SHERWOOD TSP REFINEMENT STUDY –

CEDAR BROOK WAY/MEINECKE/ELWERT

OBJECTIVE OF PROJECT:

Refine the TSP for the northwest side of Pacific Highway between Elwert and Meinecke via Cedar Brook Way to more clearly identify the functional street classification, and the number and location of connections to adjacent arterial roads.

PROCESS

Task	Timeframe*
• DKS analysis of street connectivity options	NOW
• Public and agency review and comment	5/31-6/7
• Work session with Planning Commission to discuss project and input received	6/12/12
• Proceed with TSP amendment public hearings (required agency notices, preparation of materials, etc)	6/15/12
• Notice posted and mailed	7/3/12
• Staff report available	7/17/12
• Planning Commission public hearing with recommendation to City Council	7/24/12
• City Council hearing and decision	8/14/12
Dates are tentative and intended to show the process schedule. Dates are subject to change	

We would like to hear from you!

Sherwood TSP Refinement Study – Cedar Brook Way/Meinecke/Elwert

Thank you for attending the open house to review the transportation analysis and refinement alternatives for the northwest side of Highway 99W between Elwert Road and Meinecke (via Cedar Brook Way).

1. Is there an alternative that you believe works better/best? (if yes, which one)

Alternative 1 Alternative 2 Alternative 3 Alternative 4

Why?_____

2. Is there an alternative that you believe works worse than the others? (if yes, which one)

Alternative 1 Alternative 2 Alternative 3 Alternative 4

Why?_____

3. Do you have questions about the analysis provided by DKS?

If the City proceeds with an amendment to the TSP to better identify the connectivity options and requirements in this area, is there anything specific you would ask be included or not included?

Please use the other side of the form to provide additional comments if needed

You may provide additional comments through June 7th, 2012 by e-mailing: hajdukj@sherwoodoregon.gov or mailing to 22560 SW Pine Street, Sherwood Oregon 97140, Attn: Julia Hajduk

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MEMORANDUM

REGISTERED PROFESSIONAL ENGINEER
54602PE
OREGON
Jan. 23, 2001
JOHN A. BOSKET
EXPIRES: 12/31/2013

DATE: May 25, 2012

TO: Bob Galati, PE - City of Sherwood

FROM: Garth Appanatis
John Bosket, PE
Brad Coy, PE

SUBJECT: **Sherwood TSP Connectivity Refinement - Elwert Road to Cedar Brook Way**

P12051-000-000

This memorandum documents the analysis of various street connectivity options for the City of Sherwood in the area on the northwest side of Highway 99W between Elwert Road and Cedar Brook Way. The primary purpose of this effort is to develop connectivity options that are consistent with both the City of Sherwood Transportation System Plan (TSP)[1] and the planned safety improvements at the intersection of Elwert Road and Kruger Road (which include relocating the intersection further north away from Highway 99W and considering a roundabout).

The sections of this memorandum document the background, study area, existing traffic conditions, and an evaluation of connectivity options and street capacity during the 2035 weekday p.m. peak hour. A summary of the findings is provided at the end of the memorandum.

Background

Alignments of future local and collector streets needed to serve developing areas on the northwest side of Highway 99W between Elwert Road and Cedar Brook Way have not yet been identified. However, the City of Sherwood TSP (Figure 8-8) identifies the priority "conceptual street connection[s]" for the local (intracity) transportation system. Figure 1, an excerpt of the TSP figure, shows future street connections at Elwert Road and Bushong Terrace, as well as a connection to the north side of Highway 99W between Elwert

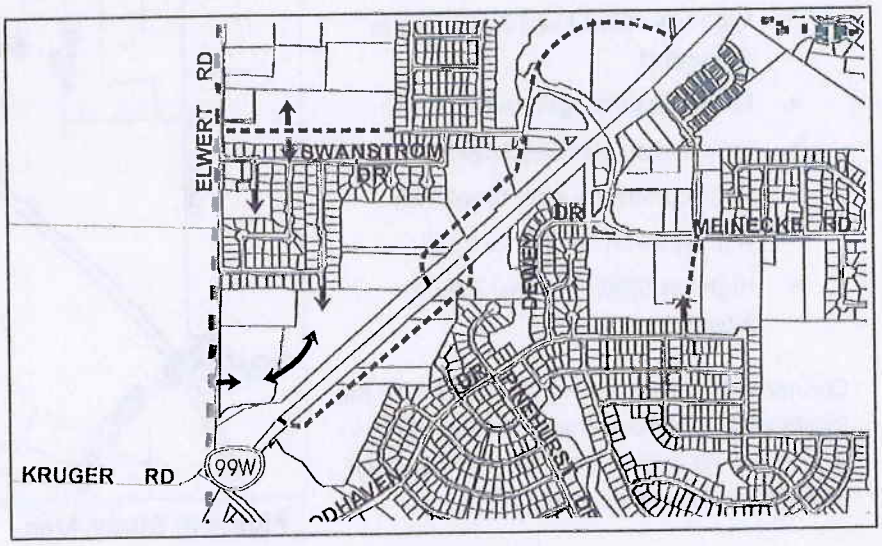


Figure 1: Local Street Connectivity (Enlargement of Sherwood TSP Figure 8-8)

[1] City of Sherwood Transportation System Plan, prepared by DKS Associates, March 2004.

Road and Cedar Brook Way. As noted in the TSP, "specific alignments and design will be better determined upon development review."

The objective of this study is to analyze the ability of various roadway connectivity options to adequately serve existing and future development in the area. Identifying the needed roadway system now will provide the basis for a detailed connectivity plan that future development proposals can follow and incorporate into site plans. This study will not identify a final roadway alignment or design. Future efforts to develop a more detailed plan will require further assessment of area constraints and input from affected property owners.

Creating a new connection to Elwert Road will be an important element of a connectivity plan for this area. However, Washington County classifies Elwert Road as an arterial and requires that only collectors or other arterials have access to arterial roadways.[2] For this reason, the future connection indicated in the City of Sherwood TSP as a local street would need to be a collector roadway. This analysis is an opportunity to clarify the TSP and explore area connectivity of the potential collector road.

Additionally, the Elwert Road/Kruger Road intersection and the proximity to Highway 99W has been identified as an existing safety concern. Exploration of potential safety improvements for this location includes the relocation of the intersection further to the north and consideration of roundabout control. Additional analysis of the system connectivity and local access needs with a realigned intersection would be helpful in pursuit of funding for this project.

Study Area

Figure 2 shows the project study area, which includes five existing study intersections and one potential future study intersection:

- Highway 99W/Elwert Road-Sunset Boulevard
- Elwert Road/Kruger Road
- Elwert Road/Handley Street
- Handley Street/Cedar Brook Way
- Highway 99W/Meinecke Road
- Highway 99W/Potential Future Intersection

Connectivity options being considered for the local/collector street network are limited to the northwest side of Highway 99W between Elwert Road and Cedar Brook Way.

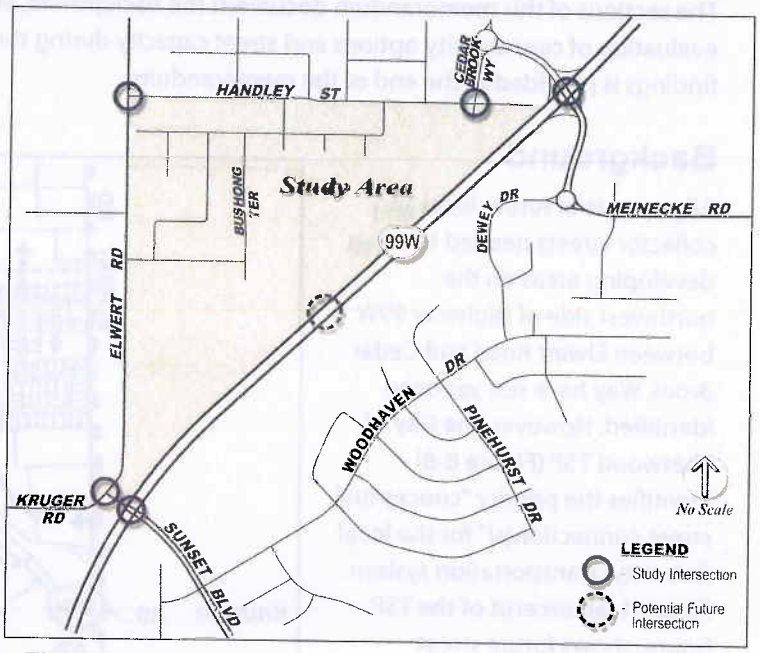


Figure 2: Study Area

[2] Article V: Public Facility and Service Requirements; Section 501-8.5 (Access to County and Public Roads), Washington County, printed 11/24/05.

Existing Conditions (2012)

This section describes existing opportunities and constraints related to traffic connectivity in the study area, including documentation of the roadway network characteristics, access conditions, and traffic operations during the weekday p.m. peak hour.

Study Area Roadway Network

Table 1 lists various characteristics of key study area roadways, indicating each roadway's capacity for serving auto, pedestrian, and bicycle trips.

Table 1: Existing Study Area Roadway Characteristics

Roadway	Travel Lanes	Speed Limit	On-Street Parking	Side-walks	Bike Lanes
Highway 99W	4-5 Lanes (Divided)	45 mph	No	No	Shoulders
Elwert Road	2 Lanes	35 mph	No	No	No
Kruger Road	2 Lanes	25 mph	No	No	No
Handley Street	2 Lanes	25 mph	Yes	Yes	No
Bushong Terrace	2 Lanes	25 mph	Yes	Yes	No
Cedar Brook Way	2 Lanes	25 mph	No	Yes	Yes
Meinecke Road	2-3 Lanes (Divided)	25 mph	No	Yes	Yes

Table 2 lists the functional classifications of study area roadways. Highway 99W and Elwert Road are classified as arterials because the efficient movement of traffic is a priority over the provision of direct access to neighboring areas. Handley Street and Meinecke Road are collectors. On these streets the need for efficient movement of traffic is more balanced with the need for access. Local streets, such as Kruger Road, Cedar Brook Way, and Bushong Terrace, are intended to be low-speed roadways where safe and convenient access to properties is a priority.

Table 2: Functional Classifications and Jurisdictions of Study Area Roadways

Roadway	Functional Classification (by Jurisdiction)[a]			
	City of Sherwood	*ODOT*	*Metro*	*Washington Co.*
Highway 99W	Principal Arterial	Statewide, NHS[b], Freight Route	Principal Arterial (Highway)	Principal Arterial
Elwert Road	Arterial	-	Minor Arterial	Arterial
Kruger Road	-	-	-	Local
Handley Street	Collector	-	-	Collector
Bushong Terrace	Local	-	-	-
Cedar Brook Way	Local[c]	-	-	Local
Meinecke Road	Collector	-	-	Collector

[a] Not all jurisdictions have functional classifications for every study area road, as indicated by the "-" in the table.
[b] NHS = National Highway System
[c] There may be some inconsistency with the functional classification referenced for Cedar Brook Way in the City TSP.
Shaded Box indicates roadway jurisdiction.

Access

As previously described, the functional classification of a street describes how it should be managed and operated with respect to mobility and access. Therefore, the functional classifications of area roadways and each jurisdiction's associated policies and standards will impact the development of connectivity options for the study area. The City of Sherwood, Washington County, and ODOT all have access spacing standards for roadways under their jurisdiction that indicate the desired separation between street and driveway intersections.

City of Sherwood

Table 3 shows the access spacing standards for roadways under City of Sherwood jurisdiction.[3] As noted in Table 2, the City only maintains jurisdiction over collector and local streets within the study area. On collector streets, intersections should be spaced at least 100 feet apart. There is no access spacing standard for local streets.

Table 3: City of Sherwood Access Spacing Standards

Street Facility	Spacing of Roadways and Driveways[a]	
	Maximum	*Minimum*
Arterial	1,000 feet	600 feet
Collector	400 feet	100 feet

[a] In addition, all roads require an access report stating that the driveway/roadway is safe as designed meeting adequate stacking, sight distance and deceleration requirements as set by ODOT, Washington County and AASHTO.

Source: Sherwood Transportation System Plan, March 2005, Table 8-12

Washington County

Washington County access spacing standards for arterials, such as Elwert Road, require a minimum of 600 feet between intersections.[4] In addition, Washington County's Community Development Code specifies that arterial roadways shall only be intersected by collectors or other arterials.[5]

There is approximately 1,700 feet of separation between the existing intersections on Elwert Road with Orchard Hill Lane and Highway 99W. Therefore, it would be feasible to create a new intersection on Elwert Road from a future extension of Cedar Brook Way that would comply with Washington County access spacing standards. However, doing so would require moving the existing driveway to the Elks Lodge from Elwert Road to the new Cedar Brook Way extension. Furthermore, because the Cedar Brook Way extension would likely be connected to Elwert Road opposite the relocated intersection with Kruger Road, the ultimate location will be limited by constraints associated with that improvement project.

In addition, to connect to Elwert Road, the Cedar Brook Way extension must be classified by the City of Sherwood as a collector street or higher. Compared to classifying this roadway as a local street, the collector classification could result in a wider roadway design requiring as much as 14 feet of additional right of way. The total length of the proposed road from Elwert Road to at least Handley Street would align with the recommended collector street length in the City's TSP and the traffic volumes using the road to access the commercial properties may be of a magnitude commonly associated with collector streets (2,000 vehicles per day or greater). However, the proposed

[3] Sherwood Transportation System Plan, March 2005, Table 8-12
[4] Washington County Community Development Code, Article V: Public Facilities and Services, 501-8.5 (A).
[5] Article V: Public Facility and Service Requirements; Section 501-8.5(B)(4) (Access to County and Public Roads), Washington County, printed 11/24/05.

Cedar Brook Way extension is currently shown in the City TSP as a local street, so an amendment would be required to change the functional classification to a collector.

ODOT

ODOT access spacing standards are documented in the 1999 Oregon Highway Plan (as amended December 2011) and OAR 734-051. Given Highway 99W's classification as a Statewide Highway and Freight Route on the National Highway System and posted speed of 45 mph through the study area, the resulting access spacing standard requires a minimum of 990 feet between driveways and intersections. There are relatively few driveways or intersections on the northwest side of Highway 99W in the study area, so it would be feasible to create a new roadway connection that would comply with ODOT's access spacing standards.

ODOT has also purchased access rights from properties abutting Highway 99W through the study area. This means that applications for new intersection or driveway connections cannot be accepted unless the applicant is in possession of a "reservation of access" (a location where access rights have been retained) or a "grant of access" has been applied for and approved by ODOT. In review of existing access rights along the northwest side of Highway 99W with ODOT staff, there are no reservations of access that could be used to establish a new public street connection. Therefore, the City would be required to apply for a grant of access to Highway 99W. It is likely that approval for such a grant of access would include a requirement that all existing driveways to Highway 99W between Meinecke Road and Elwert Road be removed when properties redevelop, with all future access being taken from the proposed Cedar Brook Way extension. Also, while ODOT does not prohibit the connection of local streets to highways, proposals to connect streets that are classified as collectors or higher in local TSPs are given preference when considering applications for a grant of access.

Traffic Operations

Traffic operations were analyzed at the study intersections and compared to the applicable jurisdiction's adopted mobility standards or targets. The mobility standards and existing traffic volumes are used as the basis for the intersection operations.

Mobility Standards

The City of Sherwood, Washington County, and ODOT each have mobility standards that must be met by roadways and intersections under their jurisdiction. These standards measure performance through either level of service or volume-to-capacity ratios:

- The **intersection level of service (LOS)** is similar to a "report card" rating based upon average vehicle delay. Level of service A, B, and C indicate conditions where traffic moves without significant delays over periods of peak hour travel demand. Level of service D and E are progressively worse operating conditions. Level of service F represents conditions where average vehicle delay has become excessive and demand has exceeded capacity. This condition is typically evident in long queues and delays.
- The **volume-to-capacity (V/C) ratio** represents the level of saturation of the intersection or individual movement. It is determined by dividing the peak hour traffic volume by the maximum hourly capacity of an intersection or turn movement. When the V/C ratio approaches 0.95, operations become unstable and small disruptions can cause the traffic flow to break down, as seen by the formation of excessive queues.

Table 4 lists mobility standards (referred to as "targets" for ODOT facilities) for the study area roadways. It also lists the roadways' applicable designations, which were used to determine the corresponding mobility standard.

Table 4: Applicable Mobility Standards/Targets[a] for Study Area Roadways

Roadway(s)	Location Designation (Source)	Mobility Standard[a]
Highway 99W	Other Principal Arterial Route inside Metro[b]	V/C ≤ 0.99
Elwert Road	Other Urban Areas (Table 5, Washington County TSP, 3/31/2003)	V/C ≤ 0.99 LOS E or better
Kruger Road	Rural Areas[c]	V/C ≤ 0.90 LOS D or better
Handley Street, Cedar Brook Way, and Meinecke Road	City of Sherwood	LOS D or better

[a] ODOT has mobility "targets", while other jurisdictions have mobility "standards."
[b] Table 7, 1999 Oregon Highway Plan, Policy 1F (as amended 12/21/2011).
[c] Table 5, Washington County TSP, 3/31/2003.

Existing Traffic Volumes

Turn movement traffic counts were performed at the study area intersections for the weekday p.m. peak period on April 11, 2012. Figure 3 shows the peak hour traffic volumes measured at each intersection. This data was used to analyze the performance of each intersection for comparison against adopted mobility standards/targets, as described in the following section.

Intersection Operations

The existing p.m. peak hour study intersection operations were determined based on the *2000 Highway Capacity Manual* methodology.[6] The estimated average delay, level of service (LOS), and volume to capacity (V/C) ratio are shown in Table 5. All study intersections currently meet applicable mobility standards and targets.

