



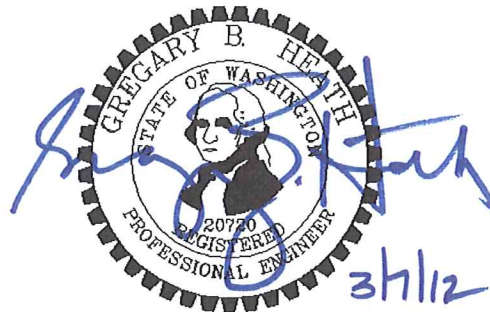
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CITY OF PUYALLUP

TARRAGON PUYALLUP
TRAFFIC IMPACT ANALYSIS

CITY OF PUYALLUP, WA



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MARCH 2012

TARRAGON PUYALLUP
TRAFFIC IMPACT ANALYSIS

TABLE OF CONTENTS

I. Introduction	3
II. Project Description	3
III. Existing Conditions	6
IV. Future Traffic Conditions	11
V. Conclusions & Mitigation	16

Appendix

LIST OF TABLES

1. Existing Level of Service	9
2. Trip Generation	11
3. Future Level of Service	15

LIST OF FIGURES

1. Vicinity Map and Roadway System	4
2. Site Plan.....	5
3. Existing Peak Hour Volumes	7
4. Project Trip Distribution & Assignment	12
5. 2015 PM Peak Hour Volumes Without Project	13
7. 2015 PM Peak Hour Volumes With Project	14

TARRAGON PUYALLUP TRAFFIC IMPACT ANALYSIS

I. INTRODUCTION

The purpose of this study is to assess specific traffic impacts related to the proposed Tarragon Puyallup project as it might affect the local street system. The final goal of this work is to meet transportation-related requirements for the general environmental review process. In order to ensure a reasonable level of accuracy, a comprehensive multi-step study procedure is used. The first step involves the collection of site specific roadway information including a detailed peak hour traffic count at the intersections that will receive the bulk of the project traffic. Next, forecasts of future traffic conditions created by the project on the surrounding street system are then made using established trip generation and trip distribution techniques. As a final step, appropriate conclusions and mitigation measures towards necessary intersection improvement projects or site access improvements are defined.

II. PROJECT DESCRIPTION

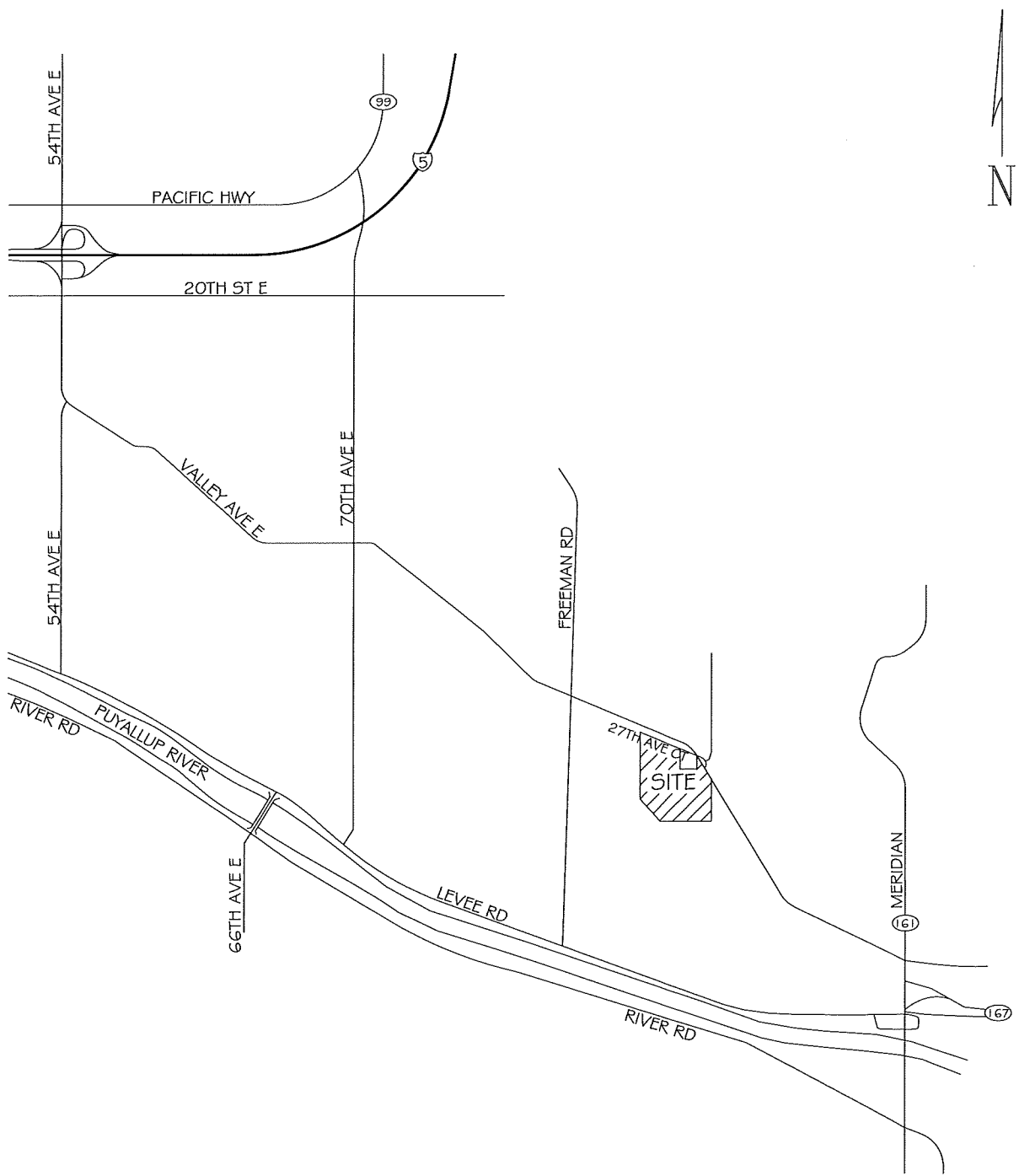
The proposed project is located on the south side of 27th Avenue Ct NW and Valley Avenue within the Puyallup city limits. The site is to contain a 459,100 square foot building and a 242,700 square foot building for a total of 701,800 square feet of high cube warehouse/distribution center use. Main access is to be provided by a new driveway connection forming a south leg at the intersection of 27th Avenue Ct NW and Valley Avenue. This intersection is proposed to be signalized. Two additional access points will be on 27th Avenue Ct NW. Developments near the proposed project are farmland or industrial use. A horizon year of 2015 was selected based on likely buildout and occupancy. Figure 1 shows the project location and the overall street network providing access. A site plan showing the lot configuration and access driveway locations is shown in Figure 2.

III. EXISTING CONDITIONS


A. Surrounding Roadways

Streets serving the proposed site generally consist of two to four lane roads that vary slightly in width, grade, and posted speeds.

Valley Avenue is a multi-lane, generally east-west roadway with a speed limit of 40 mph. Roadway surfacing consists of asphalt concrete with 11 foot lanes and paved shoulders roughly 6 feet in width near the project. Bike lanes and sidewalks are provided Fig 1

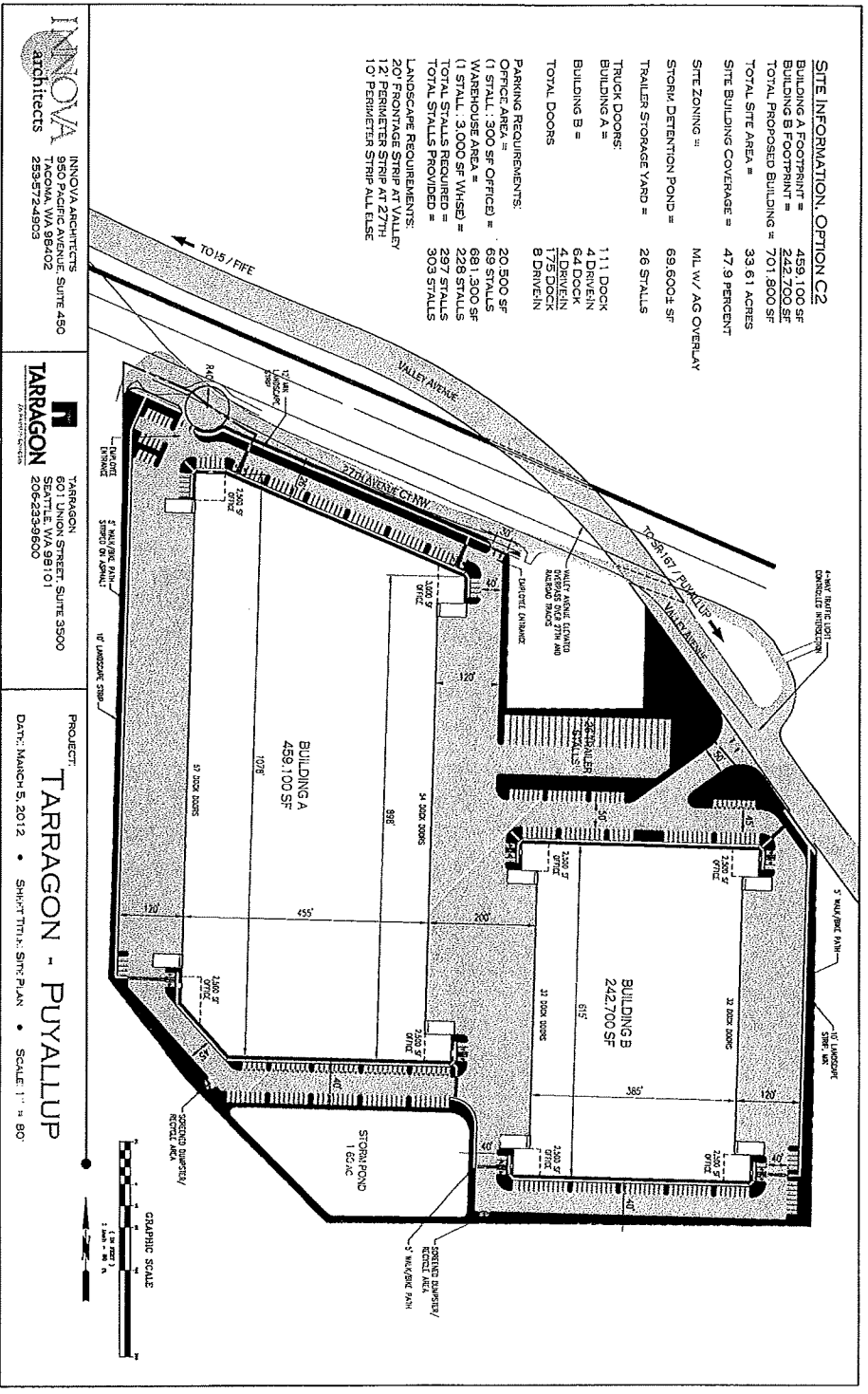


TARRAGON PUYALLUP

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 Transportation and Civil Engineering

VICINITY MAP # ROADWAY SYSTEM

FIGURE I



INNOVA
 architects
 INNOVA ARCHITECTS
 530 PACIFIC AVENUE SUITE 450
 PUYALLUP, WA 98454-4902
 253.572.4903

TARRAGON
 TARRAGON
 601 UNION STREET SUITE 3500
 PUYALLUP, WA 98454-4902
 206.233.9600

TARRAGON PUYALLUP

at other sections. Grades are modest with slopes of up to 4 percent. A center two-way left turn lane is provided for some sections. Dedicated turn lanes are provided near major intersections.

27th Avenue Court NW is an east-west local road that borders the north side of the project. The total road width is roughly 24 feet, with dirt shoulders.

Meridian, also known as SR-161, is a five-lane, north-south designated state highway that lies east of the project. The posted speed limit along this roadway varies between 35 to 40 mph in the vicinity. Road surfacing is composed of asphalt. Shoulders consist of gravel and asphalt or standard curb/gutter/sidewalk sections and are typically 3 to 4 feet in width. Grades are level to rolling with slopes in the 0 to 5 percent range. Turn lanes are provided at major intersections.

Freeman Road is a two-lane, north-south roadway with a speed limit of 25 mph. Roadway surfacing consists of asphalt concrete with gravel shoulders 2-5 feet in width. Lane widths are 11 feet. Grades are generally level. Turn lanes and road widening is located near major intersections.

Levee Road is an east-west, two-lane roadway that lies south of the project. The posted speed limit is 35 mph and pavement surfacing consists of asphalt concrete. Lane widths are generally 12 feet while shoulders are not present. Grades are generally level.

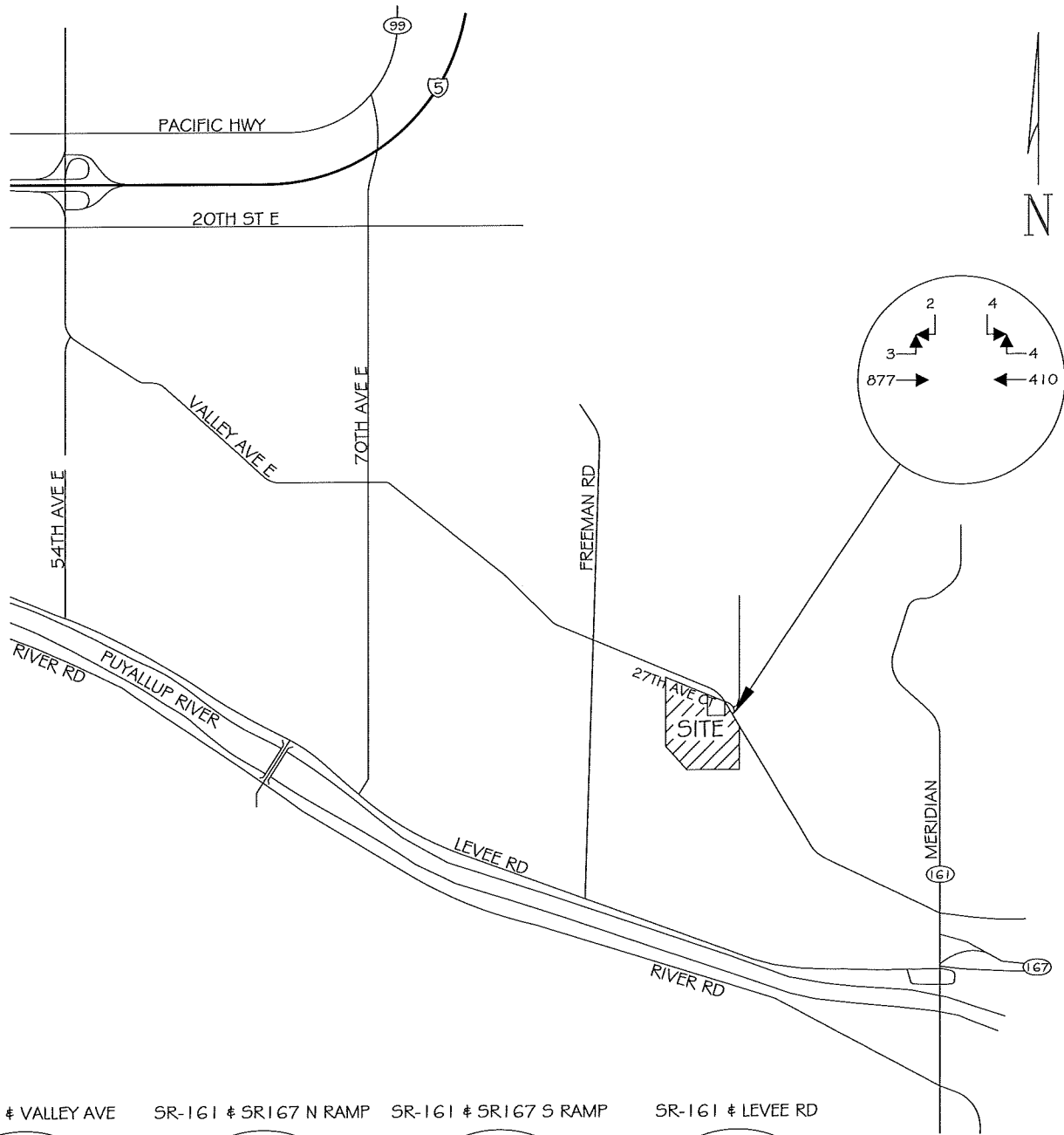
B. Peak Hour Volumes

Field data was collected at the area intersections and is contained in the appendix. Turning movement counts were collected from 4 PM to 6 PM in December of 2010 and January of 2012. The older counts were increased by a 2 percent growth rate to bring them to current levels. The PM peak hour was used for LOS analysis purposes since it generally represents the worst case scenario for most new developments with respect to traffic conditions. This is primarily due to the common 8 AM to 5 PM work schedule and the greater number of recreation and shopping trips associated with the late afternoon period. Commuters often return home or partake in shopping activity after work between 5 PM and 6 PM. This creates a natural peak in traffic volumes in the evening.

