the study area intersections for the most recent five years of data available, and review sight distance availability in accordance with the AASHTO Policy on Geometric Design of Highways and Streets.

### **Analysis Methodology**

This TIA will be prepared per *ODOT's Analysis and Procedures Manual, Version 2* and Synchro/SimTraffic software to analyze intersection operation and queuing.

City of Manzanita  
Oregon Coast Development Traffic Analysis  
Project Number 2160454.11  
August 12, 2024  
Page 4

Please let us know if you have any questions or comments on the proposed scope.

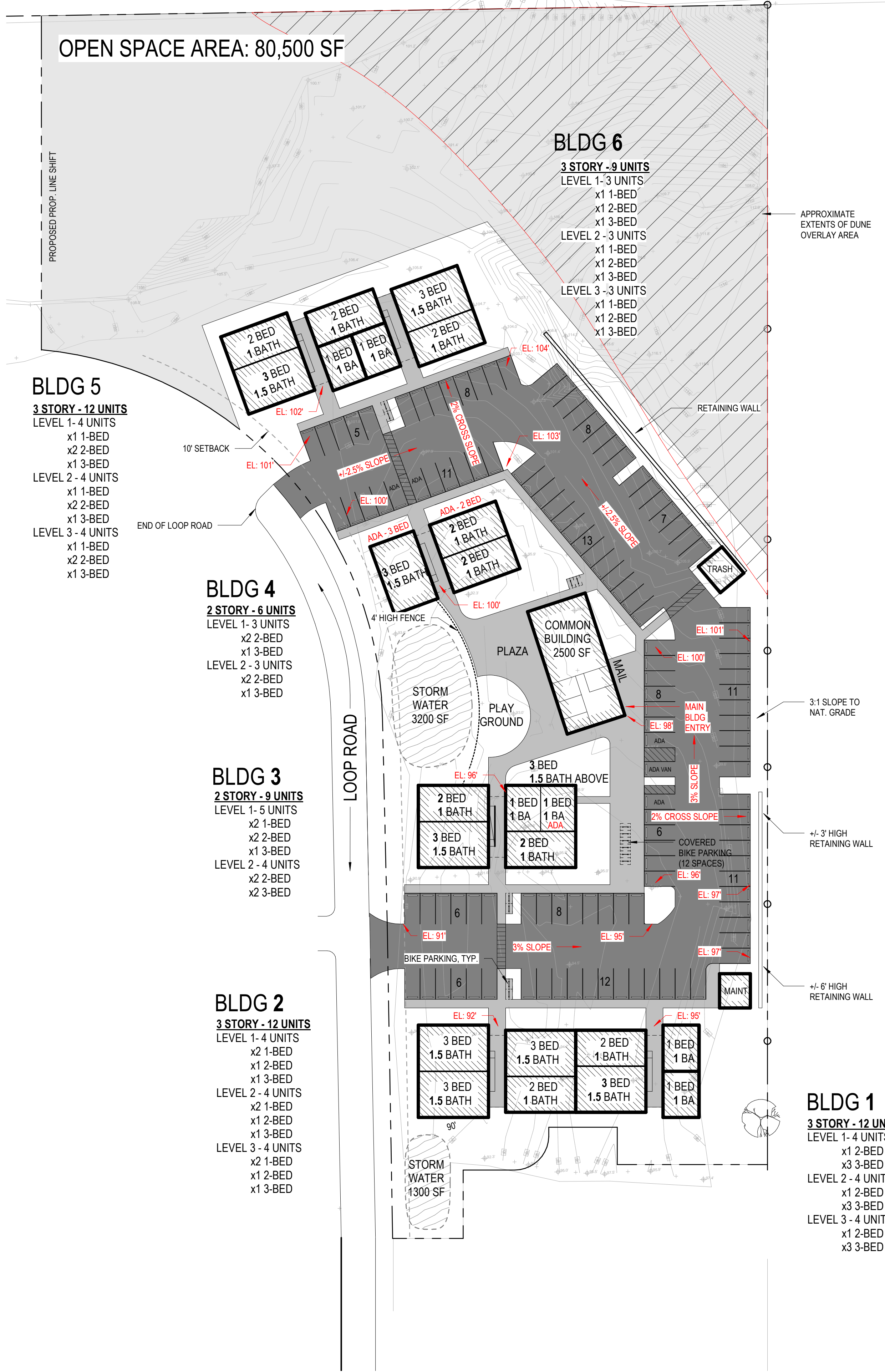
Sincerely,

Brent Ahrend, PE  
Associate Principal | Traffic Engineer

Enclosure(s): Attachment A – Site Plan  
Attachment B – Trip Distribution Figure

c: Benjamin Pray – Home First  
Jim Pentz – Pine Grove Properties Inc  
Ralph Henderson – Mackenzie





**SR/R ZONING**  
 6.5 UNITS/AC BY RIGHT  
 13 UNITS/AC CLUSTERED (REQ. 40% OS)

**PHASE I**  
 60 UNITS / 13 UNITS per acre = 4.6 ACRES REQUIRED (200,376sf)  
 PROPOSED SITE AREA: 4.6ac (200,500sf)

40% OPEN SPACE = 1.8 ACRES (80,150 SF)  
 PROPOSED OPEN SPACE: 80,500 SF

**60 UNITS**

x14	1-BED (558)	7,812
x23	2-BED (884)	20,332
x23	3-BED (1116)	25,668
<b>TOTAL</b>		<b>53,812</b>

**120 PARKING SPACES**

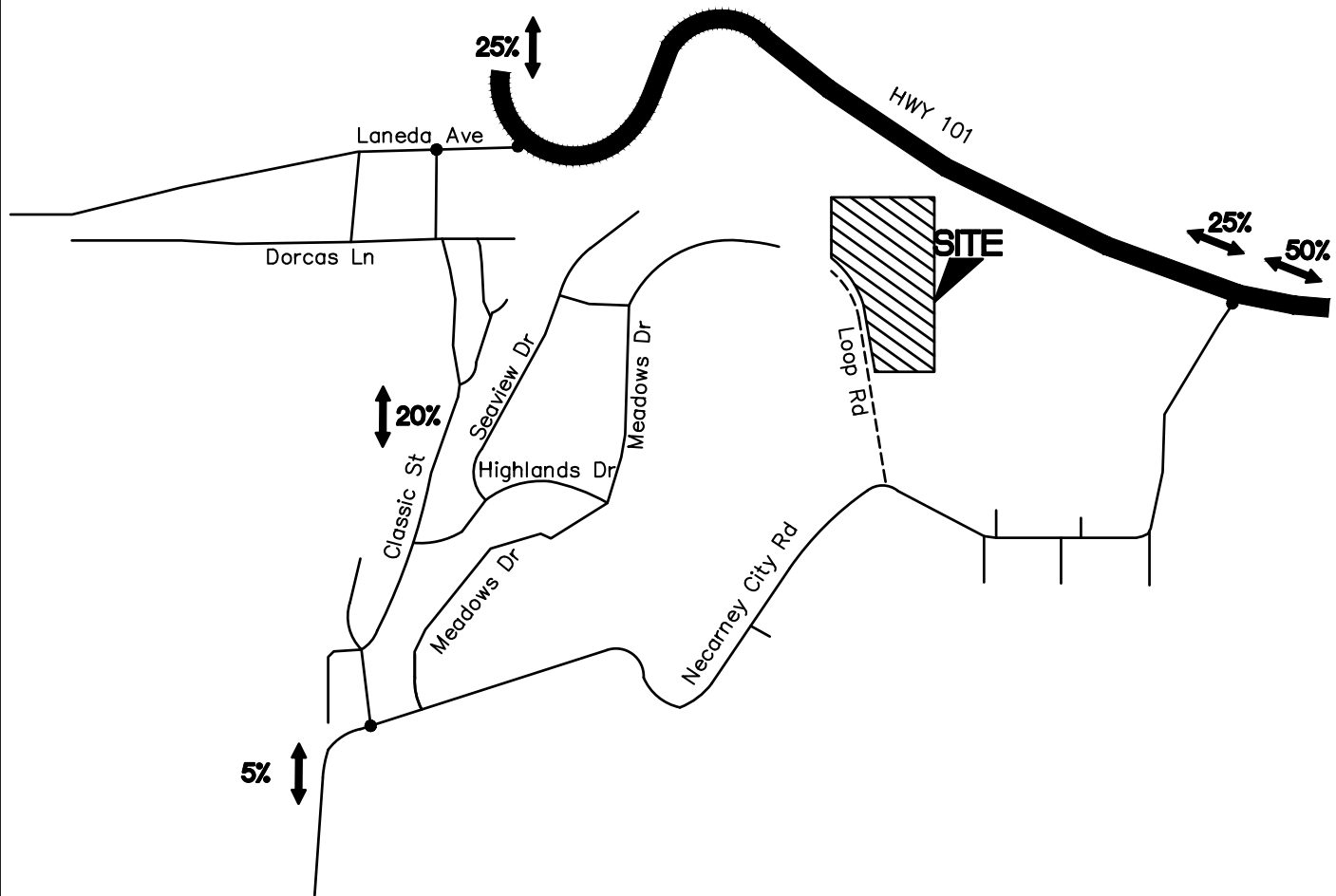
2 :1.0 RATIO

COMMON BUILDING  
 2500 SF

**IMPERVIOUS AREAS**

DRIVE AISLE:	38,000 SF
COMMON BLDG:	2,500 SF
BUILDINGS:	20,200 SF
PED PATHS:	13,500 SF
ACCESSORY STRUC:	3,000 SF

**TOTAL:** 77,200 SF



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CHECKED BY: BTA

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 2160454.11

TRIP DISTRIBUTION

OREGON COAST DEVELOPMENT  
 MANZANITA, OR

FIGURE

1



321 SW 4th Ave., Suite 400  
Portland, OR 97204  
503.248.0313  
lancastermobley.com

October 2, 2024

Scott Gebhart  
City of Manzanita  
543 Laneda Avenue  
Manzanita, OR 97130

Dear Scott,

At your request, I have reviewed the development plan for the proposed workforce housing on the 12.54 Pine Grove Properties site that was recently annexed into the City of Manzanita. I understand that the applicant is proposing the first of two development phases, with the first phase being 60 dwelling units and the second phase being 68 dwelling units, for a total of 128 units at buildout.

## Transportation Impact Study

It is recommended that a Transportation Impact Study (TIS) be conducted and submitted as part of the land use application. This letter provides a detailed scope of work for the applicant. The TIS should be prepared by a professional engineer registered in Oregon with specific experience in transportation engineering.

### **Trip Generation & Distribution**

Project-generated trips should be calculated based on the 11<sup>th</sup> Edition of the *Trip Generation Manual*, published by the Institute of Transportation Engineers (ITE). If other trip generation rates or information are used, they should first be reviewed and approved by the City of Manzanita.

The distribution of project-generated trips should be assigned to the surrounding roadway network based on the traffic count data as well as anticipated trip origins and destinations and expected travel routes to and from the site. Access to the site will be only via Necarney City Road on the eastern edge of the Manzanita city limits. The TIS should quantify the number of trips that will travel to and from the east toward Highway 101 and the number of trips that will travel to and from the west to Manzanita and Highway 101 at Laneda Avenue. Local destinations in and near Manzanita should also be identified.

### **Project Study Area**

Based on the anticipated trip generation and distribution, traffic counts and a full operational analysis shall be required at the intersection of Necarney City Road and the new site access location. Traffic counts shall be conducted at these intersections during typical weekday conditions during the evening peak hours (4:00 to 6:00 PM) as well as the Saturday afternoon peak (noon to 3:00 PM).

The operational analysis of the study-area intersection shall include left-turn lane warrants to determine the potential need for an eastbound left-turn lane on Necarney City Road, as well as an examination of sight distance. Requirements for intersection and stopping sight distances shall be based on the standards in the 7<sup>th</sup> Edition of *A Policy on Geometric Design of Highways and Streets*, published by AASHTO.

It is recognized that only the first phase of development is proposed at this time, but it is recommended that the applicant examine conditions with the site at full build out to ensure that the new intersection is constructed in a manner that can accommodate the long-term demands of the site. This will help avoid future modifications to the intersection.

If you have any questions regarding this scope of work, please do not hesitate to call.

Sincerely,

A handwritten signature in blue ink, appearing to read "Todd E. Mobley". The signature is fluid and cursive, with a long horizontal stroke at the beginning and a sharp downward hook at the end.

Todd E. Mobley, PE  
Principal



## Clara Layton

---

**From:** Todd Mobley <todd@lancastermobley.com>  
**Sent:** Tuesday, October 29, 2024 10:56 AM  
**To:** Clara Layton  
**Cc:** Brent Ahrend; Scott Gebhart  
**Subject:** Re: Manzanita Workforce Housing TIA Scoping Letter  
**Attachments:** Traffic Counts - 45411.pdf; 11LTR-City of Manzanita-Traffic Scoping-240812.pdf

**Follow Up Flag:** Follow up  
**Flag Status:** Completed

Hi Clara,

I have inserted my comments below in **red**. Thanks for sending this along and let me know if you have any questions.