Table 5: 2012 Existing Study Intersection Operations (P.M. Peak Hour)

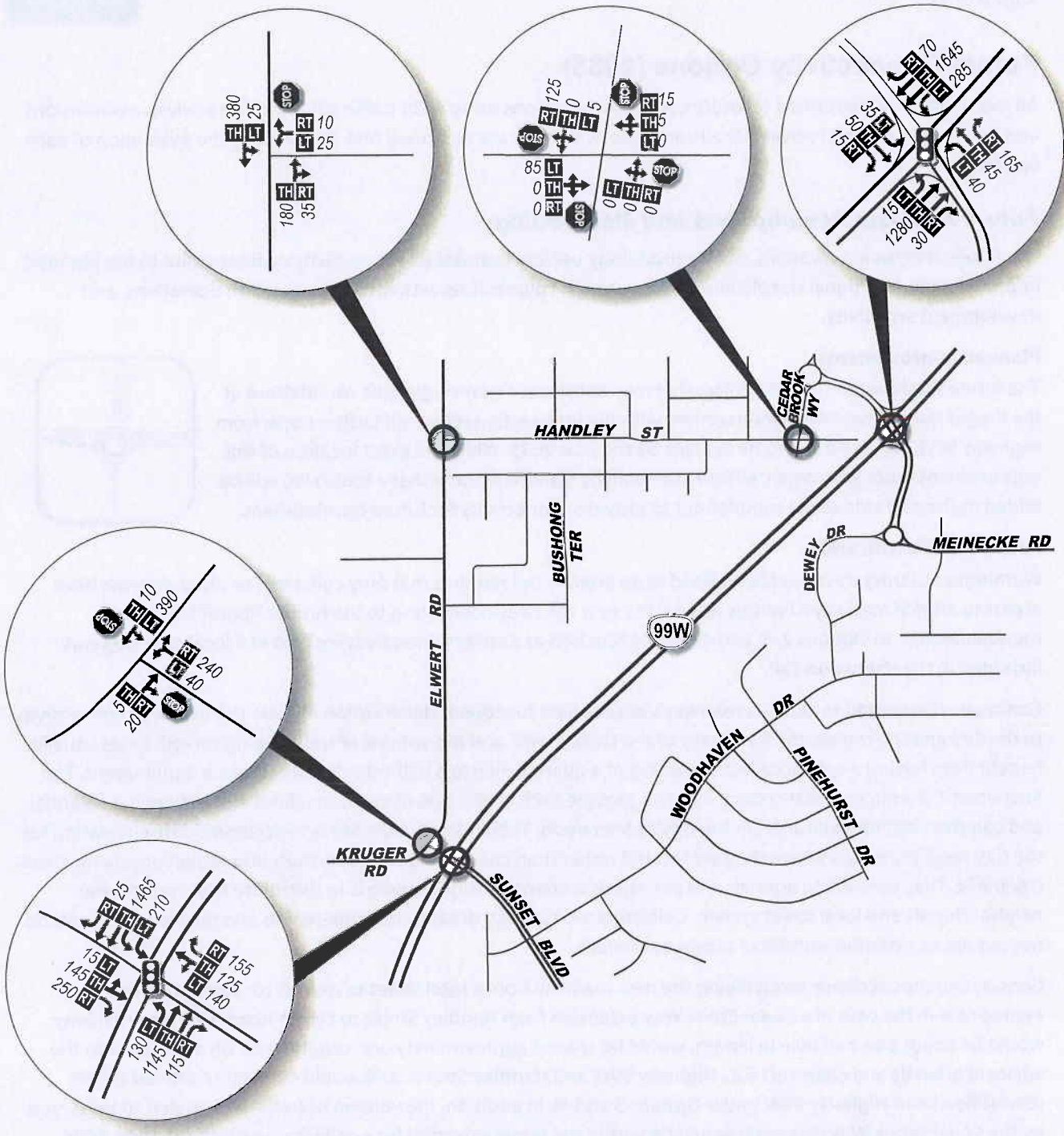
Intersection	Traffic Control	Operating Standard/Target[a]	Intersection Operations		
			Delay	*LOS*	*V/C*
Hwy 99W/Elwert Rd-Sunset Blvd	Traffic Signal	V/C ≤ 0.99	32.9	C	0.83
Hwy 99W/Meinecke Rd	Traffic Signal	V/C ≤ 0.99	18.0	B	0.66
Handley St/Cedar Brook Way	All-Way Stop	LOS D	7.5	A	0.15
Elwert Rd/Kruger Rd	Two-Way Stop	V/C ≤ 0.90, LOS D	21.7	A/C	0.69
Elwert Rd/Handley St	Two-Way Stop[b]	V/C ≤ 0.99, LOS E	13.1	A/B	0.13

Signalized and All-Way Stop Intersections:
Delay = Average Stopped Delay per Vehicle (sec)
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection

Two-Way Stop Intersections:
Delay = Average Stopped Delay per Vehicle (sec) at Worst Movement
LOS = Level of Service of Major Street/Minor Street
V/C = Volume-to-Capacity Ratio of Worst Movement

[a] ODOT has mobility "targets", while other jurisdictions have mobility "standards."
[b] Even though the intersection is a three-leg intersection and has only one minor street stopped approach, it is analyzed similar to a two-way stop controlled intersection.

[6] *2000 Highway Capacity Manual*, Transportation Research Board, Washington DC, 2000.



LEGEND

- Study Intersection
- Stop Sign
- Traffic Signal
- Lane Configuration
- 000 - PM Peak Hour Traffic Volumes
- LT TH RT (Left•Thru•Right) - Volume Turn Movements

DKS

No Scale

Figure 3

EXISTING 2012 PM PEAK HOUR TRAFFIC VOLUMES & LANE GEOMETRY

Future Connectivity Options (2035)

An evaluation was performed of future connectivity options using 2035 traffic volumes. The analysis assumptions and methodology used to evaluate all connectivity options are described first, followed by the evaluation of each option.

Future Analysis Assumptions and Methodology

The future analysis assumptions and methodology used to evaluate all connectivity options relate to the planned improvements, functional classification, access, traffic volume forecasts, future intersection operations, and development sensitivity.

Planned Improvements

The future Washington County project that may construct a new single-lane roundabout at the Kruger Road/Elwert Road intersection, with the intersection relocated farther north from Highway 99W, was assumed to be in place by the year 2035. While the exact location of this improvement is not yet known, all four connectivity options assume that a fourth leg will be added to the east side of the roundabout to provide connectivity for future development.

Functional Classification

Washington County classifies Elwert Road as an arterial and requires that only collectors or other arterials have access to arterial roadways. For this reason, the new roadway connecting to the Kruger Road/Elwert Road roundabout (i.e., in Options 2, 3, and 4) should function as a collector roadway instead of a local street, as was indicated in the Sherwood TSP.[7]

Common criteria used to assess a roadway's appropriate functional classification include the extent of connectivity to the City and the region, the frequency of the facility type, and the volume of traffic being served. Cities usually benefit from having a typical collector spacing of a quarter-mile to a half-mile, but this is not a requirement. The Sherwood TSP indicates that collector streets provide both access and circulation within and between residential and commercial/industrial areas in the City of Sherwood. Their primary purpose is to accommodate circulation for the City neighborhoods where they are located rather than connecting to the surrounding region or serving cross-city traffic. They connect to arterials and penetrate residential neighborhoods to distribute trips to/from the neighborhoods and local street system. Collectors are typically greater than one-half to one mile in length and do not require as extensive control of access as arterials.

Considering these criteria, reclassifying the new roadway from a local street to a collector street may be appropriate in the case of a Cedar Brook Way extension from Handley Street to Elwert Road. This new roadway would be about one-half mile in length, would be spaced approximately one-quarter mile on average from the adjacent arterials and collectors (i.e., Highway 99W and Handley Street), and would connect to arterial streets (Elwert Road and Highway 99W under Options 3 and 4). In addition, the volume of traffic anticipated to be served by the Cedar Brook Way extension would be within the range expected for a collector street (more than 2,000 vehicles per day). The collector classification for Cedar Brook Way could be extended as far north as the Meinecke Road roundabout. However, the northern segment of Cedar Brook Way between the Meinecke Road roundabout and Highway 99W could remain as a local street because its function is providing access to a limited number of properties.

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[7] *Sherwood Transportation System Plan (TSP)*, March 15, 2005

Access

Each connectivity option was evaluated to determine how it would impact the roadway network's ability to provide access to the nearby land uses, while also meeting applicable access management policies and standards (which are described previously in the Existing Conditions section of this memorandum).

Traffic Volume Forecasts

Future 2035 traffic volume forecasts were prepared for each of the connectivity options using a refined travel demand model that was developed based on Metro's 2010 (base) and 2035 (future) regional travel demand model. The refined model applies trip generation and trip distribution data taken directly from the Metro model, but adds additional roadway network detail to better represent local circulation in the study area.

The future model roadway network was adjusted for each connectivity option to account for the corresponding connectivity changes and different levels of access to Highway 99W. Future intersection volumes used for the operational analysis of each option were estimated by applying the increment of growth observed between the base and future year models to the existing traffic counts at study intersections. Figure 4 shows the 2035 traffic volume forecasts for Connectivity Option 1 (Partial Cedar Brook Way Extension). The 2035 traffic volumes for the other connectivity options are provided in the appendix on the operations analysis output sheets.

Future Intersection Operations

Future 2035 p.m. peak hour intersection operations analysis was performed for the study area intersections to determine how well each connectivity option and its associated intersection improvements accommodate vehicular traffic. The estimated average delay, level of service (LOS), and volume to capacity (V/C) ratio of each intersection or critical movement were determined and are documented for the connectivity options.

The signalized and unsignalized two-way stop controlled intersection performance measures were based on the *2000 Highway Capacity Manual* methodology,[8] while the roundabout intersection performance measures were determined using the methodology from the National Cooperative Highway Research Program (NCHRP) Project 3-65.[9]

Development Sensitivity

While the Metro travel demand model applied does account for a reasonable build-out scenario for future development within the study area, a sensitivity analysis was conducted for each connectivity option to assess the amount of additional development that could be accommodated without incurring major transportation improvements. This additional future development was limited to the undeveloped properties adjacent to the north side of Highway 99W between Meinecke Road and Elwert Road.

The analysis consisted of increasing the number of 2035 vehicular trips generated by these properties until major system improvements were triggered. Trip routing was determined for each connectivity option using the traffic patterns from the travel demand model.

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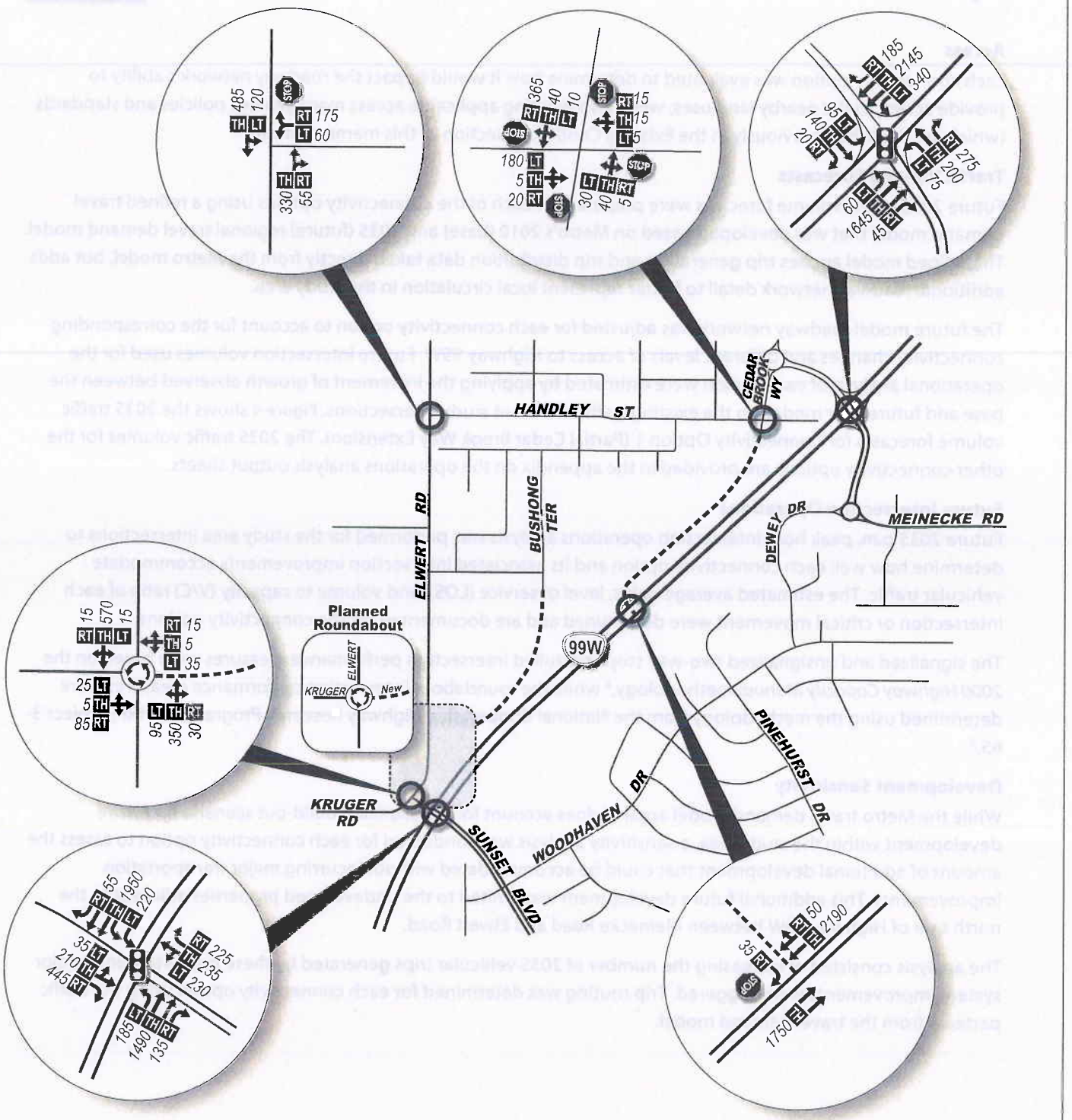
[8] *2000 Highway Capacity Manual*, Transportation Research Board, Washington DC, 2000.
[9] See NCHRP Report 572.



LEGEND

- Study Intersection
- Stop Sign
- Traffic Signal
- New Roadway (Option 1)
- Lane Configuration
- 000 - PM Peak Hour Traffic Volumes
- LT TH RT (Left•Thru•Right) - Volume Turn Movements

DKS

No Scale

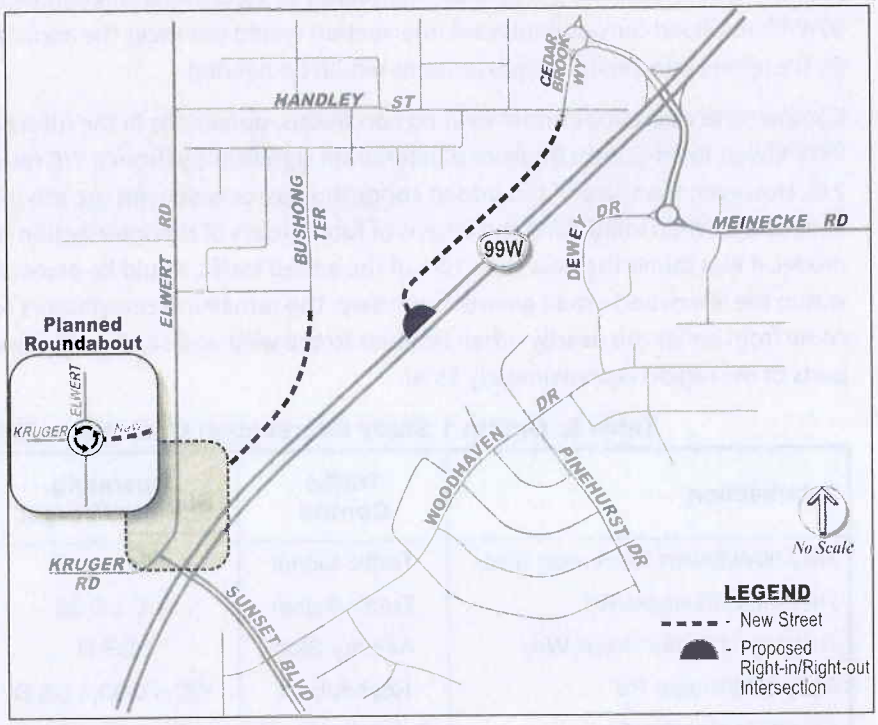
Figure 4

FUTURE 2035 PM PEAK HOUR TRAFFIC VOLUMES (Connectivity Option 1)

Option 1 (Partial Cedar Brook Way Extension)

Description of Roadway Connectivity:

Street connectivity for this option is shown at right and would be consistent with the Sherwood TSP Figure 8-8 (see Figure 1 earlier in this memorandum). This includes a new roadway that connects the Handley Street/Cedar Brook Way intersection to Highway 99W at a new intersection that is assumed to be limited to serve right-in/right-out movements only. A second new roadway, as suggested in the Sherwood TSP, would connect Bushong Terrace to the planned Kruger Road/Elwert Road roundabout.



Access to Properties:

The two new roadways would serve the properties along the north side of Highway 99W between Elwert Road and Handley Street, but they would only provide partial east-west connectivity. The properties to the east, which are primarily zoned for commercial use, would have a direct connection to westbound Highway 99W at the new right-in/right-out intersection. The properties to the west, which are primarily residentially zoned, would not be able to connect to this new intersection but would instead load onto Elwert Road.

Assuming all future access to Highway 99W from abutting properties is redirected to the local street network, the anticipated location for the new Highway 99W intersection would meet ODOT access spacing standards because it would be at least 1,500 feet away from the two adjacent signals (the ODOT standard is 990 feet). However, because access rights along the highway have been purchased by ODOT, ODOT approval of a grant of access must be obtained to establish this new intersection to Highway 99W.

Connecting the extension of Bushong Terrace to Elwert Road as the fourth leg of the future roundabout with Kruger Road would be ideal for access spacing along Elwert Road. However, Bushong Terrace is a local street, so Washington County's requirement of not allowing local streets to intersect with arterials would not be met. However, the County does allow for exceptions to this requirement through a Type II process when collector access is found to be unavailable and impracticable by the Director.[10]

[10] Article V: Public Facility and Service Requirements; Section 501-8.5(B)(4) (Access to County and Public Roads), Washington County, printed 11/24/05.

Mobility at Study Intersections:

Most study intersections will operate adequately in 2035 under this connectivity option. However, the Highway 99W/Elwert Road-Sunset Boulevard intersection would not meet the applicable ODOT mobility target (see Table 6). Therefore, intersection improvements would be needed.