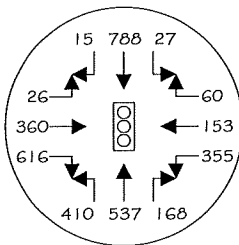
Shown in Figure 3 on the following page are the PM peak hour counts taken at the intersections of interest as determined through the scoping process.

C. Roadway Improvements

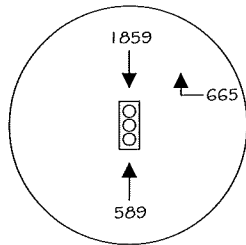
A review of the WSDOT projects list indicates two improvement projects in the site vicinity. The first is a replacement of the SR-167 (Meridian) bridge over the Puyallup River. The project is still in the design phase, and has a total cost listed at \$30,003,000. The other major improvement in the vicinity is the SR-167 Tacoma to Edgewood new freeway project. The SR-167 freeway is to be extended through Fife, with new



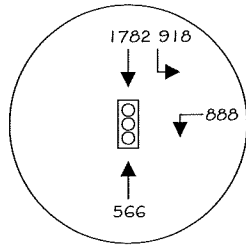
SR-161 & VALLEY AVE



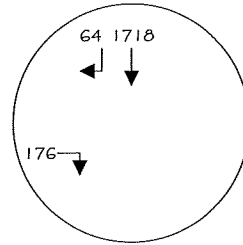
SR-161 & SR167 N RAMP



SR-161 & SR167 S RAMP



SR-161 & LEVEE RD



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EXISTING PM PEAK HOUR VOLUMES

FIGURE 3

connections at I-5 and SR-509. The SR-167/SR-161 interchange is to be rebuilt as a single point urban interchange.

A review of the 2012-2017 City of Puyallup Transportation Improvement Program (TIP) shows no major improvement projects scheduled near the proposed development.

A review of the City of Fife 2011-2016 Six Year Transportation Improvement Program indicates several projects in the site vicinity. These projects are as follows:

70th Avenue E from 20th St E to Valley Ave (Map ID 1). The roadway is to be reconstructed to a 5 lane section at a cost of \$12,200,000.

Valley Avenue E from 54th Ave E to Brookville Gardens (Map ID 8). The roadway is to be reconstructed to a 3-lane section with 2 roundabout intersections at 58th Ave E and 62nd Ave E. The cost is listed at \$8,300,000.

70th Avenue Bridge (Map ID 21). A new bridge is to be constructed over the Puyallup River from River Rd E to N Levee Rd. The cost for this phase of the project study is \$20,000.

North Levee Road from 70th Ave E to Freeman Rd (Map ID 22). The roadway is to be reconstructed and 2 intersections signalized. The cost is listed at \$50,000.

Freeman Road from N Levee Rd to Valley Ave E (Map ID 29). This is a roadway reconstruction to a 3-lane section with bike lanes and curb/gutter/sidewalks. The cost is \$50,000.

70th Avenue E from Pacific Hwy to 20th St E (Map ID 30). This project involves reconstruction of the roadway to a 4-lane section and replacement of the I-5 bridge. The cost is \$66,950,000.

D. Level of Service

Existing peak hour delays were determined through the use of the *Highway Capacity Manual 2000*. Capacity analysis is used to determine level of service (LOS) which is an established measure of congestion for transportation facilities. LOS is defined for a variety of facilities including intersections, freeways, arterials, etc. A complete definition of level of service and related criteria can be found in the HCM. The methodology for determining the LOS at signalized intersections strives to determine the volume to capacity (v/c) ratios for the various intersection movements as well as the average control delay for those movements. *Delay* is generally used to measure the degree of driver discomfort, frustration, fuel consumption, and lost time. *Control delay*, in particular, includes movements at slower speeds and stops on intersection approaches as vehicles move up in queue position or slow down upstream of an intersection.

The methodology for determining the LOS at unsignalized intersections strives to determine the potential capacities for the various vehicle movements and ultimately determines the average total delay for each movement. *Potential Capacity* represents the number of additional vehicles that could effectively utilize a particular movement, which is essentially the equivalent of the difference between the movement capacity and the existing movement volume. *Total delay* is described as the elapsed time from when a vehicle stops at the end of a queue until the vehicle departs from the stop line. *Average total delay* is simply the mean total delay over the entire stream. A number of factors influence potential capacity and total delay including the availability/usefulness of gaps.

The range for intersection level of service is LOS A to LOS F with the former indicating the best operating conditions with low control delays and the latter indicating the worst conditions with heavy control delays. Detailed descriptions of intersection LOS are given in the 2000 Highway Capacity Manual. LOS results for the key intersections can be found in Table 1. Level of Service results were determined through the use of the intersection simulation program *Synchro 6*.

TABLE 1
Existing Peak Hour Level of Service
Delays Given in Seconds Per Vehicle

<u>Intersection</u>	<u>Control</u>	<u>Approach</u>	<u>LOS</u>	<u>Delay</u>
Valley/27th Ave Ct	Stop	Southbound	C	16.3
		Eastbound LT	A	0.1
Meridian/Valley	Signal	Eastbound	C	26.6
		Westbound	D	46.8
		Northbound	C	34.3
		Southbound	C	34.6
		Overall	C	34.2
Meridian/167 N Ramp	Signal	Westbound	C	21.9
		Northbound	A	0.7
		Overall	A	8.4
Meridian/167 S Ramp	Signal	Westbound	D	51.8
		Northbound	D	46.6
		Southbound	E	59.0
		Overall	E	55.7
Meridian/Levee	Stop	Eastbound	C	19.9

E. Pedestrian and Bicycle Activity

Light, if any, pedestrian and bicycle activity was observed at the intersections during data collection. Based on the location, significant levels of non-motorist activity is not expected, although higher volumes could occur during warmer months.

F. Public Transit

A review of the Pierce Transit regional bus schedule indicates that no transit service line is provided along Valley Avenue near the proposed site. In addition, transit use is not normally associated with the proposed land use. No transit-based project trip reduction was employed.

G. Sight Distance

Sight distance measurements were taken for the primary site access driveway on Valley Avenue. Entering Sight Distance (ESD) measurements are based on a 3.5 foot eye height for passenger vehicles, an 8 foot eye height for trucks, a 3.5 foot object height, and a 13 foot setback at the access point. Stopping Sight Distance (SSD) measurements are based on a 3.5 foot eye height and a 2 foot object height on Valley Avenue.

The following shows AASHTO computations for required ESD and SSD assuming a 4 percent uphill slope to the west on Valley Avenue, 5 percent uphill slope on the access road, and a 45 mph design speed.

$$\text{Passenger Vehicle Time gap} = 7.5 \text{ sec} + 1.0 \text{ (for grade)} + 0.5 \text{ (for left turn)}$$

$$\text{ESD} = (1.47 * 45 * 9.0) = 595 \text{ Feet Required}$$

$$\text{Combination Truck Time gap} = 11.5 \text{ sec} + 1.0 \text{ (for grade)} + 0.7 \text{ (for left turn)}$$

$$\text{ESD} = (1.47 * 45 * 13.2) = 873 \text{ Feet Required}$$

$$\text{SSD} = 305 * (\text{grade factor of } 1.1) = 336 \text{ Feet Required}$$

Based on a 3.5 foot passenger vehicle eye height, field measurements indicate approximately 450 feet of ESD is available to the west, with vertical curvature and horizontal curvature coupled with the overpass guard rail being the limiting factors.

Based on a 8.0 foot truck eye height, approximately 460 feet of ESD is available to the west, with horizontal curvature coupled with the overpass guard rail being the primary limiting factor.

Approximately 525 feet of SSD was measured for the eastbound direction of Valley Avenue for a 2 foot object height at the project access point.

Based on calculations and field review, ESD to the west would be insufficient per AASHTO guidelines for the proposed project entrance at Valley Avenue for either passenger vehicles or combination trucks based on a stop controlled intersection. SSD on Valley Avenue is sufficient for an object at the project access location, however. ESD and SSD easterly of the access point is clear for over 1000 feet.

IV. FUTURE TRAFFIC CONDITIONS

A. Trip Generation

Trip generation is used to determine the magnitude of project impacts on the surrounding street system. Preliminary data presented in this report was taken from the Institute of Transportation Engineer's publication *Trip Generation*, 8th Edition. Some considerations were made in choosing the particular land use. The buildings are expected to have primarily a distribution warehouse use, which has trip generation characteristics of the high cube warehousing ITE land use. However, some standard warehouse use is considered to add a measure of conservatism introducing higher trip generation rates. For this analysis, a split of 75% Warehousing (LUC 150) and 25% High Cube Warehousing (LUC 152) were chosen for the total 701,800 square feet of building space, resulting in 526,350 square feet of LUC 150 and 175,450 square feet of LUC 152. Calculated volumes are shown in Table 2. ITE sheets with volumes calculated to the tenth of a trip can be found in the appendix.

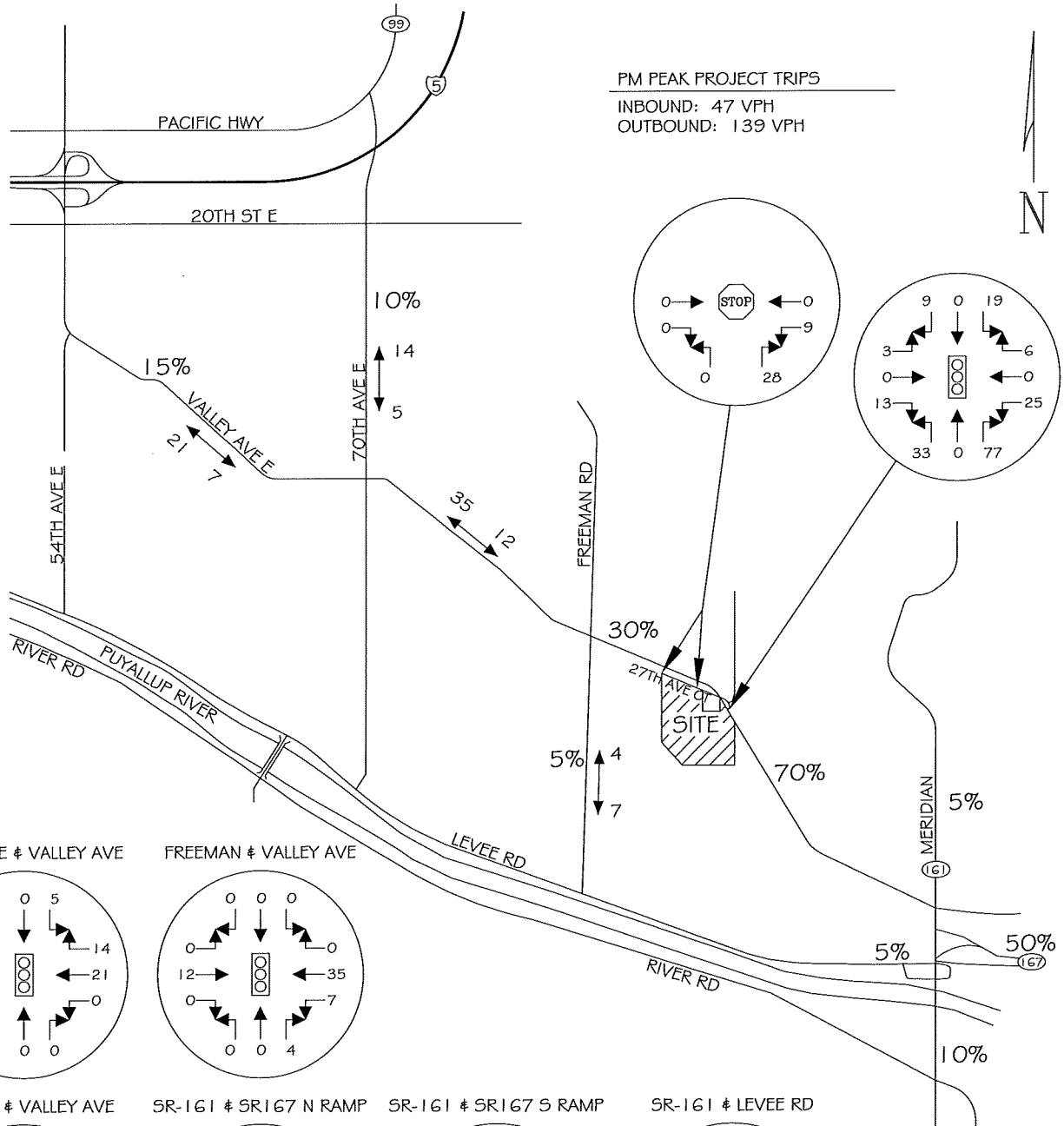
TABLE 2
Project Trip Generation

<i>Time Period</i>	<i>Volumes</i>		
	<i>526.35 ksf Whse</i>	<i>175.45 ksf HC</i>	<i>Total</i>
AWDT	1874	253	2127 vpd
AM Peak Inbound	126	11	137 vph
AM Peak Outbound	32	5	37 vph
AM Peak Total	158	16	174 vph
PM Peak Inbound	42	5	47 vph
PM Peak Outbound	126	13	139 vph
PM Peak Total	168	18	186 vph

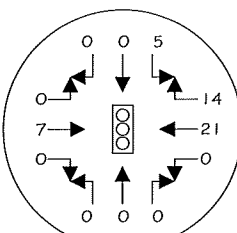
The project trip generation for the PM peak hour is slightly higher than the volumes for the AM peak hour. The inbound/outbound split for this site is estimated at 79 percent/21 percent for the AM peak and 26 percent/74 percent for the PM peak.

B. Trip Distribution and Assignment

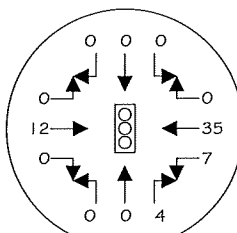
The destination and origination of future project traffic primarily dictates how trips will disperse at nearby intersections. Trips generated by the project are expected to follow the general pattern shown in Figure 4 which represents the trip distribution for project traffic as identified by the city. Some slight modification was made for inbound project traffic from Levee Road, which would not be able to use Meridian but would take Freeman Road.



