NE 238 DRIVE/NE TREHILL DRIVE SIGNAL WARRANT ANALYSIS

WOOD VILLAGE, OREGON

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Wood Village , Oregon
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EXECUTIVE SUMMARY

This report summarizes the results of existing and future traffic conditions for the NE 238 Drive/NE Treehill Drive intersection in Wood Village, Oregon. The purpose of the report is to address existing/future year safety and capacity concerns at this intersection. This traffic analysis considers the following scenarios for opening year (2020) and future design year (2040):

Scenario 1 – Existing street condition

a) Capacity analysis for full access movements with stop control on NE Treehill Drive
b) Signal warrant and capacity analysis
c) Capacity analysis with westbound left turns prohibited.

Scenario 2 - Existing street condition with NE Hawthorne Ave to NE Treehill Drive connection

a) Capacity analysis for full access movements with stop control on NE Treehill Drive
b) Signal warrant and capacity analysis
c) Capacity analysis with westbound left turns prohibited.

The analysis is conducted consistent with the procedures and methods for signal warrants as outlined in the *Manual on Traffic Control Devises (MUTCD), 2009 Edition,* the *Oregon Department of transportation's (ODOT) Analysis Procedure Manual* and *Multnomah County Design and Construction Manual*.

SUMMARY OF FINDINGS

The results of the analysis are summarized below.

- With westbound left-turn prohibited, the study intersection is forecasted to operate within the County's acceptable LOS "D" during weekday evening peak traffic hour; but, not during weekday morning peak traffic hour conditions under Scenarios 1 and 2 through year 2040.
- With stop sign control, the study intersection is projected to not operate at the County's acceptable LOS during weekday morning and evening peak traffic hour conditions under Scenarios 1 and 2 through year 2040.
- The study intersection does not meet any of the MUTCD signal warrants under Scenarios 1 and 2 through year 2040 traffic conditions.

CONCLUSION

While with the westbound left-turn prohibited the intersection does not fully meet the County's operational standard, its operation is better than with the condition that allows left-turns out of NE Treehill Drive. To fully meet the intersection operational standard (LOS "D") from "*Multnomah County Design and Construction Manual"*, a second northbound through lane on NE 238th Drive through the NE Treehill Drive intersection would be required.

INTRODUCTION

Multnomah County is proposing to make improvements to NE 238th Drive between NE Halsey Street and NE Glisan Street in Wood Village to improve freight, bicycle, and pedestrian movement. The project is identified in Metro's *East Metro Connections Plan* to improve freight traffic between 1-84 and East Multnomah County, including removing the existing restriction of trucks longer than 40 feet on NE 238th Drive. The project will be widening the existing road, construct shared bicycle/pedestrian paths, improve illumination, landscaping and drainage. The road will be widened from an existing curb-to-curb width of approximately 34 feet to 41 feet to increase space for passing vehicles through the road curvature. No additional lanes will be added. The new 10-foot shared bicycle/pedestrian paths will increase the existing total cross section width from approximately 40 feet to 61 feet.

As part of the project the NE 238th Drive/NE Treehill Drive intersection is being evaluated to determine the need for a traffic signal.

EXISTING CONDITION

The study intersection is located approximately 350 feet south of the signalized intersection of NE 238th Drive/NE Arata Road/NE Maple Boulevard and approximately 0.6 miles north of the signalized intersection of NE 238th Drive/NE Glisan Street. This intersection is a three-legged intersection with a stop control for the westbound approach. At this intersection NE 238th Drive runs north-south and NE Treehill Drive intersects NE 238th Drive on the east side of the roadway. Site vicinity map is included in Attachment A for reference.

North of the study location on the west side NE 238th Drive there is an access to several residential dwelling's parking lot. This access is located approximately 60 feet from the center of the access to the center of NE Treehill Drive. For this study, the NE 238th Drive/NE Treehill Drive intersection will be evaluated as a four-legged intersection due to intersection's configuration and the proximity of this driveway to NE Treehill Drive/ NE 238th Drive intersection.

NE 238th Drive is classified as a minor arterial in the *Multnomah County Transportation System Plan (TSP)*. It has two southbound lanes, a two-way left turn-lane, a northbound lane with a wide shoulder and sidewalk on the east side of NE 238 Drive near its intersection at NE Treehill Drive. NE Treehill Drive is an unmarked two-way uncontrolled road that intersects NE 238th Drive from the east. This street serves multifamily residential development and Treehill Day School. The driveway that intersects NE 238th Drive on the west side is approximately 40 feet wide and service four dwelling units.

A physical description of each roadway is summarized in Table 1 below.

Table 1
Existing Roadway Facilities

Roadway	Classification	No. of Lanes	Speed	Typical Pedestrian Corridor Sidewalk Width /Configuration*	Bicycle Facilities	Street Parking	Sidewalk
NE 238th Drive	Minor Arterial	1 NB lane 2 SB lanes	35 mph	6' (NB only)	None	NB only (North of Treehill Drive)	Eastside only
NE Treehill Drive	Local Street	1 lane each direction	Not Posted	None	None	None	None

* = Information obtained from google map not field verified.

Pedestrian and Bicycle Facilities: Review of project site vicinity and traffic count data revealed that a maximum of 5 pedestrians crossed NE Treehill Drive on the east side of the intersection during the morning and afternoon peak traffic hours. There were no bicyclist or pedestrians crossing NE 238th Drive or NE Treehill Drive on the west side of the intersection during the study period. There are bicycle lane lanes on NE 238th Drive that start approximately 1000 feet north of Treehill Drive. There are no bicycle lanes at the study location. Sidewalk on the east side of NE 238 Drive near its intersection at NE Treehill Drive is existing. Currently, Multnomah County has a plan to provide shared bicycle/pedestrian paths as part of the NE 238 Drive between NE Halsey Street and NE Glisan Street project to improve freight, bicycle and pedestrian movement.

CAPACITY ANALYSIS

This section describes the methodology used to assess the traffic conditions, presents the existing turning movement traffic volumes and determines the operating conditions for the study location.

The operating conditions at the study intersection was evaluated using the latest Highway Capacity Manual Operations Methodology (HCM 6th Edition) contained in the SYNCHRO software package. Adequacy at the study locations is determined based on the Multnomah County's Level-of-Service (LOS) criteria. Section 1.1.5 of the *Multnomah County Design Manual* (Reference 1) requires that all new and improved arterial and major collector roadways in urban areas operate at LOS "D" or better during the design hour. If approved by the County Engineer, local streets intersecting arterials or collectors may be LOS "F" during the peak hour.

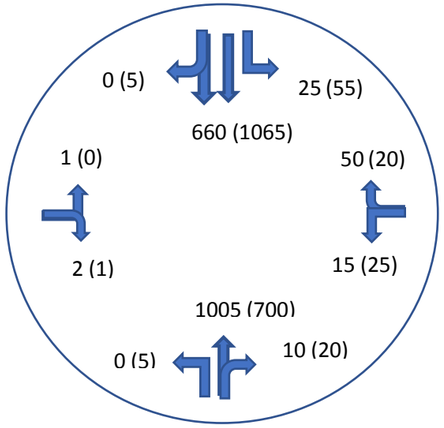
The LOS criteria for un-signalized intersections are different than the criteria used for signalized intersections. For an un-signalized intersection, the LOS is defined for each minor movement and not for the intersection. LOS criteria for signalized and un-signalized intersections is described in detail in Appendix A of the *Multnomah County Design Manual* (Reference 1) and the HCM 2016 (Reference 3).

Traffic Counts: As part of this analysis, data collection effort was conducted at the intersection of NE 238th Drive/NE Treehill Drive on Thursday, April 5, 2018. The counts were gathered from 5:00 a.m. to 7:00 p.m. (14-hour counts) on April 5, 2018. The morning and evening peak traffic hour turning-movement volumes and the eight-highest traffic counts were obtained from these counts as per the project scope.

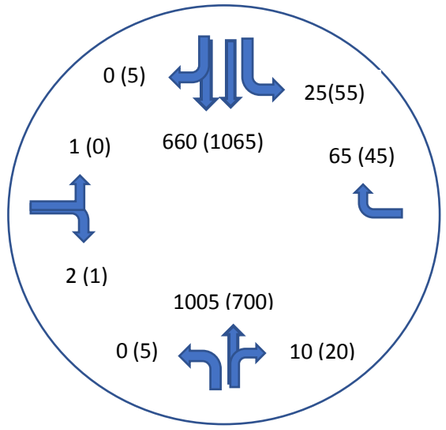
Projected future Year 2020 and Year 2040 traffic volumes were calculated by applying an annual traffic growth rate of 1%. The annual growth rate was calculated based on average daily traffic (ADT) volumes for Year 2015, Year 2027 and Year 2040 provided by Metro. A copy of the ADT and traffic counts are included in Attachment A for reference.

Year 2018, Year 2020 and Year 2040 morning and evening peak hour traffic volumes for the study location are shown in Figures 1, 2 and 3 below. The volumes on all approaches to the intersection are rounded to the nearest 5 vehicles except on the approaches with less than 3 vehicles.

SCENARIO 1



NE 238TH Dr / NE TREEHILL Dr.
EXISTING INTERSECTION CONFIGURATION



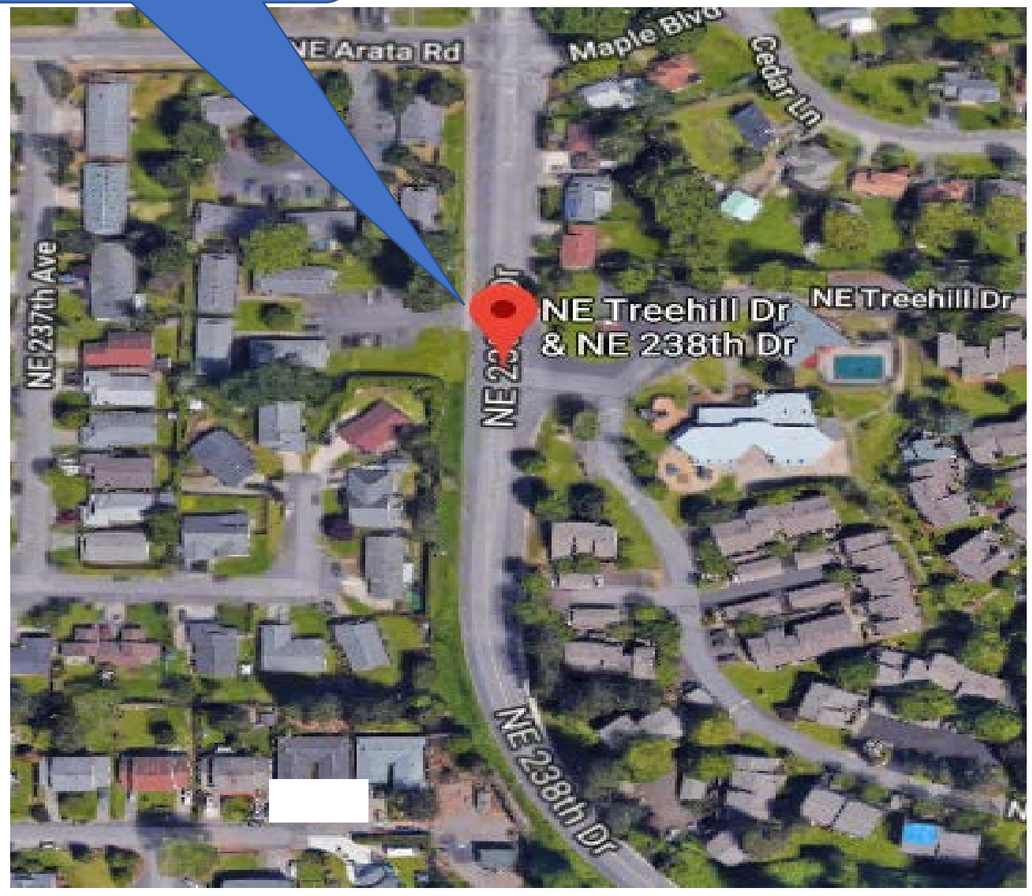
WESTBOUND LEFT TURNS PROHIBITED

LEGEND

AM (PM)

TURNING VOLUMES

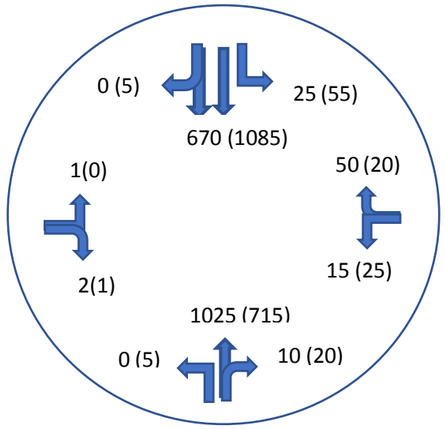
STUDY LOCATION



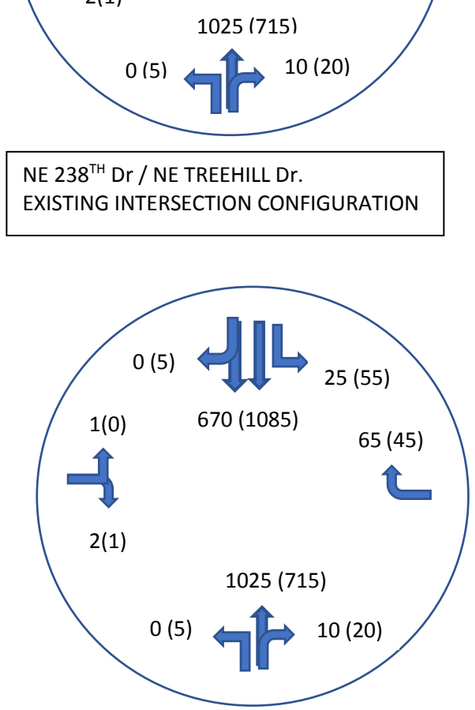
NORTH

Figure 1:Existing Year 2018 Volume

SCENARIO 1



NE 238TH Dr / NE TREEHILL Dr.
EXISTING INTERSECTION CONFIGURATION

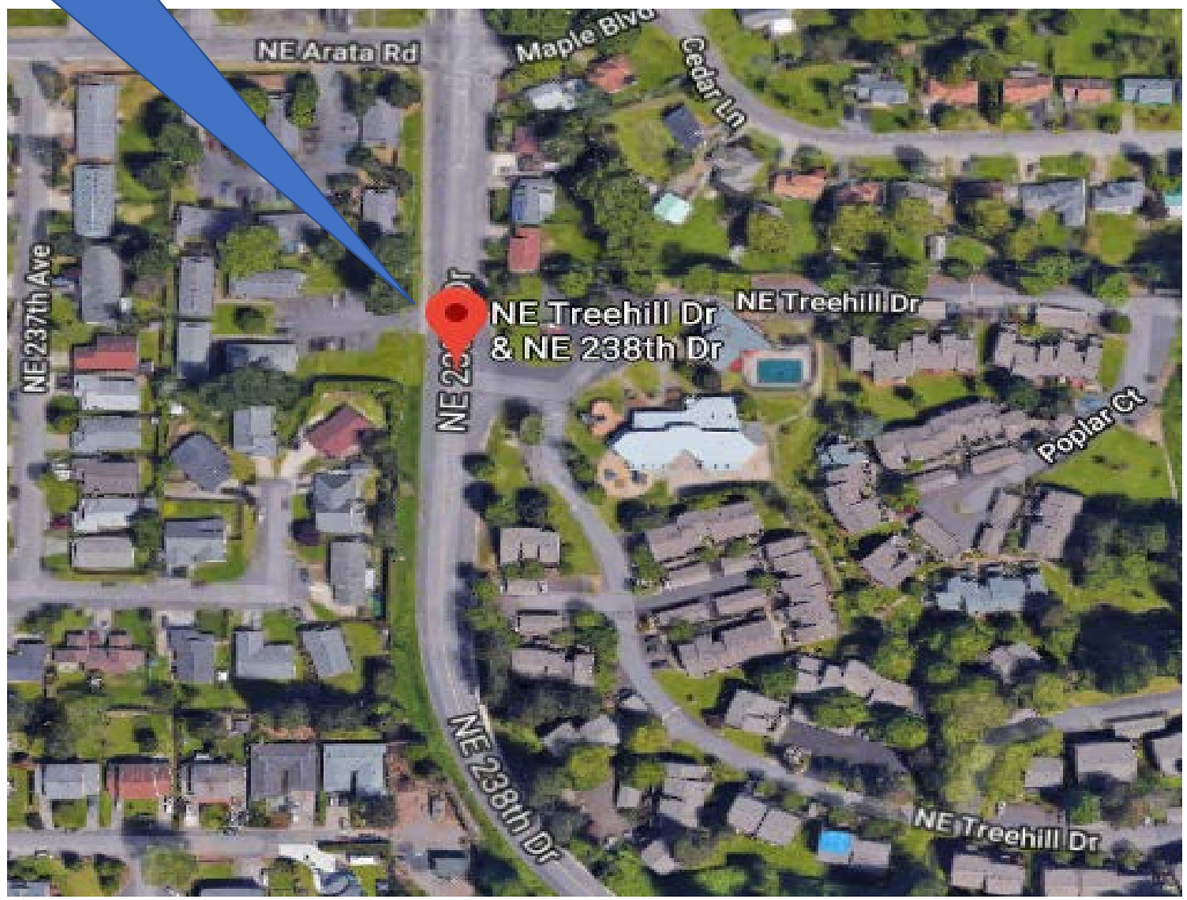


WESTBOUND LEFT TURNS POHIBITED

LEGEND

AM (PM)
TURNING VOLUME

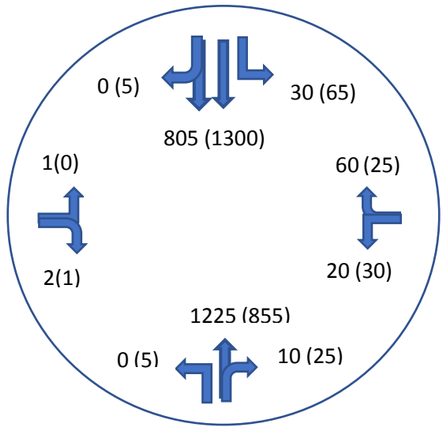
STUDY LOCATION



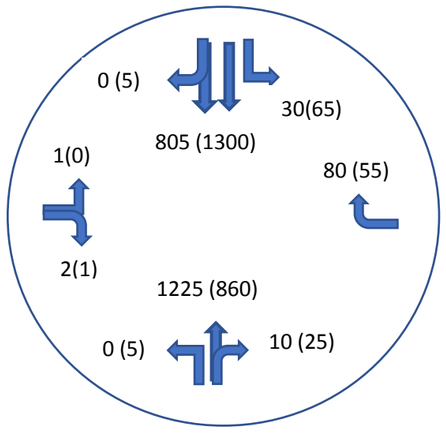
NORTH

Figure 2: Future Year 2020 Volume

SCENARIO 1

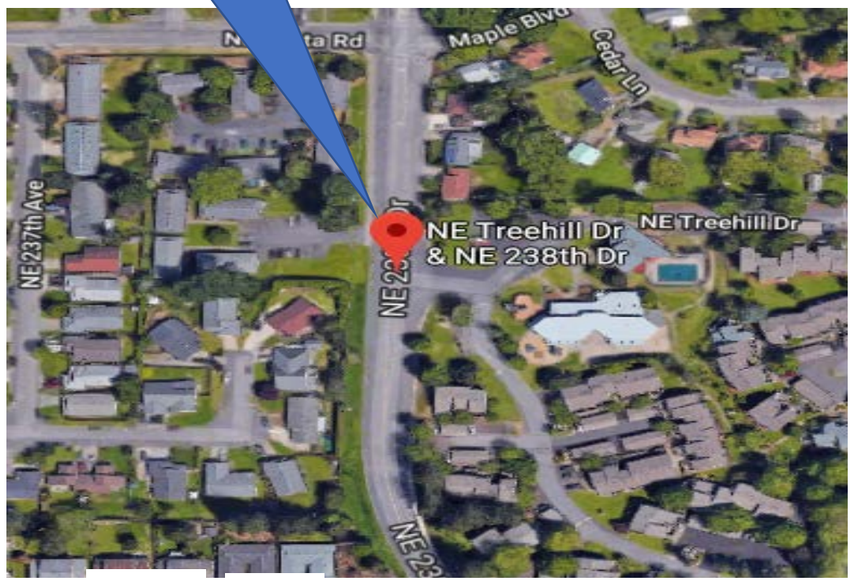


NE 238TH Dr / NE TREEHILL Dr.
EXISTING INTERSECTION CONFIGURATION



WESTBOUND LEFT TURNS PROHIBITED

STUDY LOCATION



NORTH

LEGEND

AM (PM)
TURNING VOLUMES

Figure 3: Future Year 2040 Volume

Scenario 1 – Existing Conditions

A. Intersection Capacity Analysis

The following section evaluates the LOS for the study location assuming stop sign control, traffic signal control and raised median control for right-in/right-out operation at the study intersection.