Compared to operations under existing conditions, operations in the future at the intersection of Highway 99W/Elwert Road-Sunset Boulevard deteriorate significantly (from a V/C ratio of 0.83 to a V/C ratio greater than 2.0). However, the share of this added congestion associated with growth in development within Sherwood is fairly small. When identifying the origins of future users of this intersection using the regional travel demand model, it was found that less than 10% of the added traffic would be associated with trips beginning or ending within the Sherwood urban growth boundary. The remaining contributors to this increase in congestion would come from either the nearby urban reserves to the west and south of Sherwood (approximately 35%) or other parts of the region (approximately 55%).

Table 6: Option 1 Study Intersection Operations (2035 P.M. Peak Hour)

Intersection	Traffic Control	Operating Standard/Target[a]	Intersection Operations		
			Delay	*LOS*	*V/C*
Hwy 99W/Elwert Rd-Sunset Blvd	Traffic Signal	V/C ≤ 0.99	>80	F	>2.0
Hwy 99W/Meinecke Rd	Traffic Signal	V/C ≤ 0.99	39.5	D	0.91
Handley St/Cedar Brook Way	All-Way Stop	LOS D	10.7	B	0.50
Elwert Rd/Kruger Rd	Roundabout	V/C ≤ 0.90, LOS D	13.4	B	0.64
Elwert Rd/Handley St	Two-Way Stop[b]	V/C ≤ 0.99, LOS E	25.5	A/D	0.59
Hwy 99W/New Access	Two-Way Stop[b]	V/C ≤ 0.99	28.4	A/D	0.89

Signalized and All-Way Stop Intersections:
Delay = Average Stopped Delay per Vehicle (sec)
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection
Highlighted values do not meet standards.

Two-Way Stop and Roundabout Intersections:
Delay = Average Stopped Delay per Vehicle (sec) at Worst Movement
LOS = Level of Service of Major Street/Minor Street (Two-Way Stop) or Worst Movement (Roundabout)
V/C = Volume-to-Capacity Ratio of Worst Movement

[a] ODOT has mobility "targets", while other jurisdictions have mobility "standards."
[b] Even though the intersection is a three-leg intersection and has only one minor street stopped approach, it is analyzed similar to a two-way stop controlled intersection.

Study Intersection Improvements Needed:

For the Highway 99W/Elwert Road-Sunset Boulevard intersection to meet the applicable mobility target, significant widening would be needed for the Elwert Road and Sunset Boulevard approaches. Both approaches currently include two lanes (shared through-left and right). The Elwert Road approach would have a heavy right turn volume and would need to be widened to four lanes (left, through, and dual rights). The Sunset Boulevard approach would have a heavy left-turn volume and would also need to be widened to four lanes (dual lefts, through, and right). Table 7 provides the study intersection operations with the recommended improvements.

Table 7: Option 1 Study Intersection Operations (2035 P.M. Peak Hour) – With Improvements

Intersection	Traffic Control	Operating Standard/Target[a]	Intersection Operations with Improvements		
			Delay	*LOS*	*V/C*
Hwy 99W/Elwert Rd-Sunset Blvd	Traffic Signal	V/C ≤ 0.99	51.8	D	0.93

Signalized Intersection:
Delay = Average Stopped Delay per Vehicle (sec)
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection
Highlighted values do not meet standards.

[a] ODOT has mobility "targets", while other jurisdictions have mobility "standards."

Ability to Accommodate Future Development:

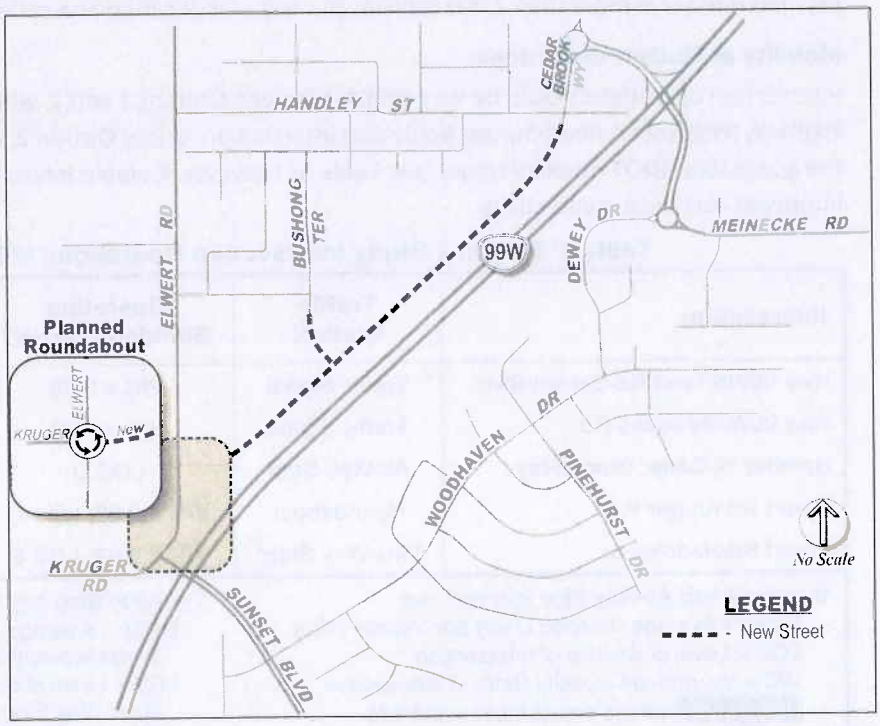
Connectivity Option 1 is expected to have the capacity to accommodate 200 more weekday p.m. peak hour trips to/from the study area before additional major improvements would be triggered. This trip level is in addition to what is assumed in the regional travel demand model and would be roughly equivalent to 200 single-family homes or an 18,000 square-foot shopping center. Accommodating more trips beyond this may require improvements at the Highway 99W/Meinecke Road intersection.

Option 2 (No Highway 99W Access)

Description of Roadway Connectivity:

Under this option, the new roadway would travel the full distance between Elwert Road and Handley Street, but would not include a connection to Highway 99W. Towards the west end, an extension of Bushong Terrace would connect to the new roadway from the north and the new roadway would connect to Elwert Road as the fourth leg of the future roundabout with Kruger Road.

While there would be very good east-west connectivity under this option, without a direct access to Highway 99W there would be more reliance on the intersections on Highway 99W with Elwert Road and Meinecke Road.



Access to Properties:

The new roadway would serve all properties along the north side of Highway 99W between Elwert Road and Handley Street, but there would not be a direct connection to Highway 99W. Instead, traffic to/from the west would likely use the Highway 99W/Elwert Road-Sunset Boulevard intersection and traffic to/from the east would likely use the Highway 99W/Meinecke Road intersection. The connection to the new roadway from Bushong Terrace would improve access to the highway-adjacent properties to and from other land uses to the north (e.g., the school and residential neighborhoods). However, it should be noted that the Bushong Terrace extension to the south may be difficult or infeasible to construct given the area topography. If it is not feasible, pedestrian and bicycle connections to the north should still be constructed.

Assuming all future access to Highway 99W from abutting properties is redirected to the local street network, this option would remove all access to the highway between Meinecke Road and Elwert Road. Therefore, there would be no conflict with ODOT access management policies and standards. In addition, the connection of Bushong Terrace to the new roadway could meet City access spacing standards as well.

Connecting the new roadway to Elwert Road as the fourth leg of the future roundabout with Kruger Road would be ideal for access spacing along Elwert Road. However, to comply with Washington County's requirement of not allowing local streets to intersect with arterials, the new roadway must be classified as a collector street or higher (unless an exception to this requirement can be obtained). Considering the approximate length of this roadway, the fact that it would be providing connectivity between arterial (Elwert Road) and collector (Handley Street) streets, would provide enhanced connectivity to a residential area via an extension of Bushong Terrace, and is estimated to serve more than 2,000 vehicles per day, classification as a collector street would be appropriate.

Mobility at Study Intersections:

Intersection operations would be very similar between Options 1 and 2, with some minor differences at the Highway 99W/Elwert Road-Sunset Boulevard intersection. Under Option 2, this intersection would still not meet the applicable ODOT mobility target (see Table 8); however, it would have slightly improved operations due to the improved east-west connectivity.

Table 8: Option 2 Study Intersection Operations (2035 P.M. Peak Hour)

Intersection	Traffic Control	Operating Standard/Target[a]	Intersection Operations		
			Delay	*LOS*	*V/C*
Hwy 99W/Elwert Rd-Sunset Blvd	Traffic Signal	V/C ≤ 0.99	>80	F	1.76
Hwy 99W/Meinecke Rd	Traffic Signal	V/C ≤ 0.99	37.9	D	0.90
Handley St/Cedar Brook Way	All-Way Stop	LOS D	11.9	B	0.58
Elwert Rd/Kruger Rd	Roundabout	V/C ≤ 0.90, LOS D	13.2	B	0.64
Elwert Rd/Handley St	Two-Way Stop[b]	V/C ≤ 0.99, LOS E	22.2	A/C	0.52

Signalized and All-Way Stop Intersections:
Delay = Average Stopped Delay per Vehicle (sec)
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection
Highlighted values do not meet standards.

Two-Way Stop and Roundabout Intersections:
Delay = Average Stopped Delay per Vehicle (sec) at Worst Movement
LOS = Level of Service of Major Street/Minor Street (Two-Way Stop) or Worst Movement (Roundabout)
V/C = Volume-to-Capacity Ratio of Worst Movement

[a] ODOT has mobility "targets", while other jurisdictions have mobility "standards."
[b] Even though the intersection is a three-leg intersection and has only one minor street stopped approach, it is analyzed similar to a two-way stop controlled intersection.

Study Intersection Improvements Needed:

For the Highway 99W/Elwert Road-Sunset Boulevard intersection to meet the applicable ODOT mobility target, the same improvements identified for Option 1 would be needed. These improvements include significant widening of the Elwert Road and Sunset Boulevard approaches. Both approaches currently include two lanes (shared through-left and right). The Elwert Road approach would have a heavy right-turn volume and would need to be widened to four lanes (left, through, and dual rights). The Sunset Boulevard approach would also need to be widened to four lanes (dual lefts, through, and right). Table 9 provides the study intersection operations with the improvements.

Table 9: Option 2 Study Intersection Operations (2035 P.M. Peak Hour) – With Improvements

Intersection	Traffic Control	Operating Standard/Target[a]	Intersection Operations with Improvements		
			Delay	*LOS*	*V/C*
Hwy 99W/Elwert Rd-Sunset Blvd	Traffic Signal	V/C ≤ 0.99	51.5	D	0.92

Signalized Intersection:
Delay = Average Stopped Delay per Vehicle (sec)
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection
Highlighted values do not meet standards.

[a] ODOT has mobility "targets", while other jurisdictions have mobility "standards."

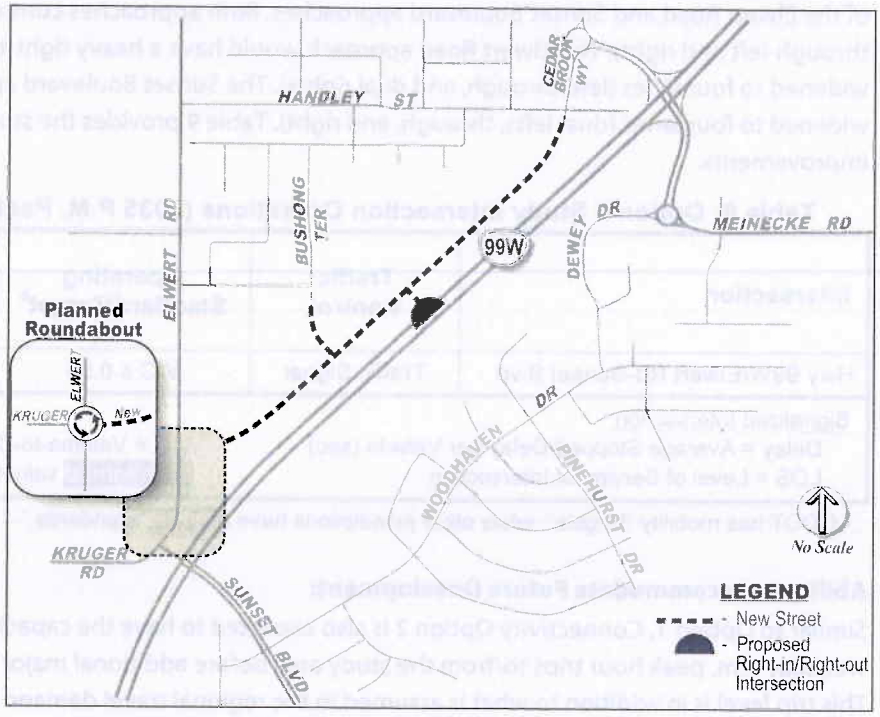
Ability to Accommodate Future Development:

Similar to Option 1, Connectivity Option 2 is also expected to have the capacity to accommodate 200 more weekday p.m. peak hour trips to/from the study area before additional major improvements would be triggered. This trip level is in addition to what is assumed in the regional travel demand model and would be roughly equivalent to 200 single-family homes or an 18,000 square-foot shopping center. Accommodating more trips beyond this may require improvements at the Highway 99W/Meinecke Road intersection.

Option 3 (Right-In/Right-Out Highway 99W Access)

Description of Roadway Connectivity:

Under this option, the new roadway would travel the full distance between Elwert Road and Handley Street, but unlike Option 2, would include a connection to Highway 99W. This connection would include an intersection to Highway 99W that is assumed to allow only right-in and right-out turning movements. Towards the west end, an extension of Bushong Terrace would connect to the new roadway from the north and the new roadway would connect to Elwert Road as the fourth leg of the future roundabout with Kruger Road.



Similar to Option 2, this option would provide very good east-west connectivity. However, with the inclusion of the access to Highway 99W, overall connectivity in this area would be significantly improved.

Access to Properties:

The new roadway would serve all properties along the north side of Highway 99W between Elwert Road and Handley Street and would also provide a direct connection to westbound Highway 99W at the new right-in/right-out intersection. Therefore, it would provide better overall accessibility and connectivity than Options 1 and 2. One limitation of the right-in/right-out intersection is that to head eastbound on Highway 99W, traffic would be required to use either the Highway 99W/Meinecke Road intersection or the Highway 99W/Elwert Road-Sunset Boulevard intersection. Alternatively drivers could also use the new right-in/right-out intersection to head westbound but then perform a U-turn at the Sunset Boulevard intersection. The connection to the new roadway from Bushong Terrace, if feasible, could meet City access spacing standards and would improve access to the highway-adjacent properties to and from other land uses to the north (e.g., the school and residential neighborhoods).

Assuming all future access to Highway 99W from abutting properties is redirected to the new roadway, the anticipated location for the new Highway 99W intersection would meet ODOT access spacing standards because it would be at least 1,500 feet away from the two adjacent signals (the ODOT standard is 990 feet). However, because access rights along the highway have been purchased by ODOT, ODOT approval of a grant of access must be obtained to establish this new intersection to Highway 99W.

Connecting the new roadway to Elwert Road as the fourth leg of the future roundabout with Kruger Road would be ideal for access spacing along Elwert Road. However, to comply with Washington County's requirement of not allowing local streets to intersect with arterials, the new roadway must be classified as a collector street or higher (unless an exception to this requirement can be obtained). Considering the approximate length of this roadway, the fact that it would be providing connectivity between arterial (Elwert Road) and collector (Handley Street) streets, would provide enhanced connectivity to a residential area via an extension of Bushong Terrace, and is estimated to serve more than 2,000 vehicles per day, classification as a collector street would be appropriate.

Mobility at Study Intersections:

Intersection operations would be nearly identical between Options 2 and 3 (which are both slightly better than Option 1). The Highway 99W/Elwert Road-Sunset Boulevard intersection would still not meet the applicable ODOT mobility target (see Table 10) and would need additional intersection improvements.

Table 10: Option 3 Study Intersection Operations (2035 P.M. Peak Hour)

Intersection	Traffic Control	Operating Standard/Target[a]	Intersection Operations		
			Delay	*LOS*	*V/C*
Hwy 99W/Elwert Rd-Sunset Blvd	Traffic Signal	V/C ≤ 0.99	>80	F	**1.78**
Hwy 99W/Meinecke Rd	Traffic Signal	V/C ≤ 0.99	39.6	D	0.92
Handley St/Cedar Brook Way	All-Way Stop	LOS D	10.7	B	0.50
Elwert Rd/Kruger Rd	Roundabout	V/C ≤ 0.90, LOS D	12.3	B	0.61
Elwert Rd/Handley St	Two-Way Stop[b]	V/C ≤ 0.99, LOS E	21.0	A/C	0.50
Hwy 99W/New Access	Two-Way Stop[b]	V/C ≤ 0.99	32.0	A/D	0.89

Signalized and All-Way Stop Intersections:
Delay = Average Stopped Delay per Vehicle (sec)
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection
Highlighted values do not meet standards.

Two-Way Stop and Roundabout Intersections:
Delay = Average Stopped Delay per Vehicle (sec) at Worst Movement
LOS = Level of Service of Major Street/Minor Street (Two-Way Stop) or Worst Movement (Roundabout)
V/C = Volume-to-Capacity Ratio of Worst Movement

[a] ODOT has mobility "targets", while other jurisdictions have mobility "standards."
[b] Even though the intersection is a three-leg intersection and has only one minor street stopped approach, it is analyzed similar to a two-way stop controlled intersection.

Study Intersection Improvements Needed:

For the Highway 99W/Elwert Road-Sunset Boulevard intersection to meet the applicable ODOT mobility target, the same improvements identified for Options 1 and 2 would be needed. These improvements include significant widening for the Elwert Road and Sunset Boulevard approaches. Both approaches currently include two lanes (shared through-left and right). The Elwert Road approach would have a heavy right-turn volume and would need to be widened to four lanes (left, through, and dual rights). The Sunset Boulevard approach would also need to be widened to four lanes (dual lefts, through, and right). Table 11 provides the study intersection operations with the improvements.

Table 11: Option 3 Study Intersection Operations (2035 P.M. Peak Hour) – With Improvements

Intersection	Traffic Control	Operating Standard/Target[a]	Intersection Operations with Improvements		
			Delay	*LOS*	*V/C*
Hwy 99W/Elwert Rd-Sunset Blvd	Traffic Signal	V/C ≤ 0.99	52.2	D	0.93

Signalized Intersection:
Delay = Average Stopped Delay per Vehicle (sec)
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection
Highlighted values do not meet standards.