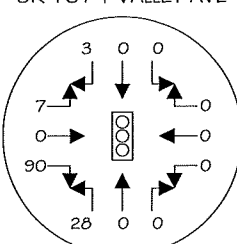
70TH AVE & VALLEY AVE



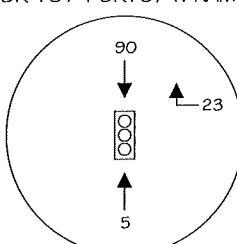
FREEMAN & VALLEY AVE



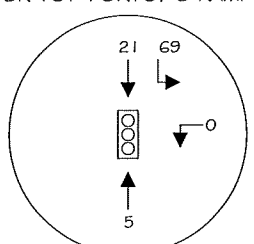
SR-161 & VALLEY AVE



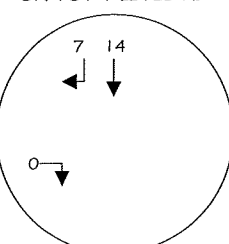
SR-161 & SR167 N RAMP



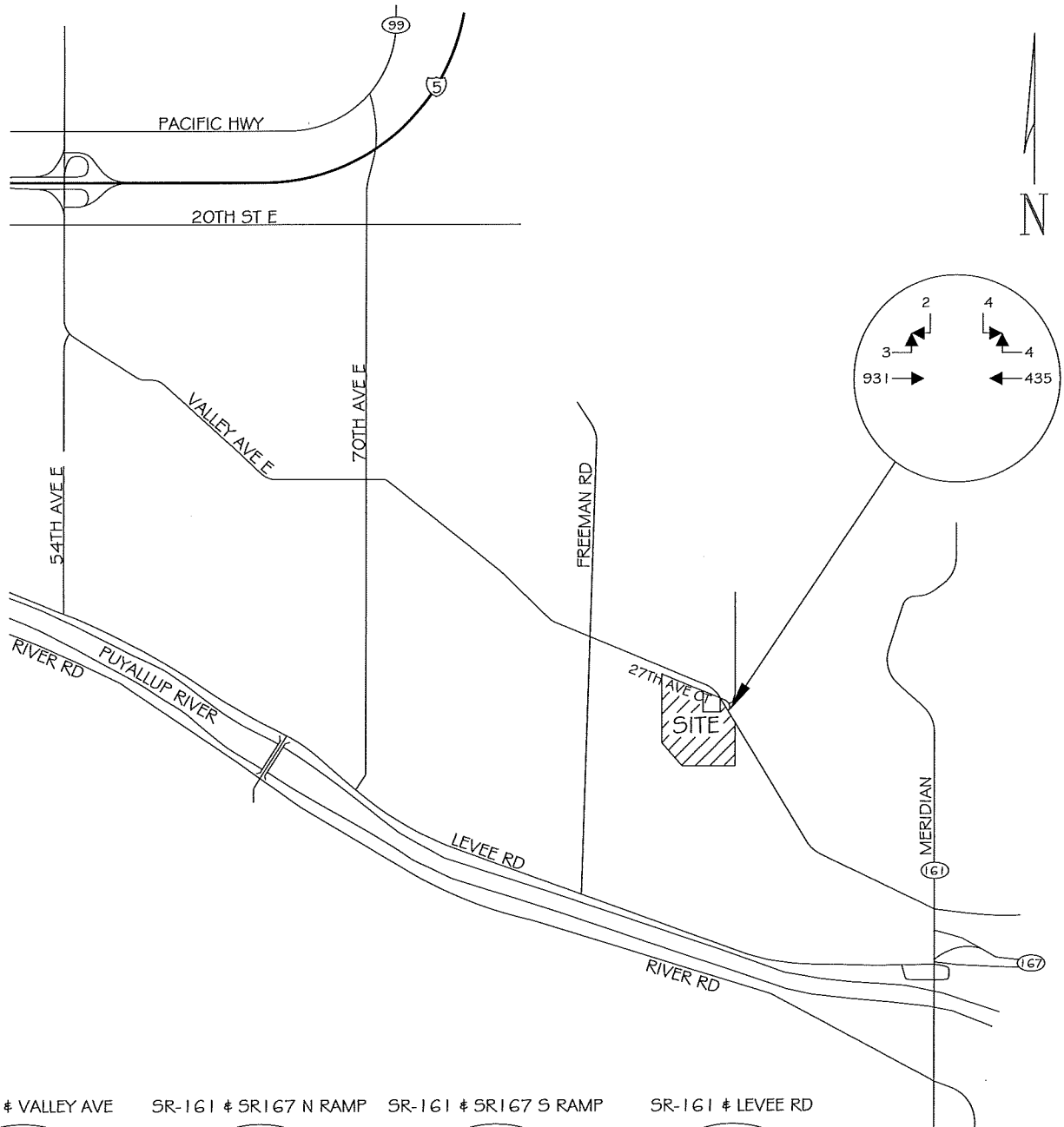
SR-161 & SR167 S RAMP



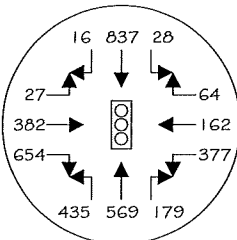
SR-161 & LEVEE RD



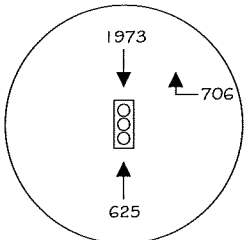
TARRAGON PUYALLUP



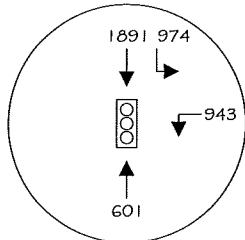
SR-161 & VALLEY AVE



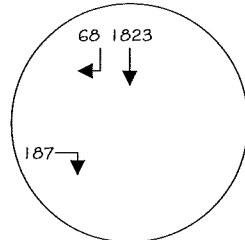
SR-161 & SR167 N RAMP



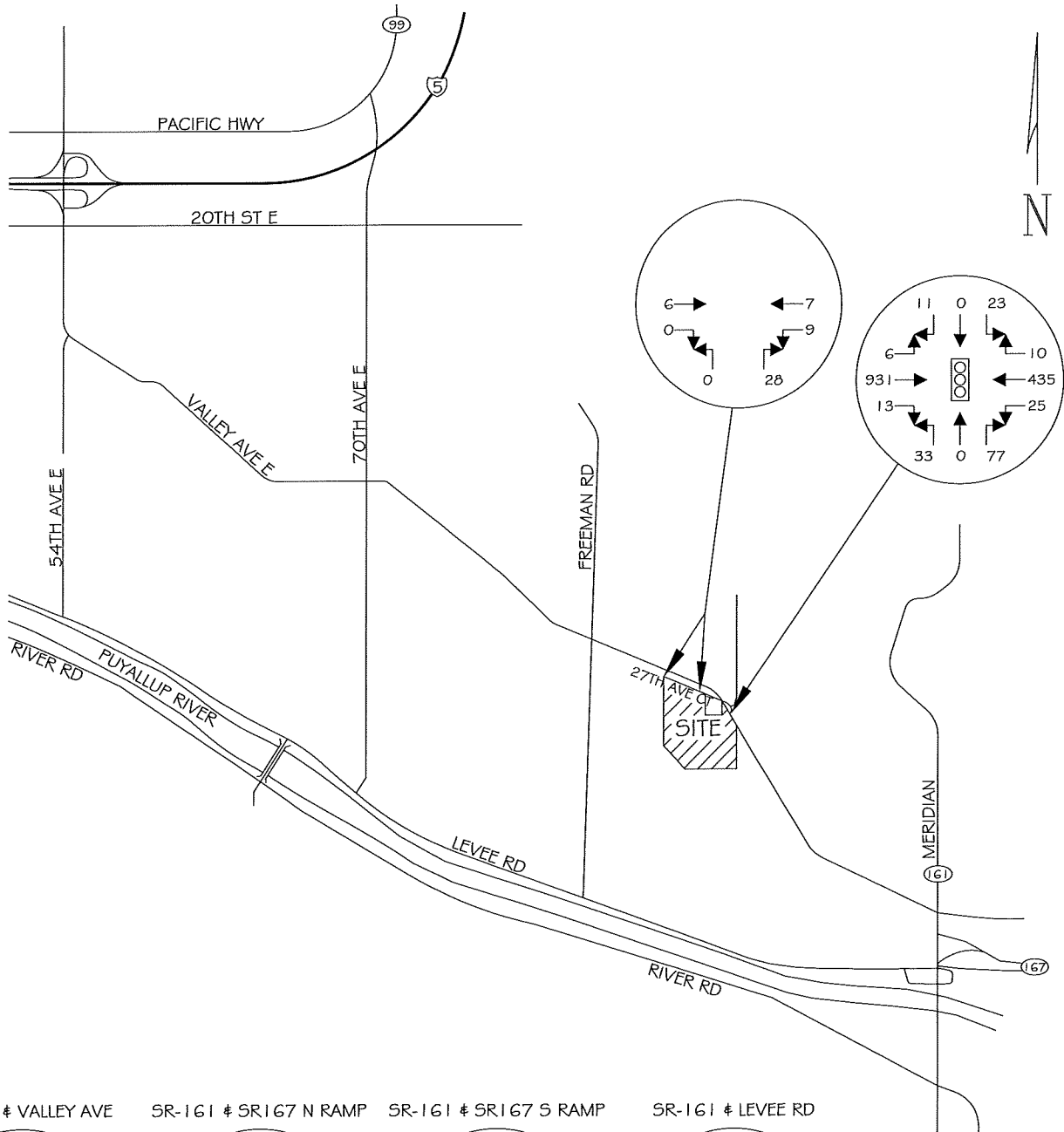
SR-161 & SR167 S RAMP



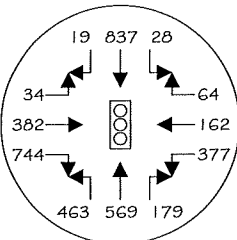
SR-161 & LEVEE RD



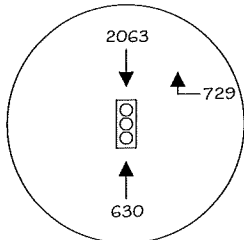
TARRAGON PUYALLUP



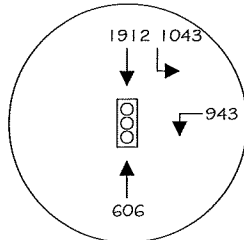
SR-161 & VALLEY AVE



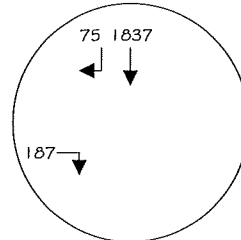
SR-161 & SR167 N RAMP



SR-161 & SR167 S RAMP



SR-161 & LEVEE RD



TARRAGON PUYALLUP

C. Peak Hour Volumes

The completion date for this project is anticipated by 2015. Future 2015 traffic volumes (without the project) were derived by applying a 2 percent growth rate per year to the existing traffic volumes shown in Figure 3. Figure 5 shows future 2015 traffic volumes without project traffic added to the intersections. Figure 6 shows future 2015 volumes with background growth and generated traffic included.

D. Level of Service

A level of service analysis performed for the future volumes with and without project peak hour trips applied. A summary of results is shown in Table 3. This analysis again involved the use of the Synchro 6 program.

TABLE 3
2015 Level of Service
Delays given in seconds per vehicle

<i>Intersection</i>	<i>Control</i>	<i>Geometry</i>	<u>Without Project</u>		<u>With Project</u>	
			<i>LOS</i>	<i>Delay</i>	<i>LOS</i>	<i>Delay</i>
Valley/27th Ave Ct	Stop	Northbound	-	-	E	44.3
		Southbound	C	17.2	E	40.5
		Eastbound	A	0.1	A	8.9
		Westbound	-	-	B	11.4
Valley/27th Ave Ct	Signal	Eastbound	-	-	A	8.6
		Westbound	-	-	A	7.2
		Northbound	-	-	A	9.5
		Southbound	-	-	B	12.1
		Overall	-	-	A	8.3
Meridian/Valley	Signal	Eastbound	C	28.6	C	32.0
		Westbound	D	47.5	D	47.4
		Northbound	C	34.1	D	35.5
		Southbound	D	37.5	D	38.3
		Overall	D	35.6	D	37.0
Meridian/167 N Ramp	Signal	Westbound	C	26.8	C	28.6
		Northbound	A	0.9	A	0.9
		Overall	C	24.7	E	60.0
Meridian/167 S Ramp	Signal	Westbound	D	54.3	D	54.3
		Northbound	D	50.2	D	50.5
		Southbound	F	89.6	F	112.1
		Overall	E	76.2	F	91.0
Meridian/Levee	Stop	Eastbound	C	18.5	C	18.0

The Valley Ave/27th Ave Ct intersection was analyzed under both unsignalized and signalized configurations (refer to the signal warrant section below), and also assumes left turn lanes are added on Valley Avenue. The highest delays in the analysis are noted at the Meridian/SR-167 south ramp intersection, with LOS D to LOS F delays. As noted previously, the interchange is to be reconstructed and improved as a part of WSDOT's SR-167 freeway extension project.

E. Valley Avenue & 27th Avenue Ct/Access Signal

The project access intersection of Valley Ave/27th Ave Ct has sight distance limitations to the west as noted in a previous section. Available sight distance is significantly lower than the required minimum for passenger vehicles (595 feet required, 450 available), and much lower than required for combination vehicles (873 feet required, 460 available). Due to the insufficient sight distance, some improvement would be required in order to mitigate this limitation. The primary improvement considered is signalization of the intersection. Without a signal, a major safety issue would be present with a high crash potential.

In addition to the safety issue, the MUTCD Peak Hour Signal Warrant 3 was investigated at this location. Based on the 2015 PM peak hour volumes plotted on Figure 4C-4, Warrant 3 would be met at the Valley Ave/27th Ave Ct access intersection. Refer to the appendix for the figure and input information.

F. Left Turn Lane Warrants

A left turn lane warrant analysis was performed for Valley Avenue at the 27th Avenue Ct access intersection. The analysis was based on Exhibit 1310-15b Left Turn Storage Guidelines (Four-Lane, Unsignalized) from the WSDOT Design Manual. The plotted point shows that a left turn lane would be warranted for the westbound left turn movement. An eastbound left turn lane would be required for approach symmetry. The WSDOT figure and input data can be found in the appendix. Note that the LOS output in the appendix shows the westbound left turn movement with a 95th percentile queue length of 28 feet, assuming 20% heavy vehicles. A minimum storage length of 100 feet would be advised for this lane in order to accommodate heavy vehicle lengths.

V. CONCLUSIONS AND MITIGATION

The Tarragon Puyallup project is two buildings with a total of 701,800 square feet of warehouse and distribution center space. Access to the site is to be provided by a new south leg approach to Valley Avenue at the intersection with 27th Avenue Ct, plus two driveways further to the west on 27th Avenue Court. This project is expected to generate up to roughly 2127 trips on a typical weekday. An estimated 174 trips may be generated during the AM peak hour, with 186 trips generated during the PM peak hour. These estimates are expected to be on the high side, with an analysis shift towards more warehousing and less distribution center/high cube warehousing. The traffic volumes

generated by the different uses planned for this type of development can be quite variable. Given this variation the TIA assumed a specific traffic volume for study.

Entering sight distance is inadequate for the expected traffic egressing the project at the Valley Avenue access point. Available sight to the west is approximately 450 feet for passenger vehicles, with a required distance of 595 feet. Sight to the west is approximately 460 feet for a combination vehicle, with a requirement of 873 feet. Stopping sight distance is adequate for eastbound traffic on Valley Avenue approaching the access point. Approximately 525 feet of stopping sight distance is available, with a requirement of 336 feet.

An LOS analysis of the key intersections indicates high delays of LOS F for the Meridian/167 South Ramp intersection. This ramp interchange is planned to be improved as a part of the WSDOT SR-167 freeway extension project.

A traffic signal would be warranted at the Valley Ave/27th Ave Ct/access intersection base on MUTCD Peak Hour Warrant 3. In addition, a signal could solve the entering sight distance limitation issue at the project access.

Left turn lanes would be warranted on Valley Avenue at the 27th Avenue Ct/access intersection based on WSDOT Design Manual procedures.

Based on the above, the following mitigations are identified.

1. Construct eastbound and westbound left turn pockets on Valley Avenue at the 27th Avenue Ct/access intersection, with appropriate taper and widening. The westbound left turn storage length should be 150 feet to accommodate heavy vehicle lengths.
2. Install a traffic signal and appropriate hardware to the Valley Avenue/27th Avenue Ct/access intersection.
3. Per Puyallup Municipal Code Section 11.08.130, construct half-street improvements on Valley Avenue E and 27th Avenue Ct NW. Half street improvements for Valley Avenue E will be based on a principal arterial classification of a 56' wide street with curb, gutter, 8' sidewalks, 6' planter strips, and street lights in an 84' total width right of way. Half street improvements for 27th Avenue Ct NW will be based on a 37' wide street with curb, gutter, 8' sidewalks, 7.5' planter strips, and street lights in a 50' total width right of way.
4. Pay Traffic Impact Fees to the City of Puyallup. Based on the calculated PM peak hour trips of 168.4 plus 17.5 vehicles per hour, and a \$4,500 cost per new PM peak hour trip, the assessed fee would be $185.9 * \$4500 = \$836,550$.

No other mitigations are identified at this time.

TARRAGON PUYALLUP
TRAFFIC IMPACT ANALYSIS

APPENDIX

LEVEL OF SERVICE

The following are excerpts from the *1994 Highway Capacity Manual - Transportation Research Board Special Report 209, as well as the 1997 Update to the HCM.*

The concept of levels of service uses qualitative measures that characterize operational conditions within a traffic stream and their perception by motorists and passengers. The descriptions of individual levels of service characterize these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience.

Six levels of service are defined for each facility for which analysis procedures are available. They are given letter designations, from A to F, with LOS A representing the best operating conditions and LOS F the worst. Each level of service represents a range of operating conditions.

Level-of-Service definitions

The following definitions generally define the various levels of service for arterials.