-Todd

Todd E. Mobley, PE

Principal



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Website: [lancastermobley.com](https://www.lancastermobley.com)

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On Thu, Oct 24, 2024 at 3:46 PM Clara Layton <[CLayton@mcknze.com](mailto:CLayton@mcknze.com)> wrote:

Good afternoon!

I'm forwarding on Brent's scoping letter, and a few questions:

- Our traffic counter equipment was vandalized and we have counts until 2:45 PM. Will that work? Counts attached.

It looks like you captured the peak, so I think that should be fine.

- Your scoping letter didn't include mention of any in-process projects. Can you confirm that we should include the following: Manzanita Lofts, Heron's Rest, and possible trips from the expansion in Nehalem Bay State Park? Do you have any further information about the expansion?

Your list is accurate, but there have also been some other smaller projects that didn't do traffic studies, so I would suggest a growth rate in addition to the in-process trips. The 1% you suggest below seems reasonable for this. As for the State Park, their master plan was just approved last month by Tillamook County. My understanding is that the immediate projects at the park will be maintenance and not expansion, but the master plan does include new campsites, more parking at the marina, and associated park upgrades. ODOT told Parks that they wouldn't generate more than 50 peak hour or 500 daily trips so they didn't need a traffic study. Arielle in Region 2 Traffic provided some trip generation info and helped them respond to some opposition testimony. That information is here:

[https://www.tillabook.org/sites/default/files/fileattachments/community\\_development/project/95710/materials\\_provided\\_by\\_applicant\\_at\\_july\\_11\\_2024\\_hearing\\_nehalem\\_bay\\_state\\_park.pdf](https://www.tillabook.org/sites/default/files/fileattachments/community_development/project/95710/materials_provided_by_applicant_at_july_11_2024_hearing_nehalem_bay_state_park.pdf)

I would recommend adding trips for the park expansion as in-process.

- Can you approve a growth rate of 1% per year? We're calculating a seasonal adjustment factor based on Coastal Destination.

This is acceptable.

- We had Necarney City Rd/Pine Ridge Ln counted to determine trip distribution as the closest intersection with a comparable development. The count is helpful for roadway volumes, but we're finding the gated community trip distribution inconsistent with our assumptions. We'll keep crunching the numbers, let us know what you think.

The count data you have at Pine Ridge shows something close to a 60/40 split with the majority out Necarney to 101. Google shows the fastest route from the site to points along 101, even points to the north, is via Necarney. That might be, but it is probably more dependent on the perception of local drivers about where it is easier to turn left onto the highway. A gated community might have a different distribution than workforce housing, but I would expect the workforce housing might have a heavier split into Manzanita than the Pine Ridge neighborhood since most local employment would be in Manzanita proper.

I'll let you and Brent sort out the analysis, but those are my thoughts on the distribution. You might also say a few things in the TIA about sensitivity because I suspect small changes to the distribution percentages won't give you different results and findings overall.



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---

APPENDIX C.  
**TRANSIT  
INFORMATION**



## Fares/ Tarifas

Each Way, Per Zone/

Ida o vuelta, por zona.....\$1.50

**Zone 1:** Hobsonville Point (S. of Garibaldi) to Sand Lake Rd (N. of Hemlock)

**Zone 2:** Clatsop County Line to Hobsonville Point (S. of Garibaldi)

**Zone 3:** Sand Lake Rd (N. of Hemlock) to Lincoln County Line

**Lincoln County Zone:** Starts at Lincoln County Line

**Clatsop County Zone:** Starts at Clatsop County Line

## Child Fares/ Tarifas Para Niños

First Child/ Primer Niño (0-4).....FREE

Additional Child/ Niño adicional (0-4)...1/2 Fare

Child/ Niño (5-11).....1/2 Fare

(When traveling with a full fare adult/ Al viajar con un adulto que paga la tarifa completa)

## Monthly Pass/ Pase de Un Mes

Regular/ Regular.....\$40

Reduced/ Descuento.....\$30

*Reduced fares offered for age 60+, children, & individuals with verifiable short or long term disability/ Se ofrecen tarifas con descuento para mayores de 60 años, niños y personas con discapacidades de corto o largo plazo comprobables*

## No Bus Service/ No Hay Servicio de Autobuses

New Years Day/ Año Nuevo

Thanksgiving Day/ Día de Acción de Gracias

Christmas Day/ Navidad

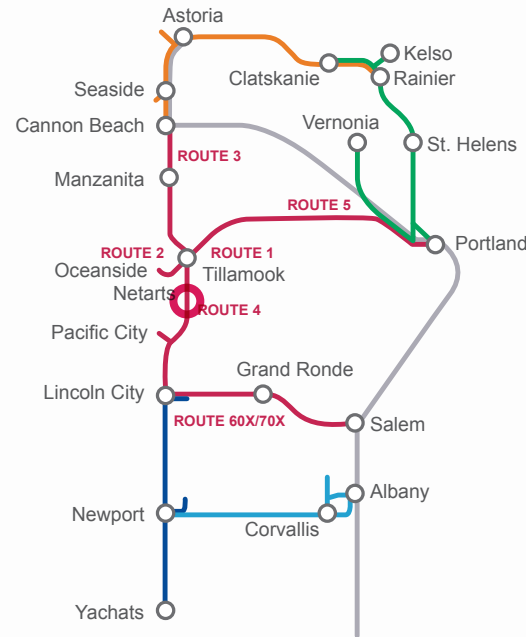
## Route & Schedule Info/ Información de Rutas y Horarios

800-815-8283

www.TillamookBus.com

800-735-2700/TTY

**nwCONNECTOR**  
NWCONNECTOR.ORG



## NWCONNECTOR Visitor Pass/ Pase Para Visitantes

3 Days/ 3 Días \$25

7 Days/ 7 Días \$30

(includes a round trip to Portland or Salem and unlimited travel on NWConnector routes/ Incluye un viaje redondo a Portland o Salem y viajes ilimitados en las rutas de NWConnector)

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### Lincoln County Transit

nwconnector.org | 541-265-4900

### Sunset Empire Transportation District

nwconnector.org | 503-861-7433

### Point Bus

oregon-point.com | 1-888-846-4183

### Greyhound

greyhound.com | 1-800-231-2222

### Amtrak

amtrak.com | 1-800-872-7245

### Tri-Met

trimet.org | 503-238-7433

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A partir del 23 de enero de 2022



# Tillamook County Transportation District



# ROUTE/ RUTA 3 Tillamook - Cannon Beach

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EL SERVICIO OPERA LOS 7 DÍAS DE LA SEMANA



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PARA OBTENER INFORMACIÓN SOBRE LOS AUTOBUSES EN TIEMPO REAL, DESCARGUE LA APLICACIÓN TRANSIT.

Transit Center 2nd & Laurel	Tillamook Fred Meyer	Idaville	Bay City	Garibaldi	Rockaway Beach	Wheeler	Nehalem	Manzanita	Cannon Beach
1	2	3	4	5	6	7	8	9	10
<b>Northbound</b>									
4:55	5:00	5:06	5:09	5:17	5:27	5:45	5:53	5:59	--
9:03	9:08	9:14	9:17	9:25	9:35	9:53	10:01	10:07	10:27
<b>1:50</b>	<b>1:55</b>	<b>2:01</b>	<b>2:04</b>	<b>2:12</b>	<b>2:22</b>	<b>2:40</b>	<b>2:48</b>	<b>2:54</b>	<b>3:14</b>
<b>6:05</b>	<b>6:10</b>	<b>6:16</b>	<b>6:19</b>	<b>6:27</b>	<b>6:37</b>	<b>6:55</b>	<b>7:03</b>	<b>7:09</b>	<b>7:29</b>

**Bold/ Negritas = PM**

Cannon Beach	Manzanita	Nehalem	Wheeler	Rockaway Beach	Garibaldi	Bay City	Idaville	Tillamook Fred Meyer	Transit Center 2nd & Laurel
10	9	8	7	6	5	4	3	2	1
<b>Southbound</b>									
--	6:09	6:15	6:23	6:41	6:51	6:59	7:02	7:08	7:13
10:37	10:57	11:03	11:11	11:29	11:39	11:47	11:50	11:56	<b>12:01</b>
<b>3:24</b>	<b>3:44</b>	<b>3:50</b>	<b>3:58</b>	<b>4:16</b>	<b>4:26</b>	<b>4:34</b>	<b>4:37</b>	<b>4:43</b>	<b>4:48</b>
<b>7:39</b>	<b>7:59</b>	<b>8:05</b>	<b>8:13</b>	<b>8:31</b>	<b>8:41</b>	<b>8:49</b>	<b>8:52</b>	<b>8:58</b>	<b>9:03</b>