[a] ODOT has mobility "targets", while other jurisdictions have mobility "standards."

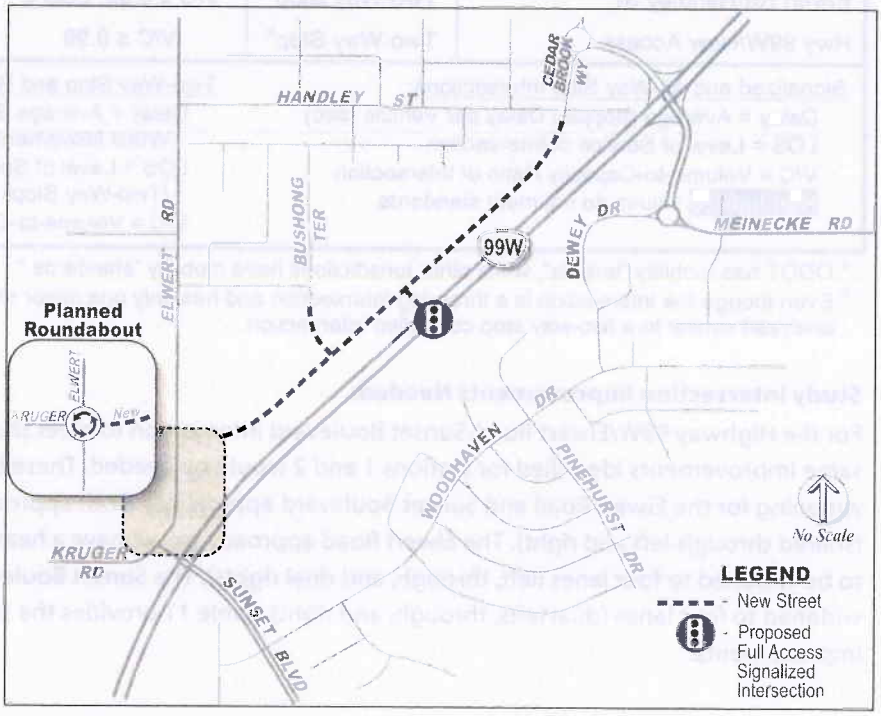
Ability to Accommodate Future Development:

Similar to Options 1 and 2, Connectivity Option 3 is also expected to have the capacity to accommodate 200 more weekday p.m. peak hour trips to/from the study area before additional major improvements would be triggered. This trip level is in addition to what is assumed in the regional travel demand model and would be roughly equivalent to 200 single-family homes or an 18,000 square-foot shopping center. Accommodating more trips beyond this may require improvements at the Highway 99W/Meinecke Road intersection.

Option 4 (Full Highway 99W Access)

Description of Roadway Connectivity:

Option 4 provides the maximum amount of connectivity. It is similar to Option 3, but the new intersection with Highway 99W serves all turning movements. Due to the high volume of traffic on Highway 99W, it was assumed that this new intersection would be signalized. For analysis purposes, the new approach to the highway was assumed to have separate left and right turning lanes. It should be noted that the new roadway alignment shown is conceptual and that further development of this option will need to consider how vehicle queues can be safely accommodated between the new roadway and the new signalized intersection on the highway.



Because Highway 99W is a state highway, ODOT approval of a new signal would be necessary prior to construction. To estimate future signalization needs, preliminary signal warrants were evaluated using Signal

Warrants 1, Case A and Case B (MUTCD), which deal primarily with high volumes on the intersecting minor street and high volumes on the major-street. This analysis indicated that signalization may be warranted (the preliminary signal warrant worksheet is attached in the appendix). Meeting preliminary signal warrants does not guarantee that a signal shall be installed. The new signal should also be compatible with the existing signal system. Before a signal can be installed, a field warrant analysis is conducted by the Region. If warrants are met, the State Traffic Engineer will make the final decision on the installation of a signal.

Access to Properties:

As previously noted, with a full signalized intersection to Highway 99W, a connection to Bushong Terrace, and connectivity reaching from Elwert Road to Handley Street, Connectivity Option 4 provides the highest level of connectivity and the most direct accessibility of any of the options considered. The connection to the new roadway from Bushong Terrace, if feasible, could meet City access spacing standards and would improve access to the highway-adjacent properties to and from other land uses to the north (e.g., the school and residential neighborhoods).

Assuming all future access to Highway 99W from abutting properties is redirected to the new roadway, the anticipated location for the new Highway 99W intersection would meet ODOT access spacing standards because it would be at least 1,500 feet away from the two adjacent signals (the ODOT standard is 990 feet). However, because access rights along the highway have been purchased by ODOT, ODOT approval of a grant of access must be obtained to establish this new intersection to Highway 99W.

Connecting the new roadway to Elwert Road as the fourth leg of the future roundabout with Kruger Road would be ideal for access spacing along Elwert Road. However, to comply with Washington County's requirement of not allowing local streets to intersect with arterials, the new roadway must be classified as a collector street or higher (unless an exception to this requirement can be obtained). Considering the approximate length of this roadway, the fact that it would be providing connectivity between arterial (Elwert Road) and collector (Handley Street) streets, would provide enhanced connectivity to a residential area via an extension of Bushong Terrace, and is estimated to serve more than 2,000 vehicles per day, classification as a collector street would be appropriate.

Mobility at Study Intersections:

Intersection operations are much improved for Option 4 compared to the other options. However, the Highway 99W/Elwert Road-Sunset Boulevard intersection would still not meet the applicable ODOT mobility target (see Table 12) and would need additional intersection improvements.

Table 12: Option 4 Study Intersection Operations (2035 P.M. Peak Hour)

Intersection	Traffic Control	Operating Standard/Target[a]	Intersection Operations		
			Delay	*LOS*	*V/C*
Hwy 99W/Elwert Rd-Sunset Blvd	Traffic Signal	V/C ≤ 0.99	>80	F	1.49
Hwy 99W/Meinecke Rd	Traffic Signal	V/C ≤ 0.99	36.2	D	0.87
Handley St/Cedar Brook Way	All-Way Stop	LOS D	10.0	A	0.46
Elwert Rd/Kruger Rd	Roundabout	V/C ≤ 0.90, LOS D	12.0	B	0.60
Elwert Rd/Handley St	Two-Way Stop[b]	V/C ≤ 0.99, LOS E	21.0	A/C	0.50
Hwy 99W/New Access	Traffic Signal	V/C ≤ 0.99	10.9	B	0.85

Signalized and All-Way Stop Intersections:
Delay = Average Stopped Delay per Vehicle (sec)
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection
Highlighted values do not meet standards.

Two-Way Stop and Roundabout Intersections:
Delay = Average Stopped Delay per Vehicle (sec) at Worst Movement
LOS = Level of Service of Major Street/Minor Street (Two-Way Stop) or Worst Movement (Roundabout)
V/C = Volume-to-Capacity Ratio of Worst Movement

[a] ODOT has mobility "targets", while other jurisdictions have mobility "standards."
[b] Even though the intersection is a three-leg intersection and has only one minor street stopped approach, it is analyzed similar to a two-way stop controlled intersection.

Study Intersection Improvements Needed:

For the Highway 99W/Elwert Road-Sunset Boulevard intersection to meet the applicable ODOT mobility target, the same improvements identified for each of the other options would be needed. These improvements include significant widening for the Elwert Road and Sunset Boulevard approaches. Both approaches currently include two lanes (shared through-left and right). The Elwert Road approach would have a heavy right-turn volume and would need to be widened to four lanes (left, through, and dual rights). The Sunset Boulevard approach would also need to be widened to four lanes (dual lefts, through, and right). Table 13 provides the study intersection operations with the improvements.

Table 13: Option 4 Study Intersection Operations (2035 P.M. Peak Hour) – With Improvements

Intersection	Traffic Control	Operating Standard/Target[a]	Intersection Operations with Improvements		
			Delay	*LOS*	*V/C*
Hwy 99W/Elwert Rd-Sunset Blvd	Traffic Signal	V/C ≤ 0.99	52.2	D	0.92

Signalized Intersection:
Delay = Average Stopped Delay per Vehicle (sec)
LOS = Level of Service of Intersection
V/C = Volume-to-Capacity Ratio of Intersection
Highlighted values do not meet standards.

[a] ODOT has mobility "targets", while other jurisdictions have mobility "standards."

Ability to Accommodate Future Development:

Connectivity Option 4 is expected to have the capacity to accommodate 750 more weekday p.m. peak hour trips than assumed to occur in the regional travel demand model before additional major improvements would be triggered at one of the study intersections. This would be roughly equivalent to 750 single-family homes or a

128,000 square-foot shopping center. The other connectivity options only accommodate 200 additional trips. Therefore, this option has the potential to accommodate a significantly higher level of development in the study area.

The reason for the higher capacity is the new signalized access to Highway 99W that serves traffic to and from both the east and the west. This intersection is also expected to be the critical location where additional improvements would be needed first (beyond the single left and right turning lanes on the new approach) before more trips beyond this could be accommodated.

Findings

This study represents the first step toward refining the ultimate roadway connectivity plan for the study area north of Highway 99W. Further refinement will be required, including discussions with affected property owners, the Oregon Department of Transportation, Washington County, and other stakeholders. The key findings of this study are summarized below:

- Two improvements will be needed at the intersection on Highway 99W with Elwert Road-Sunset Boulevard by the year 2035 to meet adopted performance targets, regardless of which local connectivity option for the study area is chosen:
    - Widen the Elwert Road approach to include a left turn lane, a through lane, and dual right turn lanes.
    - Widen the Sunset Boulevard approach to include dual left turn lanes, a through lane, and a right turn lane.
- Options 3 and 4, which include new intersections with Highway 99W, provide higher degrees of connectivity. Option 4, which includes the new signalized intersection to Highway 99W, provides the greatest degree of connectivity and the most direct accessibility for area properties.
- All options considered have a fair amount of flexibility for supporting future development. However, Option 4 may be able to support more than three times the amount of development than the other options due to the assumed traffic signal that would accommodate all turning movements.
- Under Options 2, 3, and 4, classifying the new roadway paralleling Highway 99W (Cedar Brook Way extension) as a collector street would be appropriate.
- All options are capable of meeting City/County/ODOT access spacing requirements.
- Under Option 1, approval from Washington County for an exception from their access management requirement to connect a local street (Bushong Terrace) to an arterial street (Elwert Road) would be needed.
- Establishing a new intersection on Highway 99W would require approval from ODOT for a grant of access to the highway.
- Prior to constructing a traffic signal on Highway 99W, approval must be obtained from the State Traffic Engineer.
- While non-auto modes of travel were not assessed as part of this study, the creation of a new signalized intersection on Highway 99W could have significant benefits for pedestrian and bicycle travel by

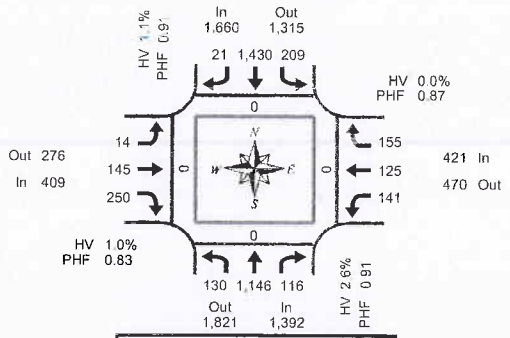
maximizing connectivity and providing a controlled crossing of the highway. Furthermore, if Bushong Terrace cannot be extended to the south to connect to the Cedar Brook Way extension, opportunities to provide pedestrian and bicycle accessways should be explored as an alternative.

Appendix

Total Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



Peak Hour Summary
5:00 PM to 6:00 PM

Hwy 99 W & SW Elwert Rd

Wednesday, April 11, 2012
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Hwy 99 W				Southbound Hwy 99 W				Eastbound SW Elwert Rd				Westbound SW Elwert Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	9	41	7	0	14	109	3	0	3	6	23	0	10	10	11	0	246	0	0	0	0
4:05 PM	6	112	8	0	10	151	1	0	1	3	17	0	8	4	11	0	332	0	0	0	0
4:10 PM	6	75	7	0	21	134	2	0	2	13	15	0	10	10	13	1	308	0	0	0	0
4:15 PM	11	91	6	0	12	108	1	0	2	5	18	0	7	5	6	0	272	0	0	0	0
4:20 PM	13	102	1	0	6	100	0	0	1	15	15	0	10	7	10	0	280	0	0	0	0
4:25 PM	3	68	6	0	11	132	2	0	1	8	23	0	9	6	10	0	279	0	0	0	0
4:30 PM	7	76	6	0	17	97	2	0	1	19	17	0	20	7	12	0	281	0	0	0	0
4:35 PM	11	104	8	0	12	152	2	0	0	10	16	0	11	9	9	0	344	0	0	0	0
4:40 PM	7	75	5	0	15	144	0	0	2	17	24	0	17	9	9	0	324	0	0	0	0
4:45 PM	12	117	8	0	15	134	3	0	2	9	27	1	7	2	18	0	354	0	0	0	0
4:50 PM	7	62	5	0	19	107	2	0	1	22	30	0	8	10	9	0	282	0	0	0	0
4:55 PM	9	76	5	0	13	83	1	0	2	16	21	0	12	5	9	0	252	0	0	0	0
5:00 PM	6	103	2	0	15	136	3	0	1	8	21	0	12	12	8	0	327	0	0	0	0
5:05 PM	12	119	13	2	13	114	0	0	0	6	18	0	20	9	15	0	339	0	0	0	0
5:10 PM	7	98	6	0	18	116	1	0	1	6	15	0	12	5	12	0	297	0	0	0	0
5:15 PM	11	85	13	0	11	115	3	0	3	7	29	0	20	11	17	0	325	0	0	0	0
5:20 PM	13	85	18	0	25	152	1	0	2	14	17	0	10	8	14	0	359	0	0	0	0
5:25 PM	13	103	5	0	14	91	1	0	1	17	23	0	8	18	9	0	303	0	0	0	0
5:30 PM	12	79	12	0	14	138	2	0	0	14	17	0	9	7	18	0	332	0	0	0	0
5:35 PM	11	91	7	0	13	101	0	0	1	19	31	0	18	4	6	0	302	0	0	0	0
5:40 PM	9	126	13	0	23	153	3	0	1	8	10	0	7	12	9	0	374	0	0	0	0
5:45 PM	12	84	9	0	17	101	3	0	1	17	30	0	10	9	20	0	313	0	0	0	0
5:50 PM	13	105	10	0	14	99	1	0	2	18	15	0	8	14	13	0	312	0	0	0	0
5:55 PM	11	68	8	0	22	114	3	0	1	11	24	0	7	16	14	0	299	0	0	0	0
Total Survey	231	2,145	188	2	374	2,881	40	0	32	288	496	1	270	209	282	1	7,436	0	0	0	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Hwy 99 W				Southbound Hwy 99 W				Eastbound SW Elwert Rd				Westbound SW Elwert Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	21	228	22	0	45	394	6	0	6	22	55	0	28	24	35	1	886	0	0	0	0
4:15 PM	27	261	13	0	29	340	3	0	4	28	56	0	26	18	26	0	831	0	0	0	0
4:30 PM	25	255	19	0	44	393	4	0	3	46	57	0	48	25	30	0	949	0	0	0	0
4:45 PM	28	255	18	0	47	324	6	0	5	47	78	1	27	17	36	0	888	0	0	0	0
5:00 PM	25	320	21	2	46	366	4	0	2	20	54	0	44	26	35	0	963	0	0	0	0
5:15 PM	37	273	36	0	50	358	5	0	6	38	69	0	38	37	40	0	987	0	0	0	0
5:30 PM	32	296	32	0	60	392	5	0	2	41	58	0	34	23	33	0	1,008	0	0	0	0
5:45 PM	36	257	27	0	53	314	7	0	4	46	69	0	25	39	47	0	924	0	0	0	0
Total Survey	231	2,145	188	2	374	2,881	40	0	32	288	496	1	270	209	282	1	7,436	0	0	0	0

Peak Hour Summary
5:00 PM to 6:00 PM

By Approach	Northbound Hwy 99 W				Southbound Hwy 99 W				Eastbound SW Elwert Rd				Westbound SW Elwert Rd				Total
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	
Volume	1,392	1,821	3,213	2	1,660	1,315	2,975	0	409	276	685	0	421	470	891	0	3,882
%HV	2.6%				1.1%				1.0%				0.0%				1.5%
PHF	0.91				0.91				0.83				0.87				0.96

Pedestrians Crosswalk			
North	South	East	West
0	0	0	0

By Movement	Northbound Hwy 99 W				Southbound Hwy 99 W				Eastbound SW Elwert Rd				Westbound SW Elwert Rd				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	130	1,146	116	1,392	209	1,430	21	1,660	14	145	250	409	141	125	155	421	3,882
%HV	1.5%	2.8%	1.7%	2.6%	0.5%	1.1%	4.8%	1.1%	0.0%	0.0%	1.6%	1.0%	0.0%	0.0%	0.0%	0.0%	1.5%
PHF	0.86	0.90	0.78	0.91	0.83	0.91	0.75	0.91	0.58	0.73	0.88	0.83	0.68	0.80	0.82	0.87	0.96

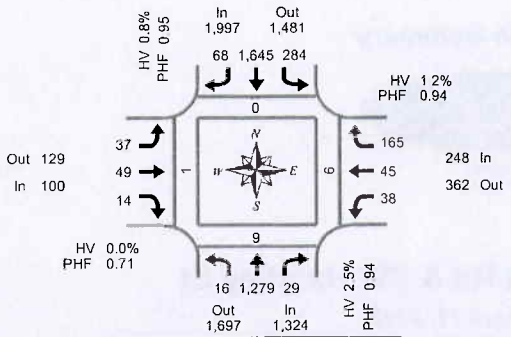
Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Hwy 99 W				Southbound Hwy 99 W				Eastbound SW Elwert Rd				Westbound SW Elwert Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	101	999	72	0	165	1,451	19	0	18	143	246	1	129	84	127	1	3,554	0	0	0	0
4:15 PM	105	1,091	71	2	166	1,423	17	0	14	141	245	1	145	86	127	0	3,631	0	0	0	0
4:30 PM	115	1,103	94	2	187	1,441	19	0	16	151	258	1	157	105	141	0	3,787	0	0	0	0
4:45 PM	122	1,144	107	2	203	1,440	20	0	15	146	259	1	143	103	144	0	3,846	0	0	0	0
5:00 PM	130	1,146	116	2	209	1,430	21	0	14	145	250	0	141	125	155	0	3,882	0	0	0	0