1. **Stop Controlled Morning and Evening Peak Traffic Hour Volume Condition:** Based on the above methodology, operational analysis was performed for the Year 2018, Year 2020 and Year 2040 traffic volumes with stop sign control. The results of the analysis are summarized in Table 2. The worksheets for the analysis are presented in Attachment B.

Table 2
Peak Hour Traffic Condition with Stop Sign Control

2018 Weekday AM Peak Traffic			**2018 Weekday PM Peak Traffic**			**County Standard Met?**
LOS	**Control Delay sec/veh**	**V/C**	**LOS**	**Control Delay sec/veh**	**V/C**	
E	44.3	0.04	E	44.6	0.35	N
2020 Weekday AM Peak Traffic			**2020 Weekday PM Peak Traffic**			**County Standard Met?**
LOS	**Control Delay sec/veh**	**V/C**	**LOS**	**Control Delay sec/veh**	**V/C**	
E	45.6	0.04	E	49	0.38	**N**
2040 Weekday AM Peak Traffic			**2040 Weekday PM Peak Traffic**			**County Standard Met?**
LOS	**Control Delay sec/veh**	**V/C**	**LOS**	**Control Delay sec/veh**	**V/C**	
F	110.5	0.80	F	125.5	0.74	**N**

* LOS, Control Delay & V/C reported are for the movement with the highest delay and worst LOS. Control Delay = seconds/vehicle (sec/veh).

As shown in Table 2 above, the study location will not operate within the County's LOS standard in existing year 2018, year 2020 and year 2040 traffic condition during weekday morning and evening peak traffic hours.

2. **Signal Controlled Morning and Evening Peak Traffic Hour Condition:** Based on the methodology noted above, operational analysis was performed for the Year 2018, Year 2020 and Year 2040 traffic volumes with traffic signal control. The results of the analysis are summarized in Table 3. The worksheets for the analysis are presented in Attachment B.

Table 3
Scenario 1 - Peak Hour Traffic Condition with Signal Control

2018 Weekday AM Peak Traffic			**2018 Weekday PM Peak Traffic**			**County Standard Met?**
LOS	**Control Delay sec/veh**	**V/C**	**LOS**	**Control Delay sec/veh**	**V/C**	
A	8.7	0.77	B	12.2	0.85	Yes
2020 Weekday AM Peak Traffic			**2020 Weekday PM Peak Traffic**			**County Standard Met?**
LOS	**Control Delay sec/veh**	**V/C**	**LOS**	**Control Delay sec/veh**	**V/C**	
E	76.6	1.25	B	11.0	0.82	No
2040 Weekday AM Peak Traffic			**2040 Weekday PM Peak Traffic**			**County Standard Met?**
LOS	**Control Delay sec/veh**	**V/C**	**LOS**	**Control Delay sec/veh**	**V/C**	
F	116.5	1.41	C	20.6	0.99	No

V/C reported is for the movement with the highest volume to capacity ratio.

Control delay and LOS reported is for intersection. Control Delay = seconds/vehicle (sec/veh)

As shown in Table 3 above, the study location will operate within the County's LOS standard in year 2018 traffic condition during weekday morning and evening peak traffic hours. The intersection is also forecasted to operate within the County's acceptable LOS in year 2020 and year 2040 traffic condition during the weekday evening peak hour; but, not during weekday morning peak traffic hour.

3. **Morning and Evening Peak Traffic Hour with Westbound Left-Turns Prohibited:** Based on the methodology noted above, operational analysis was performed for the Year 2018, Year 2020 and Year 2040 traffic volumes with westbound left-turns prohibited operation. The results of the analysis are summarized in Table 4 below. As shown in Figures 1 through 3, the left-turn traffic is assumed to

turn right at the intersection and make a series of left and right turns to access southbound NE 238th Drive. The worksheets for the analysis are presented in Attachment B.

Table 4
Scenario 1 - Peak Hour Traffic Condition with Westbound Left Turns Prohibited

2018 Weekday AM Peak Traffic			**2018 Weekday PM Peak Traffic**			**County Standard Met?**
LOS	**Control Delay sec/veh**	**V/C**	**LOS**	**Control Delay sec/veh**	**V/C**	
E	49.1	0.04	C	15.3	0.12	N
2020 Weekday AM Peak Traffic			**2020 Weekday PM Peak Traffic**			**County Standard Met?**
LOS	**Control Delay sec/veh**	**V/C**	**LOS**	**Control Delay sec/veh**	**V/C**	
E	49	0.04	C	15.7	0.13	N
2040 Weekday AM Peak Traffic			**2040 Weekday PM Peak Traffic**			**County Standard Met?**
LOS	**Control Delay sec/veh**	**V/C**	**LOS**	**Control Delay sec/veh**	**V/C**	
F	118.2	0.09	C	19.3	0.19	N

* LOS, Control Delay & V/C reported are for the movement with the highest delay and worst LOS.
Control Delay = seconds/vehicle (sec/veh).

As shown in Table 4 above, the study location will operate within the County's LOS standard in existing year 2018, year 2020 and year 2040 traffic condition during weekday evening peak traffic hours; but, not during weekday morning peak traffic hour.

B. Signal Warrant Analysis

Year 2020 Traffic Volume: As part of the traffic safety analysis, traffic signal warrants for the study location's year 2020 traffic volume and geometry were evaluated. The purpose of the traffic signal warrants is to provide an indication for when a signal should be installed. Traffic signal warrants are intended to identify the minimum conditions for when a signal might be justified at a particular location. There are nine signal warrants in the MUTCD (Reference 2) as listed below:

1) *Warrant 1, Eight-Hour Vehicular Volume.*
2) *Warrant 2, Four-Hour Vehicular Volume.*
3) *Warrant 3, Peak Hour.*
4) *Warrant 4, Pedestrian Volume.*
5) *Warrant 5, School Crossing.*
6) *Warrant 6, Coordinated Signal System.*
7) *Warrant 7, Crash Experience.*
8) *Warrant 8, Roadway Network.*
9) *Warrant 9, Intersection near a Grade Crossing.*

Signal Warrant 1: Eight-Hour Vehicular Volume

The Eight-Hour Vehicle Volume signal warrant is intended for applications where volume of intersecting traffic is the principal reason to consider installing a traffic control signal, and the volumes are present during at least 8 hours of an average day. This warrant is comprised of two separate conditions. These conditions are Condition A (Minimum Vehicular Volume) and Condition B (Interruption of Continuous Traffic).

As stated in paragraphs 01 and 02 of Section 4C.01 to 4C.02 of the MUTCD (Reference 2) "*The Minimum Vehicular Volume, Condition A, is intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal; and, the Interruption of Continuous Traffic, Condition B, is intended for application at locations where Condition A is not satisfied and where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.*

According to paragraph 03 of the section noted above, "*If Condition A is satisfied, then Warrant 1 is satisfied and analyses of Condition B and the combination of Conditions A and B are not needed. Similarly, if Condition B is satisfied, then Warrant 1 is satisfied and an analysis of the combination of Conditions A and B is not needed.*

Combination of Conditions A and B may be used if neither Condition A nor Condition B is satisfied and adequate trial of other alternatives that could cause less delay/ inconvenience to traffic has failed to solve the traffic problems. This condition is intended to be used at intersection where the major street speed exceeds 40 mph, or if the intersection is within the built-up area of an isolated community having a population of less than 10,000.

Response: To satisfy the requirements in Condition A, the study location would need to have 600 vehicles per hour on NE 238th Drive and 150 vehicles per hour on the highest traffic approach on NE Treehill Drive/Driveway. For the study location to meet the requirements in Condition B, 900 vehicles per hour along NE 238th Drive and 75 vehicles per hour on the approach with the highest traffic volume on NE Treehill Drive/Driveway would be needed.

Combination of Condition A and Condition B was not evaluated as the major street roadway is below 40 mph and the City of Wood Village is not an isolated community as the City is within the Portland Metropolitan area. An isolated community is one that either is a long distance from highly populated settlements or lacks transportation links that are typical in more populated areas. Table 5 summarizes the year 2020 highest eight-hour traffic signal warrant analysis for Condition A and Condition B. The

preliminary signal warrant analysis worksheet for Warrant #1 is included in Attachment C of this report for reference.

Table 5
Scenario 1 *Year 2020 Highest Eight-Hour Intersection Volume

Hour	Major Street			Sum of Major Street Volumes> **600/900?	Minor Street Highest Approach	Sum of Minor Street Volumes > **150/75?
	NE 238th Drive (NB)	NE 238th Drive (SB)	Total Vehicles		NE Treehill Drive (WB)	
5:00 PM	731	1144	1876	Yes/Yes	48	No/No
4:00 PM	811	1005	1816	Yes/Yes	42	No/No
3:00 PM	794	991	1785	Yes/Yes	31	No/No
7:00 AM	1031	702	1733	Yes/Yes	62	No/No
2:00 PM	731	928	1660	Yes/Yes	20	No/No
1:00 PM	803	768	1571	Yes/Yes	22	No/No
12:00 PM	786	779	1566	Yes/Yes	29	No/No
6:00 PM	638	846	1483	Yes/Yes	31	No/No

*=Year 2018 traffic volumes are projected to Year 2020 traffic volumes by applying 2% growth
**= Condition A/Condition B

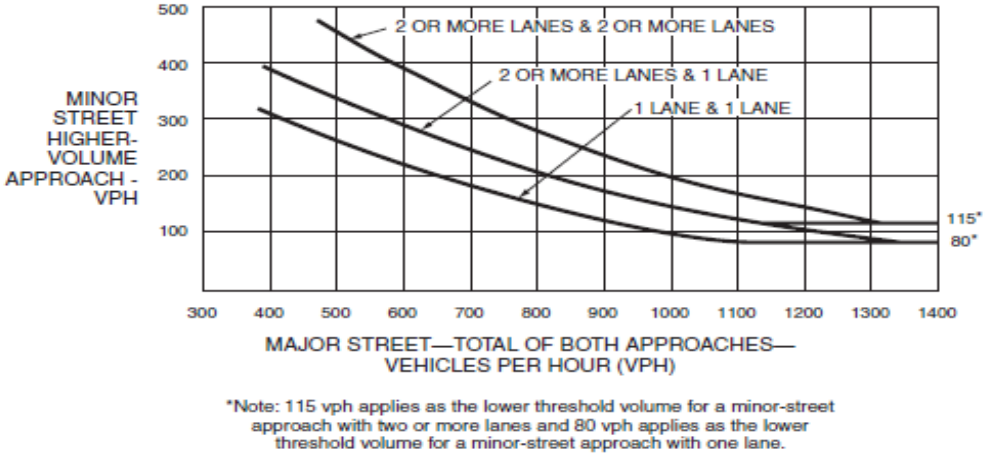
As shown in Table 5, traffic volumes for the major street meets the volume criteria but not the minor street volume criteria for Condition A or Condition B for Year 2020. Based on the analysis, a traffic signal is not justified at this intersection for Warrant 1 due to low volume on the minor street.

Signal Warrant 2: Four-Hour Vehicular Volume

As stated in paragraph 01 Section 4C.03 of the MUTCD (Reference 2) "*The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic signal.* Paragraph 02 of Section 4C.03 states that *"The need for a traffic control signal shall be considered if an engineering study finds that, for each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) all fall above the applicable curve in Figure 4C-1 for the existing combination of approach*

lanes. On the minor street, the higher volume shall not be required to be on the same approach during each of these 4 hours.

Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

Response: As shown on the MUTCD Figure 4C-1 excerpt and Table 5 above, NE 238th Drive meets the traffic volume for major street volume threshold; however, the highest traffic volume on NE Treehill Drive, does not meet the minor street higher-volume approach threshold. As shown on Figure 4C-1 of MUTCD, 80 vehicles per hour is the lowest threshold volume for an intersection with 2 or more lanes on a major street and one lane on a minor street approach. Because the controlling minor street approach volumes are 62 vehicles per hour or less the required threshold for Signal Warrant 2 is not met.

Signal Warrant 3: Peak-Hour Vehicular Volume

Paragraph 01 Section 4C.04 of the MUTCD states that "*The peak hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street.* As stated in paragraph 02 of Section 4C.04 (Reference 2), "*This signal warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, of high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time."*

Response: The study location is a typical local street/minor arterial intersection. Therefore, the peak hour signal warrant does not apply for the study location.

Signal Warrant 4: Pedestrian Volume

Paragraph 01 Section 4C.05 of the MUTCD states that *"The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street."* According to Paragraph 02 of this section, "*The need for a traffic control signal at an intersection or midblock crossing shall be considered if an engineering study finds that one of the following criteria is met:*

A. *For each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) all fall above the curve in Figure 4C-5; or*

B. For 1 hour (any four per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) falls above the curve in Figure 4C-7.

For major streets with the posted or statuary speed limit or where the 85-percentile speed exceeds 35 miles per hour (mph), Paragraph 03 of this section in MUTCD provides an option to use Figure 4C-6 rather than Figure 4C-5 to evaluate Criterion A in Paragraph 2, and Figure 4C-8 may be used in place of Figure 4C-7 to evaluate Criterion B in Paragraph 2.

Response: Pedestrian Volume requirement as shown in Figures 4C-5 through Figures 4C-8 in the MUTCD and described above were evaluated against the total traffic volume on NE 238th Drive and the total pedestrian volume crossing NE 238th Drive. The 4 highest hour pedestrian traffic crossing NE 238th Drive and the highest total traffic volumes on both approaches of NE238th Drive during the same 6 hours are presented in Table 6 below.

Table 6
Pedestrian Four-Hour Volume

Vehicle volumes in veh/hr. and Pedestrian volumes in ped/hr.	Four Greatest Hours				Peak Hour
SUM of both approaches on Major Route	1876	1816	1785	1733	1876
Pedestrians crossing the Major Route	26	14	12	2	26

As shown in Table 6 above, the number of pedestrians crossing the major street at the study location is significantly lower than the lower threshold volume (107 ped/hr) in Figures 4C-5 through 4C-8 in the MUTCD manual (Reference 2). Therefore, the installation of a traffic signal control based on this warrant is not justified.

Signal Warrant 5: School Crossing

Paragraph 01 Section 4C.06 of the MUTCD states that *"The School Crossing signal warrant is intended for application where the fact that school children cross the major street is the principal reason to consider installing a traffic control signal. For the purpose of this warrant, the word "schoolchildren" includes elementary through high school student. "*

Response: The study intersection is close to Treehill Day School, a preschool and after school day care. There are not elementary through high school students in close proximity to the intersection. Reynolds High School and Troutdale Elementary School are 1.1 miles and 2.2 miles from the study location, respectively. Based on site the 14-hour traffic counts and review of the study location, significant number of students are not expected to cross NE 238th Street at this location. Since there is neither an established school crossing nor a large numbers of school children in the study area, Signal Warrant #5 is not met.

Signal Warrant 6: Coordinated Signal System

Paragraph 01 Section 4C.07 of the MUTCD states that *"Progressive movement in a coordinated signal system sometimes necessitates installing traffic control signals at intersections where they would not otherwise be needed to maintain proper platooning of vehicles."*

This signal warrant should not be applied where the resultant spacing of traffic control signals would be less than 1,000 feet.

Response: A traffic signal control at the study location and the adjacent traffic control signals will not collectively provide a progressive operation. The nearest traffic signal controls are located 350 feet to the north at NE 238th Drive/NE Arata Road and 3,150 feet south at NE 238th Drive/NE Glisan Street/SW Cherry Park. Since the resultant spacing of traffic control signals between the study location and NE Arata Road will be less than 1000 feet, Signal Warrant #6 is not met.

Signal Warrant 7: Crash Experience

Paragraphs 01 and 02 of Section 4C.08 of the MUTCD states that *"The Crash experience signal warrant conditions are intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal. The need for a traffic control signal shall be considered if an engineering study finds that all of the following criteria are met:*

A. Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency; and
B. Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period, each crash involving personal injury or property damage), or apparently exceeding the applicable requirements for a reportable crash; and
C. For each of any 8 hours of an average day, the vehicles per hour (vph) in both of the 80 percent columns of Condition A in Table 4C-1 (see Section 4C.02), or the vph in both of the 80 percent of Condition B in Table 4C-1 exists on the major-street and the higher-volume minor-street approach, respectively, to the intersection, or the volume of pedestrian traffic is not less than 80 percent of the requirements specified in the Pedestrian Volume warrant. These major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours.

Response: None of the criteria for the installation of a traffic signal based on Signal Warrant 7 is met. Review of crash data at the study intersection did not show crash patterns that can be reduced by the installation of a traffic signal control. There have only been 3 crashes from year 2011 to year 2015 (most recent five-year records) as shown in the attached crash report from ODOT. Of the 3 crashes that occurred, two crashes were rear-end type and the third crash was fixed object type. One rear-end crash involving vehicles traveling from south to north occurred in year 2011. The fixed object and the other rear-end crash involving vehicles traveling from north to south occurred in 2015. The rear-end crash types are caused by drivers' failure to stop to avoid a parked or stopped vehicle and the fixed-object crash type is caused by a motorist driving at high speed.

Possible rear-end and fixed-object type crash reduction strategies include improving sight distance, installation of speed feedback signs, removal of unwarranted traffic signal control, speed enforcement and others depending on the crash type patterns at the study locations.

Table 7
Crash Experience

Criteria			Fulfilled? Yes	Fulfilled? No
1. *Adequate trial of alternatives with satisfactory observance and enforcement has fialed to reduce the crash frequency as shown below:*				
				X
2. ***How many crashes within the past 12 months?*** *For this criteria to be met, five or more reported crashes, of types suseptible to correction by the installation of a traffic control signal, must have occurred.*		*1*		X
3. *If Warrant 1A or Warrant 1B are 80 percent satisfied of the current values or if Warrant 4, 4-hour or peak, is met at the 80 percent values.*	Met? Yes	Met? No		
Warrant 1, Condition A, Minimum Vehicular Volume (80 percent satisfied):		X		X
Warrant 1, Condition B, Interruption of Continuous Traffic (80 percent satisfied):		X		
Warrant 4, Four-Hour Volume (80 percent satisfied):		X		
Warrant 4, Peak Hour Volume (80 percent satisfied):		X		

As shown in the Crash Experience summary table 7 above, none of the criteria listed above are met. Thus, a traffic signal is not justified at the study intersection based on this warrant.

Warrant #8: Roadway Network

Paragraph 01 of Section 4C.09 of the MUTCD states that *"Installing a traffic control signal at some intersections might be justified to encourage concentration and organization of traffic flow on a roadway network.*

In addition, paragraph 02 of Section 4C.09 of MUTCD states that "*The need for a traffic control signal shall be considered if an engineering study finds that the common intersection of two or more major routes meets one or both of the following criteria:*

A. *The intersection has a total existing, or immediately projected, entering volume of at least 1,000 vehicles per hour during the peak hour of a typical weekday and has a five-year projected traffic volume, based on an engineering study, that meet one or more of Warrants 1, 2, and 3 during an average weekday; or*
B. *The intersection has a total existing or immediately projected entering volume of at least 1,000 vehicles per hour for each of any 5 hours of a non-normal business day (Saturday or Sunday)."*

Response: The total entering volume of 1876 vehicles per hour at the study intersection currently exceeds the 1,000 entering vehicle thresholds for this warrant; however, the study location is not a common intersection of two or more major routes. NE Treehill Drive is a local street with poor street connectivity and it is not defined as a "major route" that would meet the intention of this warrant. A "major route" is the route with higher volume of traffic and with good street connectivity. Thus, a traffic signal is not justified at the study intersection based on this warrant.