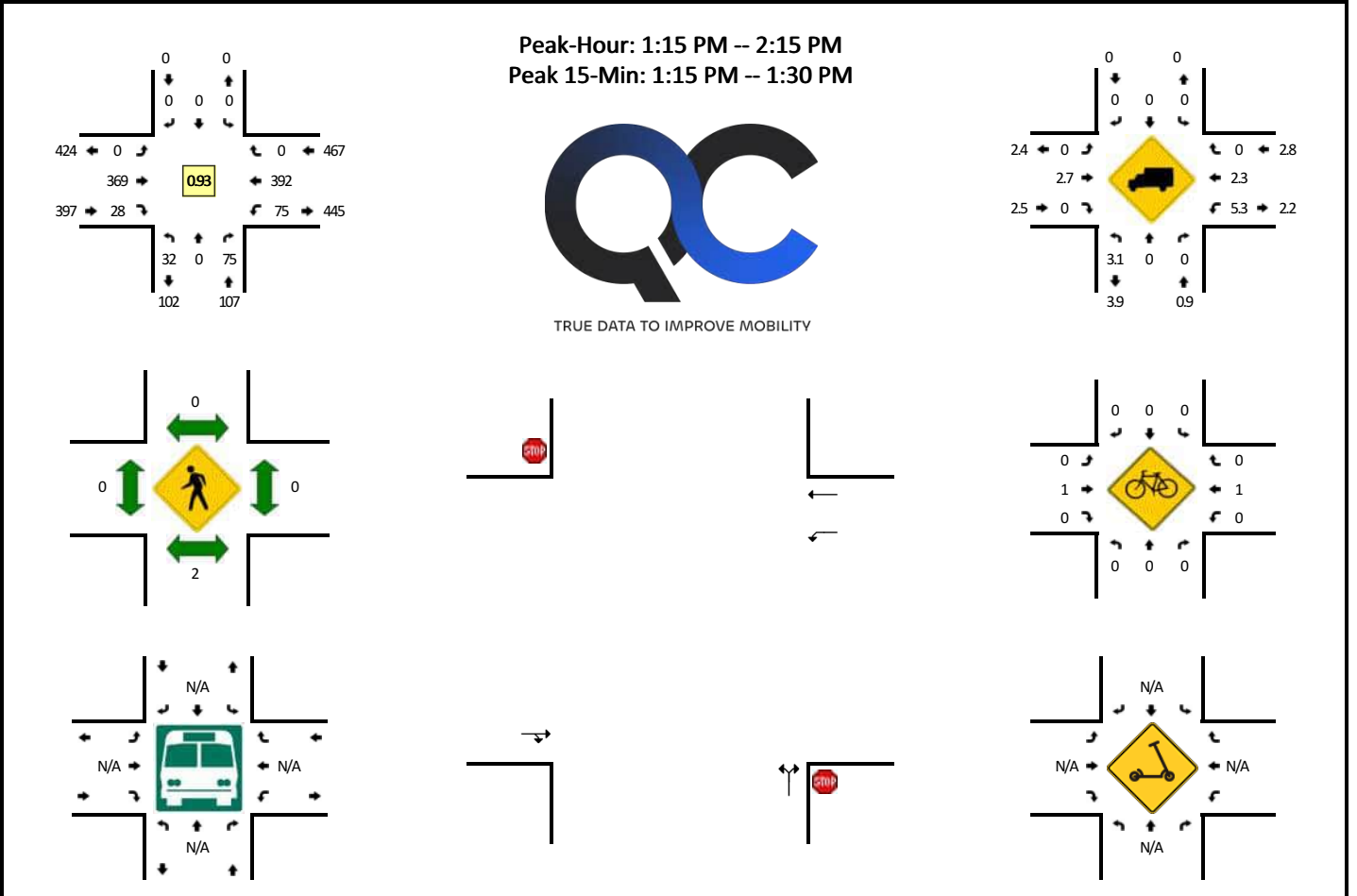
**Bold/ Negritas = PM**

---

APPENDIX D.  
**TRAFFIC COUNT  
SUMMARIES**

**LOCATION:** Necarney City Rd -- Oregon Coast Hwy  
**CITY/STATE:** Bayside Gardens, OR

**QC JOB #:** 16790002  
**DATE:** Sat, Oct 12 2024

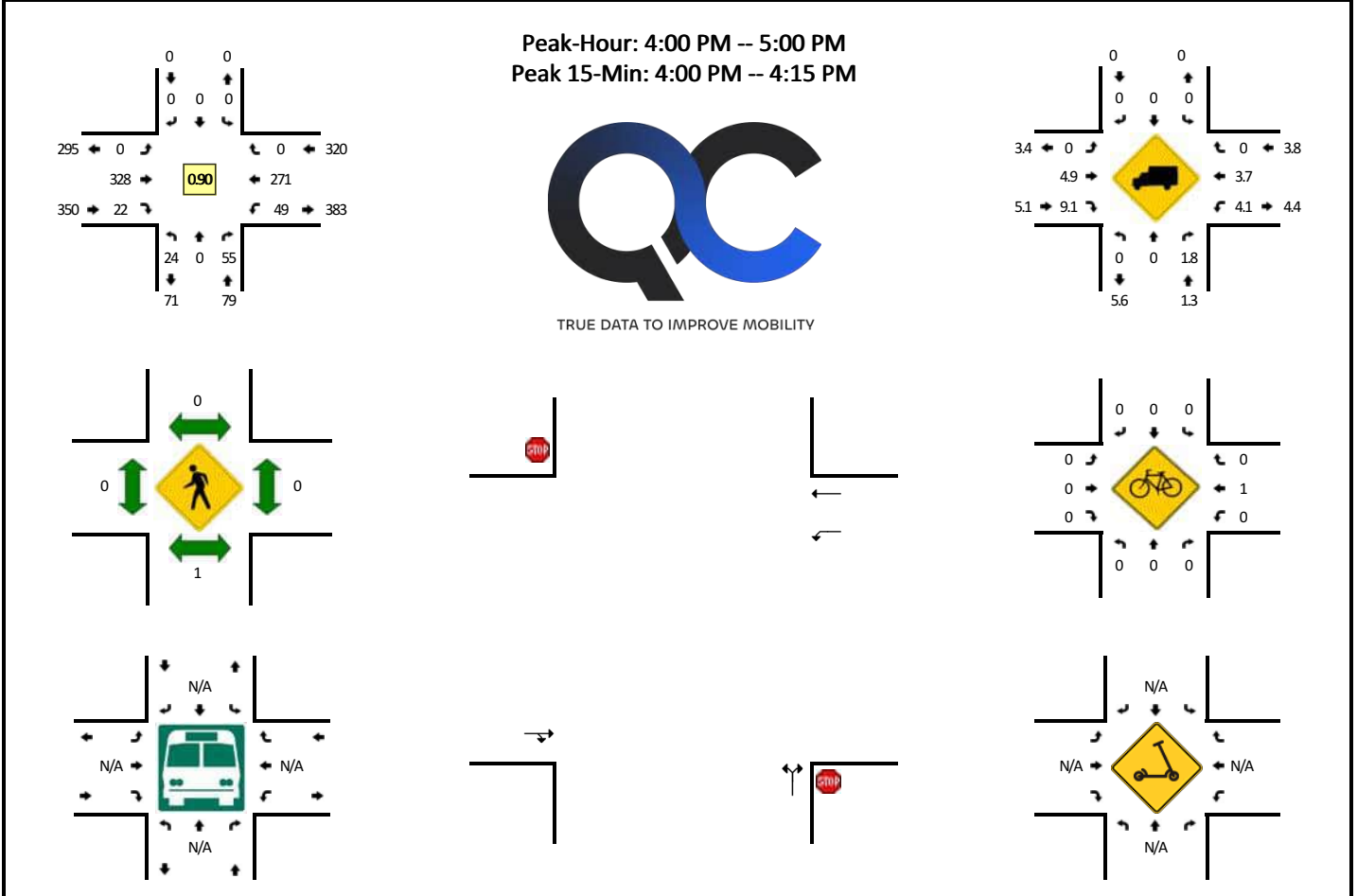


15-Min Count Period Beginning At	Necarney City Rd (Northbound)				Necarney City Rd (Southbound)				Oregon Coast Hwy (Eastbound)				Oregon Coast Hwy (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
12:00 PM	6	0	18	0	0	0	0	0	0	83	9	0	11	85	0	0	212	
12:15 PM	8	0	25	0	0	0	0	0	0	81	7	0	10	91	0	0	222	
12:30 PM	7	0	16	0	0	0	0	0	0	92	7	0	18	85	0	0	225	
12:45 PM	8	0	22	0	0	0	0	0	0	84	8	0	13	106	0	0	241	900
1:00 PM	6	0	14	0	0	0	0	0	0	89	9	0	17	80	0	0	215	903
1:15 PM	13	0	19	0	0	0	0	0	0	97	5	0	22	103	0	1	260	941
1:30 PM	4	0	19	0	0	0	0	0	0	100	8	0	13	84	0	0	228	944
1:45 PM	9	0	21	0	0	0	0	0	0	80	5	0	18	90	0	0	223	926
2:00 PM	6	0	16	0	0	0	0	0	0	92	10	0	21	115	0	0	260	971
2:15 PM	6	0	25	0	0	0	0	0	0	89	6	0	13	101	0	0	240	951
2:30 PM	5	0	10	0	0	0	0	0	0	85	4	0	15	95	0	0	214	937
2:45 PM	5	0	19	0	0	0	0	0	0	86	6	0	21	95	0	0	232	946
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
All Vehicles	52	0	76	0	0	0	0	0	0	388	20	0	88	412	0	4	1040	
Heavy Trucks	4	0	0	0	0	0	0	0	0	12	0	0	4	0	0	0	20	
Buses																		
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bicycles																		
Scoters																		

Comments:

**LOCATION:** Necarney City Rd -- Oregon Coast Hwy  
**CITY/STATE:** Bayside Gardens, OR

**QC JOB #:** 16790001  
**DATE:** Thu, Oct 10 2024

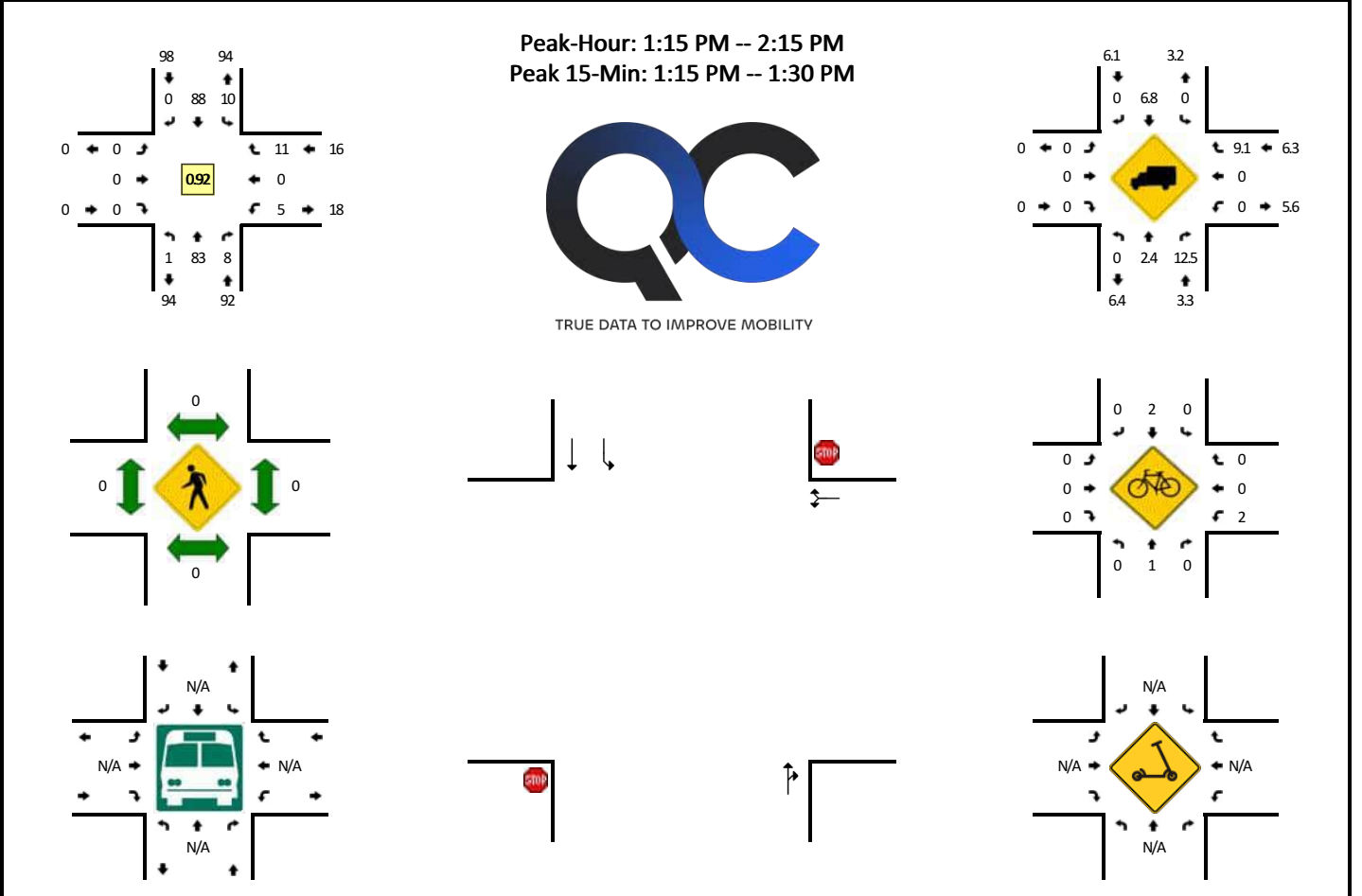


15-Min Count Period Beginning At	Necarney City Rd (Northbound)				Necarney City Rd (Southbound)				Oregon Coast Hwy (Eastbound)				Oregon Coast Hwy (Westbound)				Total	Hourly Totals	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U			
4:00 PM	3	0	12	0	0	0	0	0	0	90	6	0	12	84	0	0	207		
4:15 PM	11	0	12	0	0	0	0	0	0	90	4	0	14	69	0	0	200		
4:30 PM	7	0	17	0	0	0	0	0	0	92	4	0	14	63	0	0	197		
4:45 PM	3	0	14	0	0	0	0	0	0	56	8	0	9	55	0	0	145	749	
5:00 PM	2	0	11	0	0	0	0	0	0	74	6	0	11	71	0	0	175	717	
5:15 PM	2	0	10	0	0	0	0	0	0	78	2	0	7	48	0	0	147	664	
5:30 PM	3	0	8	0	0	0	0	0	0	63	2	0	10	54	0	0	140	607	
5:45 PM	3	0	8	0	0	0	0	0	0	69	6	0	12	67	0	0	165	627	
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total		
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U			
All Vehicles	12	0	48	0	0	0	0	0	0	360	24	0	48	336	0	0	828		
Heavy Trucks	0	0	0		0	0	0		0	28	0		4	8	0		40		
Buses																			
Pedestrians		4				0				0				0			4		
Bicycles	0	0	0		0	0	0		0	0	0		0	4	0		4		
Scoters																			

Comments:

**LOCATION:** Necarney City Rd -- Pine Ridge Ln  
**CITY/STATE:** Bayside Gardens, OR

**QC JOB #:** 16790006  
**DATE:** Sat, Oct 12 2024

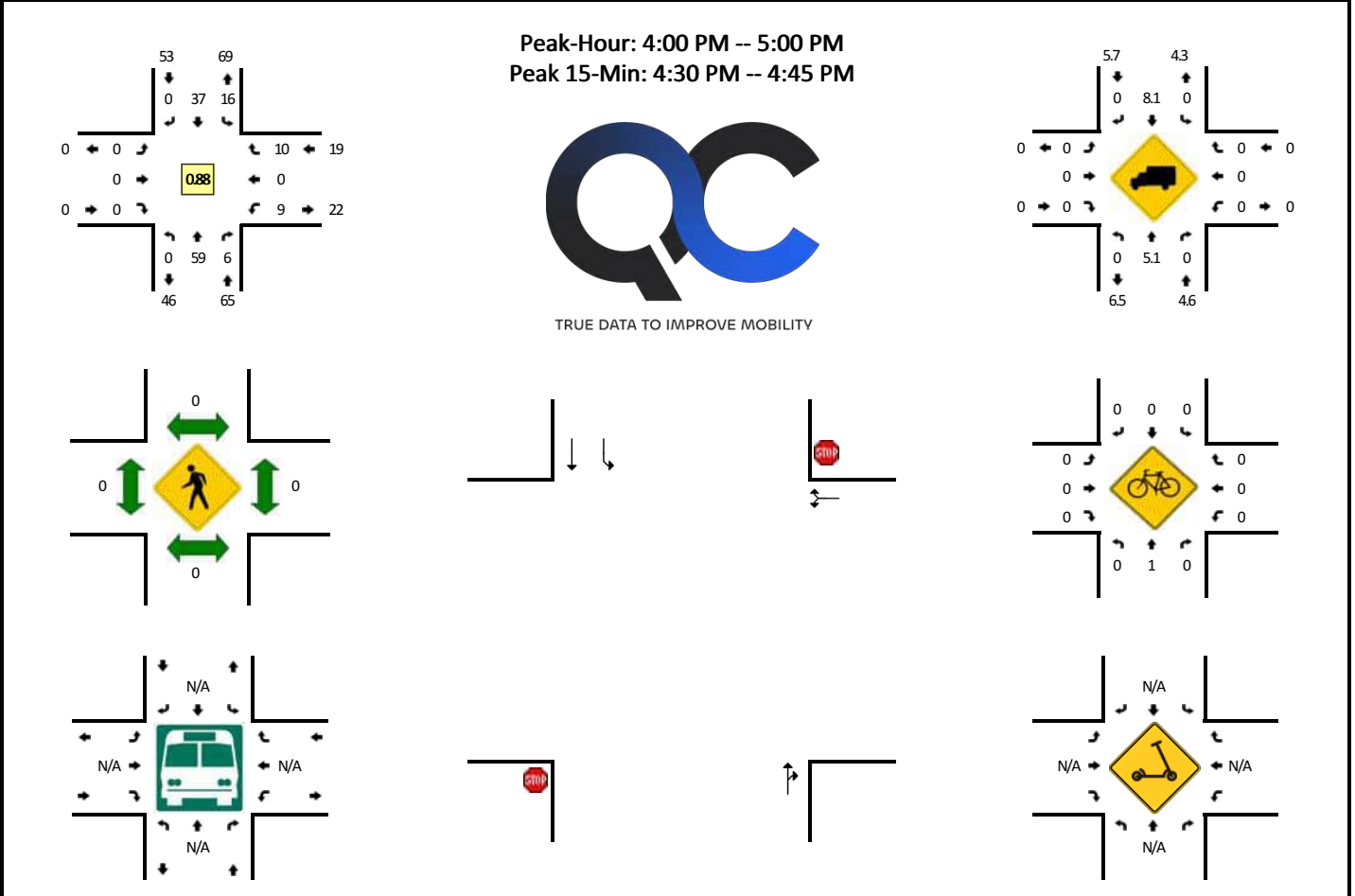


15-Min Count Period Beginning At	Necarney City Rd (Northbound)				Necarney City Rd (Southbound)				Pine Ridge Ln (Eastbound)				Pine Ridge Ln (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
11:30 AM	0	16	2	0	4	17	0	0	0	0	0	0	4	0	3	0	46	
11:45 AM	0	14	2	0	3	15	0	0	0	0	0	0	3	0	3	0	40	
12:00 PM	0	16	3	0	1	13	0	0	0	0	0	0	4	0	4	0	41	
12:15 PM	0	24	5	0	3	23	0	0	0	0	0	0	1	0	1	0	57	184
12:30 PM	0	17	2	0	0	24	0	0	0	0	0	0	2	0	3	0	48	186
12:45 PM	0	25	3	0	6	18	0	0	0	0	0	0	2	0	2	0	56	202
1:00 PM	0	14	4	0	2	22	0	0	0	0	0	0	1	0	3	0	46	207
1:15 PM	0	22	2	0	3	27	0	0	0	0	0	0	0	0	2	0	56	206
1:30 PM	0	17	3	1	2	21	0	0	0	0	0	0	2	0	3	0	49	207
1:45 PM	0	24	1	0	3	14	0	0	0	0	0	0	2	0	3	0	47	198
2:00 PM	0	20	2	0	2	26	0	0	0	0	0	0	1	0	3	0	54	206
2:15 PM	0	18	5	0	4	16	0	0	0	0	0	0	3	0	5	0	51	201
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
All Vehicles	0	88	8	0	12	108	0	0	0	0	0	0	0	0	8	0	224	
Heavy Trucks	0	4	4		0	12	0		0	0	0		0	0	0		20	
Buses																		
Pedestrians	0	0			0	0			0	0			0	0			0	
Bicycles	0	4	0		0	4	0		0	0	0		0	0	0		8	
Scoters																		

Comments:

**LOCATION:** Necarney City Rd -- Pine Ridge Ln  
**CITY/STATE:** Bayside Gardens, OR

**QC JOB #:** 16790005  
**DATE:** Thu, Oct 10 2024



15-Min Count Period Beginning At	Necarney City Rd (Northbound)				Necarney City Rd (Southbound)				Pine Ridge Ln (Eastbound)				Pine Ridge Ln (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	16	1	0	5	11	0	0	0	0	0	0	3	0	1	0	37	
4:15 PM	0	11	2	0	2	8	0	0	0	0	0	0	4	0	3	0	30	
4:30 PM	0	20	2	0	7	7	0	0	0	0	0	0	1	0	2	0	39	
4:45 PM	0	12	1	0	2	11	0	0	0	0	0	0	1	0	4	0	31	137
5:00 PM	0	7	4	0	3	9	0	0	0	0	0	0	1	0	4	0	28	128
5:15 PM	0	9	1	0	3	6	0	0	0	0	0	0	1	0	2	0	22	120
5:30 PM	0	5	1	0	4	6	0	0	0	0	0	0	1	0	2	0	19	100
5:45 PM	0	6	1	0	6	10	0	0	0	0	0	0	0	0	1	0	24	93
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	80	8	0	28	28	0	0	0	0	0	0	4	0	8	0	156	
Heavy Trucks	0	4	0		0	0	0		0	0	0		0	0	0		4	
Buses																	0	
Pedestrians		0				0				0				0			0	
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Scoters																	0	

Comments:

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APPENDIX E.  
**SEASONAL  
ADJUSTMENT  
CALCULATIONS**



**SEASONAL TREND TABLE (Updated: 11/08/2023 )**

TREND	1-Jan	15-Jan	1-Feb	15-Feb	1-Mar	15-Mar	1-Apr	15-Apr	1-May	15-May	1-Jun	15-Jun	1-Jul	15-Jul	1-Aug	15-Aug	1-Sep	15-Sep	1-Oct	15-Oct	1-Nov	15-Nov	1-Dec	15-Dec	Seasonal Trend Peak Period Factor
INTERSTATE URBANIZED	1.0869	1.1041	1.0688	1.0335	1.0182	1.0028	0.9995	0.9962	0.9901	0.9840	0.9641	0.9443	0.9502	0.9562	0.9510	0.9458	0.9575	0.9692	0.9791	0.9891	1.0107	1.0324	1.0532	1.0739	0.9443
INTERSTATE NONURBANIZED	1.2459	1.2915	1.2286	1.1657	1.0907	1.0158	1.0059	0.9960	0.9728	0.9496	0.9128	0.8760	0.8650	0.8540	0.8612	0.8684	0.8905	0.9126	0.9488	0.9850	1.0336	1.0822	1.1717	1.2612	0.8540
COMMUTER	1.0905	1.0986	1.0636	1.0285	1.0162	1.0038	0.9959	0.9879	0.9814	0.9749	0.9631	0.9512	0.9614	0.9717	0.9608	0.9500	0.9548	0.9595	0.9634	0.9673	1.0090	1.0507	1.0733	1.0958	0.9500
COASTAL DESTINATION	1.2064	1.1715	1.1234	1.0753	1.0545	1.0337	1.0372	1.0407	1.0216	1.0024	0.9586	0.9147	0.8760	0.8372	0.8371	0.8370	0.8678	0.8985	0.9578	1.0170	1.0730	1.1290	1.1823	1.2357	0.8370
COASTAL DESTINATION ROUTE	1.3937	1.2897	1.2245	1.1594	1.1247	1.0901	1.0911	1.0921	1.0516	1.0111	0.9493	0.8875	0.8172	0.7469	0.7455	0.7440	0.7916	0.8391	0.9274	1.0158	1.1126	1.2094	1.3193	1.4291	0.7440
AGRICULTURE	1.4537	1.4624	1.3705	1.2786	1.2139	1.1492	1.1207	1.0923	1.0075	0.9226	0.8742	0.8258	0.8348	0.8439	0.8422	0.8405	0.7976	0.7547	0.8073	0.8598	1.0041	1.1484	1.3339	1.5194	0.7547
RECREATIONAL SUMMER	1.6049	1.5814	1.4924	1.4034	1.3208	1.2382	1.2380	1.2377	1.0939	0.9500	0.8669	0.7839	0.7392	0.6945	0.7065	0.7185	0.7404	0.7624	0.8468	0.9311	1.1270	1.3230	1.5054	1.6879	0.6945
RECREATIONAL SUMMER WINTER	1.0075	0.9570	0.9184	0.8799	0.9701	1.0603	1.0675	1.0747	1.0843	1.0939	1.0045	0.9151	0.8244	0.7336	0.7795	0.8254	0.9368	1.0482	1.1794	1.3105	1.4969	1.6833	1.3470	1.0108	0.7336
RECREATIONAL WINTER**	0.8059	0.6710	0.6475	0.6240	0.7462	0.8685	0.9307	0.9928	1.1496	1.3064	1.2173	1.1282	0.9996	0.8709	0.9526	1.0342	1.1225	1.2108	1.4061	1.6013	1.9826	2.3639	1.6332	0.9026	0.6240
SUMMER	1.2374	1.2352	1.1733	1.1114	1.0786	1.0459	1.0330	1.0202	0.9851	0.9500	0.9160	0.8819	0.8660	0.8501	0.8561	0.8620	0.8891	0.9161	0.9430	0.9698	1.0525	1.1352	1.2002	1.2653	0.8501
SUMMER < 2500	1.2836	1.2576	1.1943	1.1310	1.1011	1.0712	1.0448	1.0184	0.9633	0.9082	0.8861	0.8641	0.8609	0.8578	0.8695	0.8813	0.8874	0.8936	0.9165	0.9394	1.0500	1.1607	1.2535	1.3463	0.8578

\* Seasonal Trend Table factors are based on previous year ATR data. The table is updated yearly.

\* Grey shading indicates months where seasonal factor is greater than or less than 30%

\*\*Use Recreation Winter Trend with Caution! ATR site was down for most of of 2022 due to loop issues and was estimated while the site was down

Seasonal Adjustment Factor (October 10th):	1.19
--	------

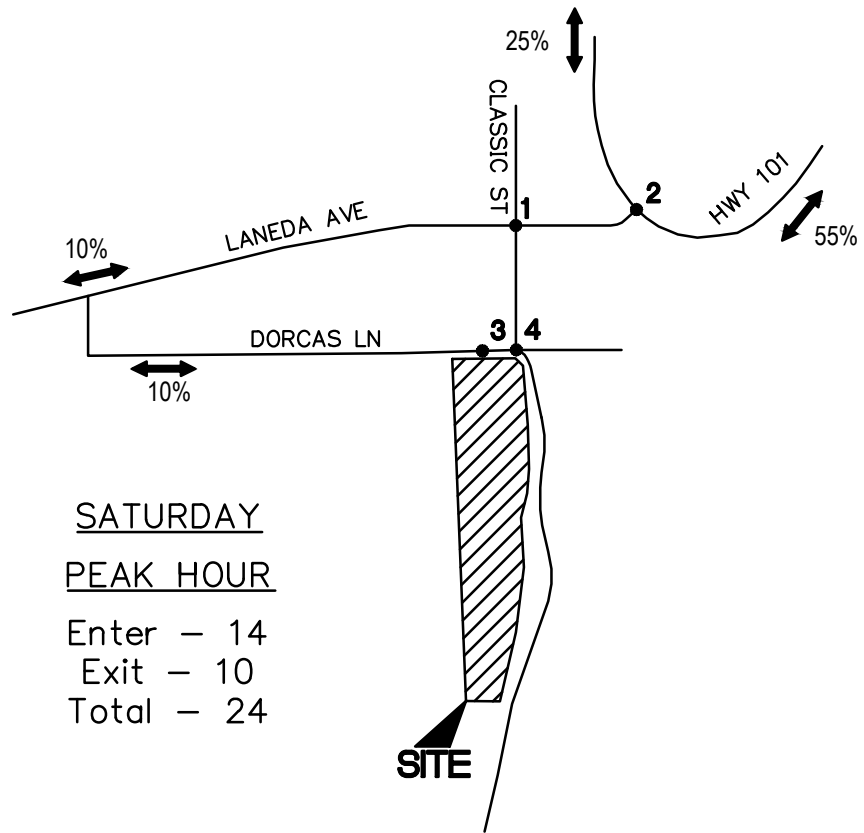


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APPENDIX F.  
**IN-PROCESS TRIPS**



NOT TO SCALE



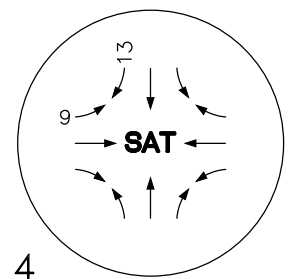
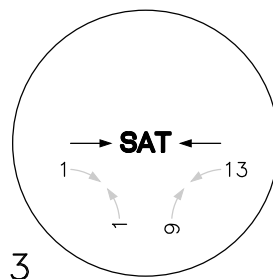
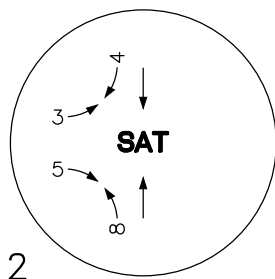
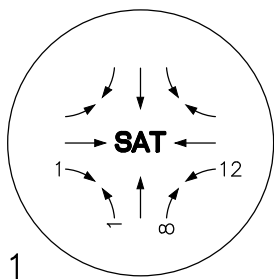
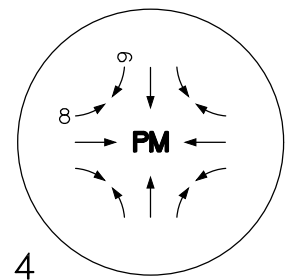
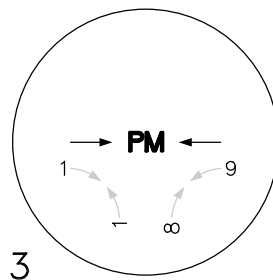
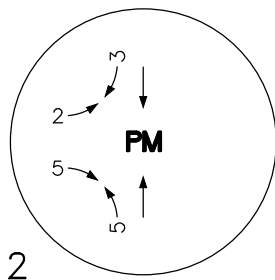
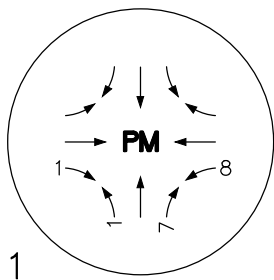
PM PEAK HOUR