Total Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



Peak Hour Summary
5:00 PM to 6:00 PM

Hwy 99 W & SW Meinecke Pkwy

Wednesday, April 11, 2012
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Hwy 99 W				Southbound Hwy 99 W				Eastbound SW Meinecke Pkwy				Westbound SW Meinecke Pkwy				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	0	83	2	0	16	125	7	0	1	3	0	0	1	2	7	0	247	0	3	3	0
4:05 PM	2	111	9	0	12	171	2	1	3	3	2	0	5	2	8	0	330	0	2	1	0
4:10 PM	0	71	1	0	29	125	2	0	3	6	0	0	6	1	12	0	256	0	3	0	0
4:15 PM	0	109	2	0	12	145	4	0	1	6	0	0	0	0	11	0	290	0	1	0	0
4:20 PM	0	110	2	0	20	121	5	0	2	5	0	0	2	3	20	0	290	0	1	1	0
4:25 PM	2	84	2	0	26	134	4	0	1	7	0	0	1	6	14	0	281	0	1	0	0
4:30 PM	1	107	3	0	18	130	3	0	2	0	2	0	0	3	16	0	285	0	1	1	0
4:35 PM	1	83	2	0	20	163	2	0	3	1	1	0	1	4	11	0	292	0	0	1	0
4:40 PM	0	69	1	0	27	132	3	0	6	6	3	0	6	6	13	0	272	0	0	0	0
4:45 PM	0	155	2	0	19	148	1	0	3	4	1	0	4	4	9	0	350	0	1	0	0
4:50 PM	0	89	3	0	18	117	3	0	4	7	0	0	3	1	6	0	251	0	0	0	0
4:55 PM	1	88	6	0	14	124	5	0	4	2	0	0	1	3	5	0	253	0	0	0	0
5:00 PM	0	99	3	2	27	114	6	0	2	5	0	0	4	5	24	0	289	0	0	0	0
5:05 PM	1	108	3	0	19	149	7	0	1	4	0	0	4	3	8	0	307	0	0	0	0
5:10 PM	1	117	2	0	15	146	0	0	1	2	1	0	1	0	13	0	299	0	4	5	0
5:15 PM	5	90	6	0	27	128	9	0	4	9	1	0	5	8	17	0	309	0	0	0	0
5:20 PM	2	100	1	0	27	141	6	0	3	2	1	0	4	7	9	0	303	0	0	0	0
5:25 PM	0	127	2	0	17	154	3	0	1	2	3	0	4	1	11	0	325	0	1	0	0
5:30 PM	1	82	1	0	29	135	7	0	2	2	1	0	5	5	20	0	290	0	0	0	0
5:35 PM	2	125	2	0	24	152	4	0	5	5	0	0	2	5	13	0	339	0	0	0	0
5:40 PM	0	101	0	0	25	145	4	0	5	7	2	0	2	0	7	0	298	0	0	0	0
5:45 PM	1	118	3	0	27	124	10	0	3	1	4	0	2	4	15	0	312	0	0	1	0
5:50 PM	1	107	3	0	23	117	6	0	4	8	1	0	3	2	14	0	289	0	2	0	1
5:55 PM	2	105	3	0	24	140	6	0	6	2	0	0	2	5	14	0	309	0	2	0	0
Total Survey	23	2,438	64	2	515	3,280	109	1	70	99	23	0	68	80	297	0	7,066	0	22	13	1

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Hwy 99 W				Southbound Hwy 99 W				Eastbound SW Meinecke Pkwy				Westbound SW Meinecke Pkwy				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	2	265	12	0	57	421	11	1	7	12	2	0	12	5	27	0	833	0	8	4	0
4:15 PM	2	303	6	0	58	400	13	0	4	18	0	0	3	9	45	0	861	0	3	1	0
4:30 PM	2	259	6	0	65	425	8	0	11	7	6	0	7	13	40	0	849	0	1	2	0
4:45 PM	1	332	11	0	51	389	9	0	11	13	1	0	8	8	20	0	854	0	1	0	0
5:00 PM	2	324	8	2	61	409	13	0	4	11	1	0	9	8	45	0	895	0	4	5	0
5:15 PM	7	317	9	0	71	423	18	0	8	13	5	0	13	16	37	0	937	0	1	0	0
5:30 PM	3	308	3	0	78	432	15	0	12	14	3	0	9	10	40	0	927	0	0	0	0
5:45 PM	4	330	9	0	74	381	22	0	13	11	5	0	7	11	43	0	910	0	4	1	1
Total Survey	23	2,438	64	2	515	3,280	109	1	70	99	23	0	68	80	297	0	7,066	0	22	13	1

Peak Hour Summary
5:00 PM to 6:00 PM

By Approach	Northbound Hwy 99 W				Southbound Hwy 99 W				Eastbound SW Meinecke Pkwy				Westbound SW Meinecke Pkwy				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	1,324	1,697	3,021	2	1,997	1,481	3,478	0	100	129	229	0	248	362	610	0	3,669	0	9	6	1
%HV	2.5%				0.8%				0.0%				1.2%				1.4%				
PHF	0.94				0.95				0.71				0.94				0.96				

By Movement	Northbound Hwy 99 W				Southbound Hwy 99 W				Eastbound SW Meinecke Pkwy				Westbound SW Meinecke Pkwy				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	16	1,279	29	1,324	284	1,645	68	1,997	37	49	14	100	38	45	165	248	3,669
%HV	0.0%	2.6%	0.0%	2.5%	0.0%	0.9%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	2.6%	2.2%	0.6%	1.2%	1.4%
PHF	0.50	0.93	0.66	0.94	0.91	0.93	0.77	0.95	0.71	0.77	0.50	0.71	0.73	0.70	0.92	0.94	0.96

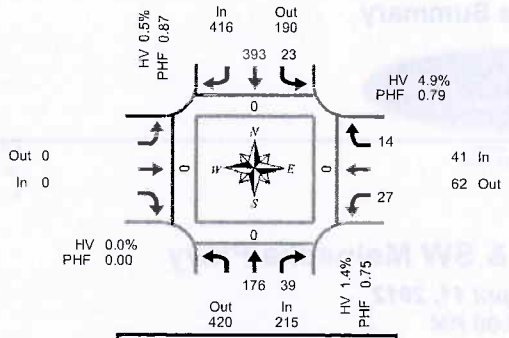
Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Hwy 99 W				Southbound Hwy 99 W				Eastbound SW Meinecke Pkwy				Westbound SW Meinecke Pkwy				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	7	1,159	35	0	231	1,635	41	1	33	50	9	0	30	35	132	0	3,397	0	13	7	0
4:15 PM	7	1,218	31	2	235	1,623	43	0	30	49	8	0	27	38	150	0	3,459	0	9	8	0
4:30 PM	12	1,232	34	2	248	1,646	48	0	34	44	13	0	37	45	142	0	3,535	0	7	7	0
4:45 PM	13	1,281	31	2	261	1,653	55	0	35	51	10	0	39	42	142	0	3,613	0	6	5	0
5:00 PM	16	1,279	29	2	284	1,645	68	0	37	49	14	0	38	45	165	0	3,669	0	9	6	1

Total Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



Peak Hour Summary
4:40 PM to 5:40 PM

SW Elwert Rd & SW Handley St

Wednesday, April 11, 2012
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SW Elwert Rd				Southbound SW Elwert Rd				Eastbound SW Handley St				Westbound SW Handley St				Interval Total	Pedestrians Crosswalk			
	T	R		Bikes	L	T		Bikes				Bikes	L		R	Bikes		North	South	East	West
4:00 PM	15	2		0	1	25		0				0	0		4	0	47	0	0	0	0
4:05 PM	12	3		0	3	18		0				0	3		0	0	39	0	0	0	0
4:10 PM	15	1		0	0	33		0				0	1		1	0	51	0	0	0	0
4:15 PM	10	1		0	1	20		0				0	1		0	0	33	0	0	0	0
4:20 PM	15	4		0	3	25		0				0	2		1	0	50	0	0	0	0
4:25 PM	16	3		0	2	27		0				0	0		1	0	49	0	0	0	0
4:30 PM	11	1		0	0	38		0				0	2		1	0	53	0	0	0	0
4:35 PM	10	0		0	0	23		0				0	1		0	0	34	0	0	0	0
4:40 PM	19	3		0	1	36		0				0	4		0	0	63	0	0	0	0
4:45 PM	8	6		0	3	39		0				0	2		0	0	58	0	0	0	0
4:50 PM	13	0		0	3	38		0				0	2		3	0	59	0	0	0	0
4:55 PM	15	5		0	0	32		0				0	4		2	0	58	0	0	0	0
5:00 PM	6	2		0	2	33		0				0	1		0	0	44	0	0	0	0
5:05 PM	16	5		0	1	29		0				0	1		1	0	53	0	0	0	0
5:10 PM	13	2		0	1	21		0				0	2		3	0	42	0	0	0	0
5:15 PM	12	2		0	5	34		0				0	2		1	0	56	0	0	0	0
5:20 PM	10	6		0	1	28		0				0	1		0	0	46	0	0	0	0
5:25 PM	24	5		0	1	35		0				0	2		1	0	68	0	0	0	0
5:30 PM	18	1		0	1	28		0				0	3		2	0	53	0	0	0	0
5:35 PM	22	2		0	4	40		0				0	3		1	0	72	0	0	0	0
5:40 PM	7	2		0	4	34		0				0	2		1	0	50	0	0	0	0
5:45 PM	19	5		0	3	30		0				0	5		0	0	62	0	0	0	0
5:50 PM	15	2		0	2	38		0				0	0		0	0	57	0	0	0	0
5:55 PM	19	2		0	2	29		0				0	2		0	0	54	0	0	0	0
Total Survey	340	65		0	44	733		0				0	46		23	0	1,251	0	0	0	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SW Elwert Rd				Southbound SW Elwert Rd				Eastbound SW Handley St				Westbound SW Handley St				Interval Total	Pedestrians Crosswalk			
	T	R		Bikes	L	T		Bikes				Bikes	L		R	Bikes		North	South	East	West
4:00 PM	42	6		0	4	76		0				0	4		5	0	137	0	0	0	0
4:15 PM	41	8		0	6	72		0				0	3		2	0	132	0	0	0	0
4:30 PM	40	4		0	1	97		0				0	7		1	0	150	0	0	0	0
4:45 PM	36	11		0	6	109		0				0	8		5	0	175	0	0	0	0
5:00 PM	35	9		0	4	83		0				0	4		4	0	139	0	0	0	0
5:15 PM	46	13		0	7	97		0				0	5		2	0	170	0	0	0	0
5:30 PM	47	5		0	9	102		0				0	8		4	0	175	0	0	0	0
5:45 PM	53	9		0	7	97		0				0	7		0	0	173	0	0	0	0
Total Survey	340	65		0	44	733		0				0	46		23	0	1,251	0	0	0	0

Peak Hour Summary
4:40 PM to 5:40 PM

By Approach	Northbound SW Elwert Rd				Southbound SW Elwert Rd				Eastbound SW Handley St				Westbound SW Handley St				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	215	420	635	0	416	190	606	0	0	0	0	0	41	62	103	0	672	0	0	0	0
%HV		1.4%				0.5%				0.0%				4.9%			1.0%				
PHF		0.75				0.87				0.00				0.79			0.87				

By Movement	Northbound SW Elwert Rd				Southbound SW Elwert Rd				Eastbound SW Handley St				Westbound SW Handley St				Total
		T	R	Total	L	T		Total				Total	L		R	Total	
Volume		176	39	215	23	393		416				0	27		14	41	672
%HV	NA	1.1%	2.6%	1.4%	4.3%	0.3%	NA	0.5%	NA	NA	NA	0.0%	3.7%	NA	7.1%	4.9%	1.0%
PHF		0.69	0.75	0.75	0.82	0.87		0.87				0.00	0.84		0.70	0.79	0.87

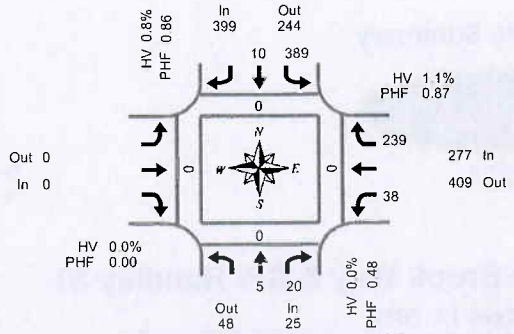
Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SW Elwert Rd				Southbound SW Elwert Rd				Eastbound SW Handley St				Westbound SW Handley St				Interval Total	Pedestrians Crosswalk			
	T	R		Bikes	L	T		Bikes				Bikes	L		R	Bikes		North	South	East	West
4:00 PM	159	29		0	17	354		0				0	22		13	0	594	0	0	0	0
4:15 PM	152	32		0	17	361		0				0	22		12	0	596	0	0	0	0
4:30 PM	157	37		0	18	386		0				0	24		12	0	634	0	0	0	0
4:45 PM	164	38		0	26	391		0				0	25		15	0	659	0	0	0	0
5:00 PM	181	36		0	27	379		0				0	24		10	0	657	0	0	0	0

Total Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



Peak Hour Summary
5:00 PM to 6:00 PM

SW Kruger Rd & SW Elwert Rd

Wednesday, April 11, 2012
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SW Kruger Rd			Southbound SW Kruger Rd			Eastbound SW Elwert Rd			Westbound SW Elwert Rd			Interval Total	Pedestrians Crosswalk			
	T	R	Bikes	L	T	Bikes			Bikes	L	R	Bikes		North	South	East	West
4:00 PM	2	2	0	27	0	0			0	2	19	0	52	0	0	0	0
4:05 PM	0	1	0	25	1	0			0	1	13	0	41	0	0	0	0
4:10 PM	0	1	0	24	1	0			0	1	12	0	39	0	0	0	0
4:15 PM	3	2	0	26	1	0			0	2	19	0	53	0	0	0	0
4:20 PM	1	2	0	26	0	0			0	0	20	0	49	0	0	0	0
4:25 PM	0	0	0	37	0	0			0	1	9	0	47	0	0	0	0
4:30 PM	1	0	0	33	1	0			0	1	12	0	48	0	0	0	0
4:35 PM	0	0	0	32	0	0			0	3	22	0	57	0	0	0	0
4:40 PM	0	0	0	36	0	0			0	1	13	0	50	0	0	0	0
4:45 PM	0	2	0	40	0	0			0	3	18	0	63	0	0	0	0
4:50 PM	0	2	0	47	1	0			0	1	18	0	69	0	0	0	0
4:55 PM	0	2	0	39	0	0			0	0	15	0	56	0	0	0	0
5:00 PM	0	0	0	29	1	0			0	3	18	0	51	0	0	0	0
5:05 PM	0	0	0	25	1	0			0	1	21	0	48	0	0	0	0
5:10 PM	0	1	0	23	0	0			0	1	12	0	37	0	0	0	0
5:15 PM	0	1	0	41	0	0			0	7	19	0	68	0	0	0	0
5:20 PM	0	4	0	30	0	0			0	0	22	0	56	0	0	0	0
5:25 PM	0	0	0	36	0	0			0	2	30	0	68	0	0	0	0
5:30 PM	1	0	0	32	1	0			0	4	16	0	54	0	0	0	0
5:35 PM	1	1	0	47	0	0			0	1	15	0	65	0	0	0	0
5:40 PM	2	1	0	22	2	0			0	1	24	0	52	0	0	0	0
5:45 PM	0	2	0	42	1	0			0	2	21	0	68	0	0	0	0
5:50 PM	0	5	0	35	3	0			0	6	23	0	72	0	0	0	0
5:55 PM	1	5	0	27	1	0			0	10	18	0	62	0	0	0	0
Total Survey	12	34	0	781	15	0			0	54	429	0	1,325	0	0	0	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SW Kruger Rd			Southbound SW Kruger Rd			Eastbound SW Elwert Rd			Westbound SW Elwert Rd			Interval Total	Pedestrians Crosswalk			
	T	R	Bikes	L	T	Bikes			Bikes	L	R	Bikes		North	South	East	West
4:00 PM	2	4	0	76	2	0			0	4	44	0	132	0	0	0	0
4:15 PM	4	4	0	89	1	0			0	3	48	0	149	0	0	0	0
4:30 PM	1	0	0	101	1	0			0	5	47	0	155	0	0	0	0
4:45 PM	0	6	0	126	1	0			0	4	51	0	188	0	0	0	0
5:00 PM	0	1	0	77	2	0			0	5	51	0	136	0	0	0	0
5:15 PM	0	5	0	107	0	0			0	9	71	0	192	0	0	0	0
5:30 PM	4	2	0	101	3	0			0	6	55	0	171	0	0	0	0
5:45 PM	1	12	0	104	5	0			0	18	62	0	202	0	0	0	0
Total Survey	12	34	0	781	15	0			0	54	429	0	1,325	0	0	0	0

Peak Hour Summary
5:00 PM to 6:00 PM

By Approach	Northbound SW Kruger Rd				Southbound SW Kruger Rd				Eastbound SW Elwert Rd				Westbound SW Elwert Rd				Total
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	
Volume	25	48	73	0	399	244	643	0	0	0	0	0	277	409	686	0	701
%HV		0.0%				0.8%				0.0%				1.1%			0.9%
PHF		0.48				0.86				0.00				0.87			0.87