Warrant #9: Intersection near a Grade Crossing

The Intersection near a Grade Crossing signal warrant is intended for use at a location where none of the conditions described in the other eight traffic warrants are met, but the proximity to the intersection of a grade crossing on an intersection approach controlled by a STOP or YIELD sign is the principal reason to consider installing a traffic signal.

Response: The nearest railroad is approximately located 2,200 feet from the study location and passes under the NE 238th Street at I-84 Ramps. Since the study intersection is not near a grade crossing, Signal Warrant 9 is not met.

Signal Warrant Findings

The signal warrant analysis review at the intersection of NE 238th Drive and NE Treehill Drive identified that MUTCD Signal Warrants are not forecasted to be met for the year 2020 traffic condition.

Year 2040 Traffic Volume: Traffic signal warrants for the study location's Year 2040 traffic condition were evaluated consistent with the *State of Oregon administrative rule (OAR 734-020-0460 (1)*. According to this administrative rule, only MUTCD Warrant 1 Case A and Case B will be used to project future needs for traffic signals beyond three years from the present time (Corrected to reflect numbering used in the Millennium Edition of the MUTCD). The *ODOT Preliminary Signal Warrant (PWS)* analysis worksheet was used to forecast year 2040 traffic signal need of the study intersection.

Per the *ODOT Analysis Procedure Manual (AMP), version 1 (Reference 4),* guidelines, the major street ADT count total volume approaching from both directions, including all turn movements, and the ADT counts for the highest approaching volume minus the right turning traffic volume on one direction of the minor street are included in the PWS analysis. According to the APM guidelines, right turning volumes of the highest approaching volume from a shared left-through-right lane are not included in the minor street ADT if the right-turn demand is less than 85% of the shared lane capacity for un-signalized intersection.

Consistent with the APM guidelines, none of the right turning volume from the highest volume approach from the westbound shared left-through-right lane are included. As shown in the Year 2040 Synchro un-signalized capacity analysis output in Attachment B, the minor street highest approach volume (westbound) lane capacity is 162. The right turn discount for this intersection is 138 (85% x162). As shown in the worksheet in Attachment B, the right-turn demand (27-138 = -111) is less than 85% of the of the shared lane capacity of the westbound approach.

The average daily traffic (ADT) that is shown in the PSW sheet is estimated by applying the K-factor to the evening peak hour traffic. The worksheet is included in Attachment B for reference. The K-factor, defined as the ratio of the design hour traffic (which is approximately equal to the evening peak hour traffic in urban areas) to the ADT was calculated using year 2040 ADT volumes and peak hour traffic volumes provided by Metro. The ADT and peak hour traffic volume work sheet is in Attachment A. As shown in the PSW worksheet, a traffic signal based on Year 2040 traffic volume conditions is not justified.

Based on the above analysis, none of the traffic signal warrant criteria will be satisfied through year 2040 traffic condition.

Scenario 2 - Existing street condition with NE Hawthorne Avenue to NE Treehill Drive connection

A. Intersection Capacity Analysis

The following section evaluates the study location's LOS with NE Treehill Drive to NE Hawthorne Avenue connection. Based on engineering judgement and knowledge of the study area's vicinity, it is anticipated that:

- Trips generated by residential development (approximately 10 single-family) near the intersection of NE Hawthorne Avenue/NE Treehill Drive are likely to use NE Treehill Drive to access NE 238th Drive. Currently, trips from this development turn left on NE Maple Boulevard at its intersection with NE 238th Drive/NE Arata Road to travel southbound on NE 238th Drive.
- Approximately 10 trips for each of the morning and evening peak traffic hour will be generated by the single-family dwelling units. The trips generated by the 10 single-family dwelling units were estimated based on trip rates for Single-Family dwelling units (Land-use code #210) obtained from the *Trip Generation Manual, 9th Edition* (Reference 5) published by the Institute of Transportation Engineers. The results of the calculation are summarized in Table 8 below.

Table 8
Trip Estimate Calculation Summary

Morning Peak Hour			Afternoon Peak Hour			Weekday
In	Out	Total	In	Out	Total	Total
(10)*0.25=2	(10)*0.75=8	10	(10)*0.63=6	(10)*0.37=4	10	100

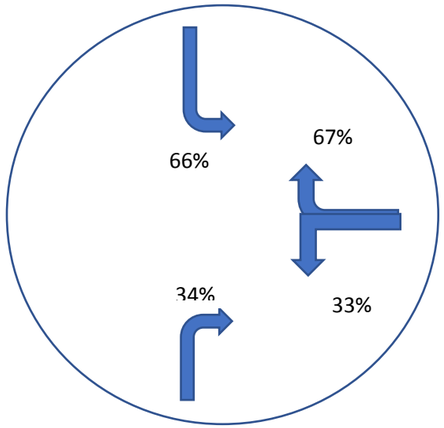
Trip distribution pattern for the additional trips at the study location was determined based on the existing turn movement counts, knowledge of existing land uses and engineering judgement. It is expected that 100% of the new trips generated by the NE Hawthorn Avenue/NE Treehill Drive connection will travel on NE 238th Drive with:

- 67% turning right from westbound NE Treehill Drive to NE 238th Drive;
- 66% turning left from southbound NE 238th Drive to NE Treehill Drive;
- 33% turning left from westbound NE Treehill Drive to NE 238th Drive; and,
- 34% from northbound NE 238th Drive to NE Treehill Drive.

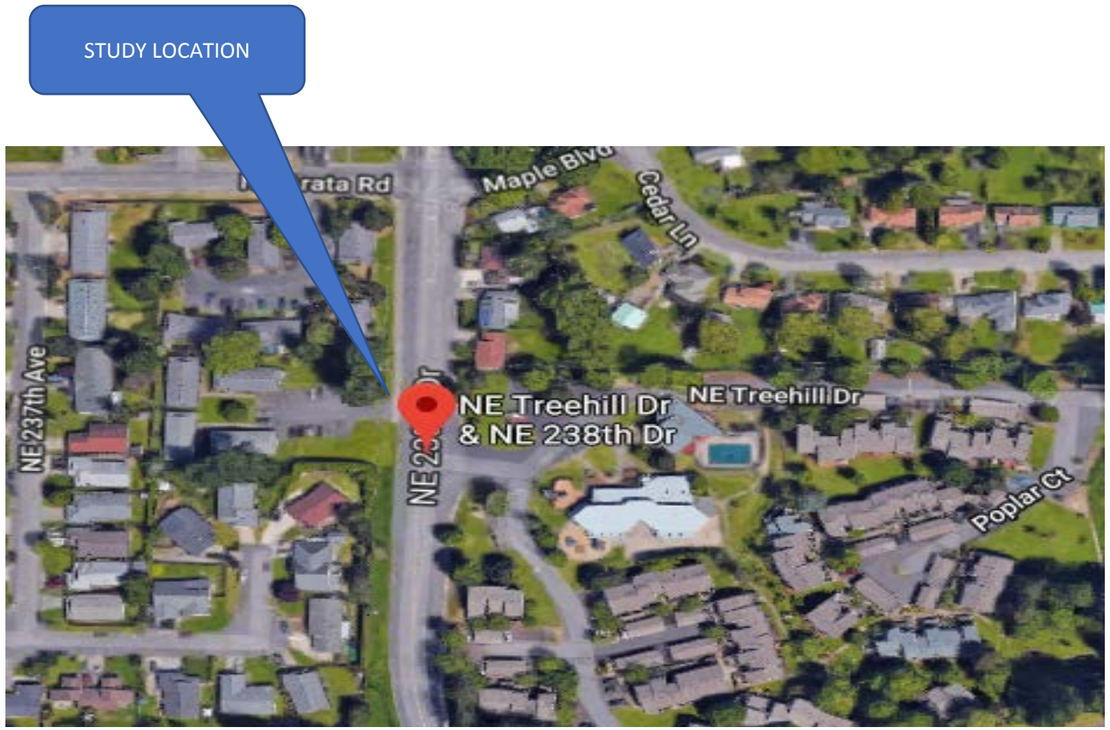
The number of trips assigned to each movement and the trip distribution percentages are presented in Figure 4 below.

The additional trips were added to the existing condition trips in Figures 2 and 3 in Scenario-1. The projected Year 2020 and Year 2040 plus the new trips at the study location are presented in Figures 5 and 6 below. Operational analysis assuming stop control, traffic signal control and right-in/right-out control for the total traffic volumes in Figures 5 and 6 was performed to assess the impact of connecting NE Treehill Drive to NE Hawthorne Road as described below.

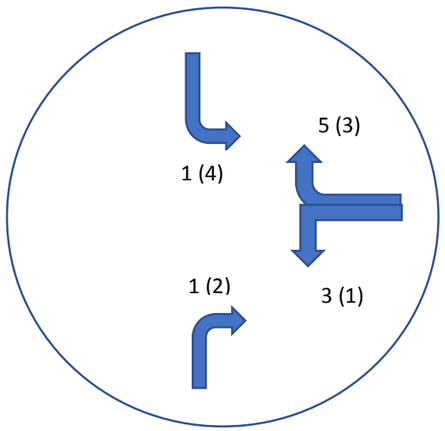
SCENARIO 2



NEW TRIPS DISTRIBUTION



NORTH



NEW TRIPS ASSIGNMENT

LEGEND

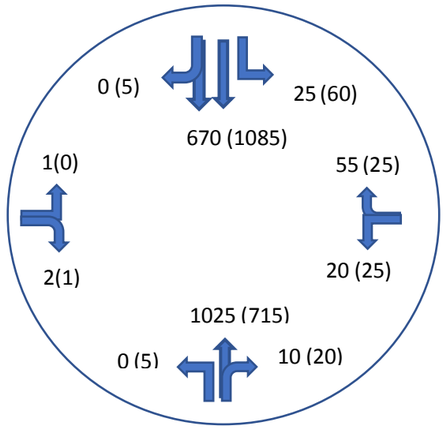
AM (PM)

STOP SIGN

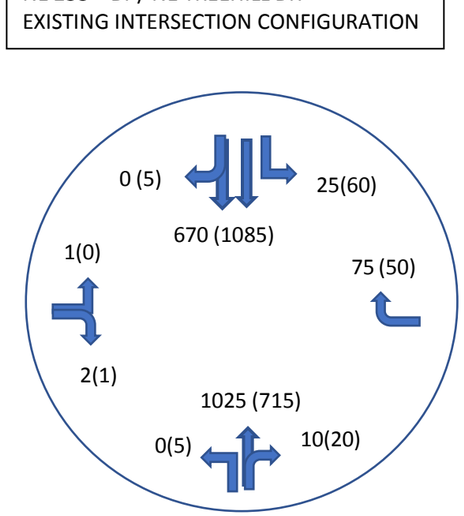
Figure 4: NEW TRIPS DISTRIBUTION & ASSIGNMENT

`

SCENARIO 2



NE 238TH Dr / NE TREEHILL Dr.
EXISTING INTERSECTION CONFIGURATION



WESTBOUND LEFT TURNS PROHIBITED

STUDY LOCATION

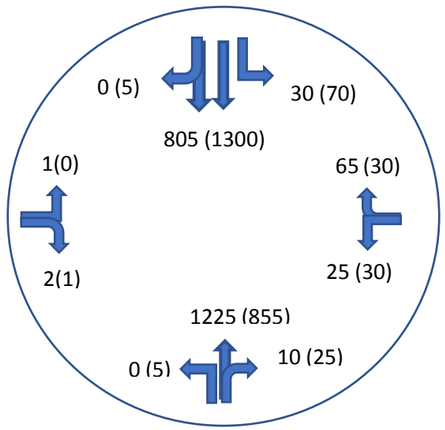
NORTH

LEGEND

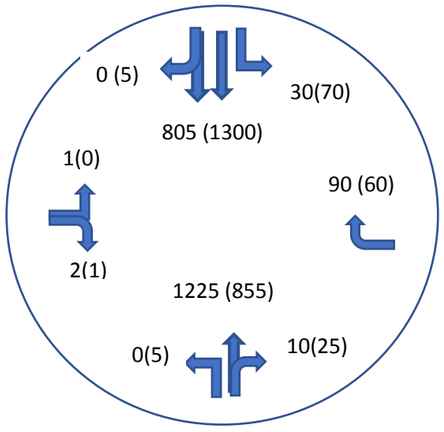
AM (PM)
TURNING VOLUMES

Figure 5: Future Year 2020 Volume plus New Trips

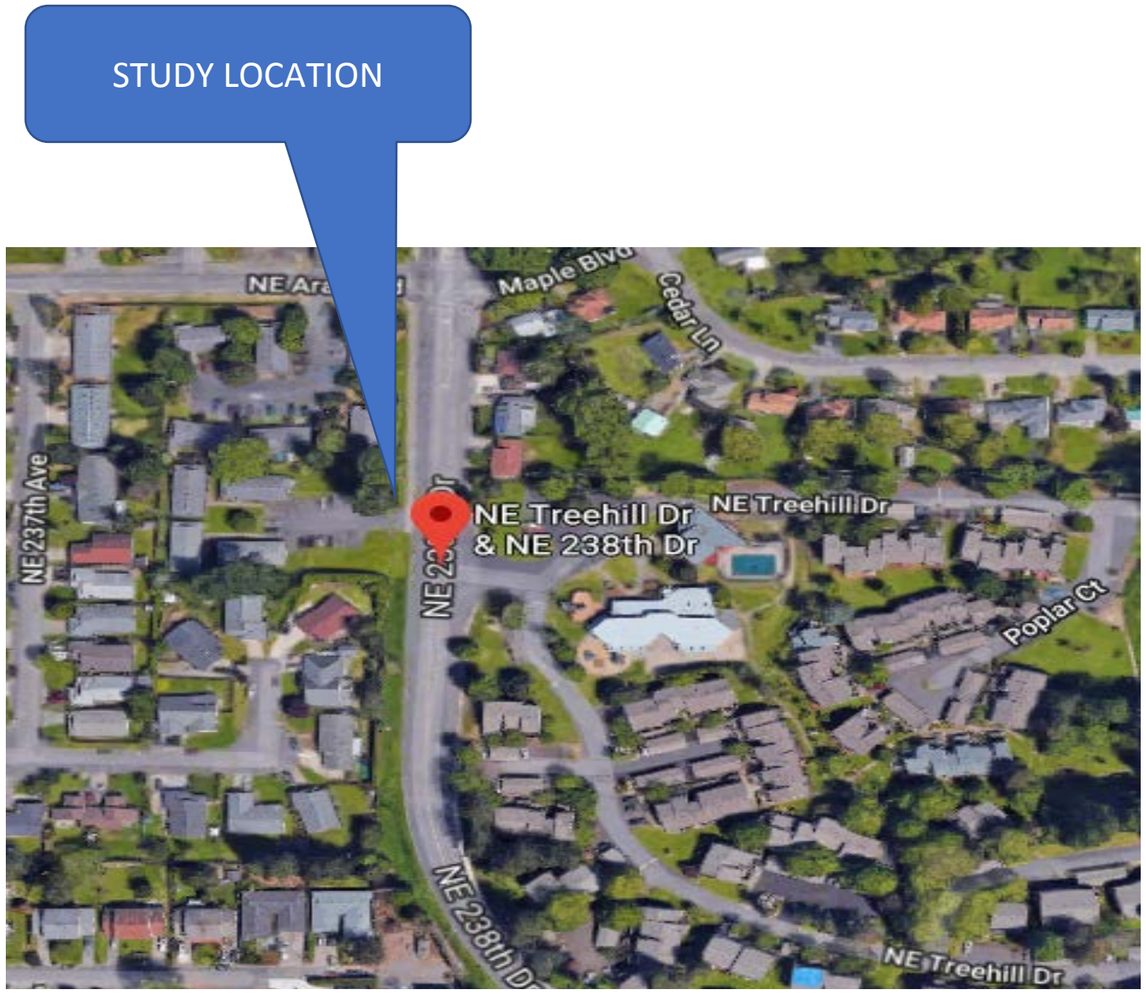
SCENARIO 2



NE 238TH Dr / NE TREEHILL Dr.
EXISTING INTERSECTION CONFIGURATION



WESTBOUND LEFT TURNS PROHIBITED



NORTH

LEGEND

AM (PM)
TURNING VOLUMES

Figure 6: Future Year 2040 Volume plus New Trips

1. **Scenario 2 - Stop Controlled Morning and Evening Peak Traffic Hour Volume Condition:** Based on the above methodology, operational analysis was performed for future year 2020 and year 2040 total traffic volumes (Figures 5 and 6) with stop sign control. The results of the analysis are summarized in Table 9. The worksheets for the analysis are presented in Attachment C.

Table 9
Peak Hour Traffic Condition with Stop Sign Control

2020 Weekday AM Peak Traffic			**2020 Weekday PM Peak Traffic**			**County Standard Met?**
LOS	**Control Delay sec/veh**	**V/C**	**LOS**	**Control Delay sec/veh**	**V/C**	
E	47.4	0.5	E	48.6	0.40	**N**
2040 Weekday AM Peak Traffic			**2040 Weekday PM Peak Traffic**			**County Standard Met?**
LOS	**Control Delay sec/veh**	**V/C**	**LOS**	**Control Delay sec/veh**	**V/C**	
F	144.8	0.93	F	126.8	0.77	**N**

* LOS, Control Delay & V/C reported are for the movement with the highest delay and worst LOS. Control Delay = seconds/vehicle (sec/veh).

As shown in Table 9, under this Scenario year 2020 and year 2040 weekday morning and evening peak traffic hour, the intersection will not operate within the County's acceptable LOS with stop-sign control.

2. **Scenario 2- Signal Controlled Morning and Evening Peak Traffic Hour Condition:** Based on the methodology noted above, operational analysis was performed for projected year 2020 and year 2040 total traffic volumes (in Figures 5 and 6) with traffic signal-control. The results of the analysis are summarized in Table 10. The worksheets for the analysis are presented in Attachment C.

Table 10
Scenario 2 - Peak Hour Traffic Condition with Signal Control

2020 Weekday AM Peak Traffic			**2020 Weekday PM Peak Traffic**			**County Standard Met?**
LOS	**Control Delay Sec/Veh**	**V/C**	**LOS**	**Control Delay Sec/Veh**	**V/C**	
E	79.2	1.26	B	11.2	0.82	N

2040 Weekday AM Peak Traffic			2040 Weekday PM Peak Traffic			County Standard Met?
LOS	**Control Delay Sec/Veh**	**V/C**	**LOS**	**Control Delay Sec/Veh**	**V/C**	
F	118.5	1.41	C	29.2	1.06	N

V/C reported is for the movement with the highest volume to capacity ratio.

Control delay and LOS reported is for intersection. Control Delay = seconds/vehicle (sec/veh)

With installation of a traffic signal control, the study location is projected to operate within the County's acceptable LOS standard in year 2020 and year 2040 during evening peak traffic hour conditions as shown in Table 10 above. In year 2020 and year 2040 morning peak traffic hour condition, the signalized intersection is projected not to operate within the County's acceptable LOS standard.

3. **Scenario 2 - Morning and Evening Peak Traffic Hour with Westbound Left-Turns Prohibited:** Based on the methodology noted above, operational analysis was performed for projected year 2020 and year 2040 total traffic volumes (in Figures 5 and 6) with westbound left-turns prohibited operation. The results of the analysis are summarized in Table 11 below. As shown in Figures 5 and 6, the left-turn traffic is assumed to turn right at the intersection and make a series of left and right turns elsewhere to travel southbound on NE 238th Drive. The worksheets for the analysis are presented in Attachment C.