Enter - 10  
 Exit - 9  
 Total - 19

SATURDAY

PEAK HOUR

Enter - 14  
 Exit - 10  
 Total - 24



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 Vancouver 360.695.7879  
 Seattle 206.749.9993  
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 Planning - Engineering

MACKENZIE

DATE: 4.27.2023

DRAWN BY: CNL

CHECKED BY: BTA

JOB NO:  
 222012000

PRIMARY TRIP DISTRIBUTION  
 + ASSIGNMENT -  
 PM + SATURDAY PEAK HOURS

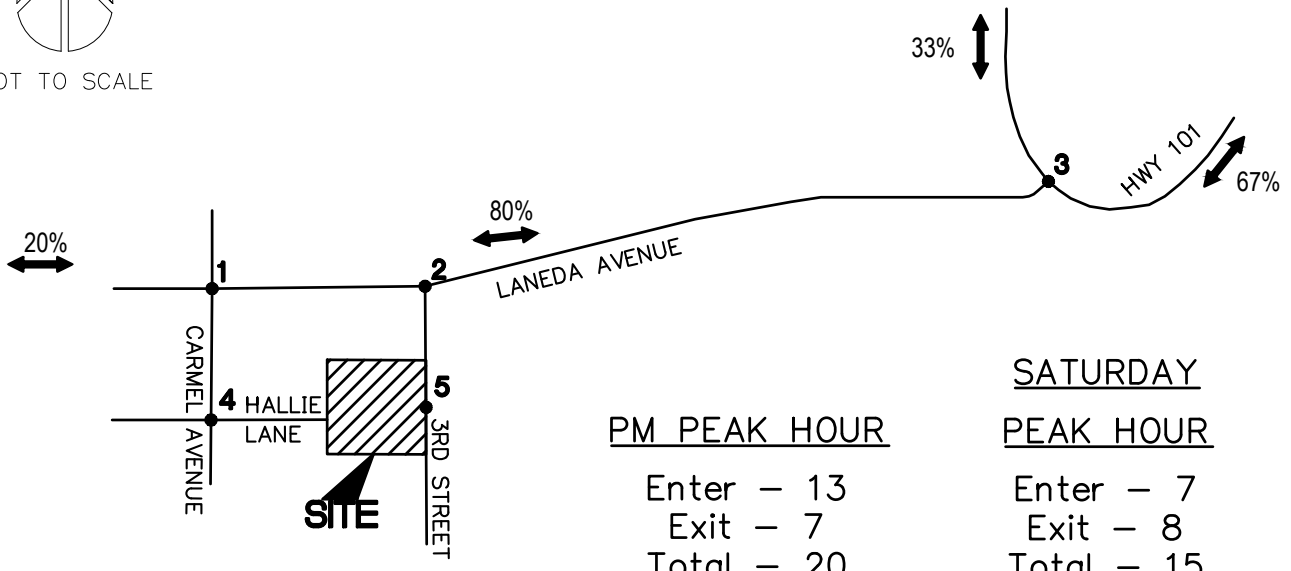
MANZANITA LOFTS  
 MANZANITA, OREGON

FIGURE

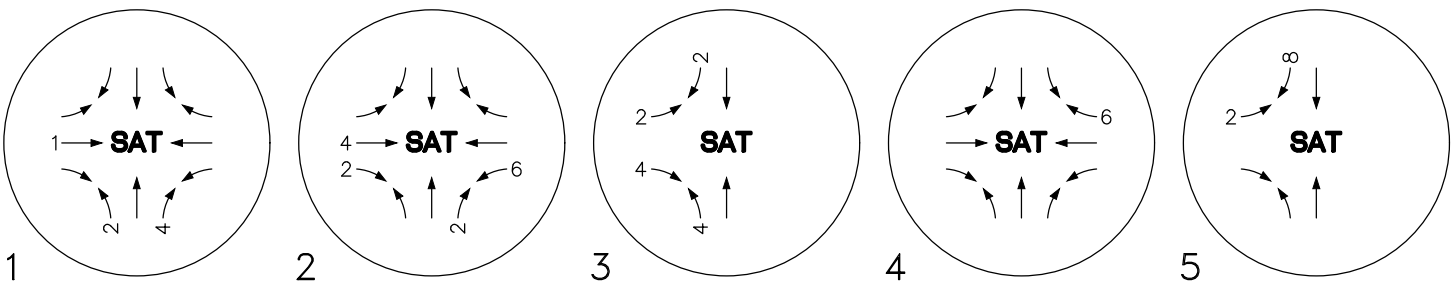
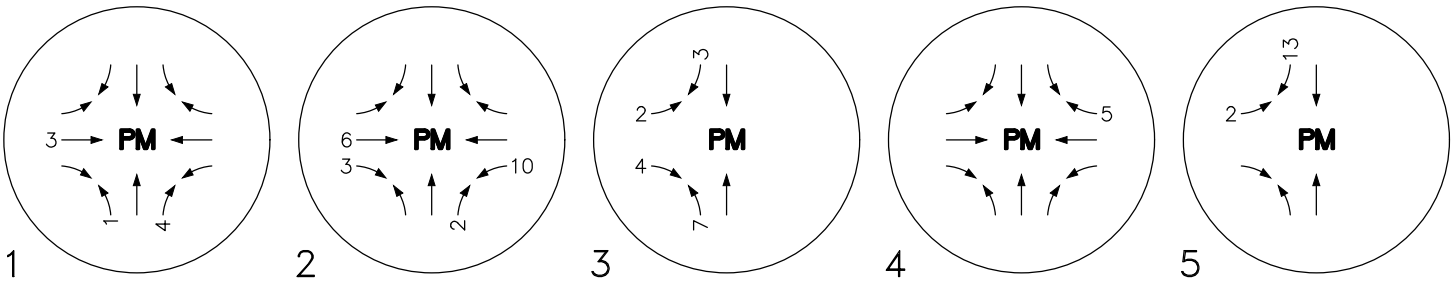
8



NOT TO SCALE



	<u>SATURDAY</u>
	<u>PM PEAK HOUR</u>
Enter	13
Exit	7
Total	20
	<u>PEAK HOUR</u>
Enter	7
Exit	8
Total	15



**M** **Portland** 503.224.9560 **Vancouver** 360.685.7879 **Seattle** 206.749.9993  
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**Planning - Engineering**

**MACKENZIE**  
 DATE: 9.21.2022  
 DRAWN BY: CNL  
 CHECKED BY: JTJ  
 JOB NO:  
 222019400

**PRIMARY TRIP DISTRIBUTION  
 + ASSIGNMENT -**  
 HERON'S REST  
 MANZANITA, OREGON

**FIGURE**  
**8**

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 USED OR REPRODUCED IN ANY MANNER, WITHOUT PRIOR WRITTEN PERMISSION

ODOT REVISED Trip Generation Analysis

Received from Arielle Childress by email 7.11.2024, 3:21 PM

ITE Code	Land Use Description	Independent Variable	No. of Units	Avg Rate or Eq	Rates					Total Trips					In/Out Trips					
					Weekday			Weekend		Weekday		Weekend			Weekday			Weekend		
					Daily Rate	AM Peak Rate	PM Peak Rate	Daily Rate	Peak Rate	Daily Trips	AM Peak Trips	PM Peak Trips	Daily Trips	Peak Trips	AM Trips In	AM Trips Out	PM Trips In	PM Trips Out	Peak Trips In	Peak Trips Out
					<b>Existing Use Totals</b>															
416	Campground/RV Park	Acre(s)	21	Avg		0.48	0.98				10	21			4	6	14	7		
420	Marina	Berth(s)	32	Avg	2.41	0.07	0.21	2.61	0.22	78	2	7	84	7	1	1	4	3	3	4
					<b>Proposed Use Totals</b>					78	12	28	84	7	5	7	18	10	3	4

**JOHNSON Tracy \* OPRD**

**From:** CHILDRESS Arielle <Arielle.CHILDRESS@odot.oregon.gov>  
**Sent:** Thursday, July 11, 2024 3:20 PM  
**To:** JOHNSON Tracy \* OPRD  
**Subject:** RE: Nehalem Bay State Park Improvements ITE Codes

Here's the table as a picture. If it doesn't print properly from within the email you should be able to easily place into a word doc.

ITE Code	Land Use Description	Independent Variable	No. of Units	Avg Rate or Eq	Rates					Total Trip			
					Weekday			Weekend		Weekday			
					Daily Rate	AM Peak Rate	PM Peak Rate	Daily Rate	Peak Rate	Daily Trips	AM Peak Trips	PM Peak Trips	
					Existing Use Totals								
416	Campground/RV Park	Acre(s)	21	Avg		0.48	0.98				10	21	
420	Marina	Berth(s)	32	Avg	2.41	0.07	0.21	2.61	0.22	78	2	7	
					Proposed Use Totals					78	12	28	

**Arielle Childress, P.E. (she/her/hers)**  
 Traffic Analysis Engineer

ODOT Region 2  
455 Airport Rd. SE, Bldg. B, Salem, OR 97031  
(971) 208-1290

---

**From:** JOHNSON Tracy \* OPRD <Tracy.JOHNSON@opr.oregon.gov>  
**Sent:** Thursday, July 11, 2024 3:13 PM  
**To:** CHILDRESS Arielle <Arielle.CHILDRESS@odot.oregon.gov>  
**Subject:** RE: Nehalem Bay State Park Improvements ITE Codes

You don't often get email from [tracy.johnson@opr.oregon.gov](mailto:tracy.johnson@opr.oregon.gov). [Learn why this is important](#)

This message was sent from outside the organization. Treat attachments, links and requests with caution. Be conscious of the information you share if you respond.

Hi again,  
I have a huge favor to ask. Could you please pdf the table and send it as an attachment? It isn't printing correctly within the body of the email text.

Thanks,



**Tracy Johnson, PLA** | Senior Project Manager  
OPRD | Central Park Services – Park Improvement, Engineering Division  
971.283.6805

---

**From:** CHILDRESS Arielle <Arielle.CHILDRESS@odot.oregon.gov>  
**Sent:** Thursday, July 11, 2024 2:47 PM  
**To:** Cassandra Dobson <CDobson@parametrix.com>; VYMAZAL Zdenek G <Zdenek.G.VYMAZAL@odot.oregon.gov>  
**Cc:** JOHNSON Tracy \* OPRD <Tracy.JOHNSON@opr.oregon.gov>; Jennifer Hughes <JHughes@parametrix.com>; Ryan Rudnick <RRudnick@parametrix.com>  
**Subject:** RE: Nehalem Bay State Park Improvements ITE Codes

You don't often get email from [arielle.childress@odot.oregon.gov](mailto:arielle.childress@odot.oregon.gov). [Learn why this is important](#)

Cassandra,

Please see responses below in red. A note on LUC 411 (Public Park), it doesn't provide daily weekday trips when using Dail Trail Users as the independent variable. It only provides data for Saturday and Sunday. It also only has one data point so I caution against using it. Therefore, I applied LUC 420 (Marina) instead.

- Are the empty rows for total trips and in/out trips for campground/RV park (highlighted below) intentionally empty, or is there data that should be shown there? **No daily weekday data is available for this land use. A very rough way to estimate is assume the PM peak hour is 10% of daily traffic, but this is a very general traffic assumption and not specific to your land use. This translates to the Campground/RV park having 210 daily trips with the total proposed uses having 288 daily trips. If it's absolutely necessary you can modify the table below as I embedded it as a table, and not a picture.**
- Is it possible to show the total trips from the proposed improvements as “proposed use totals” rather than “existing use totals” to make it clear that they are trips resulting from the proposed changes? **I've moved the trip generation down into the “proposed use” section.**
- It appears that the analysis included both Marina (420) and Public Park (411) codes to analyze trips from the new boat ramp parking spaces – is it possible to revise the analysis to include one or the other? As it stands now, both are included in the total trips measurements, which means we are accounting for the new parking lot traffic twice in the calculations. Please see the request from the original email copied below – we were hoping to provide two alternative codes to measure the trips from the parking lot based on which ODOT felt was most appropriate, rather than adding the trips from both methods. **LUC 420 (Marina) provides better data than the public park for the variables provided, therefore I'm going to just apply LUC 420**

ITE Code	Land Use Description	Independent Variable	No. of Units	Avg Rate or Eq	Rates					Total Trip		
					Weekday			Weekend		Weekday		
					Daily Rate	AM Peak Rate	PM Peak Rate	Daily Rate	Peak Rate	Daily Trips	AM Peak Trips	PM Peak Trips
					<b>Existing Use Totals</b>							
416	Campground/RV Park	Acre(s)	21	Avg		0.48	0.98				10	21
420	Marina	Berth(s)	32	Avg	2.41	0.07	0.21	2.61	0.22	78	2	7



Please let me know if you need anything else. I only work until 3:30 PM if you need a response back by today.