Pedestrians Crosswalk			
North	South	East	West
0	0	0	0

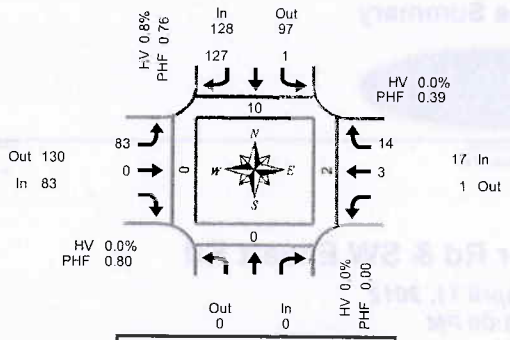
By Movement	Northbound SW Kruger Rd			Southbound SW Kruger Rd				Eastbound SW Elwert Rd				Westbound SW Elwert Rd				Total
	T	R	Total	L	T		Total				Total	L		R	Total	
Volume	5	20	25	389	10		399				0	38		239	277	701
%HV	NA 0.0%	0.0%	0.0%	0.8%	0.0%	NA	0.8%	NA	NA	NA	0.0%	0.0%	NA	1.3%	1.1%	0.9%
PHF	0.31	0.42	0.48	0.85	0.42		0.86				0.00	0.53		0.84	0.87	0.87

Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SW Kruger Rd			Southbound SW Kruger Rd			Eastbound SW Elwert Rd			Westbound SW Elwert Rd			Interval Total	Pedestrians Crosswalk			
	T	R	Bikes	L	T	Bikes			Bikes	L	R	Bikes		North	South	East	West
4:00 PM	7	14	0	392	5	0			0	16	190	0	624	0	0	0	0
4:15 PM	5	11	0	393	5	0			0	17	197	0	628	0	0	0	0
4:30 PM	1	12	0	411	4	0			0	23	220	0	671	0	0	0	0
4:45 PM	4	14	0	411	6	0			0	24	228	0	687	0	0	0	0
5:00 PM	5	20	0	389	10	0			0	38	239	0	701	0	0	0	0

Total Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



Peak Hour Summary
5:00 PM to 6:00 PM

SW Cedar Brook Way & SW Handley St

Wednesday, April 11, 2012
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SW Cedar Brook Way			Bikes	Southbound SW Cedar Brook Way			Bikes	Eastbound SW Handley St			Bikes	Westbound SW Handley St			Bikes	Interval Total	Pedestrians Crosswalk			
					L		R		L	T			T	R				North	South	East	West
4:00 PM				0	3		6	0	3	0		0	0	0		0	12	3	1	0	0
4:05 PM				0	2		6	0	7	0		0	0	3		0	18	0	0	0	0
4:10 PM				0	0		2	0	6	0		0	1	1		0	10	4	1	0	0
4:15 PM				0	1		3	0	8	0		0	0	0		0	12	0	0	0	0
4:20 PM				0	1		5	0	5	0		0	0	1		0	12	1	0	0	0
4:25 PM				0	2		7	0	6	0		0	0	0		0	15	0	1	0	0
4:30 PM				0	3		5	0	2	0		0	1	2		0	13	0	0	0	0
4:35 PM				0	0		7	0	3	0		0	1	2		0	13	0	0	0	0
4:40 PM				0	1		6	0	13	0		0	0	0		0	20	0	0	0	0
4:45 PM				0	0		9	0	9	0		0	0	1		0	19	0	0	0	0
4:50 PM				0	0		5	0	9	1		0	0	2		0	17	0	0	0	0
4:55 PM				0	1		5	0	5	0		0	0	1		0	12	0	0	0	0
5:00 PM				0	0		14	0	5	0		0	0	0		0	19	0	0	0	0
5:05 PM				0	0		7	0	5	0		0	0	2		0	14	2	0	2	0
5:10 PM				0	0		7	0	4	0		0	0	0		0	11	0	0	0	0
5:15 PM				0	0		15	0	14	0		0	0	0		0	29	7	0	0	0
5:20 PM				0	1		19	0	6	0		0	1	0		0	27	0	0	0	0
5:25 PM				0	0		6	0	3	0		0	0	1		0	10	1	0	0	0
5:30 PM				0	0		8	0	6	0		0	0	1		0	15	0	0	0	0
5:35 PM				0	0		12	0	6	0		0	2	3		0	23	0	0	0	0
5:40 PM				0	0		6	0	8	0		0	0	5		0	19	0	0	0	0
5:45 PM				0	0		10	0	7	0		0	0	1		0	18	0	0	0	0
5:50 PM				0	0		14	0	11	0		0	0	0		0	25	0	0	0	0
5:55 PM				0	0		9	0	8	0		0	0	1		0	18	0	0	0	0
Total Survey				0	15		193	0	159	1		0	6	27		0	401	18	3	2	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SW Cedar Brook Way			Bikes	Southbound SW Cedar Brook Way			Bikes	Eastbound SW Handley St			Bikes	Westbound SW Handley St			Bikes	Interval Total	Pedestrians Crosswalk			
					L		R		L	T			T	R				North	South	East	West
4:00 PM				0	5		14	0	16	0		0	1	4		0	40	7	2	0	0
4:15 PM				0	4		15	0	19	0		0	0	1		0	39	1	1	0	0
4:30 PM				0	4		18	0	18	0		0	2	4		0	46	0	0	0	0
4:45 PM				0	1		19	0	23	1		0	0	4		0	48	0	0	0	0
5:00 PM				0	0		28	0	14	0		0	0	2		0	44	2	0	2	0
5:15 PM				0	1		40	0	23	0		0	1	1		0	66	8	0	0	0
5:30 PM				0	0		26	0	20	0		0	2	9		0	57	0	0	0	0
5:45 PM				0	0		33	0	26	0		0	0	2		0	61	0	0	0	0
Total Survey				0	15		193	0	159	1		0	6	27		0	401	18	3	2	0

Peak Hour Summary
5:00 PM to 6:00 PM

By Approach	Northbound SW Cedar Brook Way				Southbound SW Cedar Brook Way				Eastbound SW Handley St				Westbound SW Handley St				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	0	0	0	0	128	97	225	0	83	130	213	0	17	1	18	0	228	10	0	2	0
%HV		0.0%				0.8%				0.0%				0.0%			0.4%				
PHF		0.00				0.76				0.80				0.39			0.85				

By Movement	Northbound SW Cedar Brook Way				Southbound SW Cedar Brook Way				Eastbound SW Handley St				Westbound SW Handley St				Total
				Total	L		R	Total	L	T		Total	T	R		Total	
Volume				0	1		127	128	83	0		83	3	14		17	228
%HV	NA	NA	NA	0.0%	0.0%	NA	0.8%	0.8%	0.0%	0.0%	NA	0.0%	NA	0.0%	0.0%	0.0%	0.4%
PHF				0.00	0.25		0.77	0.76	0.80	0.00		0.80		0.38	0.39	0.39	0.85

Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SW Cedar Brook Way			Bikes	Southbound SW Cedar Brook Way			Bikes	Eastbound SW Handley St			Bikes	Westbound SW Handley St			Bikes	Interval Total	Pedestrians Crosswalk			
					L		R		L	T			T	R				North	South	East	West
4:00 PM				0	14		66	0	76	1		0	3	13		0	173	8	3	0	0
4:15 PM				0	9		80	0	74	1		0	2	11		0	177	3	1	2	0
4:30 PM				0	6		105	0	78	1		0	3	11		0	204	10	0	2	0
4:45 PM				0	2		113	0	80	1		0	3	16		0	215	10	0	2	0
5:00 PM				0	1		127	0	83	0		0	3	14		0	228	10	0	2	0

TRAFFIC LEVELS OF SERVICE

Analysis of traffic volumes is useful in understanding the general nature of traffic in an area, but by itself indicates neither the ability of the street network to carry additional traffic nor the quality of service afforded by the street facilities. For this, the concept of *level of service* has been developed to subjectively describe traffic performance. Level of service can be measured at intersections and along key roadway segments.

Level of service categories are similar to report card ratings for traffic performance. Intersections are typically the controlling bottlenecks of traffic flow and the ability of a roadway system to carry traffic efficiently is generally diminished in their vicinities. Levels of Service A, B and C indicate conditions where traffic moves without significant delays over periods of peak travel demand. Level of service D and E are progressively worse peak hour operating conditions and F conditions represent where demand exceeds the capacity of an intersection. Most urban communities set level of service D as the minimum acceptable level of service for peak hour operation and plan for level of service C or better for all other times of the day. The *Highway Capacity Manual* provides level of service calculation methodology for both intersections and arterials.[1] The following two sections provide interpretations of the analysis approaches.

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[1] *2000 Highway Capacity Manual*, Transportation Research Board, Washington D.C., 2000, Chapters 16 and 17.

UNSIGNALIZED INTERSECTIONS (Two-Way Stop Controlled)

Unsignalized intersection level of service is reported for the major street and minor street (generally, left turn movements). The method assesses available and critical gaps in the traffic stream which make it possible for side street traffic to enter the main street flow. The *2000 Highway Capacity Manual* describes the detailed methodology. It is not unusual for an intersection to experience level of service E or F conditions for the minor street left turn movement. It should be understood that, often, a poor level of service is experienced by only a few vehicles and the intersection as a whole operates acceptably.

Unsignalized intersection levels of service are described in the following table.

Level of Service	Expected Delay	(Sec/Veh)
A	Little or no delay	0-10.0
B	Short traffic delay	>10.1-15.0
C	Average traffic delays	>15.1-25.0
D	Long traffic delays	>25.1-35.0
E	Very long traffic delays	>35.1-50.0
F	Extreme delays potentially affecting other traffic movements in the intersection	> 50

Source: 2000 *Highway Capacity Manual*, Transportation Research Board Washington, D.C.

SIGNALIZED INTERSECTIONS

For signalized intersections, level of service is evaluated based upon average vehicle delay experienced by vehicles entering an intersection. Control delay (or signal delay) includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. In previous versions of this chapter of the HCM (1994 and earlier), delay included only stopped delay. As delay increases, the level of service decreases. Calculations for signalized and unsignalized intersections are different due to the variation in traffic control. The *2000 Highway Capacity Manual* provides the basis for these calculations.

Level of Service	Delay (secs.)	Description
A	≤10.00	**Free Flow/Insignificant Delays:** No approach phase is fully utilized by traffic and no vehicle waits longer than one red indication. Most vehicles do not stop at all. Progression is extremely favorable and most vehicles arrive during the green phase.
B	10.1-20.0	**Stable Operation/Minimal Delays:** An occasional approach phase is fully utilized. Many drivers begin to feel somewhat restricted within platoons of vehicles. This level generally occurs with good progression, short cycle lengths, or both.
C	20.1-35.0	**Stable Operation/Acceptable Delays:** Major approach phases fully utilized. Most drivers feel somewhat restricted. Higher delays may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, and the number of vehicles stopping is significant.
D	35.1-55.0	**Approaching Unstable/Tolerable Delays:** The influence of congestion becomes more noticeable. Drivers may have to wait through more than one red signal indication. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. The proportion of vehicles not stopping declines, and individual cycle failures are noticeable.
E	55.1-80.0	**Unstable Operation/Significant Delays:** Volumes at or near capacity. Vehicles may wait though several signal cycles. Long queues form upstream from intersection. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are a frequent occurrence.
F	≥80.0	**Forced Flow/Excessive Delays:** Represents jammed conditions. Queues may block upstream intersections. This level occurs when arrival flow rates exceed intersection capacity, and is considered to be unacceptable to most drivers. Poor progression, long cycle lengths, and v/c ratios approaching 1.0 may contribute to these high delay levels.

Source: *2000 Highway Capacity Manual*, Transportation Research Board, Washington D.C.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	25	10	180	35	25	380
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	27	11	191	37	27	404
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	668	210			229	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	668	210			229	
tC, single (s)	6.4	6.3			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.4			2.2	
p0 queue free %	94	99			98	
cM capacity (veh/h)	412	810			1328	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	37	229	431
Volume Left	27	0	27
Volume Right	11	37	0
cSH	479	1700	1328
Volume to Capacity	0.08	0.13	0.02
Queue Length 95th (ft)	6	0	2
Control Delay (s)	13.1	0.0	0.7
Lane LOS	B		A
Approach Delay (s)	13.1	0.0	0.7
Approach LOS	B		

Intersection Summary			
Average Delay		1.1	
Intersection Capacity Utilization		46.3%	ICU Level of Service A
Analysis Period (min)		15	

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	85	0	0	0	5	15	0	0	0	5	0	125
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	100	0	0	0	6	18	0	0	0	6	0	147

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	100	24	0	153
Volume Left (vph)	100	0	0	6
Volume Right (vph)	0	18	0	147
Hadj (s)	0.20	-0.45	0.00	-0.55
Departure Headway (s)	4.4	3.9	4.3	3.6
Degree Utilization, x	0.12	0.03	0.00	0.15
Capacity (veh/h)	785	888	808	961
Control Delay (s)	8.0	7.0	7.3	7.3
Approach Delay (s)	8.0	7.0	0.0	7.3
Approach LOS	A	A	A	A

Intersection Summary			
Delay		7.5	
HCM Level of Service		A	
Intersection Capacity Utilization		26.6%	ICU Level of Service A
Analysis Period (min)		15	

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	1280	30	285	1645	70	40	45	165	35	50	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00	0.98	1.00	1.00	0.97	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3505	1555	1805	3574	1579	1752	1863	1549	1792	1900	1615
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.72	1.00	1.00	0.73	1.00	1.00
Satd. Flow (perm)	1805	3505	1555	1805	3574	1579	1334	1863	1549	1370	1900	1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	16	1333	31	297	1714	73	42	47	172	36	52	16
RTOR Reduction (vph)	0	0	14	0	0	21	0	0	148	0	0	14
Lane Group Flow (vph)	16	1333	17	297	1714	52	42	47	24	36	52	2
Confl. Peds. (#/hr)	1		6	6		1			9	9		
Confl. Bikes (#/hr)			2									
Heavy Vehicles (%)	0%	3%	0%	0%	1%	0%	3%	2%	1%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8		8	4		4
Actuated Green, G (s)	2.3	48.0	48.0	20.9	66.6	66.6	11.2	11.2	11.2	11.2	11.2	11.2
Effective Green, g (s)	2.8	50.0	50.0	21.4	68.6	68.6	13.2	13.2	13.2	13.2	13.2	13.2
Actuated g/C Ratio	0.03	0.52	0.52	0.22	0.71	0.71	0.14	0.14	0.14	0.14	0.14	0.14
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	2.3	4.5	4.5	2.3	4.5	4.5	2.5	2.5	2.5	2.5	2.5	2.5
Lane Grp Cap (vph)	52	1814	805	400	2538	1121	182	255	212	187	260	221
v/s Ratio Prot	0.01	c0.38		c0.16	0.48			0.03			0.03	
v/s Ratio Perm			0.01			0.03	c0.03		0.02	0.03		0.00
v/c Ratio	0.31	0.73	0.02	0.74	0.68	0.05	0.23	0.18	0.11	0.19	0.20	0.01
Uniform Delay, d1	46.0	18.1	11.4	35.0	7.8	4.2	37.2	36.9	36.6	37.0	37.0	36.1
Progression 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
Incremental Delay, d2	2.0	1.8	0.0	6.7	0.9	0.0	0.5	0.3	0.2	0.4	0.3	0.0
Delay (s)	47.9	19.9	11.4	41.7	8.7	4.2	37.6	37.2	36.7	37.3	37.3	36.1
Level of Service	D	B	B	D	A	A	D	D	D	D	D	D
Approach Delay (s)		20.1			13.2			37.0			37.1	
Approach LOS		C			B			D			D	

Intersection Summary				
HCM Average Control Delay	18.0	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.66			
Actuated Cycle Length (s)	96.6	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	70.1%	ICU Level of Service	C	
Analysis Period (min)	15			

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	40	240	5	20	390	10
Sign Control	Free		Stop			Stop
Grade	0%		0%			0%
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	46	276	6	23	448	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)	196					
pX, platoon unblocked						
vC, conflicting volume	0		368	0	256	230
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		368	0	256	230
tC, single (s)	4.1		6.5	6.2	7.1	6.5
tC, 2 stage (s)						
tF (s)	2.2		4.0	3.3	3.5	4.0
p0 queue free %	97		99	98	33	98
cM capacity (veh/h)	1636		548	1091	665	654

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	322	29	460
Volume Left	46	0	448
Volume Right	276	23	0
cSH	1636	911	664
Volume to Capacity	0.03	0.03	0.69
Queue Length 95th (ft)	2	2	138
Control Delay (s)	1.2	9.1	21.7
Lane LOS	A	A	C
Approach Delay (s)	1.2	9.1	21.7
Approach LOS		A	C

Intersection Summary			
Average Delay	13.1		
Intersection Capacity Utilization	52.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	145	250	140	125	155	130	1145	115	210	1465	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	4.0		4.5	4.5	4.5	4.0	4.0	4.5	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1891	1583		1851	1615	1770	3505	1563	3502	3574	1538
Flt Permitted		0.74	1.00		0.66	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1414	1583		1250	1615	1770	3505	1563	3502	3574	1538
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	16	151	260	146	130	161	135	1193	120	219	1526	26
RTOR Reduction (vph)	0	0	177	0	0	127	0	0	37	0	0	12
Lane Group Flow (vph)	0	167	83	0	276	34	135	1193	83	219	1526	14
Confl. Bikes (#/hr)									2			
Heavy Vehicles (%)	0%	0%	2%	0%	0%	0%	2%	3%	2%	0%	1%	5%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		20.4	20.4		19.9	19.9	12.4	44.2	44.2	23.0	54.8	54.8
Effective Green, g (s)		20.4	22.4		21.9	21.9	12.9	46.2	46.2	23.5	56.8	56.8
Actuated g/C Ratio		0.20	0.21		0.21	0.21	0.12	0.44	0.44	0.22	0.54	0.54
Clearance Time (s)		6.0	6.0		6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)		2.5	2.5		2.5	2.5	3.0	5.4	5.4	3.5	5.4	5.4
Lane Grp Cap (vph)		276	339		262	338	218	1548	690	787	1941	835
v/s Ratio Prot							0.08	c0.34		0.06	c0.43	
v/s Ratio Perm		0.12	0.05		c0.22	0.02			0.05			0.01
v/c Ratio		0.61	0.25		1.05	0.10	0.62	0.77	0.12	0.28	0.79	0.02
Uniform Delay, d1		38.4	34.1		41.4	33.4	43.5	24.7	17.2	33.5	19.1	11.0
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		3.1	0.3		70.3	0.1	5.2	2.9	0.2	0.2	2.6	0.0
Delay (s)		41.6	34.4		111.7	33.5	48.7	27.7	17.4	33.8	21.7	11.0
Level of Service		D	C		F	C	D	C	B	C	C	B
Approach Delay (s)		37.2			82.9			28.8			23.0	
Approach LOS		D			F			C			C	