Level of service A represents primarily free-flow operations at average travel speeds, usually about 90 percent of the free-flow speed for the arterial classification. Vehicles are seldom impeded in their ability to maneuver in the traffic stream. Delay at signalized intersections is minimal.

Level of service B represents reasonably unimpeded operations at average travel speeds, usually about 70 percent of the free-flow speed for the arterial classification. The ability to maneuver in the traffic stream is only slightly restricted and delays are not bothersome.

Level of service C represents stable operations; however, ability to maneuver and change lanes in midblock locations may be more restricted than in LOS B, and longer queues, adverse signal coordination, or both may contribute to lower average travel speeds of about 50 percent of the average free-flow speed for the arterial classification.

Level of service D borders on a range in which small increases in flow may cause substantial increases in approach delay and hence decreases in arterial speed. LOS D may be due to adverse signal progression, inappropriate signal timing, high volumes, or some combination of these. Average travel speeds are about 40 percent of free-flow speed.

Level of service E is characterized by significant delays and average travel speeds of one-third the free-flow speed or less. Such operations are caused by some combination of adverse progression, high signal density, high volumes, extensive delays at critical intersections, and inappropriate signal timing.

Level of service F characterizes arterial flow at extremely low speeds, from less than one-third to one-quarter of the free-flow speed. Intersection congestion is likely at critical signalized locations, with long delays and extensive queuing.

These definitions are general and conceptual in nature, and they apply primarily to uninterrupted flow. Levels of service for interrupted flow facilities vary widely in terms of both the user's perception of service quality and the operational variables used to describe them.

For each type of facility, levels of service are defined based on one or more operational parameters that best describe operating quality for the subject facility type. While the concept of level of service attempts to address a wide range of operating conditions, limitations on data collection and availability make it impractical to treat the full range of operational parameters for every type of facility. The parameters selected to define levels of service for each facility type are called "measures of effectiveness" or "MOE's", and represent available measures that best describe the quality of operation on the subject facility type.

Each level of service represents a range of conditions, as defined by a range in the parameters given. Thus, a level of service is not a discrete condition, but rather a range of conditions for which boundaries are established.

The following tables describe levels of service for signalized and unsignalized intersections. Level of service for signalized intersections is defined in terms of delay. Delay is a measure of driver discomfort, frustration, fuel consumption and lost travel time. Specifically, level-of-service criteria are stated in terms of the average stopped delay per vehicle for a 15-minute analysis period. Level of service for unsignalized intersections is measured in terms of potential capacity and average total delay of the lane in question.

Signalized Intersections - Level of Service

<u>Level of Service</u>	<u>Stopped Delay per Vehicle (sec)</u>
A	≤ 10
B	> 10 and ≤ 20
C	> 20 and ≤ 35
D	> 35 and ≤ 55
E	> 55 and ≤ 80
F	> 80

Unsignalized Intersections - Level of Service

<u>Level of Service</u>	<u>Average Total Delay per Vehicle (sec)</u>
A	≤ 10
B	> 10 and ≤ 15
C	> 15 and ≤ 25
D	> 25 and ≤ 35
E	> 35 and ≤ 50
F	> 50

As described in the 1997 Highway Capacity Manual, level of service breakpoints for all-way stop controlled (AWSC) intersections are somewhat different than the criteria used for signalized intersections. The primary reason for this difference is that drivers expect different levels of performance from different kinds of transportation facilities. The expectation is that a signalized intersection is designed to carry higher traffic volumes than an AWSC intersection. Thus a higher level of control delay is acceptable at a signalized intersection for the same level of service.

AWSC Intersections - Level of Service

<u>Level of Service</u>	<u>Average Total Delay per Vehicle (sec)</u>
A	≤ 10
B	> 10 and ≤ 15
C	> 15 and ≤ 25
D	> 25 and ≤ 35
E	> 35 and ≤ 50
F	> 50

Summary of Trip Generation Calculation
 For 526.35 Th.Sq.Ft. GFA of Warehousing
 March 06, 2012

	Average Rate	Standard Deviation	Adjustment Factor	Driveway Volume	
Avg. Weekday 2-Way Volume	3.56	3.58	1.00	1074	1873.8
7-9 AM Peak Hour Enter	0.24	0.00	1.00	126	126.3
7-9 AM Peak Hour Exit	0.06	0.00	1.00	32	31.6
7-9 AM Peak Hour Total	0.30	0.63	1.00	158	157.9
4-6 PM Peak Hour Enter	0.08	0.00	1.00	42	42.1
4-6 PM Peak Hour Exit	0.24	0.00	1.00	126	126.3
4-6 PM Peak Hour Total	0.32	0.67	1.00	168	168.4
AM Pk Hr, Generator, Enter	0.27	0.00	1.00	142	
AM Pk Hr, Generator, Exit	0.15	0.00	1.00	79	
AM Pk Hr, Generator, Total	0.42	0.74	1.00	221	
PM Pk Hr, Generator, Enter	0.09	0.00	1.00	47	
PM Pk Hr, Generator, Exit	0.36	0.00	1.00	189	
PM Pk Hr, Generator, Total	0.45	0.76	1.00	237	
Saturday 2-Way Volume	1.23	2.12	1.00	647	
Saturday Peak Hour Enter	0.08	0.00	1.00	42	
Saturday Peak Hour Exit	0.05	0.00	1.00	26	
Saturday Peak Hour Total	0.13	0.40	1.00	68	
Sunday 2-Way Volume	0.78	1.74	1.00	411	
Sunday Peak Hour Enter	0.04	0.00	1.00	21	
Sunday Peak Hour Exit	0.03	0.00	1.00	16	
Sunday Peak Hour Total	0.07	0.29	1.00	37	

Note: A zero indicates no data available.
 Source: Institute of Transportation Engineers
 Trip Generation, 8th Edition, 2008.

TRIP GENERATION BY MICROTRANS

Summary of Trip Generation Calculation
 For 175.45 Th.Sq.Ft. GFA of High-Cube Warehouse
 March 06, 2012

	Average Rate	Standard Deviation	Adjustment Factor	Driveway Volume	
Avg. Weekday 2-Way Volume	1.44	1.39	1.00	253	252.6
7-9 AM Peak Hour Enter	0.06	0.00	1.00	11	10.5
7-9 AM Peak Hour Exit	0.03	0.00	1.00	5	5.3
7-9 AM Peak Hour Total	0.09	0.30	1.00	16	15.8
4-6 PM Peak Hour Enter	0.03	0.00	1.00	5	5.2
4-6 PM Peak Hour Exit	0.04 0.07	0.00	1.00	7	12.3
4-6 PM Peak Hour Total	0.10	0.32	1.00	10	17.5
AM Pk Hr, Generator, Enter	0.14	0.00	1.00	25	
AM Pk Hr, Generator, Exit	0.03	0.00	1.00	5	
AM Pk Hr, Generator, Total	0.17	0.41	1.00	30	
PM Pk Hr, Generator, Enter	0.07	0.00	1.00	12	
PM Pk Hr, Generator, Exit	0.11	0.00	1.00	19	
PM Pk Hr, Generator, Total	0.18	0.43	1.00	32	
Saturday 2-Way Volume	1.05	1.21	1.00	184	
Saturday Peak Hour Enter	0.08	0.00	1.00	14	
Saturday Peak Hour Exit	0.06	0.00	1.00	11	
Saturday Peak Hour Total	0.14	0.38	1.00	25	
Sunday 2-Way Volume	0.98	1.16	1.00	172	
Sunday Peak Hour Enter	0.09	0.00	1.00	16	
Sunday Peak Hour Exit	0.05	0.00	1.00	9	
Sunday Peak Hour Total	0.14	0.38	1.00	25	

Note: A zero indicates no data available.
 Source: Institute of Transportation Engineers
 Trip Generation, 8th Edition, 2008.

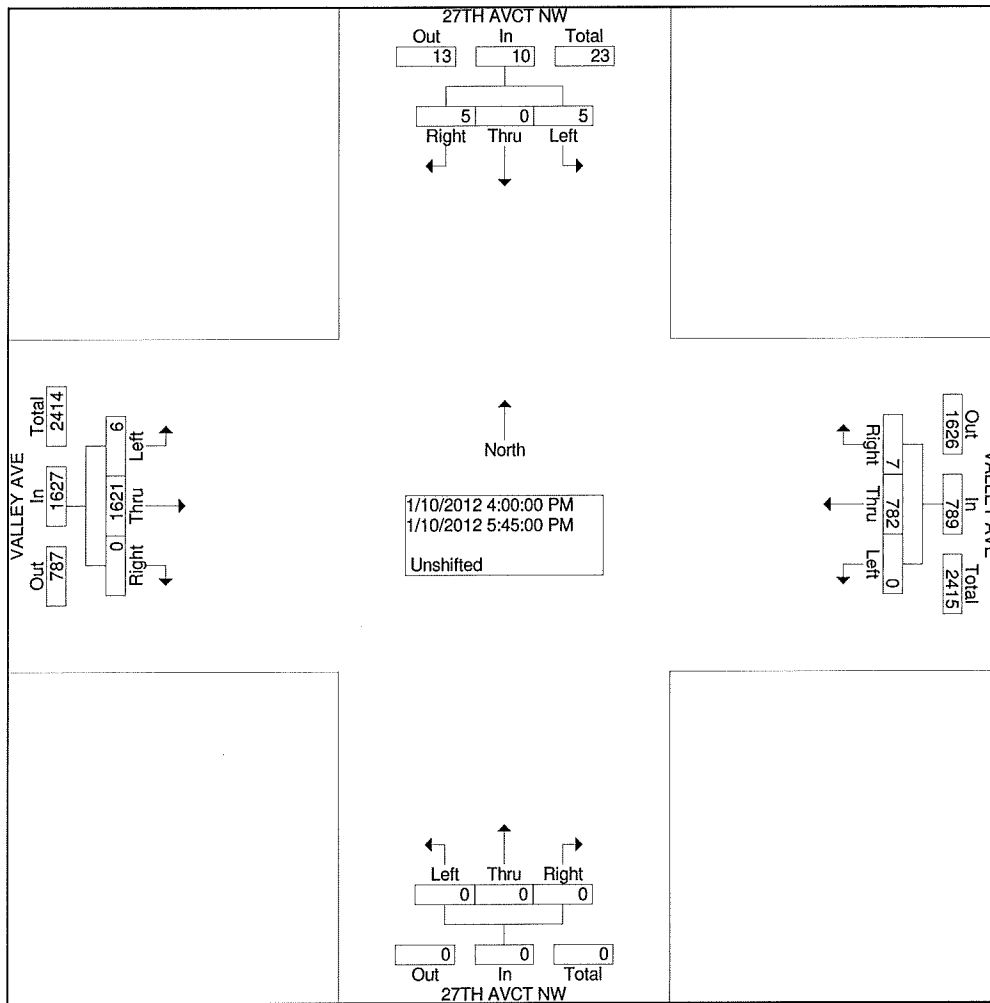
TRIP GENERATION BY MICROTRANS

Heath & Associates, Inc.
 2214 Tacoma Road
 Puyallup, WA 98371

File Name : 3282a
 Site Code : 00003282
 Start Date : 01/10/2012
 Page No : 1

Groups Printed- Unshifted

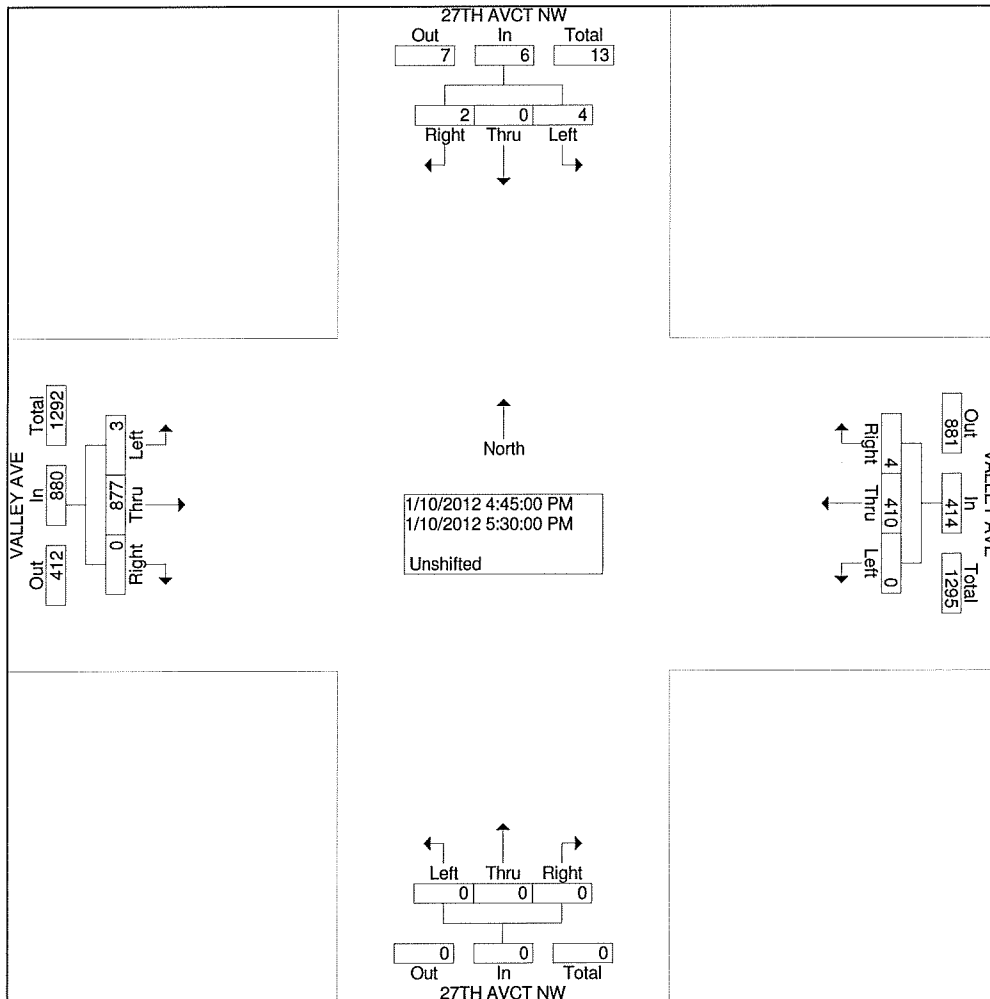
Start Time	27TH AVCT NW Southbound			VALLEY AVE Westbound			27TH AVCT NW Northbound			VALLEY AVE Eastbound			Int. Total
	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
04:00 PM	0	0	0	1	97	0	0	0	0	0	182	2	282
04:15 PM	3	0	0	1	87	0	0	0	0	0	209	0	300
04:30 PM	0	0	0	1	104	0	0	0	0	0	187	1	293
04:45 PM	0	0	3	0	123	0	0	0	0	0	221	0	347
Total	3	0	3	3	411	0	0	0	0	0	799	3	1222
05:00 PM	2	0	0	0	87	0	0	0	0	0	209	1	299
05:15 PM	0	0	0	2	111	0	0	0	0	0	231	0	344
05:30 PM	0	0	1	2	89	0	0	0	0	0	216	2	310
05:45 PM	0	0	1	0	84	0	0	0	0	0	166	0	251
Total	2	0	2	4	371	0	0	0	0	0	822	3	1204
Grand Total	5	0	5	7	782	0	0	0	0	0	1621	6	2426
Approch %	50.0	0.0	50.0	0.9	99.1	0.0	0.0	0.0	0.0	0.0	99.6	0.4	
Total %	0.2	0.0	0.2	0.3	32.2	0.0	0.0	0.0	0.0	0.0	66.8	0.2	



Heath & Associates, Inc.
 2214 Tacoma Road
 Puyallup, WA 98371

File Name : 3282a
 Site Code : 00003282
 Start Date : 01/10/2012
 Page No : 2

Start Time	27TH AVCT NW Southbound				VALLEY AVE Westbound				27TH AVCT NW Northbound				VALLEY AVE Eastbound				Int. Total
	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	04:45 PM																
Volume	2	0	4	6	4	410	0	414	0	0	0	0	0	877	3	880	1300
Percent	33.3	0.0	66.7		1.0	99.0	0.0		0.0	0.0	0.0		0.0	99.7	0.3		
04:45 Volume	0	0	3	3	0	123	0	123	0	0	0	0	0	221	0	221	347
Peak Factor	0.937																
High Int.	04:45 PM																
Volume	0	0	3	3	0	123	0	123	0	0	0	0	0	231	0	231	
Peak Factor	0.500				0.841								0.952				





Prepared for: **City of Puyallup**
Traffic Count Consultants, Inc.