Thanks!

**Arielle Childress, P.E. (she/her/hers)**

Traffic Analysis Engineer

ODOT Region 2

455 Airport Rd. SE, Bldg. B, Salem, OR 97031

(971) 208-1290

**From:** Cassandra Dobson <[CDobson@parametrix.com](mailto:CDobson@parametrix.com)>

**Sent:** Thursday, July 11, 2024 1:56 PM

**To:** VYMAZAL Zdenek G <[Zdenek.G.VYMAZAL@odot.oregon.gov](mailto:Zdenek.G.VYMAZAL@odot.oregon.gov)>

**Cc:** JOHNSON Tracy \* OPRD <[Tracy.JOHNSON@opr.oregon.gov](mailto:Tracy.JOHNSON@opr.oregon.gov)>; Jennifer Hughes <[JHughes@parametrix.com](mailto:JHughes@parametrix.com)>; Ryan Rudnick <[RRudnick@parametrix.com](mailto:RRudnick@parametrix.com)>;

CHILDRESS Arielle <[Arielle.CHILDRESS@odot.oregon.gov](mailto:Arielle.CHILDRESS@odot.oregon.gov)>

**Subject:** RE: Nehalem Bay State Park Improvements ITE Codes

This message was sent from outside the organization. Treat attachments, links and requests with caution. Be conscious of the information you share if you respond.

Thank you Z! If the traffic team is able to answer our questions today, we would greatly appreciate it.

**From:** VYMAZAL Zdenek G <[Zdenek.G.VYMAZAL@odot.oregon.gov](mailto:Zdenek.G.VYMAZAL@odot.oregon.gov)>

**Sent:** Thursday, July 11, 2024 1:50 PM

**To:** Cassandra Dobson <[CDobson@parametrix.com](mailto:CDobson@parametrix.com)>

**Cc:** JOHNSON Tracy \* OPRD <[tracy.johnson@opr.oregon.gov](mailto:tracy.johnson@opr.oregon.gov)>; Jennifer Hughes <[JHughes@parametrix.com](mailto:JHughes@parametrix.com)>; Ryan Rudnick <[RRudnick@parametrix.com](mailto:RRudnick@parametrix.com)>;

CHILDRESS Arielle <[Arielle.CHILDRESS@odot.oregon.gov](mailto:Arielle.CHILDRESS@odot.oregon.gov)>

**Subject:** RE: Nehalem Bay State Park Improvements ITE Codes

Hello Cassandra,

I know it is late. I took time of recently and was very busy after that.

I have forwarded your questions to the traffic people. Who could answer your questions better than me.

Thank you

Z

Zdenek "Z" Vymazal, PE, PLS

Development Review Coordinator (Area 1)

ODOT – Region 2

455 Airport Rd. SE, Bldg. B  
Salem, OR 97301  
(971)-345-1318 Cell/Office

[zdenek.g.vymazal@odot.oregon.gov](mailto:zdenek.g.vymazal@odot.oregon.gov)

Hours: 6:30 AM to 3:00 PM Monday - Friday

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**From:** Cassandra Dobson <[CDobson@parametrix.com](mailto:CDobson@parametrix.com)>

**Sent:** Thursday, July 11, 2024 1:13 PM

**To:** VYMAZAL Zdenek G <[Zdenek.G.VYMAZAL@odot.oregon.gov](mailto:Zdenek.G.VYMAZAL@odot.oregon.gov)>

**Cc:** JOHNSON Tracy \* OPRD <[Tracy.JOHNSON@opr.oregon.gov](mailto:Tracy.JOHNSON@opr.oregon.gov)>; Jennifer Hughes <[JHughes@parametrix.com](mailto:JHughes@parametrix.com)>; Ryan Rudnick <[RRudnick@parametrix.com](mailto:RRudnick@parametrix.com)>

**Subject:** RE: Nehalem Bay State Park Improvements ITE Codes

**Importance:** High

This message was sent from outside the organization. Treat attachments, links and requests with caution. Be conscious of the information you share if you respond.

Hello Z,

I just left you a voicemail, but wanted to follow up again on the below request. Is it possible to receive a response to our questions below before tonight's public hearing so that we may submit them to the record?

Thank you so much for your time, please let me know if you have any questions.

Cass

---

**From:** Cassandra Dobson

**Sent:** Tuesday, July 9, 2024 8:55 AM

**To:** VYMAZAL Zdenek G <[Zdenek.G.VYMAZAL@odot.oregon.gov](mailto:Zdenek.G.VYMAZAL@odot.oregon.gov)>

**Cc:** JOHNSON Tracy \* OPRD <[tracy.johnson@opr.oregon.gov](mailto:tracy.johnson@opr.oregon.gov)>; Jennifer Hughes <[JHughes@parametrix.com](mailto:JHughes@parametrix.com)>; Ryan Rudnick <[RRudnick@parametrix.com](mailto:RRudnick@parametrix.com)>

**Subject:** RE: Nehalem Bay State Park Improvements ITE Codes

Hello Z,

I wanted to reach out to follow up on the below request. Please let us know if you have any questions or need any additional information at this time.

Thank you!

Cass

---

**From:** Cassandra Dobson

**Sent:** Tuesday, July 2, 2024 4:20 PM

**To:** VYMAZAL Zdenek G <[Zdenek.G.VYMAZAL@odot.oregon.gov](mailto:Zdenek.G.VYMAZAL@odot.oregon.gov)>

**Cc:** JOHNSON Tracy \* OPRD <[tracy.johnson@opr.oregon.gov](mailto:tracy.johnson@opr.oregon.gov)>; Jennifer Hughes <[JHughes@parametrix.com](mailto:JHughes@parametrix.com)>; Ryan Rudnick <[RRudnick@parametrix.com](mailto:RRudnick@parametrix.com)>

**Subject:** RE: Nehalem Bay State Park Improvements ITE Codes

Good afternoon Z,

Thank you again for taking the time earlier this year to review potential traffic impacts from our proposed improvements at Nehalem Bay State Park. We have submitted our application for a Conditional Use Master Plan to Tillamook County and will have a public hearing with their Planning Commission next Thursday. During the application review, we have received some questions on ODOT's analysis (below) and are hoping that you may be able to help us address them. If at all possible, it would be wonderful if we could get responses to these questions and any necessary revisions to the analysis no later than **end of day, Wednesday, July 10<sup>th</sup>** so that we may incorporate them into our presentation at the Planning Commission meeting on the 11<sup>th</sup>. I know we have a short week this week due to the holiday, so we are very appreciative of any assistance you can provide in that time.

Our questions are as follows:

- Are the empty rows for total trips and in/out trips for campground/RV park (highlighted below) intentionally empty, or is there data that should be shown there?
- Is it possible to show the total trips from the proposed improvements as "proposed use totals" rather than "existing use totals" to make it clear that they are trips resulting from the proposed changes?
- It appears that the analysis included both Marina (420) and Public Park (411) codes to analyze trips from the new boat ramp parking spaces – is it possible to revise the analysis to include one or the other? As it stands now, both are included in the total trips measurements, which means we are accounting for the new parking lot traffic twice in the calculations. Please see the request from the original email copied below – we were hoping to provide two alternative codes to measure the trips from the parking lot based on which ODOT felt was most appropriate, rather than adding the trips from both methods.

Thank you very much for your help! Please let us know if you have any questions.

Best,

Cass

- **Marina (420) or Public Park (411)** for the 32 new boat ramp parking spaces proposed.
  - If using Marina (420) – 32 "berths" to represent the 32 boat trailer parking spaces
  - If using Public Park (411) – 96 "daily trail users", conservatively assuming an average of 3 boat ramp users for each of the 32 new parking spaces

ITE Code	Land Use Description	Independent Variable	No. of Units	Avg Rate or Eq	Rates					Total Trips					In/Out Trips						
					Weekday			Weekend		Weekday			Weekend		Weekday				Weekend		
					Daily Rate	AM Peak Rate	PM Peak Rate	Daily Rate	Peak Rate	Daily Trips	AM Peak Trips	PM Peak Trips	Daily Trips	Peak Trips	AM Trips In	AM Trips Out	PM Trips In	PM Trips Out	Peak Trips In		
416	Campground/RV Park	Acre(s)	21	Avg		0.48	0.98					10	21			4	6	14	7		
420	Marina	Berth(s)	32	Avg	2.41	0.07	0.21	2.61	0.22	76	2	7	64	7	1	1	4	3	3		
411	Public Park	Acre(s)	96	Avg	0.78	0.02	0.11	1.96	0.28	76	2	11	190	27	1	1	6	5	15		
					Existing Use Totals					164	14	39	274	34	6	8	24	15	18		
					Proposed Use Totals																

CHANGE OF USE EVALUATION

From: VYMAZAL Zdenek G <[Zdenek.G.VYMAZAL@odot.oregon.gov](mailto:Zdenek.G.VYMAZAL@odot.oregon.gov)>  
 Sent: Thursday, January 11, 2024 11:01 AM  
 To: Cassandra Dobson <[CDobson@parametrix.com](mailto:CDobson@parametrix.com)>  
 Subject: RE: Nehalem Bay State Park Improvements ITE Codes

Hello Cassandra,

After reviewing the new data for the proposed development (See attachment snipp), the number of peak trips will not increase to reach fifty (50) trips or more and average daily trip will not increase by five hundred (500) trips or more from the property's prior use as stated in OAR Ch734, Div51 (734-051-3020). It will not requires the Change of Use and such you do not need a traffic study for this proposed development.

However, because the proposed development will use local streets/ roads and is not connected directly to state highway, it is recommended to work with City of Manzanita (County?) on this and include them with you scopping/development work early.

Thank you

Z

Zdenek "Z" Vymazal, PE, PLS  
Development Review Coordinator (Area 1)  
ODOT – Region 2  
455 Airport Rd. SE, Bldg. B  
Salem, OR 97301  
(971)-345-1318 Cell/Office  
[zdenek.g.vymazal@odot.oregon.gov](mailto:zdenek.g.vymazal@odot.oregon.gov)  
Hours: 5:30 AM to 2:00 PM Monday – Friday

ITE Code	Land Use Description	Independent Variable	No. of Units	Avg Rate or Eq	Rates					Total Trips				
					Weekday			Weekend		Weekday			W	
					Daily Rate	AM Peak Rate	PM Peak Rate	Daily Rate	Peak Rate	Daily Trips	AM Peak Trips	PM Peak Trips	Daily Trips	
416	Campground/RV Park	Acre(s)	21	Avg		0.48	0.98					10	21	
420	Marina	Berth(s)	32	Avg	2.41	0.07	0.21	2.61	0.22	78	2	7	84	
411	Public Park	Acre(s)	96	Avg	0.78	0.02	0.11	1.96	0.28	76	2	11	19	
					<b>Existing Use Totals</b>					154	14	39	27	
					<b>Proposed Use Totals</b>									

CHANGE OF USE EVAL II

From: VYMAZAL Zdenek G  
 Sent: Tuesday, January 2, 2024 2:06 PM  
 To: Cassandra Dobson <[CDobson@parametrix.com](mailto:CDobson@parametrix.com)>  
 Subject: RE: Nehalem Bay State Park Improvements ITE Codes

Happy New Year to you Casandra too.  
 Thank you

I and traffic people will look at your info and replay as soon as possible.  
 Z

Zdenek "Z" Vymazal, PE, PLS  
Development Review Coordinator (Area 1)  
ODOT – Region 2  
455 Airport Rd. SE, Bldg. B  
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[zdenek.g.vymazal@odot.oregon.gov](mailto:zdenek.g.vymazal@odot.oregon.gov)  
Hours: 5:30 AM to 2:00 PM Monday – Friday

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**From:** Cassandra Dobson <[CDobson@parametrix.com](mailto:CDobson@parametrix.com)>  
**Sent:** Tuesday, January 2, 2024 8:36 AM  
**To:** VYMAZAL Zdenek G <[Zdenek.G.VYMAZAL@odot.oregon.gov](mailto:Zdenek.G.VYMAZAL@odot.oregon.gov)>  
**Cc:** JOHNSON Tracy \* OPRD <[Tracy.JOHNSON@opr.oregon.gov](mailto:Tracy.JOHNSON@opr.oregon.gov)>; Jennifer Hughes <[JHughes@parametrix.com](mailto:JHughes@parametrix.com)>; Ryan Rudnick <[RRudnick@parametrix.com](mailto:RRudnick@parametrix.com)>  
**Subject:** Nehalem Bay State Park Improvements ITE Codes

You don't often get email from [cdobson@parametrix.com](mailto:cdobson@parametrix.com). [Learn why this is important](#)

This message was sent from outside the organization. Treat attachments, links and requests with caution. Be conscious of the information you share if you respond.

Good morning Z, and Happy New Year!