Table 11
Scenario 2 - Peak Hour Traffic Condition with Westbound Left-Turns Prohibited

2020 Weekday AM Peak Traffic			2020 Weekday PM Peak Traffic			County Standard Met?
LOS	**Control Delay Sec/Veh**	**V/C**	**LOS**	**Control Delay Sec/Veh**	**V/C**	
F	51.9	0.04	C	15.8	0.14	N
2040 Weekday AM Peak Traffic			**2040 Weekday PM Peak Traffic**			**County Standard Met?**
LOS	**Control Delay Sec/Veh**	**V/C**	**LOS**	**Control Delay Sec/Veh**	**V/C**	
F	144.3	0.11	C	19.4	0.21	N

* LOS, Control Delay & V/C reported are for the movement with the highest delay and worst LOS. Control Delay = seconds/vehicle (sec/veh).

Under Scenario 2, the study location is forecast to operate within the County's acceptable LOS standard in Year 2020 and Year 2040 evening peak traffic hour with westbound left-turn prohibit; but, not during the morning peak traffic hour. As shown in Table 11 above, in Year 2020 and Year 2040 the intersection is projected to operate at LOS "F" during the morning peak traffic hour and at LOS "C" during the evening peak traffic hours.

B. Signal Warrant Analysis with NE Treehill Drive to NE Hawthorne Road Connection

Year 2020 Traffic Volume: Traffic signal warrants 1 and 2 described above were reevaluated to determine the need for traffic signal at the study location after NE Treehill Drive is connected to NE Hawthorne Road. All other warrants will not be impact by the NE Treehill Drive to NE Hawthorne Road connection as the volume of the intersecting traffic is not the principal reason to consider installing a traffic signal based on those warrants.

Signal warrants 1 and 2 were reevaluated based on the assumption that the NE Treehill Drive to NE Hawthorne Road connection will result on 100 new vehicles per day and that all new trips will occur during the eight highest traffic hours as shown in the worksheet in Appendix C.

Warrant #1: The projected traffic signal need for the Year 2020 eight-hour volume with the new trips are summarized in Table 12 below.

Table 12
Scenario 2 *Year 2020 Highest Eight-Hour Intersection Volume

Hour	Major Street			Sum of Major Street Volumes> **600/900?	Minor Street Highest Approach	Sum of Minor Street Volumes > **150/75?
	NE 238th Drive (NB)	NE 238th Drive (SB)	Total Vehicles		NE Treehill Drive (WB)	
5:00 PM	731	1144	1876	Yes/Yes	64	No/No
4:00 PM	811	1005	1816	Yes/Yes	57	No/No
3:00 PM	794	991	1785	Yes/Yes	42	No/No
7:00 AM	1031	702	1733	Yes/Yes	84	No/Yes
2:00 PM	731	928	1660	Yes/Yes	27	No/No
1:00 PM	803	768	1571	Yes/Yes	30	No/No
12:00 PM	786	779	1566	Yes/Yes	39	No/No
6:00 PM	638	846	1483	Yes/Yes	42	No/No

** = Condition A/Condition B

As shown in Table 12, the traffic volume criteria for the installation of a traffic signal control based on Condition A is not justified because the traffic on the minor street highest volume approach is less than 150 vehicles per hour during the eight highest hours. The maximum traffic volume for the minor street highest volume approach during the morning peak traffic hour is 84 vehicles per hour. The traffic volume criteria for the installation of a traffic signal based on Condition B is forecast to be justified during the morning peak hour traffic only. Therefore, a traffic signal control at this intersection is not forecasted to be justified based on this warrant with the additional new trips.

Warrant #2: As shown on Table 12 above, the maximum traffic volume for the minor street highest volume approach (westbound) during the morning peak traffic hour is forecast to be 84 vph; and 64 vph or less during the remaining seven of the eight highest hours. As shown on Figure 4C-1 of the MUTCD excerpt on page 9 of this report, 80 vph is the lowest threshold volume for an intersection with 2 or more lanes on a major street and one lane on a minor street approach. Because the controlling minor street approach volume (64 vph or less) for seven of the eight highest hours is below the required threshold, Warrant #2 is not met with the additional new trips.

Year 2040 Traffic Volume: MUTCD Warrant 1 Case A and Case B were reevaluated using the ODOT Preliminary Signal Warrant (PWS) analysis worksheet and the procedure discussed above under year 2040 traffic condition signal need for Scenario 1. As in Scenario 1, the right turning volume from the highest volume approach on the westbound shared left-through-right lane are not included. Based on information contained in the year 2040 un-signalized capacity analysis Synchro output for the evening peak traffic hour, the minor street lane capacity is 56 vph and the right-turn discount for the approach is estimated to be 48 vph (85% x56). Because the right-turn demand (30-48 = -18) is less than 85% of the shared lane capacity of the westbound approach, right-turns for the signal analysis are not included.

The worksheets for the right-turn discount and signal analysis are included in Attachment C. As shown in the PSW worksheet, a traffic signal based on year 2040 traffic volume conditions is not justified for Scenario - 2.

Findings

The analysis resulted in the following findings:

Scenario 1 –Existing Condition

- With stop sign control, the study intersection is forecasted to operate at a LOS “E” or worse under year 2018, year 2020 and year 2040 weekday morning and evening peak hour traffic conditions. The poor LOS at the intersection is due to high delay experienced by traffic entering NE 238th Drive from the eastbound and westbound approaches. Review of the intersection analysis output reveals that the intersection’s performance can be improved to the Multnomah County’s acceptable LOS “D” by adding a northbound through lane on NE 238th Drive through the NE Treehill Drive intersection.
- With traffic signal control, the study intersection is forecasted to operate at LOS “C” or better during the morning and evening peak hours for all study periods except during weekday morning peak hour under year 2020 and year 2040 conditions. Under year 2020 and year 2040 morning peak traffic hour condition the intersection is forecasted to operate at LOS “E” and “F”, respectively. The poor LOS is due to insufficient capacity on the northbound approach. The northbound approach is forecasted to operate at LOS “F”. To improve the intersection’s performance a northbound through lane on NE 238th Drive through NE Treehill Drive intersection will need to be added.

- With westbound left-turn prohibited, the intersection is forecasted to operate within the County's LOS standard in year 2018, year 2020 and year 2040 traffic conditions during weekday evening peak traffic hours; but, not during weekday morning peak traffic hours. The poor LOS at the intersection is due to high delay experienced by traffic entering NE 238th Drive from the eastbound and westbound approaches. This intersection's performance can be improved to the Multnomah County's acceptable LOS "D" by adding a northbound through lane on NE 238th Drive.
- The study intersection does not meet any of the MUTCD signal warrants under Scenario 1 in year 2020 and year 2040 traffic condition.

Scenario 2 – Existing Condition with NE Treehill Drive/NE Hawthorne Avenue Connection

- With stop sign control, the NE 238th Drive/NE Treehill Drive is forecasted to operate at a LOS "E" or worse under year 2020 and year 2040 morning and evening peak traffic hour conditions. The poor LOS at the intersection is due to high delay experienced by traffic entering NE 238th Drive from the eastbound and westbound approaches. This intersection's performance can be improved to the Multnomah County's acceptable LOS "D" by adding a northbound through lane on NE 238th Drive through the NE Treehill Drive Intersection.
- With traffic signal Control, the study intersection is forecasted to operate at LOS "C" or better during the evening peak traffic hour conditions. Under year 2020 and year 2040 morning peak traffic hour condition the intersection is forecasted to operate at LOS "E" and "F", respectively. The poor LOS is due to insufficient capacity on the northbound approach. The northbound approach is forecasted to operate at LOS "F". To improve the intersection's performance a northbound through lane will need to be added.
- With westbound left-turn prohibited, the intersection is forecasted to operate at the County's acceptable LOS standard in Year 2020 and Year 2040 evening peak traffic hour; but not during the morning peak traffic condition. To improve the intersection's performance a northbound through lane on NE 238th Drive through NE Treehill Drive intersection will need to be added.
- The study intersection does not meet any of the MUTCD signal warrants under Scenario 2 in year 2020 and year 2040 traffic conditions.

CONCLUSIONS

The intersection of NE 238th Drive and NE Treehill Drive does not meet traffic signal warrant criteria through 2040 traffic conditions, with and without the connection to NE Hawthorne Avenue. With westbound left-turn prohibited, the study intersection is forecasted to operate at the County's operational standard during weekday evening peak traffic hours; but, not during weekday morning peak traffic hours. While with the westbound left-turn prohibited the intersection does not fully meet the County's operational standard, its operation is better than with the condition that allows left turns out of NE Treehill Drive. To fully meet the intersection operational standard (LOS "D") from "*Multnomah County Design and Construction Manual*", a second northbound through lane on NE 238th Drive through the NE Treehill Drive intersection would be required.

We believe the above analysis, adequately address the safety and capacity concerns. Should you have any questions or comments, please do not hesitate to contact us at (541) 680-3411.

References

1) *Multnomah County Design Manual,* https://multco.us/file/16499/download
2) *Manual on Traffic Control Devices, 2009 Edition, https://mutcd.fhwa.dot.gov*
3) *Highway Capacity Manual 2010, 5th Edition (*Transportation Research Board, National Research Council, Washington, D. C., 2010)
4) *Analysis Procedure Manual, version 1, 2017*, (Oregon Department of Transportation) *http://www.oregon.gov/ODOT/Planning/Documents/APMv1.pdf*
5) *Trip Generation Manual, 9th Edition* (Institute of Transportation Engineers).

ATTACHMENT A

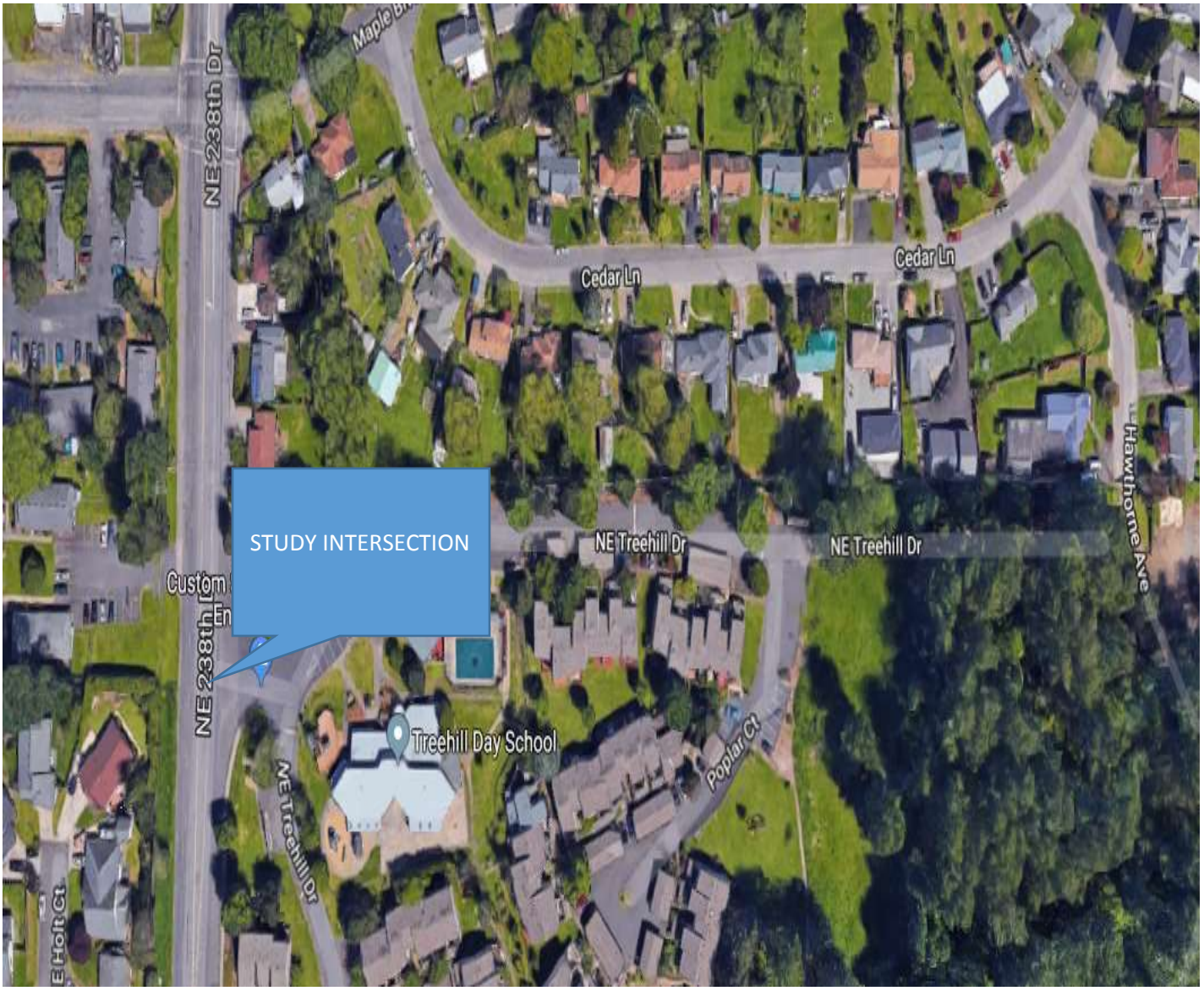
VICINITY MAP

ADT/ANNUAL GROWTH RATE/K-FACTOR

TRAFFIC COUNTS & PROJECT YEAR 202 0/ YEAR 2040

VOLUMES

VICINITY MAP



Existing 14-Hour Count Data

Hour Beginning		Major Street						Minor Street					
	NE 238th Drive (NBLT)	NE 238th Drive (NB)	NE 238th Drive (NB RT)	NE 238th Drive (SB LT)	NE 238th Drive (SB)	NE 238th Drive (SB RT)	Total	NE Treehill Drive (WB LT)	NE Treehill Drive (WB RT)	NE Treehill WB Total	Driveway (EBLT)	Driveway (EBRT)	EB Total
5:00 AM - 6:00 AM	0	682	2	3	154	0	841	1	14	15	0	0	0
6:00 AM - 7:00 AM	0	919	14	14	403	1	**1351**	9	38	**47**	1	0	1
7:00AM - 8:00 AM	0	1003	8	26	662	0	**1699**	14	48	**62**	1	0	1
8:00 AM - 9:00 AM	0	675	5	10	594	0	1284	8	23	**31**	0	0	0
9:00 AM - 10:00 AM	0	692	7	6	611	0	1316	13	13	26	0	0	0
10:00 AM - 11:00 AM	0	614	5	4	614	0	1237	7	9	16	0	0	0
11:00 AM - 12:00 AM	0	654	12	6	663	0	1335	3	18	21	0	0	0
12:00 PM - 1:00 AM	1	766	5	18	746	0	**1536**	6	23	**29**	0	1	1
1:00 PM - 2:00 PM	1	779	8	14	739	2	**1543**	5	17	22	2	0	2
2:00 PM - 3:00 PM	1	706	11	12	898	1	**1629**	8	12	20	1	0	1
3:00 PM - 4:00 PM	2	759	19	28	944	6	**1758**	12	19	**31**	0	0	0
4:00 PM - 5:00 PM	1	772	23	30	955	3	**1784**	14	28	**42**	0	0	0
5:00 PM - 6:00 PM	3	698	19	55	1067	3	**1845**	25	22	**47**	0	0	0
6:00 PM - 7:00 PM	0	610	15	26	803	1	1455	11	20	**31**	2	0	2

Existing Eight Highest Hours

Hour Beginning	Major Street					Minor Street		
	NE 238th Drive (NB)	NE 238th Drive (NB RT)	NE 238th Drive (SB)	NE 238th Drive (SB LT)	Total	NE Treehill Drive (WB LT)	NE Treehill Drive (WB RT)	Total WB LT
5:00 PM	698	19	1067	55	1839	25	22	25
4:00 PM	772	23	955	30	1780	14	28	14
3:00 PM	759	19	944	28	1750	12	19	12
7:00 AM	1003	8	662	26	1699	14	48	14
2:00 PM	706	11	898	12	1627	8	12	8
1:00 PM	779	8	739	14	1540	5	17	5
12:00 PM	766	5	746	18	1535	6	23	6
6:00 PM	610	15	803	26	1454	11	20	11

2- year growth 1.02

Project Year 2020 Eight Highest Hours (Existing Year Plus 2%)

Hour Beginning	Major Street					Minor Street Highest Approach		
	NE 238th Drive (NB)	NE 238th Drive (NB RT)	NE 238th Drive (SB)	NE 238th Drive (SB LT)	Total	NE Treehill Drive (WB LT)	NE Treehill Drive (WB RT)	Total WB
5:00 PM	712	19	1088	56	1876	26	22	48
4:00 PM	787	23	974	31	1816	14	28	42
3:00 PM	774	19	963	29	1785	12	19	31
7:00 AM	1023	8	675	27	1733	14	48	62
2:00 PM	720	11	916	12	1660	8	12	20
1:00 PM	795	8	754	14	1571	5	17	22
12:00 PM	781	5	761	18	1566	6	23	29
6:00 PM	622	15	819	27	1483	11	20	31

Type of peak hour being reported: User-Defined

Method for determining peak hour: Total Entering Volume

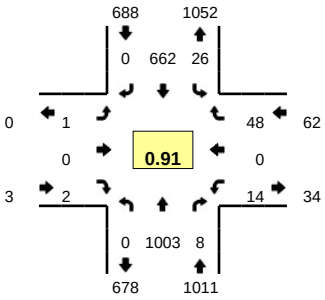
LOCATION: NE 238th Dr -- NE Treehill Dr

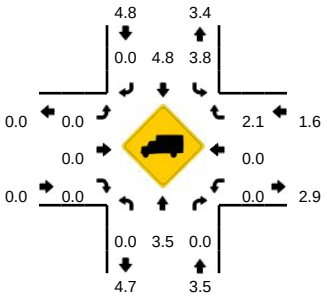
CITY/STATE: Wood Village, OR

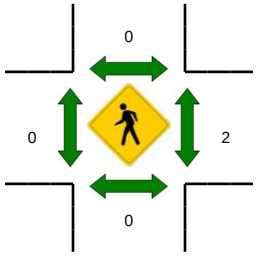
QC JOB #: 14658601

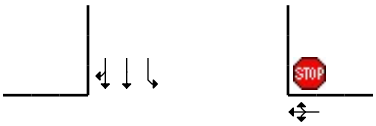
DATE: Thu, Apr 05 2018

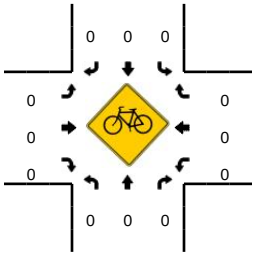
Peak-Hour: 7:00 AM -- 8:00 AM
Peak 15-Min: 7:25 AM -- 7:40 AM