Phone: (425) 861-8866 FAX: (425) 861-8877 E-Mail: TC2inc@aol.com

WBE/DBE

Intersection: N MERIDIAN AVE & VALLEY AVE
Location: PUYALLUP, WASHINGTON

Date of Count: Wed 12/1/2010
Checked By: J.H

Time Interval Ending at	From North on (SB) N MERIDIAN AVE				From South on (NB) N MERIDIAN AVE				From East on (WB) VALLEY AVE NE				From West on (EB) VALLEY AVE NW				Interval Total
	T	L	S	R	T	L	S	R	T	L	S	R	T	L	S	R	
4:15 P	3	12	183	1	14	103	148	47	4	55	37	10	23	4	73	134	807
4:30 P	0	5	188	3	15	105	142	60	4	99	26	12	28	5	97	127	869
4:45 P	4	7	183	5	2	99	136	35	4	77	36	13	28	5	101	153	850
5:00 P	1	7	186	4	5	109	139	35	8	88	48	15	10	5	71	144	851
5:15 P	2	7	185	3	5	88	135	32	5	96	32	16	9	7	89	147	837
5:30 P	1	5	219	3	7	106	116	63	2	87	34	15	8	8	92	160	908
5:45 P	1	6	185	3	5	88	134	66	2	101	21	4	9	6	60	150	824
6:00 P	0	3	174	4	10	82	160	61	1	74	11	5	9	3	33	123	733
6:15 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:30 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:45 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Total Survey	12	52	1503	26	63	780	1110	399	30	677	245	90	124	43	616	1138	6679
Peak Hour:		4:30 PM				to				5:30 PM							

Total	8	26	773	15	19	402	526	165	19	348	150	59	55	25	353	604	3446
Approach	814				1093				557				982				3446
%HV	1.0%				1.7%				3.4%				5.6%				2.9%
PHF	0.90				0.96				0.92				0.94				0.95

N MERIDIAN AVE

1424

814

610

0 Bike
0 Ped

VALLEY AVE NW

15 773 26

567 Ped 3
Bike 1

1549 25
982 353

604

4:30 PM to 5:30 PM

3 3
0 402 526 165

1725 1093

2818

N MERIDIAN AVE

3632 1.0 PHF Peak Hour Volume

VALLEY AVE NE

59
150 557
348 1101

0 Bike
0 Ped 544

PEDs across:		N	S	E	W	
INT 01		2				2
INT 02		1	5	1	2	9
INT 03			3			3
INT 04					3	3
INT 05						0
INT 06						0
INT 07		1				1
INT 08			1			1
INT 09						0
INT 10						0
INT 11						0
INT 12						0
		2	11	1	5	19

Bicycles From:	N	S	E	W	
INT 01					0
INT 02					0
INT 03					0
INT 04					0
INT 05					0
INT 06				1	1
INT 07					0
INT 08					0
	0	0	0	1	1

		PHF %HV	
Check	EB	0.94	5.6%
In: 3446	WB	0.92	3.4%
Out: 3446	NB	0.96	1.7%
	SB	0.90	1.0%
Intersection		0.95	2.9%

Special Notes:

TM09p10101



Prepared for: **City of Puyallup**
Traffic Count Consultants, Inc.

Phone: (425) 861-8866 FAX: (425) 861-8877 E-Mail: TC2inc@aol.com

WBE/DBE

Intersection: MERIDIAN AVE N & SR-161/167 OFF RAMPS
Location: PUYALLUP, WASHINGTON

Date of Count: Wed 12/1/2010
Checked By: J.H

Time Interval Ending at	From North on (SB) MERIDIAN AVE N				From South on (NB) MERIDIAN AVE N				From East on (WB) SR-161/SR-167 OFF RAMP				From West on (EB) 0				Interval Total
	T	L	S	R	T	L	S	R	T	L	S	R	T	L	S	R	
4:15 P	18	0	390	0	2	0	132	0	25	205	0	120	0	0	0	0	847
4:30 P	19	0	394	0	4	0	134	0	36	210	0	128	0	0	0	0	866
4:45 P	27	0	412	0	2	0	143	0	40	216	0	157	0	0	0	0	928
5:00 P	10	0	389	0	2	0	119	0	20	227	0	143	0	0	0	0	878
5:15 P	14	0	424	0	5	0	143	0	33	244	0	133	0	0	0	0	944
5:30 P	17	0	486	0	6	0	139	0	27	244	0	181	0	0	0	0	1050
5:45 P	8	0	479	0	7	0	142	0	19	218	0	147	0	0	0	0	986
6:00 P	12	0	434	0	1	0	153	0	30	165	0	191	0	0	0	0	943
6:15 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:30 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:45 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Total Survey	125	0	3408	0	29	0	1105	0	230	1729	0	1200	0	0	0	0	7442
Peak Hour: 5:00 PM to 6:00 PM																	

Total	51	0	1823	0	19	0	577	0	109	871	0	652	0	0	0	0	3923
Approach	1823				577				1523				0				3923
%HV	2.8%				3.3%				7.2%				n/a				4.6%
PHF	0.94				0.94				0.90				n/a				0.93

MERIDIAN AVE N

3052

1823

1823

5:00 PM to 6:00 PM

2694

3271

MERIDIAN AVE N

1229

0 Bike
0 Ped

SR-161/SR-167 OFF RAMP

652

1523

871

0 Bike
0 Ped

4200 1.0 PHF Peak Hour Volume

PEDs across:		N	S	E	W	
INT 01						0
INT 02						0
INT 03						0
INT 04						0
INT 05						0
INT 06						0
INT 07						0
INT 08						0
INT 09						0
INT 10						0
INT 11						0
INT 12						0
		0	0	0	0	0

Bicycles From:	N	S	E	W
INT 01				
INT 02				
INT 03				
INT 04				
INT 05				
INT 06				
INT 07				
INT 08				
	0	0	0	0

		PHF %HV	
Check	EB	n/a	n/a
In: 3923	WB	0.90	7.2%
Out: 3923	NB	0.94	3.3%
	SB	0.94	2.8%
	Intersection	0.93	4.6%

Special Notes:

TM07p10101



Prepared for: **City of Puyallup**
Traffic Count Consultants, Inc.

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WBE/DBE


Intersection: MERIDIAN AVE N & SR-161/SR-167 ON/OFF RAMP
Location: PUYALLUP, WASHINGTON

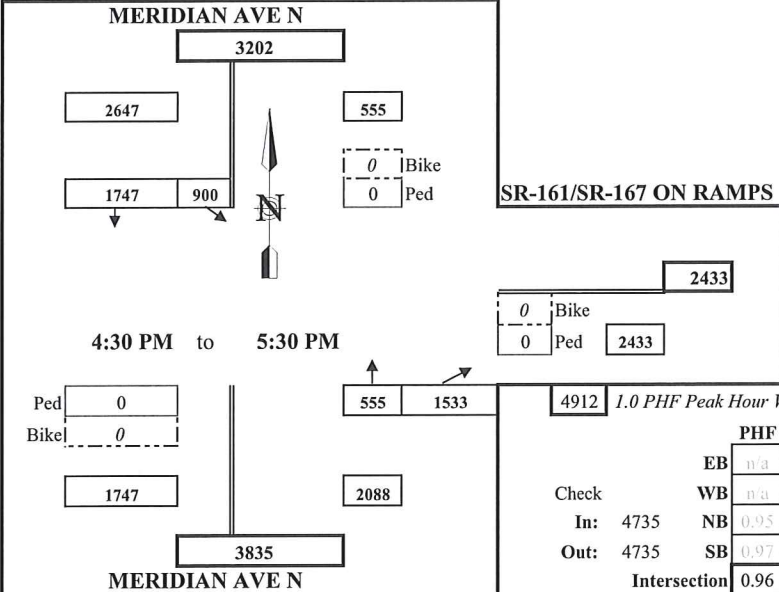
Date of Count: Wed 12/1/2010
Checked By: J.H

Time Interval Ending at	From North on (SB) MERIDIAN AVE N				From South on (NB) MERIDIAN AVE N				From East on (WB) SR-161/SR-167 ON RAMPS				From West on (EB) 0				Interval Total
	T	L	S	R	T	L	S	R	T	L	S	R	T	L	S	R	
4:15 P	35	195	417	0	10	0	155	373	0	0	0	0	0	0	0	0	1140
4:30 P	39	204	410	0	15	0	132	332	0	0	0	0	0	0	0	0	1078
4:45 P	28	219	428	0	13	0	133	401	0	0	0	0	0	0	0	0	1181
5:00 P	16	239	411	0	15	0	141	350	0	0	0	0	0	0	0	0	1141
5:15 P	23	223	457	0	10	0	150	398	0	0	0	0	0	0	0	0	1228
5:30 P	9	219	451	0	10	0	131	384	0	0	0	0	0	0	0	0	1185
5:45 P	13	223	423	0	7	0	137	369	0	0	0	0	0	0	0	0	1152
6:00 P	8	205	374	0	5	0	143	330	0	0	0	0	0	0	0	0	1052
6:15 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:30 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:45 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Total Survey	171	1727	3371	0	85	0	1122	2937	0	0	0	0	0	0	0	0	9157
Peak Hour: 4:30 PM to 5:30 PM																	

Total	76	900	1747	0	48	0	555	1533	0	0	0	0	0	0	0	0	4735
Approach	2647				2088				0				0				4735
%HV	2.9%				2.3%				n/a				n/a				2.6%
PHF	0.97				0.95				n/a				n/a				0.96





4912 1.0 PHF Peak Hour Volume

	PHF	%HV
EB	n/a	n/a
WB	n/a	n/a
In: 4735 NB	0.95	2.3%
Out: 4735 SB	0.97	2.9%
Intersection	0.96	2.6%

PEDs across:

	N	S	E	W	
INT 01					0
INT 02					0
INT 03					0
INT 04					0
INT 05					0
INT 06					0
INT 07					0
INT 08					0
INT 09					0
INT 10					0
INT 11					0
INT 12					0
	0	0	0	0	0

Bicycles From:

	N	S	E	W	
INT 01					0
INT 02					0
INT 03					0
INT 04					0
INT 05					0
INT 06					0
INT 07					0
INT 08					0
	0	0	0	0	0

Special Notes:

0

0

0

0

0

0

0

0

0

0

0

0



Prepared for: **City of Puyallup**
Traffic Count Consultants, Inc.

Phone: (425) 861-8866 FAX: (425) 861-8877 E-Mail: TC2inc@aol.com

WBE/DBE


Intersection: MERIDIAN AVE N & N LEVEE RD
Location: PUYALLUP, WASHINGTON

Date of Count: Wed 12/1/2010
Checked By: J.H

Time Interval Ending at	From North on (SB) MERIDIAN AVE N				From South on (NB) MERIDIAN AVE N				From East on (WB) N LEVEE RD				From West on (EB) N LEVEE RD				Interval Total
	T	L	S	R	T	L	S	R	T	L	S	R	T	L	S	R	
4:15 P	24	0	392	25	12	0	438	10	0	0	0	90	1	0	0	35	990
4:30 P	22	0	389	21	15	0	390	12	0	0	0	74	1	0	0	36	922
4:45 P	16	0	407	21	15	0	430	9	1	0	0	104	1	0	0	58	1029
5:00 P	9	0	395	16	15	0	406	5	5	0	0	85	2	0	0	33	940
5:15 P	12	0	443	14	11	0	459	8	2	0	0	89	1	0	0	46	1059
5:30 P	6	0	439	12	10	0	434	5	2	0	0	81	1	0	0	36	1007
5:45 P	8	0	412	11	7	0	432	5	1	0	0	74	0	0	0	42	976
6:00 P	5	0	358	16	5	0	407	8	4	0	0	66	0	0	0	21	876
6:15 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:30 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:45 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Total Survey	102	0	3235	136	90	0	3396	62	15	0	0	663	7	0	0	307	7799
Peak Hour: 4:30 PM to 5:30 PM																	

Total	43	0	1684	63	51	0	1729	27	10	0	0	359	5	0	0	173	4035
Approach	1747				1756				359				173				4035
%HV	2.5%				2.9%				2.8%				2.9%				2.7%
PHF	0.96				0.94				0.86				0.75				0.95



MERIDIAN AVE N

3835

1747

2088

0 Bike
0 Ped

N LEVEE RD

63 1684

359

386

0 Bike
0 Ped

27

4:30 PM to 5:30 PM

1729 27

4236 1.0 PHF Peak Hour Volume

1857

1756

MERIDIAN AVE N

3613

		PHF	%HV
Check	EB	0.75	2.9%
In: 4035	WB	0.86	2.8%
Out: 4035	NB	0.94	2.9%
	SB	0.96	2.5%
Intersection		0.95	2.7%

PEDs across:

	N	S	E	W
INT 01				0
INT 02				0
INT 03				0
INT 04				0
INT 05				0
INT 06				0
INT 07				0
INT 08				0
INT 09				0
INT 10				0
INT 11				0
INT 12				0
	0	0	0	0

Bicycles From:

	N	S	E	W
INT 01				
INT 02				
INT 03				
INT 04				
INT 05				
INT 06				
INT 07				
INT 08				
	0	0	0	0

Special Notes:

0

0

0

0

0

0

0

0

0

0

0

0

HCM Unsignalized Intersection Capacity Analysis
 1: Valley Ave & 27th AvCt

Existing PM Peak
 2/24/2012



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↕	↕↕		↕	
Sign Control		Free	Free		Stop	
Grade		-4%	0%		0%	
Volume (veh/h)	3	877	410	4	4	2
Peak Hour Factor	0.95	0.95	0.84	0.84	0.50	0.50
Hourly flow rate (vph)	3	923	488	5	8	4
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	493				958	246
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	493				958	246
tC, single (s)	4.2				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				97	99
cM capacity (veh/h)	1053				258	760

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	311	615	325	167	12
Volume Left	3	0	0	0	8
Volume Right	0	0	0	5	4
cSH	1053	1700	1700	1700	331
Volume to Capacity	0.00	0.36	0.19	0.10	0.04
Queue Length 95th (ft)	0	0	0	0	3
Control Delay (s)	0.1	0.0	0.0	0.0	16.3
Lane LOS	A				C
Approach Delay (s)	0.0		0.0		16.3
Approach LOS					C

Intersection Summary					
Average Delay			0.2		
Intersection Capacity Utilization		36.3%		ICU Level of Service	A
Analysis Period (min)			15		

HCM Unsignalized Intersection Capacity Analysis
 1: Valley Ave & 27th AvCt

2015 PM Peak Without Project
 2/24/2012



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔↔	↔↔		↔	
Sign Control		Free	Free		Stop	
Grade		-4%	0%		0%	
Volume (veh/h)	3	931	435	4	4	2
Peak Hour Factor	0.95	0.95	0.84	0.84	0.50	0.50
Hourly flow rate (vph)	3	980	518	5	8	4
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	523				1017	261
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	523				1017	261
tC, single (s)	4.2				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				97	99
cM capacity (veh/h)	1026				237	743

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	330	653	345	177	12
Volume Left	3	0	0	0	8
Volume Right	0	0	0	5	4
cSH	1026	1700	1700	1700	306
Volume to Capacity	0.00	0.38	0.20	0.10	0.04
Queue Length 95th (ft)	0	0	0	0	3
Control Delay (s)	0.1	0.0	0.0	0.0	17.2
Lane LOS	A				C
Approach Delay (s)	0.0		0.0		17.2
Approach LOS					C

Intersection Summary			
Average Delay		0.2	
Intersection Capacity Utilization	37.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
1: Valley Ave & 27th AvCt

2015 PM Peak With Project
3/7/2012



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↙	↕		↙	↕			↕			↕	
Sign Control		Free			Free			Stop			Stop	
Grade		-4%			0%			5%			0%	
Volume (veh/h)	6	931	13	25	435	10	33	0	77	23	0	11
Peak Hour Factor	0.95	0.95	0.95	0.84	0.84	0.84	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	980	14	30	518	12	37	0	86	26	0	12
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	530			994			1330	1589	497	1172	1590	265
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	530			994			1330	1589	497	1172	1590	265
tC, single (s)	4.5			4.5			7.9	6.6	7.3	7.9	6.5	7.3
tC, 2 stage (s)												
tF (s)	2.4			2.4			3.7	4.0	3.5	3.7	4.0	3.5
p0 queue free %	99			95			59	100	82	75	100	98
cM capacity (veh/h)	918			592			90	100	473	100	101	682