Thank you again for taking the time to meet with us to discuss improvements to Nehalem Bay State Park. As discussed at that meeting, our team has looked into the ITE codes that we feel would best fit the proposed improvements. We would recommend use of the following ITE land use codes in peak hour trip generation calculations for the proposed park uses:

- **Campground/RV park (416)** for the proposed cabins and campsites, and trip generation based on either occupied campsites or acres
  - 68 occupied campsites (excluding 8 new hiker/biker sites, as there are inherently no vehicle trips associated with these campsites)
    - 6 new staff cabins (already permitted)
    - Up to 10 new cabins at cabin loop
    - Up to 12 new park & walk-in tent sites
    - Up to 40 new cabins/sites in future loop
  - 21 acres new campground development
    - New camping/cabin loop           +15 acres
    - New hiker/biker/tent               +5 acres
    - Old hiker biker                   -1.5 acres
    - Alternate cabins                   +2 acres

Staff cabins

+0.5 acres

21 acres new campground development

- **Marina (420) or Public Park (411)** for the 32 new boat ramp parking spaces proposed.
  - If using Marina (420) – 32 “berths” to represent the 32 boat trailer parking spaces
  - If using Public Park (411) – 96 “daily trail users”, conservatively assuming an average of 3 boat ramp users for each of the 32 new parking spaces

Please let us know if you have any questions or would like to discuss further. Thank you again!

Cass



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APPENDIX G.  
**CRASH DATA**





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APPENDIX H.  
**OPERATIONS  
CALCULATIONS**

HCM 7th TWSC  
 1: Necarney City Rd & Highway 101

10/29/2024

Intersection						
Int Delay, s/veh	2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	390	26	58	322	29	65
Future Vol, veh/h	390	26	58	322	29	65
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	424	28	63	350	32	71

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	452	0	914 438
Stage 1	-	-	-	-	438 -
Stage 2	-	-	-	-	476 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1108	-	303 619
Stage 1	-	-	-	-	650 -
Stage 2	-	-	-	-	625 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1108	-	286 619
Mov Cap-2 Maneuver	-	-	-	-	412 -
Stage 1	-	-	-	-	650 -
Stage 2	-	-	-	-	589 -

Approach	EB	WB	NB
HCM Control Delay, s/v	0	1.29	13.29
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	536	-	-	1108	-
HCM Lane V/C Ratio	0.191	-	-	0.057	-
HCM Control Delay (s/veh)	13.3	-	-	8.4	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.7	-	-	0.2	-

HCM 7th TWSC  
 2: Necarney City Rd & Loop Rd

10/29/2024

Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		4	1		3	
Traffic Vol, veh/h	0	82	63	0	0	0
Future Vol, veh/h	0	82	63	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	89	68	0	0	0

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	68	0	-	0	158 68
Stage 1	-	-	-	-	68 -
Stage 2	-	-	-	-	89 -
Critical Hdwy	4.12	-	-	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	2.218	-	-	-	3.518 3.318
Pot Cap-1 Maneuver	1533	-	-	-	834 995
Stage 1	-	-	-	-	954 -
Stage 2	-	-	-	-	934 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1533	-	-	-	834 995
Mov Cap-2 Maneuver	-	-	-	-	834 -
Stage 1	-	-	-	-	954 -
Stage 2	-	-	-	-	934 -

Approach	EB	WB	SB
HCM Control Delay, s/v	0	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1533	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s/veh)	0	-	-	-	0
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-

HCM 7th TWSC  
 1: Necarney City Rd & Highway 101

10/29/2024

Intersection						
Int Delay, s/veh	2.4					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	439	33	89	466	38	89
Future Vol, veh/h	439	33	89	466	38	89
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	477	36	97	507	41	97

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	513	0	1195 495
Stage 1	-	-	-	-	495 -
Stage 2	-	-	-	-	700 -
Critical Hdwy	-	-	4.12	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.218	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1052	-	206 574
Stage 1	-	-	-	-	613 -
Stage 2	-	-	-	-	493 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1052	-	187 574
Mov Cap-2 Maneuver	-	-	-	-	318 -
Stage 1	-	-	-	-	613 -
Stage 2	-	-	-	-	447 -

Approach	EB	WB	NB
HCM Control Delay, s/v	0	1.41	16.05
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	463	-	-	1052	-
HCM Lane V/C Ratio	0.298	-	-	0.092	-
HCM Control Delay (s/veh)	16.1	-	-	8.8	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	1.2	-	-	0.3	-

HCM 7th TWSC  
2: Necarney City Rd & Loop Rd

10/29/2024

Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↶	↷		↶	
Traffic Vol, veh/h	0	112	117	0	0	0
Future Vol, veh/h	0	112	117	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	122	127	0	0	0

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	127	0	-	0	249
Stage 1	-	-	-	-	127
Stage 2	-	-	-	-	122
Critical Hdwy	4.12	-	-	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	2.218	-	-	-	3.518
Pot Cap-1 Maneuver	1459	-	-	-	740
Stage 1	-	-	-	-	899
Stage 2	-	-	-	-	904
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1459	-	-	-	740
Mov Cap-2 Maneuver	-	-	-	-	740
Stage 1	-	-	-	-	899
Stage 2	-	-	-	-	904

Approach	EB	WB	SB
HCM Control Delay, s/v	0	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1459	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s/veh)	0	-	-	-	0
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-



# HCM Unsignalized Intersection Capacity Analysis

## 1: Necarney City Rd & Highway 101

11/05/2024



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	407	31	69	340	32	72
Future Volume (Veh/h)	407	31	69	340	32	72
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	452	34	77	378	36	80
Pedestrians						1
Lane Width (ft)						12.0
Walking Speed (ft/s)						3.5
Percent Blockage						0
Right turn flare (veh)						
Median type	TWLTL		TWLTL			
Median storage veh)	2		2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			487		1002	470
vC1, stage 1 conf vol					470	
vC2, stage 2 conf vol					532	
vCu, unblocked vol			487		1002	470
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		92	87
cM capacity (veh/h)			1065		459	593

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	486	77	378	116
Volume Left	0	77	0	36
Volume Right	34	0	0	80
cSH	1700	1065	1700	544
Volume to Capacity	0.29	0.07	0.22	0.21
Queue Length 95th (ft)	0	6	0	20
Control Delay (s/veh)	0.0	8.6	0.0	13.4
Lane LOS		A		B
Approach Delay (s/veh)	0.0	1.5		13.4
Approach LOS				B

Intersection Summary			
Average Delay		2.1	
Intersection Capacity Utilization	46.2%		ICU Level of Service
Analysis Period (min)	15		A

HCM 7th TWSC  
 1: Necarney City Rd & Highway 101

11/05/2024

Intersection						
Int Delay, s/veh	2.2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	407	31	69	340	32	72
Future Vol, veh/h	407	31	69	340	32	72
Conflicting Peds, #/hr	0	1	1	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	5	9	4	4	2	2
Mvmt Flow	452	34	77	378	36	80

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	488	0	1002 470
Stage 1	-	-	-	-	470 -
Stage 2	-	-	-	-	531 -
Critical Hdwy	-	-	4.14	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	-	-	2.236	-	3.518 3.318
Pot Cap-1 Maneuver	-	-	1065	-	269 593
Stage 1	-	-	-	-	629 -
Stage 2	-	-	-	-	590 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1064	-	249 593
Mov Cap-2 Maneuver	-	-	-	-	380 -
Stage 1	-	-	-	-	628 -
Stage 2	-	-	-	-	547 -

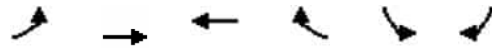
Approach	EB	WB	NB
HCM Control Delay, s/v	0	1.46	14.22
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	505	-	-	1064	-
HCM Lane V/C Ratio	0.229	-	-	0.072	-
HCM Control Delay (s/veh)	14.2	-	-	8.6	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.9	-	-	0.2	-

# HCM Unsignalized Intersection Capacity Analysis

## 2: Necarney City Rd & Loop Rd

11/05/2024



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	92	78	0	0	0
Future Volume (Veh/h)	0	92	78	0	0	0
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)	0	105	89	0	0	0
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	89				194	89
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	89				194	89
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1506				795	969
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	105	89	0			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1506	1700	1700			
Volume to Capacity	0.00	0.05	0.00			
Queue Length 95th (ft)	0	0	0			
Control Delay (s/veh)	0.0	0.0	0.0			
Lane LOS			A			
Approach Delay (s/veh)	0.0	0.0	0.0			
Approach LOS			A			
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization		8.6%		ICU Level of Service		A
Analysis Period (min)		15				

HCM 7th TWSC  
2: Necarney City Rd & Loop Rd

11/05/2024

Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		4	1		3	
Traffic Vol, veh/h	0	92	78	0	0	0
Future Vol, veh/h	0	92	78	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	88	88	88	88	88	88
Heavy Vehicles, %	2	5	8	2	2	2
Mvmt Flow	0	105	89	0	0	0

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	89	0	-	0	193
Stage 1	-	-	-	-	89
Stage 2	-	-	-	-	105
Critical Hdwy	4.12	-	-	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	2.218	-	-	-	3.518
Pot Cap-1 Maneuver	1507	-	-	-	796
Stage 1	-	-	-	-	935
Stage 2	-	-	-	-	920
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1507	-	-	-	796
Mov Cap-2 Maneuver	-	-	-	-	796
Stage 1	-	-	-	-	935
Stage 2	-	-	-	-	920

Approach	EB	WB	SB
HCM Control Delay, s/v	0	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1507	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s/veh)	0	-	-	-	0
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-

# HCM Unsignalized Intersection Capacity Analysis

## 1: Necarney City Rd & Highway 101

11/05/2024



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	457	37	99	487	42	99
Future Volume (Veh/h)	457	37	99	487	42	99
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	491	40	106	524	45	106
Pedestrians						2
Lane Width (ft)						12.0
Walking Speed (ft/s)						3.5
Percent Blockage						0
Right turn flare (veh)						
Median type	TWLTL		TWLTL			
Median storage veh	2		2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			533		1249	513
vC1, stage 1 conf vol					513	
vC2, stage 2 conf vol					736	
vCu, unblocked vol			533		1249	513
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 %			90		88	81
cM capacity (veh/h)			1018		368	560

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	531	106	524	151
Volume Left	0	106	0	45
Volume Right	40	0	0	106
cSH	1700	1018	1700	485
Volume to Capacity	0.31	0.10	0.31	0.31
Queue Length 95th (ft)	0	9	0	33
Control Delay (s/veh)	0.0	8.9	0.0	15.7
Lane LOS		A		C
Approach Delay (s/veh)	0.0	1.5		15.7
Approach LOS				C

Intersection Summary			
Average Delay		2.5	
Intersection Capacity Utilization		53.7%	ICU Level of Service
Analysis Period (min)		15	A

HCM 7th TWSC  
1: Necarney City Rd & Highway 101

11/05/2024

Intersection						
Int Delay, s/veh	2.7					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	457	37	99	487	42	99
Future Vol, veh/h	457	37	99	487	42	99
Conflicting Peds, #/hr	0	2	2	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	3	2	5	2	3	2
Mvmt Flow	491	40	106	524	45	106

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	533	0	1250 513
Stage 1	-	-	-	-	513 -
Stage 2	-	-	-	-	737 -
Critical Hdwy	-	-	4.15	-	6.43 6.22
Critical Hdwy Stg 1	-	-	-	-	5.43 -
Critical Hdwy Stg 2	-	-	-	-	5.43 -
Follow-up Hdwy	-	-	2.245	-	3.527 3.318
Pot Cap-1 Maneuver	-	-	1019	-	190 561
Stage 1	-	-	-	-	599 -
Stage 2	-	-	-	-	472 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1017	-	170 560
Mov Cap-2 Maneuver	-	-	-	-	300 -
Stage 1	-	-	-	-	598 -
Stage 2	-	-	-	-	422 -

Approach	EB	WB	NB
HCM Control Delay, s/v	0	1.51	17.21
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	445	-	-	1017	-
HCM Lane V/C Ratio	0.341	-	-	0.105	-
HCM Control Delay (s/veh)	17.2	-	-	9	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	1.5	-	-	0.3	-

# HCM Unsignalized Intersection Capacity Analysis

## 2: Necarney City Rd & Loop Rd

11/05/2024



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	
Traffic Volume (veh/h)	0	125	130	0	0	0
Future Volume (Veh/h)	0	125	130	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	136	141	0	0	0
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	141				277	141
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	141				277	141
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1442				713	907
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	136	141	0			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1442	1700	1700			
Volume to Capacity	0.00	0.08	0.00			
Queue Length 95th (ft)	0	0	0			
Control Delay (s/veh)	0.0	0.0	0.0			
Lane LOS			A			
Approach Delay (s/veh)	0.0	0.0	0.0			
Approach LOS			A			
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			10.8%	ICU Level of Service		A
Analysis Period (min)			15			

HCM 7th TWSC  
2: Necarney City Rd & Loop Rd

11/05/2024

Intersection						
Int Delay, s/veh	0					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		4	1		3	
Traffic Vol, veh/h	0	125	130	0	0	0
Future Vol, veh/h	0	125	130	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	3	7	2	2	2
Mvmt Flow	0	136	141	0	0	0

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	141	0	-	0	277 141
Stage 1	-	-	-	-	141 -
Stage 2	-	-	-	-	136 -
Critical Hdwy	4.12	-	-	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	2.218	-	-	-	3.518 3.318
Pot Cap-1 Maneuver	1442	-	-	-	713 907
Stage 1	-	-	-	-	886 -
Stage 2	-	-	-	-	891 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1442	-	-	-	713 907
Mov Cap-2 Maneuver	-	-	-	-	713 -
Stage 1	-	-	-	-	886 -
Stage 2	-	-	-	-	891 -