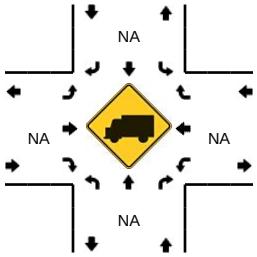


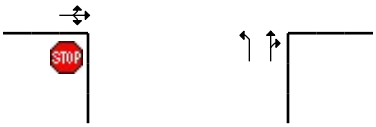


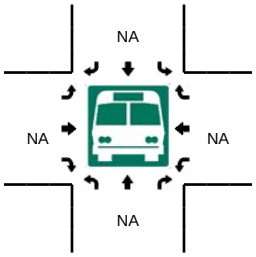












5-Min Count Period Beginning At	NE 238th Dr (Northbound)				NE 238th Dr (Southbound)				NE Treehill Dr (Eastbound)				NE Treehill Dr (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:30 AM	0	83	0	0	0	28	0	0	0	0	0	0	1	0	4	0	116	1191
6:35 AM	0	88	2	0	1	22	0	0	0	0	0	0	1	0	5	0	119	1237
6:40 AM	0	71	3	0	2	49	0	0	0	0	0	0	2	0	3	0	130	1311
6:45 AM	0	71	0	0	0	39	0	0	0	0	0	0	2	0	5	0	117	1334
6:50 AM	0	83	2	0	1	46	0	0	0	0	0	0	0	0	0	0	132	1363
6:55 AM	0	72	2	0	0	50	0	0	0	0	0	0	0	0	1	0	125	1399
7:00 AM	0	81	0	0	3	44	0	0	0	0	0	0	1	0	6	0	135	1447
7:05 AM	0	72	0	0	1	52	0	0	0	0	0	0	0	0	5	0	130	1473
7:10 AM	0	91	1	0	1	45	0	0	0	0	1	0	1	0	6	0	146	1510
7:15 AM	0	91	1	0	2	52	0	0	0	0	0	0	0	0	4	0	150	1551
7:20 AM	0	87	2	0	3	46	0	0	1	0	0	0	0	0	5	0	144	1568
7:25 AM	0	86	1	0	2	53	0	0	0	0	0	0	1	0	5	0	148	1592
7:30 AM	0	99	0	0	3	62	0	0	0	0	0	0	2	0	1	0	167	1643
7:35 AM	0	89	0	0	3	66	0	0	0	0	0	0	3	0	6	0	167	1691
7:40 AM	0	77	0	0	0	47	0	0	0	0	0	0	4	0	2	0	130	1691
7:45 AM	0	74	1	0	4	69	0	0	0	0	0	0	1	0	1	0	150	1724
7:50 AM	0	83	0	0	1	64	0	0	0	0	1	0	0	0	5	0	154	1746
7:55 AM	0	73	2	0	3	62	0	0	0	0	0	0	1	0	2	0	143	1764
8:00 AM	0	56	0	0	3	47	0	0	0	0	0	0	1	0	5	0	112	1741
8:05 AM	0	67	1	0	2	50	0	0	0	0	0	0	1	0	2	0	123	1734
8:10 AM	1	42	1	0	1	41	0	0	0	0	0	0	1	0	1	0	88	1676
8:15 AM	0	69	0	0	0	32	0	0	0	0	1	0	0	0	3	0	105	1631
8:20 AM	0	61	0	0	0	48	0	0	0	0	0	0	1	0	2	0	112	1599
8:25 AM	0	62	0	0	1	38	0	0	0	0	1	0	0	0	1	0	103	1554

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	1096	4	0	32	724	0	0	0	0	0	0	24	0	48	0	1928
Heavy Trucks	0	44	0		0	28	0		0	0	0		0	0	4		76
Pedestrians		0				0				0				8			8
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 4/27/2018 10:31 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

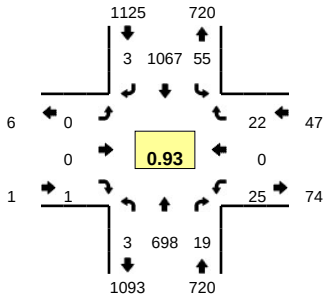
LOCATION: NE 238th Dr -- NE Treehill Dr

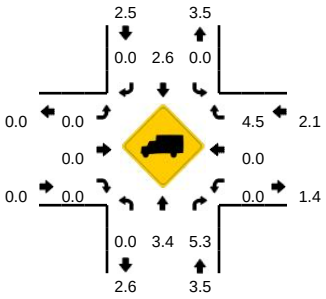
QC JOB #: 14658601

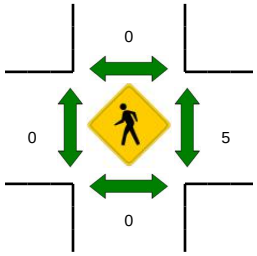
CITY/STATE: Wood Village, OR

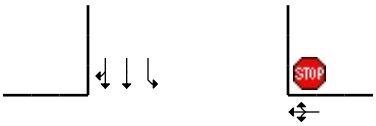
DATE: Thu, Apr 05 2018

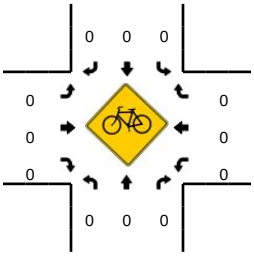
Peak-Hour: 5:00 PM -- 6:00 PM
Peak 15-Min: 5:45 PM -- 6:00 PM

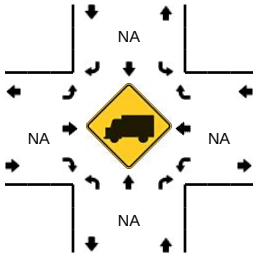


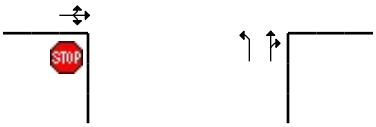


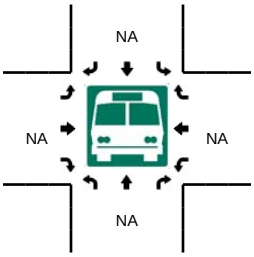












5-Min Count Period Beginning At	NE 238th Dr (Northbound)				NE 238th Dr (Southbound)				NE Treehill Dr (Eastbound)				NE Treehill Dr (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:30 PM	0	66	2	0	1	84	1	0	0	0	0	0	0	0	1	0	155	1873
4:35 PM	0	67	2	0	4	65	0	0	0	0	1	0	1	0	2	0	142	1848
4:40 PM	0	64	2	0	2	72	0	0	0	0	0	0	0	0	2	0	142	1837
4:45 PM	0	71	3	0	0	66	0	0	0	0	0	0	0	0	2	0	142	1821
4:50 PM	0	68	3	0	6	62	0	0	0	0	0	0	3	0	0	0	142	1800
4:55 PM	0	67	2	0	4	85	0	0	0	0	0	0	2	0	5	0	165	1830
5:00 PM	0	65	0	0	7	70	0	0	0	0	0	0	2	0	5	0	149	1823
5:05 PM	0	37	2	0	5	77	0	0	0	0	0	0	3	0	1	0	125	1795
5:10 PM	0	59	3	0	5	100	1	0	0	0	0	0	2	0	2	0	172	1821
5:15 PM	0	62	0	0	6	93	0	0	0	0	0	0	3	0	0	0	164	1838
5:20 PM	0	42	2	0	4	98	0	0	0	0	0	0	2	0	1	0	149	1820
5:25 PM	0	47	2	0	3	89	1	0	0	0	0	0	3	0	2	0	147	1794
5:30 PM	0	54	3	0	6	82	0	0	0	0	0	0	3	0	2	0	150	1789
5:35 PM	1	62	2	0	4	85	0	0	0	0	0	0	2	0	2	0	158	1805
5:40 PM	0	75	1	0	4	86	0	0	0	0	0	0	2	0	1	0	169	1832
5:45 PM	0	64	3	0	3	83	1	0	0	0	0	0	2	0	2	0	158	1848
5:50 PM	1	64	1	0	4	108	0	0	0	0	1	0	1	0	2	0	182	1888
5:55 PM	1	67	0	0	4	96	0	0	0	0	0	0	0	0	2	0	170	1893
6:00 PM	0	49	4	0	0	64	0	0	0	0	0	0	2	0	3	0	122	1866
6:05 PM	0	59	2	0	4	73	0	0	1	0	0	0	2	0	3	0	144	1885
6:10 PM	0	49	1	0	1	77	0	1	0	0	0	0	0	0	0	0	129	1842
6:15 PM	0	52	2	0	1	69	0	0	0	0	0	0	2	0	1	0	127	1805
6:20 PM	0	51	2	0	6	82	0	0	0	0	0	0	1	0	2	0	144	1800
6:25 PM	0	53	0	0	1	77	0	0	1	0	0	0	1	0	3	0	136	1789

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	8	780	16	0	44	1148	4	0	0	0	4	0	12	0	24	0	2040
Heavy Trucks	0	16	0		0	28	0		0	0	0		0	0	0		44
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 4/11/2018 12:02 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

NE 238th Drive
Source: Metro

AVERAGE DAILY TRAFFIC (ADT)

	2015 ADT				2015 Truck Peak Hour				2015 PM Peak Hour			
	Total	Passenger Cars	Medium Trucks	Heavy Trucks	Total	Passenger Cars	Medium Trucks	Heavy Trucks	Total	Passenger Cars	Medium Trucks	Heavy Trucks
Northbound	7773	7757	16	0			1	0		486		
Southbound	12759	12714	45	0			2	0		1014		
Both Directions	20532	20471	61	0			3	0		1500		

	2027 ADT				2027 Truck Peak Hour				2027 PM Peak Hour			
	Total	Passenger Cars	Medium Trucks	Heavy Trucks	Total	Passenger Cars	Medium Trucks	Heavy Trucks	Total	Passenger Cars	Medium Trucks	Heavy Trucks
Northbound	8667	8562	36	69			3	3		534		
Southbound	14446	14133	97	216			6	13		1050		
Both Directions	23113	22695	133	285			9	16		1584		

	2040 ADT				2040 Truck Peak Hour				2040 PM Peak Hour			
	Total	Passenger Cars	Medium Trucks	Heavy Trucks	Total	Passenger Cars	Medium Trucks	Heavy Trucks	Total	Passenger Cars	Medium Trucks	Heavy Trucks
Northbound	9378	9199	60	119			6	6		552		
Southbound	15409	14947	140	322			10	22		1106		
Both Directions	24787	24146	200	441			16	28		1658		

K-Factor Calculation

	Percente Change	Number of Years	Annual Rate	K-Factor (Ratio of Peak Hour Volumes to ADT)
				14
Northbound	11.50	12	1.0	
Southbound	13.22	12	1.1	
Both Directions	12.57	12	1.0	14
Northbound	20.65	25	0.8	
Southbound	20.77	25	0.8	
Both Directions	20.72	25	0.8	15

ATTACHMENT B

SCENARIO 1- EXISTING STREET CONDITION

SYNCHRO WORKSHEET

ODOT CRASH DATA RECORDS

RIGHT TURN VOLUME DISCOUNT WORKSHEET

ODOT PRELIMINARY SIGNAL WARRANT WORKSHEET

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	2	15	0	50	0	1005	10	25	660	0
Future Vol, veh/h	1	0	2	15	0	50	0	1005	10	25	660	0
Conflicting Peds, #/hr	0	0	0	2	0	2	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	5	5	5
Mvmt Flow	1	0	2	16	0	55	0	1104	11	27	725	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1918	1894	365	1529	1889	1112	725	0	0	1115	0	0
Stage 1	779	779	-	1110	1110	-	-	-	-	-	-	-
Stage 2	1139	1115	-	419	779	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	7.33	6.53	6.23	4.16	-	-	4.175	-	-
Critical Hdwy Stg 1	6.5	5.5	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.53	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.519	4.019	3.319	2.238	-	-	2.2475	-	-
Pot Cap-1 Maneuver	46	71	638	88	70	253	865	-	-	610	-	-
Stage 1	359	409	-	253	284	-	-	-	-	-	-	-
Stage 2	247	286	-	583	405	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	35	68	637	85	67	253	865	-	-	610	-	-
Mov Cap-2 Maneuver	35	68	-	85	67	-	-	-	-	-	-	-
Stage 1	359	391	-	253	284	-	-	-	-	-	-	-
Stage 2	193	286	-	554	387	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	44.3	39.4	0	0.4
HCM LOS	E	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	865	-	-	95	174	610	-	-
HCM Lane V/C Ratio	-	-	-	0.035	0.411	0.045	-	-
HCM Control Delay (s)	0	-	-	44.3	39.4	11.2	-	-
HCM Lane LOS	A	-	-	E	E	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	1.8	0.1	-	-

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	1	25	0	20	5	700	20	55	1065	5
Future Vol, veh/h	0	0	1	25	0	20	5	700	20	55	1065	5
Conflicting Peds, #/hr	0	0	0	5	0	5	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	3	3	3
Mvmt Flow	0	0	1	27	0	22	5	753	22	59	1145	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2056	2051	580	1470	2042	769	1150	0	0	775	0	0
Stage 1	1266	1266	-	774	774	-	-	-	-	-	-	-
Stage 2	790	785	-	696	1268	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	7.33	6.53	6.23	4.16	-	-	4.145	-	-
Critical Hdwy Stg 1	6.5	5.5	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.53	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.519	4.019	3.319	2.238	-	-	2.2285	-	-
Pot Cap-1 Maneuver	37	56	463	97	56	400	596	-	-	833	-	-
Stage 1	182	242	-	390	407	-	-	-	-	-	-	-
Stage 2	386	407	-	399	239	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	33	52	461	91	52	398	596	-	-	833	-	-
Mov Cap-2 Maneuver	33	52	-	91	52	-	-	-	-	-	-	-
Stage 1	181	225	-	387	404	-	-	-	-	-	-	-
Stage 2	360	404	-	368	222	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	12.8	44.6	0.1	0.5
HCM LOS	B	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	596	-	-	461	138	833	-	-
HCM Lane V/C Ratio	0.009	-	-	0.002	0.351	0.071	-	-
HCM Control Delay (s)	11.1	-	-	12.8	44.6	9.7	-	-
HCM Lane LOS	B	-	-	B	E	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	1.4	0.2	-	-

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	2	15	0	50	0	1025	10	25	670	0
Future Vol, veh/h	1	0	2	15	0	50	0	1025	10	25	670	0
Conflicting Peds, #/hr	0	0	0	2	0	2	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	5	5	5
Mvmt Flow	1	0	2	16	0	54	0	1114	11	27	728	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1931	1907	366	1540	1902	1122	728	0	0	1125	0	0
Stage 1	782	782	-	1120	1120	-	-	-	-	-	-	-
Stage 2	1149	1125	-	420	782	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	7.33	6.53	6.23	4.16	-	-	4.175	-	-
Critical Hdwy Stg 1	6.5	5.5	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.53	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.519	4.019	3.319	2.238	-	-	2.2475	-	-
Pot Cap-1 Maneuver	45	69	637	86	69	250	862	-	-	605	-	-
Stage 1	358	408	-	250	281	-	-	-	-	-	-	-
Stage 2	244	283	-	582	404	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	34	66	636	83	66	250	862	-	-	605	-	-
Mov Cap-2 Maneuver	34	66	-	83	66	-	-	-	-	-	-	-
Stage 1	358	390	-	250	281	-	-	-	-	-	-	-
Stage 2	191	283	-	553	386	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	45.6	40.1	0	0.4
HCM LOS	E	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	862	-	-	92	171	605	-	-
HCM Lane V/C Ratio	-	-	-	0.035	0.413	0.045	-	-
HCM Control Delay (s)	0	-	-	45.6	40.1	11.2	-	-
HCM Lane LOS	A	-	-	E	E	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	1.8	0.1	-	-

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	1	25	0	20	5	715	20	55	1085	5
Future Vol, veh/h	0	0	1	25	0	20	5	715	20	55	1085	5
Conflicting Peds, #/hr	0	0	0	5	0	5	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	1000	-	-	1000	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	3	3	3
Mvmt Flow	0	0	1	27	0	22	5	777	22	60	1179	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2116	2111	597	1513	2102	793	1184	0	0	799	0	0
Stage 1	1302	1302	-	798	798	-	-	-	-	-	-	-
Stage 2	814	809	-	715	1304	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	7.33	6.53	6.23	4.16	-	-	4.145	-	-
Critical Hdwy Stg 1	6.5	5.5	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.53	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.519	4.019	3.319	2.238	-	-	2.2285	-	-
Pot Cap-1 Maneuver	33	52	451	90	51	388	579	-	-	816	-	-
Stage 1	173	233	-	379	397	-	-	-	-	-	-	-
Stage 2	375	396	-	389	229	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	29	48	449	84	47	386	579	-	-	816	-	-
Mov Cap-2 Maneuver	29	48	-	84	47	-	-	-	-	-	-	-
Stage 1	171	216	-	376	393	-	-	-	-	-	-	-
Stage 2	349	392	-	358	212	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13	49	0.1	0.5
HCM LOS	B	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	579	-	-	449	129	816	-	-
HCM Lane V/C Ratio	0.009	-	-	0.002	0.379	0.073	-	-
HCM Control Delay (s)	11.3	-	-	13	49	9.8	-	-
HCM Lane LOS	B	-	-	B	E	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	1.6	0.2	-	-

Intersection	
Int Delay, s/veh	4.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	2	20	0	60	0	1225	10	30	805	0
Future Vol, veh/h	1	0	2	20	0	60	0	1225	10	30	805	0
Conflicting Peds, #/hr	0	0	0	2	0	2	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	1000	-	-	1000	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	5	5	5
Mvmt Flow	1	0	2	22	0	65	0	1332	11	33	875	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2313	2284	440	1844	2279	1340	875	0	0	1343	0	0
Stage 1	941	941	-	1338	1338	-	-	-	-	-	-	-
Stage 2	1372	1343	-	506	941	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	7.33	6.53	6.23	4.16	-	-	4.175	-	-
Critical Hdwy Stg 1	6.5	5.5	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.53	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.519	4.019	3.319	2.238	-	-	2.2475	-	-
Pot Cap-1 Maneuver	24	40	570	52	40	186	759	-	-	498	-	-
Stage 1	287	345	-	188	221	-	-	-	-	-	-	-
Stage 2	182	223	-	518	341	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	15	37	569	49	37	186	759	-	-	498	-	-
Mov Cap-2 Maneuver	15	37	-	49	37	-	-	-	-	-	-	-
Stage 1	287	322	-	188	221	-	-	-	-	-	-	-
Stage 2	118	223	-	481	318	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	95.5	110.5	0	0.5
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	759	-	-	43	109	498	-	-
HCM Lane V/C Ratio	-	-	-	0.076	0.798	0.065	-	-
HCM Control Delay (s)	0	-	-	95.5	110.5	12.7	-	-
HCM Lane LOS	A	-	-	F	F	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0.2	4.5	0.2	-	-

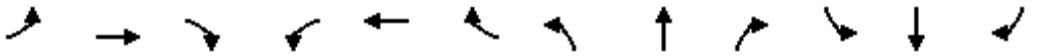
Intersection	
Int Delay, s/veh	3.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	1	30	0	25	5	855	25	65	1300	5
Future Vol, veh/h	0	0	1	30	0	25	5	855	25	65	1300	5
Conflicting Peds, #/hr	0	0	0	5	0	5	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	1000	-	-	1000	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	3	3	3
Mvmt Flow	0	0	1	33	0	27	5	929	27	71	1413	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2529	2524	714	1807	2513	948	1418	0	0	956	0	0
Stage 1	1558	1558	-	953	953	-	-	-	-	-	-	-
Stage 2	971	966	-	854	1560	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	7.33	6.53	6.23	4.16	-	-	4.145	-	-
Critical Hdwy Stg 1	6.5	5.5	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.53	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.519	4.019	3.319	2.238	-	-	2.2285	-	-
Pot Cap-1 Maneuver	16	28	378	55	28	315	470	-	-	712	-	-
Stage 1	120	175	-	310	337	-	-	-	-	-	-	-
Stage 2	307	336	-	321	172	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	13	25	376	50	25	314	470	-	-	712	-	-
Mov Cap-2 Maneuver	13	25	-	50	25	-	-	-	-	-	-	-
Stage 1	119	158	-	307	333	-	-	-	-	-	-	-
Stage 2	276	332	-	287	155	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	14.6	125.5	0.1	0.5
HCM LOS	B	F		

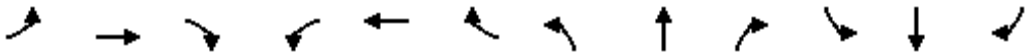
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	470	-	-	376	81	712	-	-
HCM Lane V/C Ratio	0.012	-	-	0.003	0.738	0.099	-	-
HCM Control Delay (s)	12.7	-	-	14.6	125.5	10.6	-	-
HCM Lane LOS	B	-	-	B	F	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0	3.6	0.3	-	-