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	6	653	340	30	345	185	122	38
Volume Left	6	0	0	30	0	0	37	26
Volume Right	0	0	14	0	0	12	86	12
cSH	918	1700	1700	592	1700	1700	208	139
Volume to Capacity	0.01	0.38	0.20	0.05	0.20	0.11	0.59	0.27
Queue Length 95th (ft)	1	0	0	4	0	0	82	26
Control Delay (s)	8.9	0.0	0.0	11.4	0.0	0.0	44.3	40.5
Lane LOS	A			B			E	E
Approach Delay (s)	0.1			0.6			44.3	40.5
Approach LOS							E	E

Intersection Summary		
Average Delay		4.3
Intersection Capacity Utilization	39.4%	ICU Level of Service A
Analysis Period (min)		15

Lanes, Volumes, Timings
1: Valley Ave & 27th AvCt

2015 PM Peak With Project
3/7/2012



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-4%			0%			5%			0%	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.997			0.906			0.957	
Flt Protected	0.950			0.950				0.985			0.967	
Satd. Flow (prot)	1534	3526	0	1504	3417	0	0	1378	0	0	1465	0
Flt Permitted	0.950			0.950				0.920			0.826	
Satd. Flow (perm)	1534	3526	0	1504	3417	0	0	1287	0	0	1252	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			5			86			12	
Headway Factor	0.97	0.97	0.97	1.00	1.00	1.00	1.03	1.03	1.03	1.00	1.00	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		2510			5007			400			346	
Travel Time (s)		57.0			113.8			9.1			7.9	
Volume (vph)	6	931	13	25	435	10	33	0	77	23	0	11
Peak Hour Factor	0.95	0.95	0.95	0.84	0.84	0.84	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	20%	4%	20%	20%	5%	20%	20%	2%	20%	20%	2%	20%
Adj. Flow (vph)	6	980	14	30	518	12	37	0	86	26	0	12
Lane Group Flow (vph)	6	994	0	30	530	0	0	123	0	0	38	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Detector Phases	7	4		3	8		2	2		6	6	
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	8.0	20.0		8.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	9.0	29.0	0.0	9.0	29.0	0.0	22.0	22.0	0.0	22.0	22.0	0.0
Total Split (%)	15.0%	48.3%	0.0%	15.0%	48.3%	0.0%	36.7%	36.7%	0.0%	36.7%	36.7%	0.0%
Maximum Green (s)	5.0	25.0		5.0	25.0		18.0	18.0		18.0	18.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Flash Dont Walk (s)		11.0			11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effct Green (s)	5.2	15.7		5.2	15.7			7.4			7.4	
Actuated g/C Ratio	0.13	0.48		0.13	0.48			0.22			0.22	
v/c Ratio	0.03	0.59		0.15	0.32			0.35			0.13	
Control Delay	20.0	8.5		21.4	6.4			9.5			12.1	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	20.0	8.5		21.4	6.4			9.5			12.1	
LOS	B	A		C	A			A			B	



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		8.6			7.2			9.5			12.1	
Approach LOS		A			A			A			B	
Queue Length 50th (ft)	1	41		4	18			4			3	
Queue Length 95th (ft)	11	166		28	73			45			26	
Internal Link Dist (ft)		2430			4927			320			266	
Turn Bay Length (ft)												
Base Capacity (vph)	197	2126		194	2061			599			541	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.03	0.47		0.15	0.26			0.21			0.07	

Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 32.9

Natural Cycle: 50

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.59

Intersection Signal Delay: 8.3

Intersection LOS: A

Intersection Capacity Utilization 39.4%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 1: Valley Ave & 27th AvCt

22 s	9 s	29 s
22 s	9 s	29 s

Lanes, Volumes, Timings
2: Valley Ave & SR-161

Existing PM Peak
2/23/2012



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		450	300		0	200		0	170		0
Storage Lanes	1		2	2		0	2		1	1		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	0.95	0.88	0.97	0.95	0.95	0.97	0.95	1.00	1.00	0.95	0.95
Frnt			0.850		0.958				0.850		0.997	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1703	3406	2682	3400	3358	0	3433	3539	1583	1787	3564	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1703	3406	2682	3400	3358	0	3433	3539	1583	1787	3564	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			616		49				175		2	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		5007			3015			405			1771	
Travel Time (s)		113.8			68.5			9.2			40.3	
Volume (vph)	26	360	616	355	153	60	410	537	168	27	788	15
Peak Hour Factor	0.94	0.94	0.94	0.92	0.92	0.92	0.96	0.96	0.96	0.90	0.90	0.90
Heavy Vehicles (%)	6%	6%	6%	3%	3%	3%	2%	2%	2%	1%	1%	1%
Adj. Flow (vph)	28	383	655	386	166	65	427	559	175	30	876	17
Lane Group Flow (vph)	28	383	655	386	231	0	427	559	175	30	893	0
Turn Type	Prot		Perm	Prot			Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			
Detector Phases	7	4	4	3	8		5	2	2	1	6	
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Minimum Split (s)	8.0	20.0	20.0	8.0	20.0		8.0	20.0	20.0	8.0	20.0	
Total Split (s)	10.0	26.0	26.0	24.0	40.0	0.0	26.0	60.0	60.0	10.0	44.0	0.0
Total Split (%)	8.3%	21.7%	21.7%	20.0%	33.3%	0.0%	21.7%	50.0%	50.0%	8.3%	36.7%	0.0%
Maximum Green (s)	6.0	22.0	22.0	20.0	36.0		22.0	56.0	56.0	6.0	40.0	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5	
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lead	Lead	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	None	None		None	C-Max	C-Max	None	C-Max	
Walk Time (s)		5.0	5.0		5.0			5.0	5.0		5.0	
Flash Dont Walk (s)		11.0	11.0		11.0			11.0	11.0		11.0	
Pedestrian Calls (#/hr)		0	0		0			0	0		0	
Act Effct Green (s)	5.9	19.6	19.6	17.8	35.4		19.4	64.6	64.6	5.9	47.3	
Actuated g/C Ratio	0.05	0.16	0.16	0.15	0.30		0.16	0.54	0.54	0.05	0.39	
v/c Ratio	0.33	0.69	0.69	0.77	0.23		0.77	0.29	0.19	0.34	0.64	
Control Delay	66.2	53.9	9.0	59.6	25.5		58.8	23.0	10.0	66.0	33.5	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.3	0.0	0.0	0.1	
Total Delay	66.2	53.9	9.0	59.6	25.5		58.8	23.2	10.0	66.0	33.5	

Lanes, Volumes, Timings
2: Valley Ave & SR-161

Existing PM Peak
2/23/2012



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	E	D	A	E	C		E	C	A	E	C	
Approach Delay		26.6			46.8			34.3			34.6	
Approach LOS		C			D			C			C	
Queue Length 50th (ft)	21	146	14	148	56		162	151	28	23	303	
Queue Length 95th (ft)	53	198	72	200	87		m185	m170	m56	56	399	
Internal Link Dist (ft)		4927			2935			325			1691	
Turn Bay Length (ft)			450	300			200			170		
Base Capacity (vph)	85	624	995	567	1056		629	1907	933	89	1405	
Starvation Cap Reductn	0	0	0	0	0		0	687	0	0	0	
Spillback Cap Reductn	0	0	5	0	0		0	0	0	0	28	
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Reduced v/c Ratio	0.33	0.61	0.66	0.68	0.22		0.68	0.46	0.19	0.34	0.65	

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green, Master Intersection

Natural Cycle: 75

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.77

Intersection Signal Delay: 34.2

Intersection LOS: C

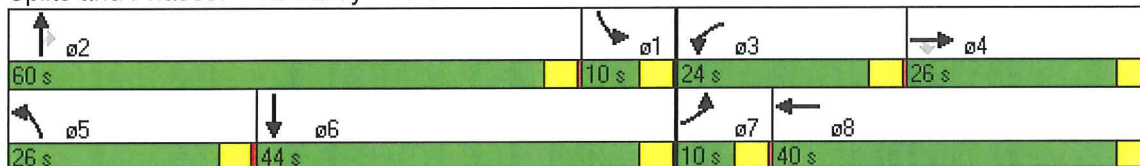
Intersection Capacity Utilization 67.4%

ICU Level of Service C

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Valley Ave & SR-161



Lanes, Volumes, Timings
2: Valley Ave & SR-161

2015 PM Peak Without Project
2/23/2012



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		450	300		0	200		0	170		0
Storage Lanes	1		2	2		0	2		1	1		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	0.95	0.88	0.97	0.95	0.95	0.97	0.95	1.00	1.00	0.95	0.95
Frnt			0.850		0.957				0.850		0.997	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1703	3406	2682	3400	3354	0	3433	3539	1583	1787	3564	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1703	3406	2682	3400	3354	0	3433	3539	1583	1787	3564	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			607		51				186		2	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30			30			30		30		30
Link Distance (ft)		5007			3015			405		1771		
Travel Time (s)		113.8			68.5			9.2		40.3		
Volume (vph)	27	382	654	377	162	64	435	569	179	28	837	16
Peak Hour Factor	0.94	0.94	0.94	0.92	0.92	0.92	0.96	0.96	0.96	0.90	0.90	0.90
Heavy Vehicles (%)	6%	6%	6%	3%	3%	3%	2%	2%	2%	1%	1%	1%
Adj. Flow (vph)	29	406	696	410	176	70	453	593	186	31	930	18
Lane Group Flow (vph)	29	406	696	410	246	0	453	593	186	31	948	0
Turn Type	Prot		Perm	Prot			Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4						2			
Detector Phases	7	4	4	3	8		5	2	2	1	6	
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Minimum Split (s)	8.0	20.0	20.0	8.0	20.0		8.0	20.0	20.0	8.0	20.0	
Total Split (s)	10.0	26.0	26.0	24.0	40.0	0.0	26.0	60.0	60.0	10.0	44.0	0.0
Total Split (%)	8.3%	21.7%	21.7%	20.0%	33.3%	0.0%	21.7%	50.0%	50.0%	8.3%	36.7%	0.0%
Maximum Green (s)	6.0	22.0	22.0	20.0	36.0		22.0	56.0	56.0	6.0	40.0	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5	
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lead	Lead	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	None	None		None	C-Max	C-Max	None	C-Max	
Walk Time (s)		5.0	5.0		5.0			5.0	5.0		5.0	
Flash Dont Walk (s)		11.0	11.0		11.0			11.0	11.0		11.0	
Pedestrian Calls (#/hr)		0	0		0			0	0		0	
Act Effct Green (s)	5.9	20.0	20.0	18.3	36.3		20.2	63.7	63.7	5.9	45.5	
Actuated g/C Ratio	0.05	0.17	0.17	0.15	0.30		0.17	0.53	0.53	0.05	0.38	
v/c Ratio	0.35	0.71	0.73	0.79	0.23		0.78	0.32	0.20	0.35	0.70	
Control Delay	66.7	54.6	11.8	60.7	25.3		58.3	23.1	9.4	66.6	36.2	
Queue Delay	0.0	0.0	0.1	0.0	0.0		0.0	0.3	0.0	0.0	0.3	
Total Delay	66.7	54.6	11.9	60.7	25.3		58.3	23.3	9.4	66.6	36.5	



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	E	D	B	E	C		E	C	A	E	D	
Approach Delay		28.6			47.5			34.1			37.5	
Approach LOS		C			D			C			D	
Queue Length 50th (ft)	22	154	33	157	59		154	151	31	24	347	
Queue Length 95th (ft)	55	210	102	212	93		m199	m171	m54	57	431	
Internal Link Dist (ft)		4927			2935			325			1691	
Turn Bay Length (ft)			450	300			200			170		
Base Capacity (vph)	85	625	987	567	1065		630	1879	928	89	1352	
Starvation Cap Reductn	0	0	0	0	0		0	659	0	0	0	
Spillback Cap Reductn	0	0	12	0	0		0	0	0	0	75	
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Reduced v/c Ratio	0.34	0.65	0.71	0.72	0.23		0.72	0.49	0.20	0.35	0.74	

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green, Master Intersection

Natural Cycle: 80

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.79

Intersection Signal Delay: 35.6

Intersection LOS: D

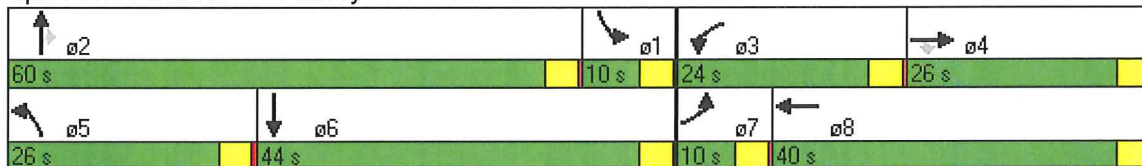
Intersection Capacity Utilization 70.7%

ICU Level of Service C

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Valley Ave & SR-161



Lanes, Volumes, Timings
2: Valley Ave & SR-161

2015 PM Peak With Project
3/7/2012



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		450	300		0	200		0	170		0
Storage Lanes	1		2	2		0	2		1	1		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50	50	50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Lane Util. Factor	1.00	0.95	0.88	0.97	0.95	0.95	0.97	0.95	1.00	1.00	0.95	0.95
Frnt			0.850		0.957				0.850		0.997	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1703	3406	2682	3400	3354	0	3433	3539	1583	1787	3564	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1703	3406	2682	3400	3354	0	3433	3539	1583	1787	3564	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			607		51				186		2	
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		5007			3015			405			1771	
Travel Time (s)		113.8			68.5			9.2			40.3	
Volume (vph)	34	382	744	377	162	64	463	569	179	28	837	19
Peak Hour Factor	0.94	0.94	0.94	0.92	0.92	0.92	0.96	0.96	0.96	0.90	0.90	0.90
Heavy Vehicles (%)	6%	6%	6%	3%	3%	3%	2%	2%	2%	1%	1%	1%
Adj. Flow (vph)	36	406	791	410	176	70	482	593	186	31	930	21
Lane Group Flow (vph)	36	406	791	410	246	0	482	593	186	31	951	0
Turn Type	Prot		Perm	Prot			Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4					2				
Detector Phases	7	4	4	3	8		5	2	2	1	6	
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Minimum Split (s)	8.0	20.0	20.0	8.0	20.0		8.0	20.0	20.0	8.0	20.0	
Total Split (s)	10.0	26.0	26.0	24.0	40.0	0.0	26.0	60.0	60.0	10.0	44.0	0.0
Total Split (%)	8.3%	21.7%	21.7%	20.0%	33.3%	0.0%	21.7%	50.0%	50.0%	8.3%	36.7%	0.0%
Maximum Green (s)	6.0	22.0	22.0	20.0	36.0		22.0	56.0	56.0	6.0	40.0	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5	
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lead	Lead	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	None	None		None	C-Max	C-Max	None	C-Max	
Walk Time (s)		5.0	5.0		5.0			5.0	5.0		5.0	
Flash Dont Walk (s)		11.0	11.0		11.0			11.0	11.0		11.0	
Pedestrian Calls (#/hr)		0	0		0			0	0		0	
Act Effct Green (s)	5.9	20.5	20.5	18.3	36.8		20.3	63.2	63.2	5.9	44.9	
Actuated g/C Ratio	0.05	0.17	0.17	0.15	0.31		0.17	0.53	0.53	0.05	0.37	
v/c Ratio	0.43	0.70	0.82	0.79	0.23		0.83	0.32	0.20	0.35	0.71	
Control Delay	71.4	53.5	18.9	60.7	25.1		61.0	22.7	9.0	66.6	36.9	
Queue Delay	0.0	0.0	0.2	0.0	0.0		0.0	0.3	0.0	0.0	0.5	
Total Delay	71.4	53.5	19.1	60.7	25.1		61.0	23.0	9.0	66.6	37.4	



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	E	D	B	E	C		E	C	A	E	D	
Approach Delay		32.0			47.4			35.5			38.3	
Approach LOS		C			D			D			D	
Queue Length 50th (ft)	28	154	73	157	58		162	148	30	24	350	
Queue Length 95th (ft)	64	210	164	212	93		m214	m167	m52	57	433	
Internal Link Dist (ft)		4927			2935			325			1691	
Turn Bay Length (ft)			450	300			200			170		
Base Capacity (vph)	85	627	989	567	1071		629	1865	922	89	1334	
Starvation Cap Reductn	0	0	0	0	0		0	658	0	0	0	
Spillback Cap Reductn	0	0	18	0	0		0	0	0	0	106	
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	
Reduced v/c Ratio	0.42	0.65	0.81	0.72	0.23		0.77	0.49	0.20	0.35	0.77	