Approach	EB	WB	SB
HCM Control Delay, s/v	0	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1442	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s/veh)	0	-	-	-	0
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-



# HCM Unsignalized Intersection Capacity Analysis

## 1: Necarney City Rd & Highway 101

11/05/2024



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	407	34	75	340	35	77
Future Volume (Veh/h)	407	34	75	340	35	77
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	438	37	81	366	38	83
Pedestrians						2
Lane Width (ft)						12.0
Walking Speed (ft/s)						3.5
Percent Blockage						0
Right turn flare (veh)						
Median type	TWLTL		TWLTL			
Median storage veh	2		2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			477		987	459
vC1, stage 1 conf vol					459	
vC2, stage 2 conf vol					528	
vCu, unblocked vol			477		987	459
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		92	86
cM capacity (veh/h)			1068		460	601
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>WB 2</b>	<b>NB 1</b>		
Volume Total	475	81	366	121		
Volume Left	0	81	0	38		
Volume Right	37	0	0	83		
cSH	1700	1068	1700	549		
Volume to Capacity	0.28	0.08	0.22	0.22		
Queue Length 95th (ft)	0	6	0	21		
Control Delay (s/veh)	0.0	8.6	0.0	13.4		
Lane LOS	A		B			
Approach Delay (s/veh)	0.0	1.6		13.4		
Approach LOS			B			
<b>Intersection Summary</b>						
Average Delay			2.2			
Intersection Capacity Utilization			47.3%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM 7th TWSC  
1: Necarney City Rd & Highway 101

11/05/2024

Intersection						
Int Delay, s/veh	2.3					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	407	34	75	340	35	77
Future Vol, veh/h	407	34	75	340	35	77
Conflicting Peds, #/hr	0	2	2	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	3	2	5	2	3	2
Mvmt Flow	438	37	81	366	38	83

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	476	0	985 458
Stage 1	-	-	-	-	458 -
Stage 2	-	-	-	-	527 -
Critical Hdwy	-	-	4.15	-	6.43 6.22
Critical Hdwy Stg 1	-	-	-	-	5.43 -
Critical Hdwy Stg 2	-	-	-	-	5.43 -
Follow-up Hdwy	-	-	2.245	-	3.527 3.318
Pot Cap-1 Maneuver	-	-	1070	-	274 603
Stage 1	-	-	-	-	635 -
Stage 2	-	-	-	-	590 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1068	-	253 602
Mov Cap-2 Maneuver	-	-	-	-	382 -
Stage 1	-	-	-	-	634 -
Stage 2	-	-	-	-	546 -

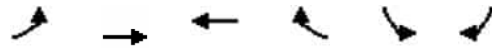
Approach	EB	WB	NB
HCM Control Delay, s/v	0	1.56	14.23
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	510	-	-	1068	-
HCM Lane V/C Ratio	0.236	-	-	0.075	-
HCM Control Delay (s/veh)	14.2	-	-	8.6	-
HCM Lane LOS	B	-	-	A	-
HCM 95th %tile Q(veh)	0.9	-	-	0.2	-

# HCM Unsignalized Intersection Capacity Analysis

## 2: Necarney City Rd & Loop Rd

11/05/2024



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	
Traffic Volume (veh/h)	6	92	78	9	8	5
Future Volume (Veh/h)	6	92	78	9	8	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	100	85	10	9	5
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	95				204	90
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	95				204	90
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	99
cM capacity (veh/h)	1499				781	968
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	107	95	14			
Volume Left	7	0	9			
Volume Right	0	10	5			
cSH	1499	1700	839			
Volume to Capacity	0.00	0.06	0.02			
Queue Length 95th (ft)	0	0	1			
Control Delay (s/veh)	0.5	0.0	9.4			
Lane LOS	A		A			
Approach Delay (s/veh)	0.5	0.0	9.4			
Approach LOS			A			
Intersection Summary						
Average Delay			0.9			
Intersection Capacity Utilization		20.6%		ICU Level of Service		A
Analysis Period (min)		15				

HCM 7th TWSC  
2: Necarney City Rd & Loop Rd

11/05/2024

Intersection						
Int Delay, s/veh	0.8					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		4	1		3	
Traffic Vol, veh/h	6	92	78	9	8	5
Future Vol, veh/h	6	92	78	9	8	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	3	7	2	2	2
Mvmt Flow	7	100	85	10	9	5

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	95	0	-	0	203 90
Stage 1	-	-	-	-	90 -
Stage 2	-	-	-	-	113 -
Critical Hdwy	4.12	-	-	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	2.218	-	-	-	3.518 3.318
Pot Cap-1 Maneuver	1499	-	-	-	786 968
Stage 1	-	-	-	-	934 -
Stage 2	-	-	-	-	912 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1499	-	-	-	782 968
Mov Cap-2 Maneuver	-	-	-	-	782 -
Stage 1	-	-	-	-	930 -
Stage 2	-	-	-	-	912 -

Approach	EB	WB	SB
HCM Control Delay, s/v	0.45	0	9.33
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	110	-	-	-	845
HCM Lane V/C Ratio	0.004	-	-	-	0.017
HCM Control Delay (s/veh)	7.4	0	-	-	9.3
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

# HCM Unsignalized Intersection Capacity Analysis

## 1: Necarney City Rd & Highway 101

11/05/2024



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	457	40	104	487	44	102
Future Volume (Veh/h)	457	40	104	487	44	102
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	491	43	112	524	47	110
Pedestrians						2
Lane Width (ft)						12.0
Walking Speed (ft/s)						3.5
Percent Blockage						0
Right turn flare (veh)						
Median type	TWLTL		TWLTL			
Median storage veh	2		2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			536		1263	515
vC1, stage 1 conf vol					515	
vC2, stage 2 conf vol					748	
vCu, unblocked vol			536		1263	515
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 %			89		87	80
cM capacity (veh/h)			1015		362	559

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	534	112	524	157
Volume Left	0	112	0	47
Volume Right	43	0	0	110
cSH	1700	1015	1700	481
Volume to Capacity	0.31	0.11	0.31	0.33
Queue Length 95th (ft)	0	9	0	35
Control Delay (s/veh)	0.0	9.0	0.0	16.1
Lane LOS		A		C
Approach Delay (s/veh)	0.0	1.6		16.1
Approach LOS				C

Intersection Summary			
Average Delay		2.7	
Intersection Capacity Utilization		54.5%	ICU Level of Service
Analysis Period (min)		15	A

HCM 7th TWSC  
 1: Necarney City Rd & Highway 101

11/05/2024

Intersection						
Int Delay, s/veh	2.8					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	457	40	104	487	44	102
Future Vol, veh/h	457	40	104	487	44	102
Conflicting Peds, #/hr	0	2	2	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	100	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	3	2	5	2	3	2
Mvmt Flow	491	43	112	524	47	110

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	536	0	1262 515
Stage 1	-	-	-	-	515 -
Stage 2	-	-	-	-	747 -
Critical Hdwy	-	-	4.15	-	6.43 6.22
Critical Hdwy Stg 1	-	-	-	-	5.43 -
Critical Hdwy Stg 2	-	-	-	-	5.43 -
Follow-up Hdwy	-	-	2.245	-	3.527 3.318
Pot Cap-1 Maneuver	-	-	1017	-	187 560
Stage 1	-	-	-	-	598 -
Stage 2	-	-	-	-	466 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1015	-	166 559
Mov Cap-2 Maneuver	-	-	-	-	295 -
Stage 1	-	-	-	-	597 -
Stage 2	-	-	-	-	415 -

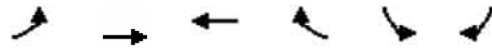
Approach	EB	WB	NB
HCM Control Delay, s/v	0	1.58	17.63
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	440	-	-	1015	-
HCM Lane V/C Ratio	0.356	-	-	0.11	-
HCM Control Delay (s/veh)	17.6	-	-	9	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	1.6	-	-	0.4	-

# HCM Unsignalized Intersection Capacity Analysis

## 2: Necarney City Rd & Loop Rd

11/05/2024



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	8	125	130	8	5	5
Future Volume (Veh/h)	8	125	130	8	5	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	136	141	9	5	5
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	150				300	146
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	150				300	146
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				99	99
cM capacity (veh/h)	1431				688	902
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	145	150	10			
Volume Left	9	0	5			
Volume Right	0	9	5			
cSH	1431	1700	780			
Volume to Capacity	0.01	0.09	0.01			
Queue Length 95th (ft)	0	0	1			
Control Delay (s/veh)	0.5	0.0	9.7			
Lane LOS	A		A			
Approach Delay (s/veh)	0.5	0.0	9.7			
Approach LOS			A			
Intersection Summary						
Average Delay			0.6			
Intersection Capacity Utilization		24.3%		ICU Level of Service		A
Analysis Period (min)		15				

HCM 7th TWSC  
2: Necarney City Rd & Loop Rd

11/05/2024

Intersection						
Int Delay, s/veh	0.6					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		4	4		4	
Traffic Vol, veh/h	8	125	130	8	5	5
Future Vol, veh/h	8	125	130	8	5	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	3	7	2	2	2
Mvmt Flow	9	136	141	9	5	5

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	150	0	-	0	299 146
Stage 1	-	-	-	-	146 -
Stage 2	-	-	-	-	153 -
Critical Hdwy	4.12	-	-	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	2.218	-	-	-	3.518 3.318
Pot Cap-1 Maneuver	1431	-	-	-	692 901
Stage 1	-	-	-	-	882 -
Stage 2	-	-	-	-	875 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1431	-	-	-	688 901
Mov Cap-2 Maneuver	-	-	-	-	688 -
Stage 1	-	-	-	-	876 -
Stage 2	-	-	-	-	875 -

Approach	EB	WB	SB
HCM Control Delay, s/v	0.45	0	9.68
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	108	-	-	-	780
HCM Lane V/C Ratio	0.006	-	-	-	0.014
HCM Control Delay (s/veh)	7.5	0	-	-	9.7
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0



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APPENDIX I.  
**QUEUING ANALYSIS**

Queuing and Blocking Report  
2024 Seasonally Adjusted

11/05/2024

Intersection: 1: Necarney City Rd & Highway 101

Movement	WB	NB
Directions Served	L	LR
Maximum Queue (ft)	79	89
Average Queue (ft)	22	38
95th Queue (ft)	55	70
Link Distance (ft)	1129	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	100	
Storage Blk Time (%)	0	
Queuing Penalty (veh)	0	

Intersection: 2: Necarney City Rd & Loop Rd

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 0
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Queuing and Blocking Report  
2024 Seasonally Adjusted

11/05/2024

Intersection: 1: Necarney City Rd & Highway 101

Movement	WB	NB
Directions Served	L	LR
Maximum Queue (ft)	85	122
Average Queue (ft)	32	52
95th Queue (ft)	65	98
Link Distance (ft)	1129	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	100	
Storage Blk Time (%)	0	
Queuing Penalty (veh)	0	

Intersection: 2: Necarney City Rd & Loop Rd

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 0
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Intersection: 1: Necarney City Rd & Highway 101

Movement	EB	WB	NB
Directions Served	TR	L	LR
Maximum Queue (ft)	4	66	99
Average Queue (ft)	0	26	37
95th Queue (ft)	3	59	68
Link Distance (ft)	1178		1129
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		100	
Storage Blk Time (%)		0	
Queuing Penalty (veh)		0	

Intersection: 2: Necarney City Rd & Loop Rd

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 0
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Intersection: 1: Necarney City Rd & Highway 101

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Movement	WB	NB
Directions Served	L	LR
Maximum Queue (ft)	89	143
Average Queue (ft)	35	60
95th Queue (ft)	71	116
Link Distance (ft)		1129
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	100	
Storage Blk Time (%)	0	
Queuing Penalty (veh)	0	

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Intersection: 2: Necarney City Rd & Loop Rd

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Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

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Network Summary

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Network wide Queuing Penalty: 0

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Intersection: 1: Necarney City Rd & Highway 101

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Movement	WB	NB
Directions Served	L	LR
Maximum Queue (ft)	71	131
Average Queue (ft)	26	44
95th Queue (ft)	58	89
Link Distance (ft)		1129
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	100	
Storage Blk Time (%)	0	
Queuing Penalty (veh)	0	

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Intersection: 2: Necarney City Rd & Loop Rd

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Movement	SB
Directions Served	LR
Maximum Queue (ft)	36
Average Queue (ft)	9
95th Queue (ft)	34
Link Distance (ft)	370
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Network Summary

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Network wide Queuing Penalty: 0

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Intersection: 1: Necarney City Rd & Highway 101

Movement	EB	WB	NB
Directions Served	TR	L	LR
Maximum Queue (ft)	5	94	147
Average Queue (ft)	0	35	56
95th Queue (ft)	4	73	110
Link Distance (ft)	1178		1129
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		100	
Storage Blk Time (%)		0	
Queuing Penalty (veh)		1	

Intersection: 2: Necarney City Rd & Loop Rd

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	14	35
Average Queue (ft)	1	9
95th Queue (ft)	9	35
Link Distance (ft)	1054	370
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 1
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