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	0	2	15	0	50	0	1005	10	25	660	0
Future Volume (veh/h)	1	0	2	15	0	50	0	1005	10	25	660	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1900	1870	1870	1870	1841	1841	1841	1826	1826	1826
Adj Flow Rate, veh/h	1	0	2	16	0	55	0	1104	11	27	725	0
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	0	0	0	2	2	2	4	4	4	5	5	5
Cap, veh/h	2	0	4	22	0	75	80	1429	14	304	2724	0
Arrive On Green	0.00	0.00	0.00	0.06	0.00	0.06	0.00	0.79	0.79	0.79	0.79	0.00
Sat Flow, veh/h	557	0	1114	361	0	1242	717	1819	18	493	3561	0
Grp Volume(v), veh/h	3	0	0	71	0	0	0	0	1115	27	725	0
Grp Sat Flow(s),veh/h/ln	1672	0	0	1604	0	0	717	0	1837	493	1735	0
Q Serve(g_s), s	0.2	0.0	0.0	3.9	0.0	0.0	0.0	0.0	29.7	2.8	5.1	0.0
Cycle Q Clear(g_c), s	0.2	0.0	0.0	3.9	0.0	0.0	0.0	0.0	29.7	32.6	5.1	0.0
Prop In Lane	0.33		0.67	0.23		0.77	1.00		0.01	1.00		0.00
Lane Grp Cap(c), veh/h	7	0	0	97	0	0	80	0	1443	304	2724	0
V/C Ratio(X)	0.45	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.77	0.09	0.27	0.00
Avail Cap(c_a), veh/h	335	0	0	322	0	0	80	0	1443	304	2724	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	44.6	0.0	0.0	41.5	0.0	0.0	0.0	0.0	5.3	14.2	2.6	0.0
Incr Delay (d2), s/veh	40.3	0.0	0.0	10.2	0.0	0.0	0.0	0.0	4.1	0.6	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0	1.8	0.0	0.0	0.0	0.0	8.0	0.3	1.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	84.9	0.0	0.0	51.7	0.0	0.0	0.0	0.0	9.3	14.7	2.9	0.0
LnGrp LOS	F	A	A	D	A	A	A	A	A	B	A	A
Approach Vol, veh/h		3			71			1115			752	
Approach Delay, s/veh		84.9			51.7			9.3			3.3	
Approach LOS		F			D			A			A	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		75.0		4.9		75.0		9.9				
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5				
Max Green Setting (Gmax), s		70.5		18.0		70.5		18.0				
Max Q Clear Time (g_c+I1), s		31.7		2.2		34.6		5.9				
Green Ext Time (p_c), s		12.9		0.0		6.0		0.2				

Intersection Summary												
HCM 6th Ctrl Delay			8.7									
HCM 6th LOS			A									



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	1	25	0	20	5	700	20	55	1065	5
Future Volume (veh/h)	0	0	1	25	0	20	5	700	20	55	1065	5
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1900	1870	1870	1870	1841	1841	1841	1856	1856	1856
Adj Flow Rate, veh/h	0	0	1	27	0	22	5	753	22	59	1145	5
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	0	0	2	2	2	4	4	4	3	3	3
Cap, veh/h	0	0	5	60	0	49	359	888	26	322	1796	8
Arrive On Green	0.00	0.00	0.00	0.07	0.00	0.07	0.50	0.50	0.50	0.50	0.50	0.50
Sat Flow, veh/h	0	0	1610	923	0	752	481	1779	52	690	3600	16
Grp Volume(v), veh/h	0	0	1	49	0	0	5	0	775	59	561	589
Grp Sat Flow(s),veh/h/ln	0	0	1610	1675	0	0	481	0	1831	690	1763	1853
Q Serve(g_s), s	0.0	0.0	0.0	0.9	0.0	0.0	0.2	0.0	11.4	2.5	7.3	7.3
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.9	0.0	0.0	7.5	0.0	11.4	13.9	7.3	7.3
Prop In Lane	0.00		1.00	0.55		0.45	1.00		0.03	1.00		0.01
Lane Grp Cap(c), veh/h	0	0	5	109	0	0	359	0	914	322	879	924
V/C Ratio(X)	0.00	0.00	0.19	0.45	0.00	0.00	0.01	0.00	0.85	0.18	0.64	0.64
Avail Cap(c_a), veh/h	0	0	803	836	0	0	359	0	914	322	879	924
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	15.5	14.0	0.0	0.0	8.5	0.0	6.8	12.8	5.7	5.7
Incr Delay (d2), s/veh	0.0	0.0	17.1	2.9	0.0	0.0	0.1	0.0	9.6	1.2	3.5	3.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	4.1	0.4	1.9	1.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	32.6	16.9	0.0	0.0	8.5	0.0	16.4	14.1	9.2	9.1
LnGrp LOS	A	A	C	B	A	A	A	A	B	B	A	A
Approach Vol, veh/h		1			49			780			1209	
Approach Delay, s/veh		32.6			16.9			16.4			9.4	
Approach LOS		C			B			B			A	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		20.0		4.5		20.0		6.5				
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5				
Max Green Setting (Gmax), s		15.5		15.5		15.5		15.5				
Max Q Clear Time (g_c+I1), s		13.4		2.0		15.9		2.9				
Green Ext Time (p_c), s		1.1		0.0		0.0		0.1				

Intersection Summary												
HCM 6th Ctrl Delay			12.2									
HCM 6th LOS			B									

Notes

User approved pedestrian interval to be less than phase max green.

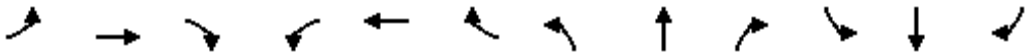
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	0	2	15	0	50	0	1025	10	25	670	0
Future Volume (veh/h)	1	0	2	15	0	50	0	1025	10	25	670	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1900	1870	1870	1870	1841	1841	1841	1826	1826	1826
Adj Flow Rate, veh/h	1	0	2	16	0	54	0	1114	11	27	728	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	2	2	2	4	4	4	5	5	5
Cap, veh/h	2	0	5	28	0	95	228	894	9	228	1705	0
Arrive On Green	0.00	0.00	0.00	0.08	0.00	0.08	0.00	0.49	0.49	0.49	0.49	0.00
Sat Flow, veh/h	557	0	1114	370	0	1248	715	1820	18	489	3561	0
Grp Volume(v), veh/h	3	0	0	70	0	0	0	0	1125	27	728	0
Grp Sat Flow(s),veh/h/ln	1672	0	0	1618	0	0	715	0	1837	489	1735	0
Q Serve(g_s), s	0.1	0.0	0.0	1.3	0.0	0.0	0.0	0.0	15.5	0.0	4.3	0.0
Cycle Q Clear(g_c), s	0.1	0.0	0.0	1.3	0.0	0.0	0.0	0.0	15.5	15.5	4.3	0.0
Prop In Lane	0.33		0.67	0.23		0.77	1.00		0.01	1.00		0.00
Lane Grp Cap(c), veh/h	7	0	0	124	0	0	228	0	903	228	1705	0
V/C Ratio(X)	0.44	0.00	0.00	0.57	0.00	0.00	0.00	0.00	1.25	0.12	0.43	0.00
Avail Cap(c_a), veh/h	821	0	0	795	0	0	228	0	903	228	1705	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	15.7	0.0	0.0	14.1	0.0	0.0	0.0	0.0	8.0	15.8	5.2	0.0
Incr Delay (d2), s/veh	38.1	0.0	0.0	4.0	0.0	0.0	0.0	0.0	119.9	0.2	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0	0.5	0.0	0.0	0.0	0.0	32.5	0.2	0.7	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	53.8	0.0	0.0	18.1	0.0	0.0	0.0	0.0	127.9	16.0	5.3	0.0
LnGrp LOS	D	A	A	B	A	A	A	A	F	B	A	A
Approach Vol, veh/h		3			70			1125			755	
Approach Delay, s/veh		53.8			18.1			127.9			5.7	
Approach LOS		D			B			F			A	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		20.0		4.6		20.0		6.9				
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5				
Max Green Setting (Gmax), s		15.5		15.5		15.5		15.5				
Max Q Clear Time (g_c+I1), s		17.5		2.1		17.5		3.3				
Green Ext Time (p_c), s		0.0		0.0		0.0		0.2				

Intersection Summary		
HCM 6th Ctrl Delay		76.6
HCM 6th LOS		E

Notes

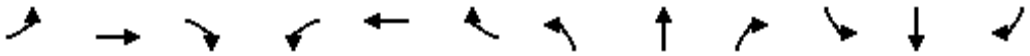
User approved pedestrian interval to be less than phase max green.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	1	25	0	20	5	715	20	55	1085	5
Future Volume (veh/h)	0	0	1	25	0	20	5	715	20	55	1085	5
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1900	1870	1870	1870	1841	1841	1841	1856	1856	1856
Adj Flow Rate, veh/h	0	0	1	27	0	22	5	777	22	60	1179	5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	2	2	2	4	4	4	3	3	3
Cap, veh/h	0	0	5	61	0	49	356	949	27	329	1919	8
Arrive On Green	0.00	0.00	0.00	0.07	0.00	0.07	0.53	0.53	0.53	0.53	0.53	0.53
Sat Flow, veh/h	0	0	1610	922	0	751	466	1781	50	675	3600	15
Grp Volume(v), veh/h	0	0	1	49	0	0	5	0	799	60	577	607
Grp Sat Flow(s),veh/h/ln	0	0	1610	1674	0	0	466	0	1832	675	1763	1853
Q Serve(g_s), s	0.0	0.0	0.0	1.0	0.0	0.0	0.3	0.0	12.2	2.7	7.7	7.7
Cycle Q Clear(g_c), s	0.0	0.0	0.0	1.0	0.0	0.0	7.9	0.0	12.2	14.9	7.7	7.7
Prop In Lane	0.00		1.00	0.55		0.45	1.00		0.03	1.00		0.01
Lane Grp Cap(c), veh/h	0	0	5	110	0	0	356	0	976	329	940	988
V/C Ratio(X)	0.00	0.00	0.21	0.44	0.00	0.00	0.01	0.00	0.82	0.18	0.61	0.61
Avail Cap(c_a), veh/h	0	0	858	892	0	0	356	0	976	329	940	988
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	16.8	15.2	0.0	0.0	8.2	0.0	6.5	12.7	5.5	5.5
Incr Delay (d2), s/veh	0.0	0.0	20.5	2.8	0.0	0.0	0.1	0.0	7.6	1.2	3.0	2.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	3.9	0.4	1.9	1.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	37.3	18.0	0.0	0.0	8.3	0.0	14.1	13.9	8.5	8.3
LnGrp LOS	A	A	D	B	A	A	A	A	B	B	A	A
Approach Vol, veh/h		1			49			804			1244	
Approach Delay, s/veh		37.3			18.0			14.1			8.7	
Approach LOS		D			B			B			A	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		22.5		4.5		22.5		6.7				
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5				
Max Green Setting (Gmax), s		18.0		18.0		18.0		18.0				
Max Q Clear Time (g_c+I1), s		14.2		2.0		16.9		3.0				
Green Ext Time (p_c), s		1.9		0.0		0.8		0.1				

Intersection Summary												
HCM 6th Ctrl Delay			11.0									
HCM 6th LOS			B									



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	0	2	20	0	60	0	1225	10	30	805	0
Future Volume (veh/h)	1	0	2	20	0	60	0	1225	10	30	805	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1900	1870	1870	1870	1841	1841	1841	1826	1826	1826
Adj Flow Rate, veh/h	1	0	2	22	0	65	0	1332	11	33	875	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	2	2	2	4	4	4	5	5	5
Cap, veh/h	2	0	5	35	0	104	208	948	8	208	1804	0
Arrive On Green	0.00	0.00	0.00	0.09	0.00	0.09	0.00	0.52	0.52	0.52	0.52	0.00
Sat Flow, veh/h	557	0	1114	410	0	1212	624	1823	15	397	3561	0
Grp Volume(v), veh/h	3	0	0	87	0	0	0	0	1343	33	875	0
Grp Sat Flow(s),veh/h/ln	1672	0	0	1622	0	0	624	0	1838	397	1735	0
Q Serve(g_s), s	0.1	0.0	0.0	1.8	0.0	0.0	0.0	0.0	18.0	0.0	5.6	0.0
Cycle Q Clear(g_c), s	0.1	0.0	0.0	1.8	0.0	0.0	0.0	0.0	18.0	18.0	5.6	0.0
Prop In Lane	0.33		0.67	0.25		0.75	1.00		0.01	1.00		0.00
Lane Grp Cap(c), veh/h	7	0	0	140	0	0	208	0	956	208	1804	0
V/C Ratio(X)	0.44	0.00	0.00	0.62	0.00	0.00	0.00	0.00	1.41	0.16	0.49	0.00
Avail Cap(c_a), veh/h	869	0	0	843	0	0	208	0	956	208	1804	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	17.2	0.0	0.0	15.3	0.0	0.0	0.0	0.0	8.3	17.3	5.3	0.0
Incr Delay (d2), s/veh	38.2	0.0	0.0	4.5	0.0	0.0	0.0	0.0	188.8	1.6	0.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0	0.7	0.0	0.0	0.0	0.0	53.1	0.3	1.1	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	55.4	0.0	0.0	19.8	0.0	0.0	0.0	0.0	197.1	18.9	6.3	0.0
LnGrp LOS	E	A	A	B	A	A	A	A	F	B	A	A
Approach Vol, veh/h		3			87			1343			908	
Approach Delay, s/veh		55.4			19.8			197.1			6.7	
Approach LOS		E			B			F			A	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		22.5		4.6		22.5		7.5				
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5				
Max Green Setting (Gmax), s		18.0		18.0		18.0		18.0				
Max Q Clear Time (g_c+I1), s		20.0		2.1		20.0		3.8				
Green Ext Time (p_c), s		0.0		0.0		0.0		0.3				

Intersection Summary												
HCM 6th Ctrl Delay			116.5									
HCM 6th LOS			F									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	1	30	0	25	5	855	25	65	1300	5
Future Volume (veh/h)	0	0	1	30	0	25	5	855	25	65	1300	5
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1900	1870	1870	1870	1841	1841	1841	1856	1856	1856
Adj Flow Rate, veh/h	0	0	1	33	0	27	5	929	27	71	1413	5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	2	2	2	4	4	4	3	3	3
Cap, veh/h	0	0	5	69	0	56	294	940	27	218	1902	7
Arrive On Green	0.00	0.00	0.00	0.07	0.00	0.07	0.53	0.53	0.53	0.53	0.53	0.53
Sat Flow, veh/h	0	0	1610	920	0	753	373	1780	52	583	3603	13
Grp Volume(v), veh/h	0	0	1	60	0	0	5	0	956	71	691	727
Grp Sat Flow(s),veh/h/ln	0	0	1610	1673	0	0	373	0	1831	583	1763	1853
Q Serve(g_s), s	0.0	0.0	0.0	1.2	0.0	0.0	0.4	0.0	17.6	0.4	10.4	10.4
Cycle Q Clear(g_c), s	0.0	0.0	0.0	1.2	0.0	0.0	10.7	0.0	17.6	18.0	10.4	10.4
Prop In Lane	0.00		1.00	0.55		0.45	1.00		0.03	1.00		0.01
Lane Grp Cap(c), veh/h	0	0	5	125	0	0	294	0	967	218	931	978
V/C Ratio(X)	0.00	0.00	0.21	0.48	0.00	0.00	0.02	0.00	0.99	0.32	0.74	0.74
Avail Cap(c_a), veh/h	0	0	850	884	0	0	294	0	967	218	931	978
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	17.0	15.1	0.0	0.0	10.4	0.0	7.9	17.0	6.2	6.2
Incr Delay (d2), s/veh	0.0	0.0	20.9	2.8	0.0	0.0	0.1	0.0	26.3	3.9	5.3	5.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	9.8	0.7	2.9	3.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	37.9	18.0	0.0	0.0	10.5	0.0	34.3	20.9	11.6	11.3
LnGrp LOS	A	A	D	B	A	A	B	A	C	C	B	B
Approach Vol, veh/h		1			60			961			1489	
Approach Delay, s/veh		37.9			18.0			34.2			11.9	
Approach LOS		D			B			C			B	

Timer - Assigned Phs	2	4	6	8
Phs Duration (G+Y+Rc), s	22.5	4.5	22.5	7.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	18.0	18.0	18.0	18.0
Max Q Clear Time (g_c+I1), s	19.6	2.0	20.0	3.2
Green Ext Time (p_c), s	0.0	0.0	0.0	0.2

Intersection Summary	
HCM 6th Ctrl Delay	20.6
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	2	0	0	65	0	1005	10	25	660	0
Future Vol, veh/h	1	0	2	0	0	65	0	1005	10	25	660	0
Conflicting Peds, #/hr	0	0	0	2	0	2	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	0	0	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	5	5	5
Mvmt Flow	1	0	2	0	0	71	0	1104	11	27	725	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1926	1894	363	-	-	1112	725	0	0	1115	0	0
Stage 1	779	779	-	-	-	-	-	-	-	-	-	-
Stage 2	1147	1115	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	-	-	6.23	4.16	-	-	4.175	-	-
Critical Hdwy Stg 1	6.5	5.5	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	-	-	3.319	2.238	-	-	2.2475	-	-
Pot Cap-1 Maneuver	46	71	640	0	0	253	865	-	-	610	-	-
Stage 1	359	409	-	0	0	-	-	-	-	-	-	-
Stage 2	244	286	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	31	66	640	-	-	253	865	-	-	610	-	-
Mov Cap-2 Maneuver	31	66	-	-	-	-	-	-	-	-	-	-
Stage 1	359	379	-	-	-	-	-	-	-	-	-	-
Stage 2	175	286	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	49.1	24.7	0	0.4
HCM LOS	E	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	865	-	-	85	253	610	-	-
HCM Lane V/C Ratio	-	-	-	0.039	0.282	0.045	-	-
HCM Control Delay (s)	0	-	-	49.1	24.7	11.2	-	-
HCM Lane LOS	A	-	-	E	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	1.1	0.1	-	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	1	0	0	45	5	700	20	55	1065	5
Future Vol, veh/h	0	0	1	0	0	45	5	700	20	55	1065	5
Conflicting Peds, #/hr	0	0	0	5	0	5	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	0	0	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	3	3	3
Mvmt Flow	0	0	1	0	0	48	5	753	22	59	1145	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2069	2051	575	-	-	769	1150	0	0	775	0	0
Stage 1	1266	1266	-	-	-	-	-	-	-	-	-	-
Stage 2	803	785	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	-	-	6.23	4.16	-	-	4.145	-	-
Critical Hdwy Stg 1	6.5	5.5	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	-	-	3.319	2.238	-	-	2.2285	-	-
Pot Cap-1 Maneuver	36	56	466	0	0	400	596	-	-	833	-	-
Stage 1	182	242	-	0	0	-	-	-	-	-	-	-
Stage 2	380	407	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	30	52	466	-	-	398	596	-	-	833	-	-
Mov Cap-2 Maneuver	30	52	-	-	-	-	-	-	-	-	-	-
Stage 1	181	225	-	-	-	-	-	-	-	-	-	-
Stage 2	329	404	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	12.7	15.3	0.1	0.5
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	596	-	-	466	398	833	-	-
HCM Lane V/C Ratio	0.009	-	-	0.002	0.122	0.071	-	-
HCM Control Delay (s)	11.1	-	-	12.7	15.3	9.7	-	-
HCM Lane LOS	B	-	-	B	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0.4	0.2	-	-