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green, Master Intersection

Natural Cycle: 80

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.83

Intersection Signal Delay: 37.0

Intersection LOS: D

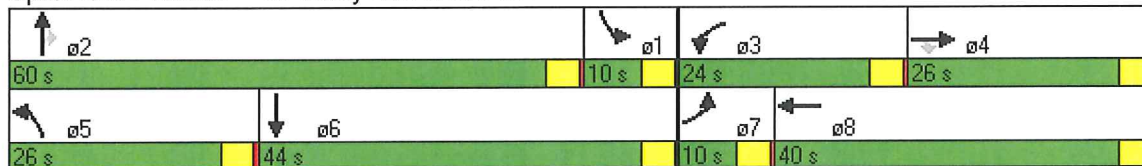
Intersection Capacity Utilization 71.6%

ICU Level of Service C

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Valley Ave & SR-161



Lanes, Volumes, Timings
7: SR-167 N Ramp & SR-161

Existing PM Peak
2/23/2012



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↑↑	↑↑			↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)		50	50			50
Trailing Detector (ft)		0	0			0
Turning Speed (mph)	15	9		9	15	
Lane Util. Factor	1.00	0.88	0.95	1.00	1.00	0.95
Fr't		0.850				
Flt Protected						
Satd. Flow (prot)	0	2656	3505	0	0	3505
Flt Permitted						
Satd. Flow (perm)	0	2656	3505	0	0	3505
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		593				
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)	30		30			30
Link Distance (ft)	1125		324			405
Travel Time (s)	25.6		7.4			9.2
Volume (vph)	0	665	589	0	0	1859
Peak Hour Factor	0.90	0.90	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	7%	7%	3%	3%	3%	3%
Adj. Flow (vph)	0	739	627	0	0	1978
Lane Group Flow (vph)	0	739	627	0	0	1978
Turn Type		custom				
Protected Phases			2			6
Permitted Phases		8				
Detector Phases		8	2			6
Minimum Initial (s)		4.0	4.0			4.0
Minimum Split (s)		20.0	20.0			20.0
Total Split (s)	0.0	33.0	87.0	0.0	0.0	87.0
Total Split (%)	0.0%	27.5%	72.5%	0.0%	0.0%	72.5%
Maximum Green (s)		29.0	83.0			83.0
Yellow Time (s)		3.5	3.5			3.5
All-Red Time (s)		0.5	0.5			0.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)		3.0	3.0			3.0
Recall Mode		None	C-Min			C-Min
Walk Time (s)		5.0	5.0			5.0
Flash Dont Walk (s)		11.0	11.0			11.0
Pedestrian Calls (#/hr)		0	0			0
Act Effct Green (s)		14.8	97.2			97.2
Actuated g/C Ratio		0.12	0.81			0.81
v/c Ratio		0.87	0.22			0.70
Control Delay		21.9	0.4			3.6
Queue Delay		0.0	0.3			2.2
Total Delay		21.9	0.7			5.8
LOS		C	A			A
Approach Delay			0.7			5.8



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Approach LOS			A			A
Queue Length 50th (ft)		60	3			58
Queue Length 95th (ft)		132	3			86
Internal Link Dist (ft)	1045		244			325
Turn Bay Length (ft)						
Base Capacity (vph)		1092	2840			2840
Starvation Cap Reductn		0	1438			249
Spillback Cap Reductn		0	0			688
Storage Cap Reductn		0	0			0
Reduced v/c Ratio		0.68	0.45			0.92

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 5 (4%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.87

Intersection Signal Delay: 8.4

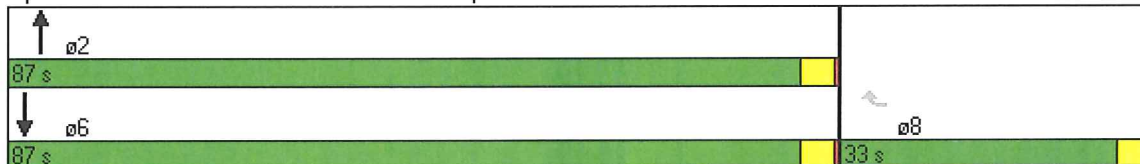
Intersection LOS: A

Intersection Capacity Utilization 54.7%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 7: SR-167 N Ramp & SR-161



Lanes, Volumes, Timings
7: SR-167 N Ramp & SR-161

2015 PM Peak Without Project
2/23/2012



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↑↑	↑↑			↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)		50	50			50
Trailing Detector (ft)		0	0			0
Turning Speed (mph)	15	9		9	15	
Lane Util. Factor	1.00	0.88	0.95	1.00	1.00	0.95
Fr't		0.850				
Flt Protected						
Satd. Flow (prot)	0	2656	3505	0	0	3505
Flt Permitted						
Satd. Flow (perm)	0	2656	3505	0	0	3505
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		551				
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)	30		30			30
Link Distance (ft)	1125		324			405
Travel Time (s)	25.6		7.4			9.2
Volume (vph)	0	706	625	0	0	1973
Peak Hour Factor	0.90	0.90	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	7%	7%	3%	3%	3%	3%
Adj. Flow (vph)	0	784	665	0	0	2099
Lane Group Flow (vph)	0	784	665	0	0	2099
Turn Type		custom				
Protected Phases			2			6
Permitted Phases		8				
Detector Phases		8	2			6
Minimum Initial (s)		4.0	4.0			4.0
Minimum Split (s)		20.0	20.0			20.0
Total Split (s)	0.0	33.0	87.0	0.0	0.0	87.0
Total Split (%)	0.0%	27.5%	72.5%	0.0%	0.0%	72.5%
Maximum Green (s)		29.0	83.0			83.0
Yellow Time (s)		3.5	3.5			3.5
All-Red Time (s)		0.5	0.5			0.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)		3.0	3.0			3.0
Recall Mode		None	C-Min			C-Min
Walk Time (s)		5.0	5.0			5.0
Flash Dont Walk (s)		11.0	11.0			11.0
Pedestrian Calls (#/hr)		0	0			0
Act Effct Green (s)		18.7	93.3			93.3
Actuated g/C Ratio		0.16	0.78			0.78
v/c Ratio		0.89	0.24			0.77
Control Delay		26.8	0.6			5.8
Queue Delay		0.0	0.3			25.7
Total Delay		26.8	0.9			31.5
LOS		C	A			C
Approach Delay			0.9			31.5

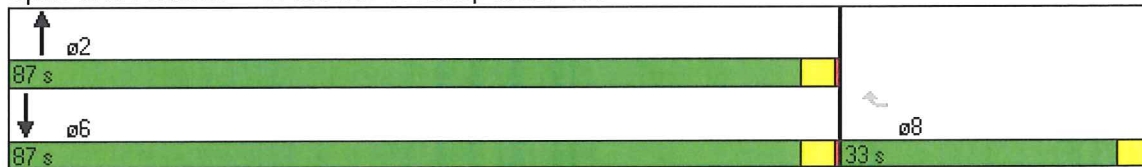


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Approach LOS			A			C
Queue Length 50th (ft)		105	3			68
Queue Length 95th (ft)		177	4			646
Internal Link Dist (ft)	1045		244			325
Turn Bay Length (ft)						
Base Capacity (vph)		1060	2724			2724
Starvation Cap Reductn		0	1350			262
Spillback Cap Reductn		0	0			721
Storage Cap Reductn		0	0			0
Reduced v/c Ratio		0.74	0.48			1.05

Intersection Summary

Area Type: Other
 Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 5 (4%), Referenced to phase 2:NBT and 6:SBT, Start of Green
 Natural Cycle: 65
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.89
 Intersection Signal Delay: 24.7
 Intersection LOS: C
 Intersection Capacity Utilization 57.9%
 ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 7: SR-167 N Ramp & SR-161





Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↑↑	↑↑			↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)		50	50			50
Trailing Detector (ft)		0	0			0
Turning Speed (mph)	15	9		9	15	
Lane Util. Factor	1.00	0.88	0.95	1.00	1.00	0.95
Fr _t		0.850				
Flt Protected						
Satd. Flow (prot)	0	2656	3505	0	0	3505
Flt Permitted						
Satd. Flow (perm)	0	2656	3505	0	0	3505
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		546				
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)	30		30			30
Link Distance (ft)	1125		324			405
Travel Time (s)	25.6		7.4			9.2
Volume (vph)	0	729	630	0	0	2063
Peak Hour Factor	0.90	0.90	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	7%	7%	3%	3%	3%	3%
Adj. Flow (vph)	0	810	670	0	0	2195
Lane Group Flow (vph)	0	810	670	0	0	2195
Turn Type		custom				
Protected Phases			2			6
Permitted Phases		8				
Detector Phases		8	2			6
Minimum Initial (s)		4.0	4.0			4.0
Minimum Split (s)		20.0	20.0			20.0
Total Split (s)	0.0	33.0	87.0	0.0	0.0	87.0
Total Split (%)	0.0%	27.5%	72.5%	0.0%	0.0%	72.5%
Maximum Green (s)		29.0	83.0			83.0
Yellow Time (s)		3.5	3.5			3.5
All-Red Time (s)		0.5	0.5			0.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)		3.0	3.0			3.0
Recall Mode		None	C-Min			C-Min
Walk Time (s)		5.0	5.0			5.0
Flash Dont Walk (s)		11.0	11.0			11.0
Pedestrian Calls (#/hr)		0	0			0
Act Effct Green (s)		20.2	91.8			91.8
Actuated g/C Ratio		0.17	0.76			0.76
v/c Ratio		0.90	0.25			0.82
Control Delay		28.6	0.6			7.8
Queue Delay		0.0	0.3			81.7
Total Delay		28.6	0.9			89.6
LOS		C	A			F
Approach Delay			0.9			89.6



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Approach LOS			A			F
Queue Length 50th (ft)		121	3			77
Queue Length 95th (ft)		197	4			718
Internal Link Dist (ft)	1045		244			325
Turn Bay Length (ft)						
Base Capacity (vph)		1056	2682			2682
Starvation Cap Reductn		0	1316			265
Spillback Cap Reductn		0	0			821
Storage Cap Reductn		0	0			0
Reduced v/c Ratio		0.77	0.49			1.18

Intersection Summary

Area Type: Other
 Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 5 (4%), Referenced to phase 2:NBT and 6:SBT, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.90
 Intersection Signal Delay: 60.0
 Intersection LOS: E
 Intersection Capacity Utilization 60.4%
 ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 7: SR-167 N Ramp & SR-161



Lanes, Volumes, Timings
9: SR-167 S Ramp & SR-161

Existing PM Peak
2/23/2012



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↑↑		↑↑		↑↑	↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0		0	250	
Storage Lanes	2	0		0	2	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50		50		50	50
Trailing Detector (ft)	0		0		0	0
Turning Speed (mph)	15	9		9	15	
Lane Util. Factor	0.97	1.00	0.95	1.00	0.97	0.95
Frt						
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3273	0	3539	0	3400	3505
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3273	0	3539	0	3400	3505
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)	30		30			30
Link Distance (ft)	1137		281			324
Travel Time (s)	25.8		6.4			7.4
Volume (vph)	888	0	566	0	918	1782
Peak Hour Factor	0.90	0.90	0.95	0.95	0.97	0.97
Heavy Vehicles (%)	7%	7%	2%	2%	3%	3%
Adj. Flow (vph)	987	0	596	0	946	1837
Lane Group Flow (vph)	987	0	596	0	946	1837
Turn Type					Prot	
Protected Phases	8		2		1	6
Permitted Phases						
Detector Phases	8		2		1	6
Minimum Initial (s)	4.0		4.0		4.0	4.0
Minimum Split (s)	20.0		20.0		8.0	20.0
Total Split (s)	46.0	0.0	31.0	0.0	43.0	74.0
Total Split (%)	38.3%	0.0%	25.8%	0.0%	35.8%	61.7%
Maximum Green (s)	42.0		27.0		39.0	70.0
Yellow Time (s)	3.5		3.5		3.5	3.5
All-Red Time (s)	0.5		0.5		0.5	0.5
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Recall Mode	None		C-Max		None	C-Max
Walk Time (s)	5.0		5.0			5.0
Flash Dont Walk (s)	11.0		11.0			11.0
Pedestrian Calls (#/hr)	0		0			0
Act Effct Green (s)	39.6		29.4		39.0	72.4
Actuated g/C Ratio	0.33		0.24		0.32	0.60
v/c Ratio	0.91		0.69		0.86	0.87
Control Delay	51.8		46.6		36.3	16.5
Queue Delay	0.0		0.0		88.7	8.5
Total Delay	51.8		46.6		125.0	25.0



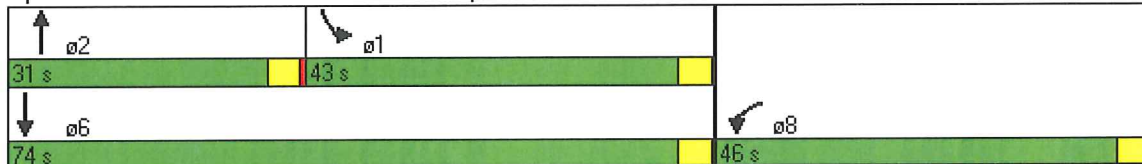
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
LOS	D		D		F C	
Approach Delay	51.8		46.6		59.0	
Approach LOS	D		D		E	
Queue Length 50th (ft)	363		227		315 555	
Queue Length 95th (ft)	452		294		412 545	
Internal Link Dist (ft)	1057		201		244	
Turn Bay Length (ft)						250
Base Capacity (vph)	1146		868		1105 2116	
Starvation Cap Reductn	0		0		313 268	
Spillback Cap Reductn	0		0		0 0	
Storage Cap Reductn	0		0		0 0	
Reduced v/c Ratio	0.86		0.69		1.19 0.99	

Intersection Summary

Area Type: Other
 Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 9 (8%), Referenced to phase 2:NBT and 6:SBT, Start of Green
 Natural Cycle: 80
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.91
 Intersection Signal Delay: 55.7
 Intersection Capacity Utilization 81.3%
 Analysis Period (min) 15

Intersection LOS: E
 ICU Level of Service D

Splits and Phases: 9: SR-167 S Ramp & SR-161



Lanes, Volumes, Timings
9: SR-167 S Ramp & SR-161

2015 PM Peak Without Project
2/23/2012



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔↔		↑↑		↔↔	↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0		0	250	
Storage Lanes	2	0		0	2	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50		50		50	50
Trailing Detector (ft)	0		0		0	0
Turning Speed (mph)	15	9		9	15	
Lane Util. Factor	0.97	1.00	0.95	1.00	0.97	0.95
Fr						
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3273	0	3539	0	3400	3505
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3273	0	3539	0	3400	3505
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)	30		30		30	30
Link Distance (ft)	1137		281		324	324
Travel Time (s)	25.8		6.4		7.4	7.4
Volume (vph)	943	0	601	0	974	1891
Peak Hour Factor	0.90	0.90	0.95	0.95	0.97	0.97
Heavy Vehicles (%)	7%	7%	2%	2%	3%	3%
Adj. Flow (vph)	1048	0	633	0	1004	1949
Lane Group Flow (vph)	1048	0	633	0	1004	1949
Turn Type						
Protected Phases	8		2		1	6
Permitted Phases						
Detector Phases	8		2		1	6
Minimum Initial (s)	4.0		4.0		4.0	4.0
Minimum Split (s)	20.0		20.0		8.0	20.0
Total Split (s)	46.0	0.0	31.0	0.0	43.0	74.0
Total Split (%)	38.3%	0.0%	25.8%	0.0%	35.8%	61.7%
Maximum Green (s)	42.0		27.0		39.0	70.0
Yellow Time (s)	3.5		3.5		3.5	3.5
All-Red Time (s)	0.5		0.5		0.5	0.5
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Recall Mode	None		C-Max		None	C-Max
Walk Time (s)	5.0		5.0		5.0	5.0
Flash Dont Walk (s)	11.0		11.0		11.0	11.0
Pedestrian Calls (#/hr)	0		0		0	0
Act Effct Green (s)	40.9		28.1		39.0	71.1
Actuated g/C Ratio	0.34		0.23		0.32	0.59
v/c Ratio	0.94		0.76		0.91	0.94
Control Delay	54.3		50.2		40.7	22.8
Queue Delay	0.0		0.0		117.1	31.6
Total Delay	54.3		50.2		157.8	54.5