Intersection Summary			
HCM Average Control Delay	32.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	104.6	Sum of lost time (s)	8.5
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	60	175	330	55	120	485
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	62	182	344	57	125	505
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	1128	372			401	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1128	372			401	
tC, single (s)	6.4	6.3			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.4			2.2	
p0 queue free %	69	72			89	
cM capacity (veh/h)	200	656			1147	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	245	401	630
Volume Left	62	0	125
Volume Right	182	57	0
cSH	414	1700	1147
Volume to Capacity	0.59	0.24	0.11
Queue Length 95th (ft)	92	0	9
Control Delay (s)	25.5	0.0	2.8
Lane LOS	D		A
Approach Delay (s)	25.5	0.0	2.8
Approach LOS	D		

Intersection Summary			
Average Delay	6.2		
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	180	5	20	5	15	15	30	40	5	10	40	365
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	188	5	21	5	16	16	31	42	5	10	42	380

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	214	36	78	432
Volume Left (vph)	188	5	31	10
Volume Right (vph)	21	15	5	380
Hadj (s)	0.12	-0.23	0.04	-0.51
Departure Headway (s)	5.2	5.2	5.1	4.2
Degree Utilization, x	0.31	0.05	0.11	0.50
Capacity (veh/h)	637	609	646	822
Control Delay (s)	10.5	8.4	8.8	11.3
Approach Delay (s)	10.5	8.4	8.8	11.3
Approach LOS	B	A	A	B

Intersection Summary			
Delay	10.7		
HCM Level of Service	B		
Intersection Capacity Utilization	50.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	1645	45	340	2145	185	75	200	275	95	140	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00	0.98	1.00	1.00	0.97	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3505	1546	1805	3574	1577	1752	1863	1557	1793	1900	1615
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.52	1.00	1.00	0.37	1.00	1.00
Satd. Flow (perm)	1805	3505	1546	1805	3574	1577	952	1863	1557	701	1900	1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	62	1714	47	354	2234	193	78	208	286	99	146	21
RTOR Reduction (vph)	0	0	17	0	0	56	0	0	210	0	0	17
Lane Group Flow (vph)	62	1714	30	354	2234	137	78	208	76	99	146	4
Confl. Peds. (#/hr)	1		6	6		1			9	9		
Confl. Bikes (#/hr)			2									
Heavy Vehicles (%)	0%	3%	0%	0%	1%	0%	3%	2%	1%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8		8	4		4
Actuated Green, G (s)	7.7	67.3	67.3	25.1	84.7	84.7	22.4	22.4	22.4	22.4	22.4	22.4
Effective Green, g (s)	8.2	69.3	69.3	25.6	86.7	86.7	24.4	24.4	24.4	24.4	24.4	24.4
Actuated g/C Ratio	0.06	0.53	0.53	0.19	0.66	0.66	0.19	0.19	0.19	0.19	0.19	0.19
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	2.3	4.5	4.5	2.3	4.5	4.5	2.5	2.5	2.5	2.5	2.5	2.5
Lane Grp Cap (vph)	113	1850	816	352	2360	1041	177	346	289	130	353	300
v/s Ratio Prot	0.03	0.49		c0.20	c0.63			0.11			0.08	
v/s Ratio Perm			0.02			0.09	0.08		0.05	c0.14		0.00
v/c Ratio	0.55	0.93	0.04	1.01	0.95	0.13	0.44	0.60	0.26	0.76	0.41	0.01
Uniform Delay, d1	59.8	28.6	14.9	52.9	20.2	8.3	47.4	49.0	45.8	50.7	47.1	43.6
Progression 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
Incremental Delay, d2	3.7	8.8	0.0	49.4	9.1	0.1	1.3	2.5	0.4	21.9	0.6	0.0
Delay (s)	63.5	37.4	15.0	102.3	29.3	8.4	48.7	51.5	46.1	72.6	47.7	43.6
Level of Service	E	D	B	F	C	A	D	D	D	E	D	D
Approach Delay (s)		37.7			37.1			48.4			56.6	
Approach LOS		D			D			D			E	

Intersection Summary			
HCM Average Control Delay	39.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	131.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	93.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Intersection Delay (sec/veh)	10.8
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adjusted Approach Flow (vph)	120	57	495	626
Demand Flow Rate (pc/h)	120	58	496	632
Vehicles Circulating (pc/h)	653	490	47	141
Vehicles Exiting (pc/h)	120	53	726	407
Follow-Up Headway (s)	3.186	3.186	3.186	3.186
Ped Vol. Crossing Leg (#/hr)	0	0	0	0
Ped Capacity Adjustment	1.000	1.000	1.000	1.000
Approach Delay (sec/veh)	8.7	6.2	8.5	13.4
Approach LOS	A	A	A	B

Lane	Left	Left	Left	Left
Designated moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
Right Turn Channelized				
Lane Utilization	1.000	1.000	1.000	1.000
Critical Headway (s)	5.193	5.193	5.193	5.193
Entry Flow Rate (pc/h)	120	58	496	632
Capacity, Entry Lane (pc/h)	588	692	1078	981
Entry HV Adjustment Factor	0.999	0.981	0.998	0.991
Flow Rate, Entry (vph)	120	57	495	626
Capacity, Entry (vph)	588	679	1076	972
Volume to Capacity Ratio	0.204	0.084	0.460	0.644
Control Delay (sec/veh)	8.7	6.2	8.5	13.4
Level of Service	A	A	A	B
95th-Percentile Queue (veh)	1	0	2	5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	210	445	230	235	225	185	1490	135	220	1950	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	4.0		4.5	4.5	4.5	4.0	4.0	4.5	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99	1.00		0.98	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1887	1615		1854	1599	1805	3610	1594	3467	3610	1615
Flt Permitted		0.11	1.00		0.34	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		217	1615		640	1599	1805	3610	1594	3467	3610	1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	36	219	464	240	245	234	193	1552	141	229	2031	57
RTOR Reduction (vph)	0	0	168	0	0	150	0	0	31	0	0	20
Lane Group Flow (vph)	0	255	296	0	485	84	193	1552	110	229	2031	37
Confl. Bikes (#/hr)									2			
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%	0%	0%	0%	1%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		20.0	20.0		19.5	19.5	14.7	58.5	58.5	29.9	73.7	73.7
Effective Green, g (s)		20.0	22.0		21.5	21.5	15.2	60.5	60.5	30.4	75.7	75.7
Actuated g/C Ratio		0.16	0.18		0.17	0.17	0.12	0.48	0.48	0.24	0.60	0.60
Clearance Time (s)		6.0	6.0		6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)		2.5	2.5		2.5	2.5	3.0	5.4	5.4	3.5	5.4	5.4
Lane Grp Cap (vph)		35	283		110	274	219	1742	769	840	2179	975
v/s Ratio Prot							0.11	c0.43		0.07	c0.56	
v/s Ratio Perm		c1.18	0.18		0.76	0.05			0.07			0.02
v/c Ratio		7.29	1.05		4.41	0.31	0.88	0.89	0.14	0.27	0.93	0.04
Uniform Delay, d1		52.7	51.7		52.0	45.4	54.2	29.5	18.0	38.5	22.5	10.1
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2887.0	65.8		1555.0	0.5	31.1	6.7	0.2	0.2	8.4	0.0
Delay (s)		2939.7	117.5		1606.9	45.9	85.4	36.2	18.3	38.7	30.9	10.1
Level of Service		F	F		F	D	F	D	B	D	C	B
Approach Delay (s)		1118.4			1098.9			39.9			31.2	
Approach LOS		F			F			D			C	

Intersection Summary			
HCM Average Control Delay	308.7	HCM Level of Service	F
HCM Volume to Capacity ratio	2.09		
Actuated Cycle Length (s)	125.4	Sum of lost time (s)	14.0
Intersection Capacity Utilization	118.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	1750	2190	50	0	35
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	0	1823	2281	52	0	36
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	2333				3219	1167
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2333				3219	1167
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	81
cM capacity (veh/h)	215				8	190

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	911	911	1521	812	36
Volume Left	0	0	0	0	0
Volume Right	0	0	0	52	36
cSH	1700	1700	1700	1700	190
Volume to Capacity	0.54	0.54	0.89	0.48	0.19
Queue Length 95th (ft)	0	0	0	0	17
Control Delay (s)	0.0	0.0	0.0	0.0	28.4
Lane LOS					D
Approach Delay (s)	0.0		0.0		28.4
Approach LOS					D

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	72.1%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	210	445	230	235	225	185	1490	135	220	1950	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	6.0	4.0	2.0	4.5	4.5	4.5	4.0	4.0	4.5	4.0	4.0
Lane Util. Factor	1.00	1.00	0.88	0.97	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	1900	2842	3502	1900	1599	1805	3610	1594	3467	3610	1615
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1805	1900	2842	3502	1900	1599	1805	3610	1594	3467	3610	1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	36	219	464	240	245	234	193	1552	141	229	2031	57
RTOR Reduction (vph)	0	0	272	0	0	192	0	0	30	0	0	19
Lane Group Flow (vph)	36	219	192	240	245	42	193	1552	111	229	2031	38
Confl. Bikes (#/hr)									2			
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%	0%	0%	0%	1%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	6.1	18.7	18.7	9.0	21.1	21.1	14.2	68.1	68.1	17.9	71.8	71.8
Effective Green, g (s)	8.1	18.7	20.7	11.0	23.1	23.1	14.7	70.1	70.1	18.4	73.8	73.8
Actuated g/C Ratio	0.06	0.14	0.15	0.08	0.17	0.17	0.11	0.52	0.52	0.14	0.55	0.55
Clearance Time (s)	4.0	6.0	6.0	4.0	6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	3.0	2.5	2.5	3.0	2.5	2.5	3.0	5.4	5.4	3.5	5.4	5.4
Lane Grp Cap (vph)	109	264	437	286	326	274	197	1879	830	474	1978	885
v/s Ratio Prot	0.02	0.12		c0.07	c0.13		c0.11	0.43		0.07	c0.56	
v/s Ratio Perm			0.07			0.03			0.07			0.02
v/c Ratio	0.33	0.83	0.44	0.84	0.75	0.15	0.98	0.83	0.13	0.48	1.03	0.04
Uniform Delay, d1	60.7	56.4	51.7	61.0	53.1	47.5	59.9	27.2	16.6	53.8	30.4	14.1
Progression 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
Incremental Delay, d2	1.8	18.6	0.5	18.9	9.0	0.2	57.5	3.6	0.2	0.9	27.4	0.0
Delay (s)	62.5	75.0	52.3	79.9	62.0	47.7	117.4	30.7	16.8	54.7	57.9	14.2
Level of Service	E	E	D	E	E	D	F	C	B	D	E	B
Approach Delay (s)		59.7			63.3			38.6			56.5	
Approach LOS		E			E			D			E	

Intersection Summary			
HCM Average Control Delay	51.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	134.7	Sum of lost time (s)	10.5
Intersection Capacity Utilization	97.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	55	160	320	45	110	495
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	57	167	333	47	115	516
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	1102	357			380	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1102	357			380	
tC, single (s)	6.4	6.3			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.4			2.2	
p0 queue free %	73	75			90	
cM capacity (veh/h)	209	670			1167	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	224	380	630
Volume Left	57	0	115
Volume Right	167	47	0
cSH	429	1700	1167
Volume to Capacity	0.52	0.22	0.10
Queue Length 95th (ft)	74	0	8
Control Delay (s)	22.2	0.0	2.5
Lane LOS	C		A
Approach Delay (s)	22.2	0.0	2.5
Approach LOS	C		

Intersection Summary			
Average Delay	5.3		
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	185	5	15	5	10	20	20	60	5	10	65	400
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	193	5	16	5	10	21	21	62	5	10	68	417

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	214	36	89	495
Volume Left (vph)	193	5	21	10
Volume Right (vph)	16	21	5	417
Hadj (s)	0.14	-0.31	0.01	-0.49
Departure Headway (s)	5.4	5.3	5.2	4.3
Degree Utilization, x	0.32	0.05	0.13	0.58
Capacity (veh/h)	610	584	635	815
Control Delay (s)	11.0	8.6	9.0	13.1
Approach Delay (s)	11.0	8.6	9.0	13.1
Approach LOS	B	A	A	B

Intersection Summary			
Delay	11.9		
HCM Level of Service	B		
Intersection Capacity Utilization	54.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	1640	40	340	2080	250	75	200	275	100	145	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00	0.98	1.00	1.00	0.97	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3505	1546	1805	3574	1577	1752	1863	1557	1793	1900	1615
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.50	1.00	1.00	0.37	1.00	1.00
Satd. Flow (perm)	1805	3505	1546	1805	3574	1577	931	1863	1557	701	1900	1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	62	1708	42	354	2167	260	78	208	286	104	151	47
RTOR Reduction (vph)	0	0	15	0	0	78	0	0	211	0	0	38
Lane Group Flow (vph)	62	1708	27	354	2167	182	78	208	75	104	151	9
Confl. Peds. (#/hr)	1		6	6		1			9	9		
Confl. Bikes (#/hr)			2									
Heavy Vehicles (%)	0%	3%	0%	0%	1%	0%	3%	2%	1%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8		8	4		4
Actuated Green, G (s)	7.7	67.2	67.2	25.1	84.6	84.6	22.4	22.4	22.4	22.4	22.4	22.4
Effective Green, g (s)	8.2	69.2	69.2	25.6	86.6	86.6	24.4	24.4	24.4	24.4	24.4	24.4
Actuated g/C Ratio	0.06	0.53	0.53	0.20	0.66	0.66	0.19	0.19	0.19	0.19	0.19	0.19
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	2.3	4.5	4.5	2.3	4.5	4.5	2.5	2.5	2.5	2.5	2.5	2.5
Lane Grp Cap (vph)	113	1849	815	352	2359	1041	173	346	290	130	353	300
v/s Ratio Prot	0.03	0.49		c0.20	c0.61			0.11			0.08	
v/s Ratio Perm			0.02			0.12	0.08		0.05	c0.15		0.01
v/c Ratio	0.55	0.92	0.03	1.01	0.92	0.17	0.45	0.60	0.26	0.80	0.43	0.03
Uniform Delay, d1	59.7	28.6	14.9	52.8	19.3	8.6	47.4	48.9	45.7	51.1	47.2	43.7
Progression 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
Incremental Delay, d2	3.7	8.5	0.0	49.4	6.5	0.1	1.4	2.5	0.3	27.9	0.6	0.0
Delay (s)	63.4	37.1	14.9	102.2	25.8	8.7	48.8	51.4	46.0	79.0	47.8	43.7
Level of Service	E	D	B	F	C	A	D	D	D	E	D	D
Approach Delay (s)		37.5			33.9			48.4			57.9	
Approach LOS		D			C			D			E	

Intersection Summary			
HCM Average Control Delay	37.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	131.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	93.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Intersection Delay (sec/veh)	10.6
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adjusted Approach Flow (vph)	120	46	479	620
Demand Flow Rate (pc/h)	120	47	480	626
Vehicles Circulating (pc/h)	647	479	41	141
Vehicles Exiting (pc/h)	120	42	726	385
Follow-Up Headway (s)	3.186	3.186	3.186	3.186
Ped Vol. Crossing Leg (#/hr)	0	0	0	0
Ped Capacity Adjustment	1.000	1.000	1.000	1.000
Approach Delay (sec/veh)	8.6	6.0	8.2	13.2
Approach LOS	A	A	A	B

Lane	Left	Left	Left	Left
Designated moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
Right Turn Channelized				
Lane Utilization	1.000	1.000	1.000	1.000
Critical Headway (s)	5.193	5.193	5.193	5.193
Entry Flow Rate (pc/h)	120	47	480	626
Capacity, Entry Lane (pc/h)	592	700	1085	981
Entry HV Adjustment Factor	0.999	0.977	0.998	0.991
Flow Rate, Entry (vph)	120	46	479	620
Capacity, Entry (vph)	591	684	1082	972
Volume to Capacity Ratio	0.203	0.067	0.443	0.638
Control Delay (sec/veh)	8.6	6.0	8.2	13.2
Level of Service	A	A	A	B
95th-Percentile Queue (veh)	1	0	2	5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	210	455	230	235	225	185	1490	135	220	1940	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	4.0		4.5	4.5	4.5	4.0	4.0	4.5	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99	1.00		0.98	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1890	1615		1854	1599	1805	3610	1594	3467	3610	1615
Flt Permitted		0.15	1.00		0.37	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		278	1615		697	1599	1805	3610	1594	3467	3610	1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	26	219	474	240	245	234	193	1552	141	229	2021	42
RTOR Reduction (vph)	0	0	168	0	0	150	0	0	31	0	0	15
Lane Group Flow (vph)	0	245	306	0	485	84	193	1552	110	229	2021	27
Confl. Bikes (#/hr)									2			
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%	0%	0%	0%	1%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		20.0	20.0		19.5	19.5	14.7	58.4	58.4	29.8	73.5	73.5
Effective Green, g (s)		20.0	22.0		21.5	21.5	15.2	60.4	60.4	30.3	75.5	75.5
Actuated g/C Ratio		0.16	0.18		0.17	0.17	0.12	0.48	0.48	0.24	0.60	0.60
Clearance Time (s)		6.0	6.0		6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)		2.5	2.5		2.5	2.5	3.0	5.4	5.4	3.5	5.4	5.4
Lane Grp Cap (vph)		44	284		120	275	219	1742	769	839	2177	974
v/s Ratio Prot							0.11	c0.43		0.07	c0.56	
v/s Ratio Perm		c0.88	0.19		0.70	0.05			0.07			0.02
v/c Ratio		5.57	1.08		4.04	0.31	0.88	0.89	0.14	0.27	0.93	0.03
Uniform Delay, d1		52.6	51.6		51.9	45.3	54.1	29.4	18.0	38.5	22.4	10.0
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2104.4	75.4		1388.4	0.5	31.1	6.7	0.2	0.2	8.0	0.0
Delay (s)		2157.0	127.0		1440.2	45.8	85.3	36.1	18.2	38.7	30.4	10.1
Level of Service		F	F		F	D	F	D	B	D	C	B
Approach Delay (s)		818.7			986.4			39.8			30.9	
Approach LOS		F			F			D			C	