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	2	0	0	65	0	1025	10	25	670	0
Future Vol, veh/h	1	0	2	0	0	65	0	1025	10	25	670	0
Conflicting Peds, #/hr	0	0	0	2	0	2	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	0	0	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	5	5	5
Mvmt Flow	1	0	2	0	0	71	0	1114	11	27	728	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1939	1907	364	-	-	1122	728	0	0	1125	0	0
Stage 1	782	782	-	-	-	-	-	-	-	-	-	-
Stage 2	1157	1125	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	-	-	6.23	4.16	-	-	4.175	-	-
Critical Hdwy Stg 1	6.5	5.5	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	-	-	3.319	2.238	-	-	2.2475	-	-
Pot Cap-1 Maneuver	45	69	639	0	0	250	862	-	-	605	-	-
Stage 1	358	408	-	0	0	-	-	-	-	-	-	-
Stage 2	241	283	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	31	66	639	-	-	250	862	-	-	605	-	-
Mov Cap-2 Maneuver	31	66	-	-	-	-	-	-	-	-	-	-
Stage 1	358	390	-	-	-	-	-	-	-	-	-	-
Stage 2	173	283	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	49	25	0	0.4
HCM LOS	E	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	862	-	-	85	250	605	-	-
HCM Lane V/C Ratio	-	-	-	0.038	0.283	0.045	-	-
HCM Control Delay (s)	0	-	-	49	25	11.2	-	-
HCM Lane LOS	A	-	-	E	D	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	1.1	0.1	-	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	1	0	0	45	5	715	20	55	1085	5
Future Vol, veh/h	0	0	1	0	0	45	5	715	20	55	1085	5
Conflicting Peds, #/hr	0	0	0	5	0	5	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	1000	-	-	1000	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	3	3	3
Mvmt Flow	0	0	1	0	0	49	5	777	22	60	1179	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2130	2111	592	-	-	793	1184	0	0	799	0	0
Stage 1	1302	1302	-	-	-	-	-	-	-	-	-	-
Stage 2	828	809	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	-	-	6.23	4.16	-	-	4.145	-	-
Critical Hdwy Stg 1	6.5	5.5	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	-	-	3.319	2.238	-	-	2.2285	-	-
Pot Cap-1 Maneuver	32	52	454	0	0	388	579	-	-	816	-	-
Stage 1	173	233	-	0	0	-	-	-	-	-	-	-
Stage 2	368	396	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	26	48	454	-	-	386	579	-	-	816	-	-
Mov Cap-2 Maneuver	26	48	-	-	-	-	-	-	-	-	-	-
Stage 1	171	216	-	-	-	-	-	-	-	-	-	-
Stage 2	317	392	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	12.9	15.7	0.1	0.5
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	579	-	-	454	386	816	-	-
HCM Lane V/C Ratio	0.009	-	-	0.002	0.127	0.073	-	-
HCM Control Delay (s)	11.3	-	-	12.9	15.7	9.8	-	-
HCM Lane LOS	B	-	-	B	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0.4	0.2	-	-

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	2	0	0	80	0	1225	10	30	805	0
Future Vol, veh/h	1	0	2	0	0	80	0	1225	10	30	805	0
Conflicting Peds, #/hr	0	0	0	2	0	2	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	1000	-	-	1000	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	5	5	5
Mvmt Flow	1	0	2	0	0	87	0	1332	11	33	875	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2324	2284	438	-	-	1340	875	0	0	1343	0	0
Stage 1	941	941	-	-	-	-	-	-	-	-	-	-
Stage 2	1383	1343	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	-	-	6.23	4.16	-	-	4.175	-	-
Critical Hdwy Stg 1	6.5	5.5	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	-	-	3.319	2.238	-	-	2.2475	-	-
Pot Cap-1 Maneuver	23	40	572	0	0	186	759	-	-	498	-	-
Stage 1	287	345	-	0	0	-	-	-	-	-	-	-
Stage 2	180	223	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	12	37	572	-	-	186	759	-	-	498	-	-
Mov Cap-2 Maneuver	12	37	-	-	-	-	-	-	-	-	-	-
Stage 1	287	322	-	-	-	-	-	-	-	-	-	-
Stage 2	96	223	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	118.2	40.3	0	0.5
HCM LOS	F	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	759	-	-	35	186	498	-	-
HCM Lane V/C Ratio	-	-	-	0.093	0.468	0.065	-	-
HCM Control Delay (s)	0	-	-	118.2	40.3	12.7	-	-
HCM Lane LOS	A	-	-	F	E	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0.3	2.2	0.2	-	-

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	1	0	0	55	5	860	25	65	1300	5
Future Vol, veh/h	0	0	1	0	0	55	5	860	25	65	1300	5
Conflicting Peds, #/hr	0	0	0	5	0	5	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	1000	-	-	1000	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	3	3	3
Mvmt Flow	0	0	1	0	0	60	5	935	27	71	1413	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2552	2530	709	-	-	954	1418	0	0	962	0	0
Stage 1	1558	1558	-	-	-	-	-	-	-	-	-	-
Stage 2	994	972	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	-	-	6.23	4.16	-	-	4.145	-	-
Critical Hdwy Stg 1	6.5	5.5	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	-	-	3.319	2.238	-	-	2.2285	-	-
Pot Cap-1 Maneuver	16	28	381	0	0	313	470	-	-	708	-	-
Stage 1	120	175	-	0	0	-	-	-	-	-	-	-
Stage 2	298	333	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	12	25	381	-	-	312	470	-	-	708	-	-
Mov Cap-2 Maneuver	12	25	-	-	-	-	-	-	-	-	-	-
Stage 1	119	158	-	-	-	-	-	-	-	-	-	-
Stage 2	237	329	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	14.5	19.3	0.1	0.5
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	470	-	-	381	312	708	-	-
HCM Lane V/C Ratio	0.012	-	-	0.003	0.192	0.1	-	-
HCM Control Delay (s)	12.7	-	-	14.5	19.3	10.6	-	-
HCM Lane LOS	B	-	-	B	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0.7	0.3	-	-

TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT

CRASH SUMMARIES BY YEAR BY COLLISION TYPE

NE 238th Dr & NE Treehill Dr

January 1, 2011 through December 31, 2015

COLLISION TYPE	FATAL CRASHES	NON-FATAL CRASHES	PROPERTY DAMAGE ONLY	TOTAL CRASHES	PEOPLE KILLED	PEOPLE INJURED	TRUCKS	DRY SURF	WET SURF	DAY	DARK	INTER-SECTION	INTER-SECTION RELATED	OFF-ROAD
YEAR: 2015														
FIXED / OTHER OBJECT	0	0	1	1	0	0	0	1	0	0	1	1	0	1
REAR-END	0	0	1	1	0	0	0	0	1	0	1	1	0	0
2015 TOTAL	0	0	2	2	0	0	0	1	1	0	2	2	0	1
YEAR: 2011														
REAR-END	0	1	0	1	0	1	0	1	0	0	1	1	0	0
2011 TOTAL	0	1	0	1	0	1	0	1	0	0	1	1	0	0
FINAL TOTAL	0	1	2	3	0	1	0	2	1	0	3	3	0	1

Disclaimer: A higher number of crashes may be reported as of 2011 compared to prior years. This does not reflect an increase in annual crashes. The higher numbers result from a change to an internal departmental process that allows the Crash Analysis and Reporting Unit to add previously unavailable, non-fatal crash reports to the annual data file. Please be aware of this change when comparing pre-2011 crash statistics.

Scenario - 1

Project Year 2040 PM Peak Traffic Hour (Existing Year Plus 22%)

Hour Beginning	Major Street					Minor Street		
	NE 238th Drive (NB)	NE 238th Drive (NB RT)	NE 238th Drive (SB)	NE 238th Drive (SB LT)	Total	NE Treehill Drive (WB LT)	NE Treehill Drive (WB RT)	Total WB LT
5:00 PM	852	23	1302	67	2244	31	27	57

Right-turn Volume Discount

Shared left-through-right lane capacity = 162

Right-turn discount = 0.85x162 =138

Right-turn volume = 27

Right -turn volume to include = 27-138=-111

Major Street:	NE 238th Drive
Minor Street:	NE Treehill Drive
Project Name:	NE 238th Dr/NE Dr Traffic Analysis
City/County:	Multnomah County
Analysis Year:	2040
Alternative:	Existing Condition
Meet 70% Warrants?:	No
	100%

Major	
Approach Lanes:	2
Minor	
Approach Lanes:	1
Major	
Approach Volumes (vph):	2244
Minor	
Approach Volume (vph):	31
Right Turn Volume (vph):	27
Capacity of Shared/Exclusive Right Turn Lane[1]:	162
Right Turn Discount:	138
Right Turn Volume included in Warrant:	0
Minor Approach Volume in Warrant:	4
Major Approach K factor:	14
Minor Approach K factor:	14

[1] Capacity obtained from unsignalized intersection analysis
For guidance on preliminary signal warrant analysis, refer to the Analysis Procedures Manual.

Last Updated: February 2009

Oregon Department of Transportation

Transportation Development Branch

Transportation Planning Analysis Unit

Preliminary Traffic Signal Warrant Analysis[1]

Major Street:	NE 238th Drive	**Minor Street:**	NE Treehill Drive
Project:	NE 238th Dr/NE Dr Traffic An	**City/County:**	Multnomah County
Year:	2040	**Alternative:**	Existing Condition

Preliminary Signal Warrant Volumes

Number of Approach lanes		ADT on major street approaching from both directions		ADT on minor street, highest approaching volume	
Major Street	Minor Street	Percent of standard warrants 100	70	Percent of standard warrants 100	70
Case A: Minimum Vehicular Traffic					
1	1	8850	6200	2650	1850
2 or more	1	10600	7400	2650	1850
2 or more	2 or more	10600	7400	3550	2500
1	2 or more	8850	6200	3550	2500
Case B: Interruption of Continuous Traffic					
1	1	13300	9300	1350	950
2 or more	1	15900	11100	1350	950
2 or more	2 or more	15900	11100	1750	1250
1	2 or more	13300	9300	1750	1250
X	100 percent of standard warrants				
	70 percent of standard warrants[2]				

Preliminary Signal Warrant Calculation

	Street	Number of Lanes	Warrant Volumes	Approach Volumes	Warrant Met
Case A	Major	2	10600	8847	N
	Minor	1	2650	140	
Case B	Major	2	15900	8847	N
	Minor	1	1350	140	
Analyst and Date:			Reviewer and Date:		

[1] Meeting preliminary signal warrants does **not** guarantee that a signal will be installed. When preliminary signal warrants are met, project analysts need to coordinate with Region Traffic to initiate the traffic signal engineering investigation as outlined in the Traffic Manual. Before a signal can be installed, the engineering investigation must be conducted or reviewed by the Region Traffic Manager who will forward signal recommendations to headquarters. Traffic signal warrants must be met and the State Traffic Engineer's approval obtained before a traffic signal can be installed on a state highway.

[2] Used due to 85th percentile speed in excess of 40 mph or isolated community with population of less than 10,000.

Analysis Procedures Manual
February 2009

ATTACHMENT C

SCENARIO 2 – EXISTING STREET CONDITION WITH NE HAWTHORNE AVENUE CONNECTION

SYNCHRO WORKSHEET

NEW ADT TRIP DISTRIBUTION WORKSHEET

RIGHT TURN VOLUME DISCOUNT WORKSHEET

ODOT PRELIMINARY SIGNAL WARRANT WORKSHEET

Intersection	
Int Delay, s/veh	2.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	2	20	0	55	0	1025	10	25	670	0
Future Vol, veh/h	1	0	2	20	0	55	0	1025	10	25	670	0
Conflicting Peds, #/hr	0	0	0	2	0	2	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	5	5	5
Mvmt Flow	1	0	2	22	0	60	0	1114	11	27	728	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1934	1907	366	1540	1902	1122	728	0	0	1125	0	0
Stage 1	782	782	-	1120	1120	-	-	-	-	-	-	-
Stage 2	1152	1125	-	420	782	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	7.33	6.53	6.23	4.16	-	-	4.175	-	-
Critical Hdwy Stg 1	6.5	5.5	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.53	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.519	4.019	3.319	2.238	-	-	2.2475	-	-
Pot Cap-1 Maneuver	45	69	637	86	69	250	862	-	-	605	-	-
Stage 1	358	408	-	250	281	-	-	-	-	-	-	-
Stage 2	243	283	-	582	404	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	33	66	636	83	66	250	862	-	-	605	-	-
Mov Cap-2 Maneuver	33	66	-	83	66	-	-	-	-	-	-	-
Stage 1	358	390	-	250	281	-	-	-	-	-	-	-
Stage 2	185	283	-	553	386	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	46.5	47.4	0	0.4
HCM LOS	E	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	862	-	-	90	163	605	-	-
HCM Lane V/C Ratio	-	-	-	0.036	0.5	0.045	-	-
HCM Control Delay (s)	0	-	-	46.5	47.4	11.2	-	-
HCM Lane LOS	A	-	-	E	E	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	2.4	0.1	-	-

Intersection	
Int Delay, s/veh	1.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	1	25	0	25	5	715	20	60	1085	5
Future Vol, veh/h	0	0	1	25	0	25	5	715	20	60	1085	5
Conflicting Peds, #/hr	0	0	0	5	0	5	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	5	5	5
Mvmt Flow	0	0	1	27	0	27	5	777	22	65	1179	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2129	2121	597	1523	2112	793	1184	0	0	799	0	0
Stage 1	1312	1312	-	798	798	-	-	-	-	-	-	-
Stage 2	817	809	-	725	1314	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	7.33	6.53	6.23	4.16	-	-	4.175	-	-
Critical Hdwy Stg 1	6.5	5.5	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.53	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.519	4.019	3.319	2.238	-	-	2.2475	-	-
Pot Cap-1 Maneuver	32	51	451	89	51	388	579	-	-	805	-	-
Stage 1	170	230	-	379	397	-	-	-	-	-	-	-
Stage 2	373	396	-	383	227	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	28	46	449	82	46	386	579	-	-	805	-	-
Mov Cap-2 Maneuver	28	46	-	82	46	-	-	-	-	-	-	-
Stage 1	168	211	-	376	393	-	-	-	-	-	-	-
Stage 2	342	392	-	350	209	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	13	48.6	0.1	0.5
HCM LOS	B	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	579	-	-	449	135	805	-	-
HCM Lane V/C Ratio	0.009	-	-	0.002	0.403	0.081	-	-
HCM Control Delay (s)	11.3	-	-	13	48.6	9.9	-	-
HCM Lane LOS	B	-	-	B	E	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	1.7	0.3	-	-

Intersection	
Int Delay, s/veh	6.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	2	25	0	65	0	1225	10	30	805	0
Future Vol, veh/h	1	0	2	25	0	65	0	1225	10	30	805	0
Conflicting Peds, #/hr	0	0	0	2	0	2	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	5	5	5
Mvmt Flow	1	0	2	27	0	71	0	1332	11	33	875	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2316	2284	440	1844	2279	1340	875	0	0	1343	0	0
Stage 1	941	941	-	1338	1338	-	-	-	-	-	-	-
Stage 2	1375	1343	-	506	941	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	7.33	6.53	6.23	4.16	-	-	4.175	-	-
Critical Hdwy Stg 1	6.5	5.5	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.53	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.519	4.019	3.319	2.238	-	-	2.2475	-	-
Pot Cap-1 Maneuver	24	40	570	52	40	186	759	-	-	498	-	-
Stage 1	287	345	-	188	221	-	-	-	-	-	-	-
Stage 2	181	223	-	518	341	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	14	37	569	49	37	186	759	-	-	498	-	-
Mov Cap-2 Maneuver	14	37	-	49	37	-	-	-	-	-	-	-
Stage 1	287	322	-	188	221	-	-	-	-	-	-	-
Stage 2	112	223	-	481	318	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	102.8	144.8	0	0.5
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	759	-	-	40	105	498	-	-
HCM Lane V/C Ratio	-	-	-	0.082	0.932	0.065	-	-
HCM Control Delay (s)	0	-	-	102.8	144.8	12.7	-	-
HCM Lane LOS	A	-	-	F	F	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0.3	5.6	0.2	-	-

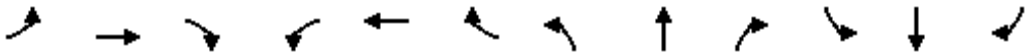
Intersection	
Int Delay, s/veh	3.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	1	30	0	30	5	855	25	70	1300	5
Future Vol, veh/h	0	0	1	30	0	30	5	855	25	70	1300	5
Conflicting Peds, #/hr	0	0	0	5	0	5	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	0	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	5	5	5
Mvmt Flow	0	0	1	33	0	33	5	929	27	76	1413	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2542	2534	714	1817	2523	948	1418	0	0	956	0	0
Stage 1	1568	1568	-	953	953	-	-	-	-	-	-	-
Stage 2	974	966	-	864	1570	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	7.33	6.53	6.23	4.16	-	-	4.175	-	-
Critical Hdwy Stg 1	6.5	5.5	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.53	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.519	4.019	3.319	2.238	-	-	2.2475	-	-
Pot Cap-1 Maneuver	16	28	378	54	28	315	470	-	-	702	-	-
Stage 1	118	173	-	310	337	-	-	-	-	-	-	-
Stage 2	305	336	-	316	170	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	13	25	376	49	25	314	470	-	-	702	-	-
Mov Cap-2 Maneuver	13	25	-	49	25	-	-	-	-	-	-	-
Stage 1	117	154	-	307	333	-	-	-	-	-	-	-
Stage 2	269	332	-	280	152	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	14.6	126.8	0.1	0.5
HCM LOS	B	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	470	-	-	376	85	702	-	-
HCM Lane V/C Ratio	0.012	-	-	0.003	0.767	0.108	-	-
HCM Control Delay (s)	12.7	-	-	14.6	126.8	10.8	-	-
HCM Lane LOS	B	-	-	B	F	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0	3.9	0.4	-	-



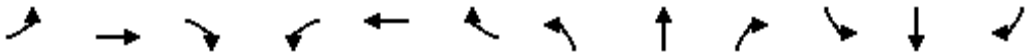
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	0	2	20	0	55	0	1025	10	25	670	0
Future Volume (veh/h)	1	0	2	20	0	55	0	1025	10	25	670	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1900	1870	1870	1870	1841	1841	1841	1826	1826	1826
Adj Flow Rate, veh/h	1	0	2	22	0	60	0	1114	11	27	728	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	2	2	2	4	4	4	5	5	5
Cap, veh/h	2	0	5	37	0	101	226	886	9	226	1690	0
Arrive On Green	0.00	0.00	0.00	0.08	0.00	0.08	0.00	0.49	0.49	0.49	0.49	0.00
Sat Flow, veh/h	557	0	1114	436	0	1189	715	1820	18	489	3561	0
Grp Volume(v), veh/h	3	0	0	82	0	0	0	0	1125	27	728	0
Grp Sat Flow(s),veh/h/ln	1672	0	0	1625	0	0	715	0	1837	489	1735	0
Q Serve(g_s), s	0.1	0.0	0.0	1.5	0.0	0.0	0.0	0.0	15.5	0.0	4.3	0.0
Cycle Q Clear(g_c), s	0.1	0.0	0.0	1.5	0.0	0.0	0.0	0.0	15.5	15.5	4.3	0.0
Prop In Lane	0.33		0.67	0.27		0.73	1.00		0.01	1.00		0.00
Lane Grp Cap(c), veh/h	7	0	0	138	0	0	226	0	895	226	1690	0
V/C Ratio(X)	0.44	0.00	0.00	0.60	0.00	0.00	0.00	0.00	1.26	0.12	0.43	0.00
Avail Cap(c_a), veh/h	814	0	0	792	0	0	226	0	895	226	1690	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	15.8	0.0	0.0	14.0	0.0	0.0	0.0	0.0	8.2	15.9	5.3	0.0
Incr Delay (d2), s/veh	38.1	0.0	0.0	4.1	0.0	0.0	0.0	0.0	124.8	0.2	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0	0.6	0.0	0.0	0.0	0.0	33.5	0.2	0.7	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	53.9	0.0	0.0	18.1	0.0	0.0	0.0	0.0	133.0	16.1	5.5	0.0
LnGrp LOS	D	A	A	B	A	A	A	A	F	B	A	A
Approach Vol, veh/h		3			82			1125			755	
Approach Delay, s/veh		53.9			18.1			133.0			5.9	
Approach LOS		D			B			F			A	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		20.0		4.6		20.0		7.2				
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5				
Max Green Setting (Gmax), s		15.5		15.5		15.5		15.5				
Max Q Clear Time (g_c+I1), s		17.5		2.1		17.5		3.5				
Green Ext Time (p_c), s		0.0		0.0		0.0		0.3				

Intersection Summary												
HCM 6th Ctrl Delay			79.2									
HCM 6th LOS			E									