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
LOS	D		D		F	D
Approach Delay	54.3		50.2			89.6
Approach LOS	D		D			F
Queue Length 50th (ft)	397		245		348	546
Queue Length 95th (ft)	#526		315		#500	#915
Internal Link Dist (ft)	1057		201			244
Turn Bay Length (ft)					250	
Base Capacity (vph)	1146		828		1105	2077
Starvation Cap Reductn	0		0		310	254
Spillback Cap Reductn	0		0		0	0
Storage Cap Reductn	0		0		0	0
Reduced v/c Ratio	0.91		0.76		1.26	1.07

Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 9 (8%), Referenced to phase 2:NBT and 6:SBT, Start of Green

Natural Cycle: 80

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.94

Intersection Signal Delay: 76.2

Intersection LOS: E

Intersection Capacity Utilization 85.8%

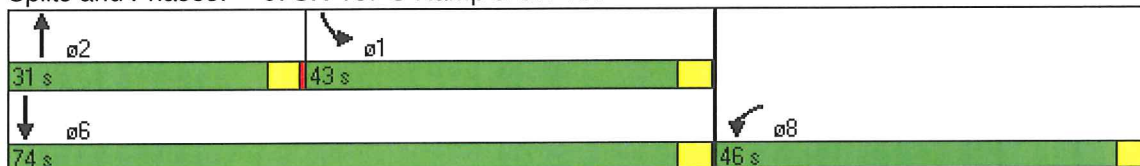
ICU Level of Service E

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 9: SR-167 S Ramp & SR-161





Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↑↑		↑↑		↑↑	↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0		0	250	
Storage Lanes	2	0		0	2	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50		50		50	50
Trailing Detector (ft)	0		0		0	0
Turning Speed (mph)	15	9		9	15	
Lane Util. Factor	0.97	1.00	0.95	1.00	0.97	0.95
Fr						
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3273	0	3539	0	3400	3505
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3273	0	3539	0	3400	3505
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)	30		30			30
Link Distance (ft)	1137		281			324
Travel Time (s)	25.8		6.4			7.4
Volume (vph)	943	0	606	0	1043	1912
Peak Hour Factor	0.90	0.90	0.95	0.95	0.97	0.97
Heavy Vehicles (%)	7%	7%	2%	2%	3%	3%
Adj. Flow (vph)	1048	0	638	0	1075	1971
Lane Group Flow (vph)	1048	0	638	0	1075	1971
Turn Type						
Protected Phases	8		2		1	6
Permitted Phases						
Detector Phases	8		2		1	6
Minimum Initial (s)	4.0		4.0		4.0	4.0
Minimum Split (s)	20.0		20.0		8.0	20.0
Total Split (s)	46.0	0.0	31.0	0.0	43.0	74.0
Total Split (%)	38.3%	0.0%	25.8%	0.0%	35.8%	61.7%
Maximum Green (s)	42.0		27.0		39.0	70.0
Yellow Time (s)	3.5		3.5		3.5	3.5
All-Red Time (s)	0.5		0.5		0.5	0.5
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Recall Mode	None		C-Max		None	C-Max
Walk Time (s)	5.0		5.0			5.0
Flash Dont Walk (s)	11.0		11.0			11.0
Pedestrian Calls (#/hr)	0		0			0
Act Effct Green (s)	40.9		28.1		39.0	71.1
Actuated g/C Ratio	0.34		0.23		0.32	0.59
v/c Ratio	0.94		0.77		0.97	0.95
Control Delay	54.3		50.5		50.4	24.5
Queue Delay	0.0		0.0		144.6	42.4
Total Delay	54.3		50.5		195.0	66.8

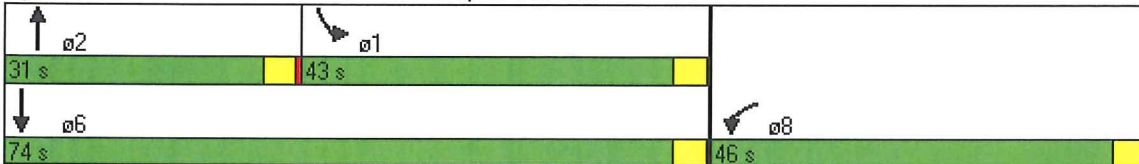


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
LOS	D		D		F	E
Approach Delay	54.3		50.5			112.1
Approach LOS	D		D			F
Queue Length 50th (ft)	397		247		398	620
Queue Length 95th (ft)	#526		317		#561	#934
Internal Link Dist (ft)	1057		201			244
Turn Bay Length (ft)					250	
Base Capacity (vph)	1146		828		1105	2077
Starvation Cap Reductn	0		0		301	279
Spillback Cap Reductn	0		0		0	0
Storage Cap Reductn	0		0		0	0
Reduced v/c Ratio	0.91		0.77		1.34	1.10

Intersection Summary

Area Type: Other
 Cycle Length: 120
 Actuated Cycle Length: 120
 Offset: 9 (8%), Referenced to phase 2:NBT and 6:SBT, Start of Green
 Natural Cycle: 80
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.97
 Intersection Signal Delay: 91.0 Intersection LOS: F
 Intersection Capacity Utilization 86.4% ICU Level of Service E
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 9: SR-167 S Ramp & SR-161



HCM Unsignalized Intersection Capacity Analysis
 16: Levee Rd & SR-161

Existing PM Peak
 2/23/2012



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↓	
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	0	176	0	566	1718	64
Peak Hour Factor	0.75	0.75	0.94	0.94	0.96	0.96
Hourly flow rate (vph)	0	235	0	602	1790	67
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)					281	
pX, platoon unblocked	0.60	0.60	0.60			
vC, conflicting volume	2124	928	1856			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2207	213	1760			
tC, single (s)	6.9	7.0	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	50	100			
cM capacity (veh/h)	22	473	208			
Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	235	301	301	1193	663	
Volume Left	0	0	0	0	0	
Volume Right	235	0	0	0	67	
cSH	473	1700	1700	1700	1700	
Volume to Capacity	0.50	0.18	0.18	0.70	0.39	
Queue Length 95th (ft)	68	0	0	0	0	
Control Delay (s)	19.9	0.0	0.0	0.0	0.0	
Lane LOS	C					
Approach Delay (s)	19.9	0.0		0.0		
Approach LOS	C					
Intersection Summary						
Average Delay			1.7			
Intersection Capacity Utilization		67.1%		ICU Level of Service		C
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 16: Levee Rd & SR-161

2015 PM Peak Without Project
 2/23/2012



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	0	187	0	601	1823	68
Peak Hour Factor	0.75	0.75	0.94	0.94	0.96	0.96
Hourly flow rate (vph)	0	249	0	639	1899	71
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)					281	
pX, platoon unblocked	0.53	0.53	0.53			
vC, conflicting volume	2254	985	1970			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2483	70	1943			
tC, single (s)	6.9	7.0	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	51	100			
cM capacity (veh/h)	13	513	155			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	249	320	320	1266	704
Volume Left	0	0	0	0	0
Volume Right	249	0	0	0	71
cSH	513	1700	1700	1700	1700
Volume to Capacity	0.49	0.19	0.19	0.74	0.41
Queue Length 95th (ft)	66	0	0	0	0
Control Delay (s)	18.5	0.0	0.0	0.0	0.0
Lane LOS	C				
Approach Delay (s)	18.5	0.0		0.0	
Approach LOS	C				

Intersection Summary					
Average Delay			1.6		
Intersection Capacity Utilization		70.8%		ICU Level of Service	C
Analysis Period (min)			15		

HCM Unsignalized Intersection Capacity Analysis
 16: Levee Rd & SR-161

2015 PM Peak With Project
 3/7/2012



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↗		↑↑	↑↑	
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	0	187	0	606	1837	75
Peak Hour Factor	0.75	0.75	0.94	0.94	0.96	0.96
Hourly flow rate (vph)	0	249	0	645	1914	78
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)					281	
pX, platoon unblocked	0.51	0.51	0.51			
vC, conflicting volume	2275	996	1992			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2537	38	1984			
tC, single (s)	6.9	7.0	4.2			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	52	100			
cM capacity (veh/h)	11	523	145			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	249	322	322	1276	716
Volume Left	0	0	0	0	0
Volume Right	249	0	0	0	78
cSH	523	1700	1700	1700	1700
Volume to Capacity	0.48	0.19	0.19	0.75	0.42
Queue Length 95th (ft)	64	0	0	0	0
Control Delay (s)	18.0	0.0	0.0	0.0	0.0
Lane LOS	C				
Approach Delay (s)	18.0	0.0		0.0	
Approach LOS	C				

Intersection Summary					
Average Delay			1.6		
Intersection Capacity Utilization		71.4%		ICU Level of Service	C
Analysis Period (min)			15		

SIGNAL WARRANT ANALYSIS, WARRANT 3

**Valley Avenue E & 27th Avenue Court E
2015 PM Peak Hour Volumes With Project**

Warrant met if criteria in either of the following two categories A and B are met:

A. If all 3 of the following conditions exist for the same 1 hour of an average day:

1. The total stopped time delay for the minor-street approach equals or exceeds 4 vehicle-hours for a one-lane approach (5 veh-hrs for a two-lane approach).

NB: $[122(44.3)]/(3600) = 1.5 < 4.0$ NOT MET

2. The volume on the same minor street approach equals or exceeds 100 vehicles per hour for one moving lane of traffic (150 veh/hr for two moving lanes).

NB : $33+77 = 110 > 100$ MET

3. The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with 3 approaches (800 veh/hr for 4 approaches).

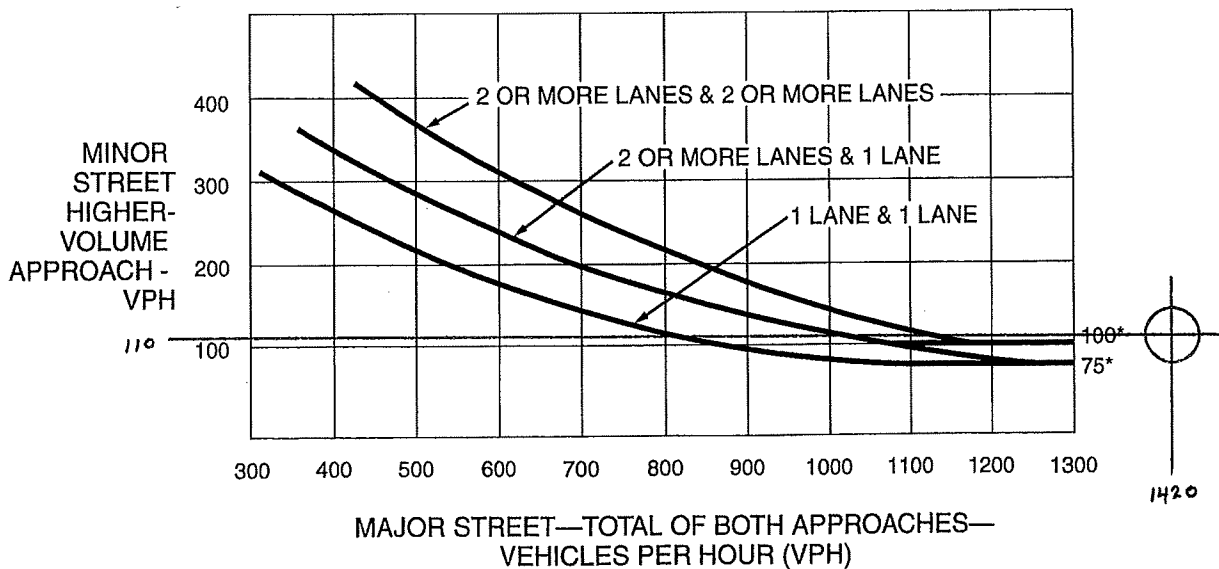
$1564 > 800$ MET

B. The plotted point in Figure 4C-3 falls above the applicable curve for the existing combination of approach lanes. MET for 4C-4 (above 40 mph)

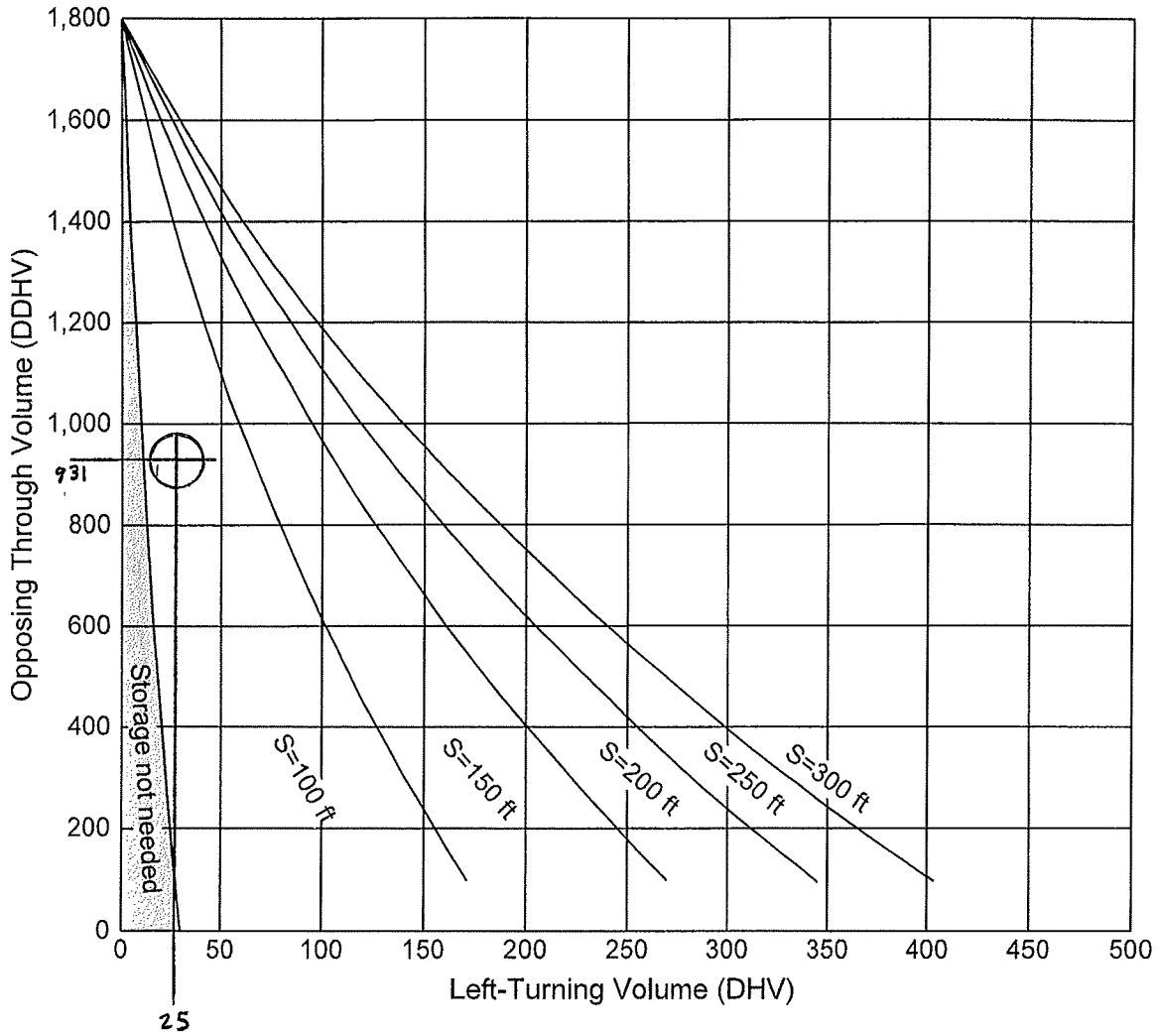
WARRANT 3 MET

(Based on estimated future volumes in 2015 with Tarragon Puyallup)

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.



S = Left-turn storage length

VALLEY AVE & 27TH AVE CT/ACCESS

WB LT: 25 VPH

EB THRU: 931 VPH

LEFT TURN LANE IS WARRANTED

Left-Turn Storage Guidelines: Four-Lane, Unsignalized

Exhibit 1310-15b