Notes

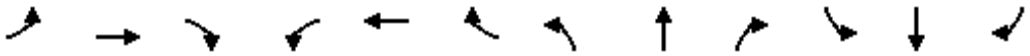
User approved pedestrian interval to be less than phase max green.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	1	25	0	25	5	715	20	60	1085	5
Future Volume (veh/h)	0	0	1	25	0	25	5	715	20	60	1085	5
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	1841	1841	1841	1856	1856	1856
Adj Flow Rate, veh/h	0	0	1	27	0	27	5	777	22	65	1179	5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	0	0	0	4	4	4	3	3	3
Cap, veh/h	0	0	5	59	0	59	353	945	27	325	1910	8
Arrive On Green	0.00	0.00	0.00	0.07	0.00	0.07	0.53	0.53	0.53	0.53	0.53	0.53
Sat Flow, veh/h	0	0	1610	844	0	844	466	1781	50	675	3600	15
Grp Volume(v), veh/h	0	0	1	54	0	0	5	0	799	65	577	607
Grp Sat Flow(s),veh/h/ln	0	0	1610	1689	0	0	466	0	1832	675	1763	1853
Q Serve(g_s), s	0.0	0.0	0.0	1.0	0.0	0.0	0.3	0.0	12.3	3.0	7.8	7.8
Cycle Q Clear(g_c), s	0.0	0.0	0.0	1.0	0.0	0.0	8.0	0.0	12.3	15.3	7.8	7.8
Prop In Lane	0.00		1.00	0.50		0.50	1.00		0.03	1.00		0.01
Lane Grp Cap(c), veh/h	0	0	5	118	0	0	353	0	972	325	935	983
V/C Ratio(X)	0.00	0.00	0.21	0.46	0.00	0.00	0.01	0.00	0.82	0.20	0.62	0.62
Avail Cap(c_a), veh/h	0	0	854	896	0	0	353	0	972	325	935	983
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	16.9	15.2	0.0	0.0	8.4	0.0	6.6	13.0	5.6	5.6
Incr Delay (d2), s/veh	0.0	0.0	20.7	2.7	0.0	0.0	0.1	0.0	7.8	1.4	3.0	2.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	4.0	0.5	1.9	2.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	37.6	17.9	0.0	0.0	8.4	0.0	14.4	14.4	8.6	8.5
LnGrp LOS	A	A	D	B	A	A	A	A	B	B	A	A
Approach Vol, veh/h		1			54			804			1249	
Approach Delay, s/veh		37.6			17.9			14.4			8.8	
Approach LOS		D			B			B			A	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		22.5		4.5		22.5		6.9				
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5				
Max Green Setting (Gmax), s		18.0		18.0		18.0		18.0				
Max Q Clear Time (g_c+I1), s		14.3		2.0		17.3		3.0				
Green Ext Time (p_c), s		1.9		0.0		0.5		0.2				

Intersection Summary												
HCM 6th Ctrl Delay			11.2									
HCM 6th LOS			B									



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	0	2	25	0	65	0	1225	10	30	805	0
Future Volume (veh/h)	1	0	2	25	0	65	0	1225	10	30	805	0
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1900	1870	1870	1870	1841	1841	1841	1826	1826	1826
Adj Flow Rate, veh/h	1	0	2	27	0	71	0	1332	11	33	875	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	2	2	2	4	4	4	5	5	5
Cap, veh/h	2	0	5	41	0	109	207	941	8	207	1792	0
Arrive On Green	0.00	0.00	0.00	0.09	0.00	0.09	0.00	0.52	0.52	0.52	0.52	0.00
Sat Flow, veh/h	557	0	1114	448	0	1178	624	1823	15	397	3561	0
Grp Volume(v), veh/h	3	0	0	98	0	0	0	0	1343	33	875	0
Grp Sat Flow(s),veh/h/ln	1672	0	0	1626	0	0	624	0	1838	397	1735	0
Q Serve(g_s), s	0.1	0.0	0.0	2.0	0.0	0.0	0.0	0.0	18.0	0.0	5.7	0.0
Cycle Q Clear(g_c), s	0.1	0.0	0.0	2.0	0.0	0.0	0.0	0.0	18.0	18.0	5.7	0.0
Prop In Lane	0.33		0.67	0.28		0.72	1.00		0.01	1.00		0.00
Lane Grp Cap(c), veh/h	7	0	0	150	0	0	207	0	949	207	1792	0
V/C Ratio(X)	0.44	0.00	0.00	0.65	0.00	0.00	0.00	0.00	1.41	0.16	0.49	0.00
Avail Cap(c_a), veh/h	863	0	0	840	0	0	207	0	949	207	1792	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	17.3	0.0	0.0	15.3	0.0	0.0	0.0	0.0	8.4	17.4	5.4	0.0
Incr Delay (d2), s/veh	38.2	0.0	0.0	4.8	0.0	0.0	0.0	0.0	192.9	1.6	1.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0	0.8	0.0	0.0	0.0	0.0	54.0	0.3	1.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	55.5	0.0	0.0	20.1	0.0	0.0	0.0	0.0	201.4	19.1	6.4	0.0
LnGrp LOS	E	A	A	C	A	A	A	A	F	B	A	A
Approach Vol, veh/h		3			98			1343			908	
Approach Delay, s/veh		55.5			20.1			201.4			6.9	
Approach LOS		E			C			F			A	

Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		22.5		4.6		22.5		7.7				
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5				
Max Green Setting (Gmax), s		18.0		18.0		18.0		18.0				
Max Q Clear Time (g_c+I1), s		20.0		2.1		20.0		4.0				
Green Ext Time (p_c), s		0.0		0.0		0.0		0.4				

Intersection Summary												
HCM 6th Ctrl Delay			118.5									
HCM 6th LOS			F									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	1	30	0	30	5	855	25	70	1300	5
Future Volume (veh/h)	0	0	1	30	0	30	5	855	25	70	1300	5
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1900	1900	1870	1870	1870	1841	1841	1841	1826	1826	1826
Adj Flow Rate, veh/h	0	0	1	33	0	33	5	929	27	76	1413	5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	0	0	2	2	2	4	4	4	5	5	5
Cap, veh/h	0	0	5	66	0	66	286	875	25	228	1743	6
Arrive On Green	0.00	0.00	0.00	0.08	0.00	0.08	0.49	0.49	0.49	0.49	0.49	0.49
Sat Flow, veh/h	0	0	1610	832	0	832	373	1780	52	573	3546	13
Grp Volume(v), veh/h	0	0	1	66	0	0	5	0	956	76	691	727
Grp Sat Flow(s),veh/h/ln	0	0	1610	1663	0	0	373	0	1831	573	1735	1824
Q Serve(g_s), s	0.0	0.0	0.0	1.2	0.0	0.0	0.4	0.0	15.5	0.0	10.6	10.6
Cycle Q Clear(g_c), s	0.0	0.0	0.0	1.2	0.0	0.0	11.0	0.0	15.5	15.5	10.6	10.6
Prop In Lane	0.00		1.00	0.50		0.50	1.00		0.03	1.00		0.01
Lane Grp Cap(c), veh/h	0	0	5	131	0	0	286	0	900	228	853	896
V/C Ratio(X)	0.00	0.00	0.20	0.50	0.00	0.00	0.02	0.00	1.06	0.33	0.81	0.81
Avail Cap(c_a), veh/h	0	0	791	818	0	0	286	0	900	228	853	896
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	15.7	13.9	0.0	0.0	11.4	0.0	8.0	15.8	6.8	6.8
Incr Delay (d2), s/veh	0.0	0.0	17.7	3.0	0.0	0.0	0.0	0.0	47.8	0.8	5.9	5.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	14.4	0.5	3.0	3.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	33.4	16.9	0.0	0.0	11.4	0.0	55.9	16.6	12.7	12.5
LnGrp LOS	A	A	C	B	A	A	B	A	F	B	B	B
Approach Vol, veh/h		1			66			961			1494	
Approach Delay, s/veh		33.4			16.9			55.6			12.8	
Approach LOS		C			B			E			B	

Timer - Assigned Phs	2	4	6	8
Phs Duration (G+Y+Rc), s	20.0	4.5	20.0	7.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	15.5	15.5	15.5	15.5
Max Q Clear Time (g_c+I1), s	17.5	2.0	17.5	3.2
Green Ext Time (p_c), s	0.0	0.0	0.0	0.2

Intersection Summary	
HCM 6th Ctrl Delay	29.2
HCM 6th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	2	0	0	75	0	1025	10	25	670	0
Future Vol, veh/h	1	0	2	0	0	75	0	1025	10	25	670	0
Conflicting Peds, #/hr	0	0	0	2	0	2	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	0	0	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	5	5	5
Mvmt Flow	1	0	2	0	0	82	0	1114	11	27	728	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1945	1907	364	-	-	1122	728	0	0	1125	0	0
Stage 1	782	782	-	-	-	-	-	-	-	-	-	-
Stage 2	1163	1125	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	-	-	6.23	4.16	-	-	4.175	-	-
Critical Hdwy Stg 1	6.5	5.5	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	-	-	3.319	2.238	-	-	2.2475	-	-
Pot Cap-1 Maneuver	44	69	639	0	0	250	862	-	-	605	-	-
Stage 1	358	408	-	0	0	-	-	-	-	-	-	-
Stage 2	239	283	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	29	66	639	-	-	250	862	-	-	605	-	-
Mov Cap-2 Maneuver	29	66	-	-	-	-	-	-	-	-	-	-
Stage 1	358	390	-	-	-	-	-	-	-	-	-	-
Stage 2	161	283	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	51.9	26.2	0	0.4
HCM LOS	F	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	862	-	-	80	250	605	-	-
HCM Lane V/C Ratio	-	-	-	0.041	0.326	0.045	-	-
HCM Control Delay (s)	0	-	-	51.9	26.2	11.2	-	-
HCM Lane LOS	A	-	-	F	D	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	1.4	0.1	-	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	1	0	0	50	5	715	20	60	1085	5
Future Vol, veh/h	0	0	1	0	0	50	5	715	20	60	1085	5
Conflicting Peds, #/hr	0	0	0	5	0	5	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	0	0	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	5	5	5
Mvmt Flow	0	0	1	0	0	54	5	777	22	65	1179	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2142	2121	592	-	-	793	1184	0	0	799	0	0
Stage 1	1312	1312	-	-	-	-	-	-	-	-	-	-
Stage 2	830	809	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	-	-	6.23	4.16	-	-	4.175	-	-
Critical Hdwy Stg 1	6.5	5.5	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	-	-	3.319	2.238	-	-	2.2475	-	-
Pot Cap-1 Maneuver	32	51	454	0	0	388	579	-	-	805	-	-
Stage 1	170	230	-	0	0	-	-	-	-	-	-	-
Stage 2	367	396	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	26	46	454	-	-	386	579	-	-	805	-	-
Mov Cap-2 Maneuver	26	46	-	-	-	-	-	-	-	-	-	-
Stage 1	168	211	-	-	-	-	-	-	-	-	-	-
Stage 2	311	392	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	12.9	15.8	0.1	0.5
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	579	-	-	454	386	805	-	-
HCM Lane V/C Ratio	0.009	-	-	0.002	0.141	0.081	-	-
HCM Control Delay (s)	11.3	-	-	12.9	15.8	9.9	-	-
HCM Lane LOS	B	-	-	B	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0.5	0.3	-	-

Intersection	
Int Delay, s/veh	2.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	0	2	0	0	90	0	1225	10	30	805	0
Future Vol, veh/h	1	0	2	0	0	90	0	1225	10	30	805	0
Conflicting Peds, #/hr	0	0	0	2	0	2	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	0	0	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	5	5	5
Mvmt Flow	1	0	2	0	0	98	0	1332	11	33	875	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2330	2284	438	-	-	1340	875	0	0	1343	0	0
Stage 1	941	941	-	-	-	-	-	-	-	-	-	-
Stage 2	1389	1343	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	-	-	6.23	4.16	-	-	4.175	-	-
Critical Hdwy Stg 1	6.5	5.5	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	-	-	3.319	2.238	-	-	2.2475	-	-
Pot Cap-1 Maneuver	23	40	572	0	0	186	759	-	-	498	-	-
Stage 1	287	345	-	0	0	-	-	-	-	-	-	-
Stage 2	178	223	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	10	37	572	-	-	186	759	-	-	498	-	-
Mov Cap-2 Maneuver	10	37	-	-	-	-	-	-	-	-	-	-
Stage 1	287	322	-	-	-	-	-	-	-	-	-	-
Stage 2	84	223	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	144.3	44	0	0.5
HCM LOS	F	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	759	-	-	29	186	498	-	-
HCM Lane V/C Ratio	-	-	-	0.112	0.526	0.065	-	-
HCM Control Delay (s)	0	-	-	144.3	44	12.7	-	-
HCM Lane LOS	A	-	-	F	E	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0.3	2.7	0.2	-	-

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	1	0	0	60	5	855	25	70	1300	5
Future Vol, veh/h	0	0	1	0	0	60	5	855	25	70	1300	5
Conflicting Peds, #/hr	0	0	0	5	0	5	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	0	0	-	-	0	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	2	2	2	4	4	4	5	5	5
Mvmt Flow	0	0	1	0	0	65	5	929	27	76	1413	5

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2558	2534	709	-	-	948	1418	0	0	956	0	0
Stage 1	1568	1568	-	-	-	-	-	-	-	-	-	-
Stage 2	990	966	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	7.3	6.5	6.9	-	-	6.23	4.16	-	-	4.175	-	-
Critical Hdwy Stg 1	6.5	5.5	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	-	-	3.319	2.238	-	-	2.2475	-	-
Pot Cap-1 Maneuver	16	28	381	0	0	315	470	-	-	702	-	-
Stage 1	118	173	-	0	0	-	-	-	-	-	-	-
Stage 2	299	336	-	0	0	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	11	25	381	-	-	314	470	-	-	702	-	-
Mov Cap-2 Maneuver	11	25	-	-	-	-	-	-	-	-	-	-
Stage 1	117	154	-	-	-	-	-	-	-	-	-	-
Stage 2	233	332	-	-	-	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	14.5	19.4	0.1	0.5
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	470	-	-	381	314	702	-	-
HCM Lane V/C Ratio	0.012	-	-	0.003	0.208	0.108	-	-
HCM Control Delay (s)	12.7	-	-	14.5	19.4	10.8	-	-
HCM Lane LOS	B	-	-	B	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0.8	0.4	-	-

NEW ADT TRIP DISTRIBUTION

Existing Eight Highest Hours											
	Major Street					Minor Street			Treehill Drive		
Hour Beginning	NE 238th Drive (NB)	NE 238th Drive (NB RT)	NE 238th Drive (SB)	NE 238th Drive (SB LT)	Total	NE Treehill Drive (WB LT)	NE Treehill Drive (WB RT)	Total WB	Highest 8-Hour Percentage	New Trips	
5:00 PM	698	19	1067	55	1839	25	22	47	0.17	17	
4:00 PM	772	23	955	30	1780	14	28	42	0.15	15	
3:00 PM	759	19	944	28	1750	12	19	31	0.11	11	
7:00 AM	1003	8	662	26	1699	14	48	62	0.22	22	
2:00 PM	706	11	898	12	1627	8	12	20	0.07	7	
1:00 PM	779	8	739	14	1540	5	17	22	0.08	8	
12:00 PM	766	5	746	18	1535	6	23	29	0.10	10	
6:00 PM	610	15	803	26	1454	11	20	31	0.11	11	
							Total	284	Total ADT	100	

2- year growth 1.02

Project Year 2020 Eight Highest Hours plus New Trips(Existing Year Plus 2%)											
	Major Street					Minor Street Highest Approach			Treehill Drive		
Hour Beginning	NE 238th Drive (NB)	NE 238th Drive (NB RT)	NE 238th Drive (SB)	NE 238th Drive (SB LT)	Total	NE Treehill Drive (WB LT)	NE Treehill Drive (WB RT)	Total WB	Highest 8-Hour Percentage	New Trips	Highest 8-Hour plus New Trips
5:00 PM	712	19	1088	56	1876	26	22	48	0.17	17	64
4:00 PM	787	23	974	31	1816	14	28	42	0.15	15	57
3:00 PM	774	19	963	29	1785	12	19	31	0.11	11	42
7:00 AM	1023	8	675	27	1733	14	48	62	0.22	22	84
2:00 PM	720	11	916	12	1660	8	12	20	0.07	7	27
1:00 PM	795	8	754	14	1571	5	17	22	0.08	8	30
12:00 PM	781	5	761	18	1566	6	23	29	0.10	10	39
6:00 PM	622	15	819	27	1483	11	20	31	0.11	11	42
								286	Total ADT	100	

Scenario - 2

Project Year 2040 PM Peak Traffic Hour plus New Trips (Existing Year Plus 22%)								
Hour Beginning	Major Street					Minor Street		
	NE 238th Drive (NB)	NE 238th Drive (NB RT)	NE 238th Drive (SB)	NE 238th Drive (SB LT)	Total	NE Treehill Drive (WB LT)	NE Treehill Drive (WB RT)	Total WB
5:00 PM	855	25	1300	70	2250	30	30	60

Right-turn Volume Discount

Shared left-through-right lane capacity = 56

Right-turn discount = 0.85x56 =48

Right-turn volume = 30

Right -turn volume to include = 30-48=-18

Major Street:	NE 238th Drive
Minor Street:	NE Treehill Drive
Project Name:	NE 238th Dr/NE Dr Traffic Analysis
City/County:	Multnomah County
Analysis Year:	2040
Alternative:	Treehill to Hawthorne Connection
Meet 70% Warrants?:	No
	100%
Major Approach Lanes:	2
Minor Approach Lanes:	1
Major Approach Volumes (vph):	2250
Minor Approach Volume (vph):	30
Right Turn Volume (vph):	30
Capacity of Shared/Exclusive Right Turn Lane[1]:	56
Right Turn Discount:	48
Right Turn Volume included in Warrant:	0
Minor Approach Volume in Warrant:	30
Major Approach K factor:	14
Minor Approach K factor:	14

[1] Capacity obtained from unsignalized intersection analysis

For guidance on preliminary signal warrant analysis, refer to the Analysis Procedures Manual.

Last Updated: February 2009

Oregon Department of Transportation

Transportation Development Branch

Transportation Planning Analysis Unit

Preliminary Traffic Signal Warrant Analysis[1]

Major Street:	NE 238th Drive	**Minor Street:**	NE Treehill Drive
Project:	NE 238th Dr/NE Dr Traffic An	**City/County:**	Multnomah County
Year:	2040	**Alternative:**	Treehill to Hawthorne Connect

Preliminary Signal Warrant Volumes

Number of Approach lanes		ADT on major street approaching from both directions		ADT on minor street, highest approaching volume	
Major Street	Minor Street	Percent of standard warrants 100	70	Percent of standard warrants 100	70
Case A: Minimum Vehicular Traffic					
1	1	8850	6200	2650	1850
2 or more	1	10600	7400	2650	1850
2 or more	2 or more	10600	7400	3550	2500
1	2 or more	8850	6200	3550	2500
Case B: Interruption of Continuous Traffic					
1	1	13300	9300	1350	950
2 or more	1	15900	11100	1350	950
2 or more	2 or more	15900	11100	1750	1250
1	2 or more	13300	9300	1750	1250
X	100 percent of standard warrants				
	70 percent of standard warrants[2]				

Preliminary Signal Warrant Calculation

	Street	Number of Lanes	Warrant Volumes	Approach Volumes	Warrant Met
Case A	Major	2	10600	16071	N
	Minor	1	2650	214	
Case B	Major	2	15900	16071	N
	Minor	1	1350	214	
Analyst and Date:			Reviewer and Date:		

[1] Meeting preliminary signal warrants does **not** guarantee that a signal will be installed. When preliminary signal warrants are met, project analysts need to coordinate with Region Traffic to initiate the traffic signal engineering investigation as outlined in the Traffic Manual. Before a signal can be installed, the engineering investigation must be conducted or reviewed by the Region Traffic Manager who will forward signal recommendations to headquarters. Traffic signal warrants must be met and the State Traffic Engineer's approval obtained before a traffic signal can be installed on a state highway.

[2] Used due to 85th percentile speed in excess of 40 mph or isolated community with population of less than 10,000.

Analysis Procedures Manual
February 2009