Intersection Summary			
HCM Average Control Delay	257.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.76		
Actuated Cycle Length (s)	125.2	Sum of lost time (s)	14.0
Intersection Capacity Utilization	117.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	210	455	230	235	225	185	1490	135	220	1940	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	6.0	4.0	2.0	4.5	4.5	4.5	4.0	4.0	4.5	4.0	4.0
Lane Util. Factor	1.00	1.00	0.88	0.97	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	1900	2842	3502	1900	1599	1805	3610	1594	3467	3610	1615
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1805	1900	2842	3502	1900	1599	1805	3610	1594	3467	3610	1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	26	219	474	240	245	234	193	1552	141	229	2021	42
RTOR Reduction (vph)	0	0	275	0	0	183	0	0	29	0	0	13
Lane Group Flow (vph)	26	219	199	240	245	51	193	1552	112	229	2021	29
Confl. Bikes (#/hr)									2			
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%	0%	0%	0%	1%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.7	20.6	20.6	8.0	23.4	23.4	16.0	76.0	76.0	20.0	80.0	80.0
Effective Green, g (s)	6.7	20.6	22.6	10.0	25.4	25.4	16.5	78.0	78.0	20.5	82.0	82.0
Actuated g/C Ratio	0.05	0.14	0.16	0.07	0.17	0.17	0.11	0.54	0.54	0.14	0.56	0.56
Clearance Time (s)	4.0	6.0	6.0	4.0	6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	3.0	2.5	2.5	3.0	2.5	2.5	3.0	5.4	5.4	3.5	5.4	5.4
Lane Grp Cap (vph)	83	269	441	241	331	279	205	1934	854	488	2033	910
v/s Ratio Prot	0.01	0.12		c0.07	c0.13		c0.11	0.43		0.07	c0.56	
v/s Ratio Perm			0.07			0.03			0.07			0.02
v/c Ratio	0.31	0.81	0.45	1.00	0.74	0.18	0.94	0.80	0.13	0.47	0.99	0.03
Uniform Delay, d1	67.2	60.6	55.9	67.8	57.0	51.2	64.1	27.5	16.9	57.5	31.6	14.1
Progression 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
Incremental Delay, d2	2.2	16.6	0.5	56.5	8.2	0.2	46.3	2.9	0.2	0.8	18.5	0.0
Delay (s)	69.4	77.2	56.4	124.2	65.1	51.5	110.4	30.4	17.0	58.4	50.1	14.2
Level of Service	E	E	E	F	E	D	F	C	B	E	D	B
Approach Delay (s)		63.2			80.4			37.6			50.3	
Approach LOS		E			F			D			D	

Intersection Summary			
HCM Average Control Delay	51.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	145.6	Sum of lost time (s)	10.5
Intersection Capacity Utilization	96.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	50	160	320	45	110	495
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	52	167	333	47	115	516
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	1102	357			380	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1102	357			380	
tC, single (s)	6.4	6.3			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.4			2.2	
p0 queue free %	75	75			90	
cM capacity (veh/h)	209	670			1167	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	219	380	630
Volume Left	52	0	115
Volume Right	167	47	0
cSH	440	1700	1167
Volume to Capacity	0.50	0.22	0.10
Queue Length 95th (ft)	68	0	8
Control Delay (s)	21.0	0.0	2.5
Lane LOS	C		A
Approach Delay (s)	21.0	0.0	2.5
Approach LOS	C		

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	170	5	30	10	10	15	20	50	5	10	50	355
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	177	5	31	10	10	16	21	52	5	10	52	370

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	214	36	78	432
Volume Left (vph)	177	10	21	10
Volume Right (vph)	31	16	5	370
Hadj (s)	0.08	-0.20	0.01	-0.49
Departure Headway (s)	5.2	5.2	5.1	4.2
Degree Utilization, x	0.31	0.05	0.11	0.50
Capacity (veh/h)	641	606	650	821
Control Delay (s)	10.5	8.5	8.7	11.3
Approach Delay (s)	10.5	8.5	8.7	11.3
Approach LOS	B	A	A	B

Intersection Summary			
Delay	10.7		
HCM Level of Service	B		
Intersection Capacity Utilization	50.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	1640	40	340	2145	185	75	200	275	100	145	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00	0.98	1.00	1.00	0.97	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3505	1546	1805	3574	1577	1752	1863	1557	1793	1900	1615
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.50	1.00	1.00	0.37	1.00	1.00
Satd. Flow (perm)	1805	3505	1546	1805	3574	1577	931	1863	1557	701	1900	1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	62	1708	42	354	2234	193	78	208	286	104	151	21
RTOR Reduction (vph)	0	0	15	0	0	56	0	0	211	0	0	17
Lane Group Flow (vph)	62	1708	27	354	2234	137	78	208	75	104	151	4
Confl. Peds. (#/hr)	1		6	6		1			9	9		
Confl. Bikes (#/hr)			2									
Heavy Vehicles (%)	0%	3%	0%	0%	1%	0%	3%	2%	1%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8		8	4		4
Actuated Green, G (s)	7.7	67.2	67.2	25.1	84.6	84.6	22.4	22.4	22.4	22.4	22.4	22.4
Effective Green, g (s)	8.2	69.2	69.2	25.6	86.6	86.6	24.4	24.4	24.4	24.4	24.4	24.4
Actuated g/C Ratio	0.06	0.53	0.53	0.20	0.66	0.66	0.19	0.19	0.19	0.19	0.19	0.19
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	2.3	4.5	4.5	2.3	4.5	4.5	2.5	2.5	2.5	2.5	2.5	2.5
Lane Grp Cap (vph)	113	1849	815	352	2359	1041	173	346	290	130	353	300
v/s Ratio Prot	0.03	0.49		c0.20	c0.63			0.11			0.08	
v/s Ratio Perm			0.02			0.09	0.08		0.05	c0.15		0.00
v/c Ratio	0.55	0.92	0.03	1.01	0.95	0.13	0.45	0.60	0.26	0.80	0.43	0.01
Uniform Delay, d1	59.7	28.6	14.9	52.8	20.2	8.3	47.4	48.9	45.7	51.1	47.2	43.6
Progression 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
Incremental Delay, d2	3.7	8.5	0.0	49.4	9.1	0.1	1.4	2.5	0.3	27.9	0.6	0.0
Delay (s)	63.4	37.1	14.9	102.2	29.4	8.4	48.8	51.4	46.0	79.0	47.8	43.6
Level of Service	E	D	B	F	C	A	D	D	D	E	D	D
Approach Delay (s)		37.5			37.2			48.4			59.2	
Approach LOS		D			D			D			E	

Intersection Summary			
HCM Average Control Delay	39.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	131.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	93.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Intersection Delay (sec/veh)	10.1
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adjusted Approach Flow (vph)	120	41	474	599
Demand Flow Rate (pc/h)	120	42	474	605
Vehicles Circulating (pc/h)	616	479	41	131
Vehicles Exiting (pc/h)	120	36	695	390
Follow-Up Headway (s)	3.186	3.186	3.186	3.186
Ped Vol. Crossing Leg (#/hr)	0	0	0	0
Ped Capacity Adjustment	1.000	1.000	1.000	1.000
Approach Delay (sec/veh)	8.3	5.9	8.1	12.3
Approach LOS	A	A	A	B

Lane	Left	Left	Left	Left
Designated moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
Right Turn Channelized				
Lane Utilization	1.000	1.000	1.000	1.000
Critical Headway (s)	5.193	5.193	5.193	5.193
Entry Flow Rate (pc/h)	120	42	474	605
Capacity, Entry Lane (pc/h)	610	700	1085	991
Entry HV Adjustment Factor	0.999	0.974	1.000	0.991
Flow Rate, Entry (vph)	120	41	474	599
Capacity, Entry (vph)	610	682	1085	982
Volume to Capacity Ratio	0.197	0.060	0.437	0.610
Control Delay (sec/veh)	8.3	5.9	8.1	12.3
Level of Service	A	A	A	B
95th-Percentile Queue (veh)	1	0	2	4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	210	425	230	235	225	185	1490	135	220	1970	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	4.0		4.5	4.5	4.5	4.0	4.0	4.5	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.99	1.00		0.98	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1890	1615		1854	1599	1805	3610	1594	3467	3610	1615
Flt Permitted		0.14	1.00		0.36	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		275	1615		690	1599	1805	3610	1594	3467	3610	1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	26	219	443	240	245	234	193	1552	141	229	2052	36
RTOR Reduction (vph)	0	0	168	0	0	150	0	0	31	0	0	12
Lane Group Flow (vph)	0	245	275	0	485	84	193	1552	110	229	2052	24
Confl. Bikes (#/hr)									2			
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%	0%	0%	0%	1%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		20.0	20.0		19.5	19.5	14.8	58.7	58.7	30.2	74.1	74.1
Effective Green, g (s)		20.0	22.0		21.5	21.5	15.3	60.7	60.7	30.7	76.1	76.1
Actuated g/C Ratio		0.16	0.17		0.17	0.17	0.12	0.48	0.48	0.24	0.60	0.60
Clearance Time (s)		6.0	6.0		6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)		2.5	2.5		2.5	2.5	3.0	5.4	5.4	3.5	5.4	5.4
Lane Grp Cap (vph)		44	282		118	273	219	1740	769	845	2182	976
v/s Ratio Prot							0.11	c0.43		0.07	c0.57	
v/s Ratio Perm		c0.89	0.17		0.70	0.05			0.07			0.01
v/c Ratio		5.57	0.98		4.11	0.31	0.88	0.89	0.14	0.27	0.94	0.02
Uniform Delay, d1		53.0	51.7		52.2	45.7	54.4	29.6	18.1	38.5	22.8	10.0
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2104.4	46.7		1419.5	0.5	31.1	6.8	0.2	0.2	9.2	0.0
Delay (s)		2157.3	98.4		1471.7	46.2	85.5	36.4	18.3	38.7	32.0	10.0
Level of Service		F	F		F	D	F	D	B	D	C	B
Approach Delay (s)		831.6			1007.7			40.1			32.3	
Approach LOS		F			F			D			C	

Intersection Summary				
HCM Average Control Delay	258.0	HCM Level of Service	F	
HCM Volume to Capacity ratio	1.78			
Actuated Cycle Length (s)	125.9	Sum of lost time (s)	14.0	
Intersection Capacity Utilization	118.1%	ICU Level of Service	H	
Analysis Period (min)	15			
c Critical Lane Group				

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	1740	2170	70	0	55
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	0	1812	2260	73	0	57
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	2333				3203	1167
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2333				3203	1167
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	70
cM capacity (veh/h)	215				8	190

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	906	906	1507	826	57
Volume Left	0	0	0	0	0
Volume Right	0	0	0	73	57
cSH	1700	1700	1700	1700	190
Volume to Capacity	0.53	0.53	0.89	0.49	0.30
Queue Length 95th (ft)	0	0	0	0	30
Control Delay (s)	0.0	0.0	0.0	0.0	32.0
Lane LOS					D
Approach Delay (s)	0.0		0.0		32.0
Approach LOS					D

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	72.3%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	210	425	230	235	225	185	1490	135	220	1970	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	6.0	4.0	2.0	4.5	4.5	4.5	4.0	4.0	4.5	4.0	4.0
Lane Util. Factor	1.00	1.00	0.88	0.97	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	1900	2842	3502	1900	1599	1805	3610	1594	3467	3610	1615
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1805	1900	2842	3502	1900	1599	1805	3610	1594	3467	3610	1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	26	219	443	240	245	234	193	1552	141	229	2052	36
RTOR Reduction (vph)	0	0	277	0	0	180	0	0	30	0	0	11
Lane Group Flow (vph)	26	219	166	240	245	54	193	1552	111	229	2052	25
Confl. Bikes (#/hr)									2			
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%	0%	0%	0%	1%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.5	19.8	19.8	8.9	23.7	23.7	16.0	76.6	76.6	19.9	80.5	80.5
Effective Green, g (s)	6.5	19.8	21.8	10.9	25.7	25.7	16.5	78.6	78.6	20.4	82.5	82.5
Actuated g/C Ratio	0.04	0.14	0.15	0.07	0.18	0.18	0.11	0.54	0.54	0.14	0.56	0.56
Clearance Time (s)	4.0	6.0	6.0	4.0	6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	3.0	2.5	2.5	3.0	2.5	2.5	3.0	5.4	5.4	3.5	5.4	5.4
Lane Grp Cap (vph)	80	257	424	261	334	281	204	1941	857	484	2037	911
v/s Ratio Prot	0.01	0.12		c0.07	c0.13		c0.11	0.43		0.07	c0.57	
v/s Ratio Perm			0.06			0.03			0.07			0.02
v/c Ratio	0.33	0.85	0.39	0.92	0.73	0.19	0.95	0.80	0.13	0.47	1.01	0.03
Uniform Delay, d1	67.7	61.8	56.2	67.2	57.0	51.4	64.4	27.4	16.8	57.9	31.8	14.1
Progression 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
Incremental Delay, d2	2.4	22.6	0.4	34.5	7.6	0.2	47.4	2.8	0.2	0.9	21.7	0.0
Delay (s)	70.1	84.4	56.7	101.7	64.7	51.7	111.8	30.2	17.0	58.8	53.6	14.1
Level of Service	E	F	E	F	E	D	F	C	B	E	D	B
Approach Delay (s)		66.0			72.8			37.6			53.5	
Approach LOS		E			E			D			D	

Intersection Summary			
HCM Average Control Delay	52.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	146.2	Sum of lost time (s)	10.5
Intersection Capacity Utilization	97.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	50	160	320	45	110	495
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	52	167	333	47	115	516
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	1102	357			380	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1102	357			380	
tC, single (s)	6.4	6.3			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.4			2.2	
p0 queue free %	75	75			90	
cM capacity (veh/h)	209	670			1167	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	219	380	630
Volume Left	52	0	115
Volume Right	167	47	0
cSH	440	1700	1167
Volume to Capacity	0.50	0.22	0.10
Queue Length 95th (ft)	68	0	8
Control Delay (s)	21.0	0.0	2.5
Lane LOS	C		A
Approach Delay (s)	21.0	0.0	2.5
Approach LOS	C		

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	135	5	30	10	10	15	20	20	5	10	40	350
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	141	5	31	10	10	16	21	21	5	10	42	365

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	177	36	47	417
Volume Left (vph)	141	10	21	10
Volume Right (vph)	31	16	5	365
Hadj (s)	0.05	-0.20	0.02	-0.51
Departure Headway (s)	5.0	5.0	4.9	4.0
Degree Utilization, x	0.25	0.05	0.06	0.46
Capacity (veh/h)	664	644	674	858
Control Delay (s)	9.6	8.2	8.3	10.4
Approach Delay (s)	9.6	8.2	8.3	10.4
Approach LOS	A	A	A	B

Intersection Summary			
Delay	10.0		
HCM Level of Service	A		
Intersection Capacity Utilization	47.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	1705	40	340	2145	185	75	200	275	35	145	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00	0.98	1.00	1.00	0.97	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3505	1547	1805	3574	1577	1752	1863	1555	1793	1900	1615
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.48	1.00	1.00	0.34	1.00	1.00
Satd. Flow (perm)	1805	3505	1547	1805	3574	1577	890	1863	1555	634	1900	1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	47	1776	42	354	2234	193	78	208	286	36	151	21
RTOR Reduction (vph)	0	0	14	0	0	52	0	0	214	0	0	17
Lane Group Flow (vph)	47	1776	28	354	2234	141	78	208	72	36	151	4
Confl. Peds. (#/hr)	1		6	6		1			9	9		
Confl. Bikes (#/hr)			2									
Heavy Vehicles (%)	0%	3%	0%	0%	1%	0%	3%	2%	1%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2			6	8		8	4		4
Actuated Green, G (s)	6.9	67.7	67.7	25.2	86.0	86.0	19.6	19.6	19.6	19.6	19.6	19.6
Effective Green, g (s)	7.4	69.7	69.7	25.7	88.0	88.0	21.6	21.6	21.6	21.6	21.6	21.6
Actuated g/C Ratio	0.06	0.54	0.54	0.20	0.68	0.68	0.17	0.17	0.17	0.17	0.17	0.17
Clearance Time (s)	4.5	6.0	6.0	4.5	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	2.3	4.5	4.5	2.3	4.5	4.5	2.5	2.5	2.5	2.5	2.5	2.5
Lane Grp Cap (vph)	104	1894	836	360	2438	1076	149	312	260	106	318	270
v/s Ratio Prot	0.03	0.51		c0.20	c0.63			c0.11			0.08	
v/s Ratio Perm			0.02			0.09	0.09		0.05	0.06		0.00
v/c Ratio	0.45	0.94	0.03	0.98	0.92	0.13	0.52	0.67	0.28	0.34	0.47	0.01
Uniform Delay, d1	58.8	27.6	13.9	51.4	17.4	7.2	49.0	50.3	46.9	47.4	48.6	44.8
Progression 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
Incremental Delay, d2	1.8	9.7	0.0	42.6	6.2	0.1	2.5	4.8	0.4	1.4	0.8	0.0
Delay (s)	60.7	37.4	13.9	94.1	23.6	7.2	51.5	55.1	47.3	48.8	49.4	44.8
Level of Service	E	D	B	F	C	A	D	E	D	D	D	D
Approach Delay (s)		37.4			31.4			50.7			48.8	
Approach LOS		D			C			D			D	

Intersection Summary			
HCM Average Control Delay	36.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	129.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	94.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Intersection Delay (sec/veh)	9.9
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adjusted Approach Flow (vph)	120	31	464	599
Demand Flow Rate (pc/h)	120	31	464	605
Vehicles Circulating (pc/h)	605	474	41	120
Vehicles Exiting (pc/h)	120	31	684	385
Follow-Up Headway (s)	3.186	3.186	3.186	3.186
Ped Vol. Crossing Leg (#/hr)	0	0	0	0
Ped Capacity Adjustment	1.000	1.000	1.000	1.000
Approach Delay (sec/veh)	8.2	5.6	7.9	12.0
Approach LOS	A	A	A	B

Lane	Left	Left	Left	Left
Designated moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
Right Turn Channelized				
Lane Utilization	1.000	1.000	1.000	1.000
Critical Headway (s)	5.193	5.193	5.193	5.193
Entry Flow Rate (pc/h)	120	31	464	605
Capacity, Entry Lane (pc/h)	617	703	1085	1002
Entry HV Adjustment Factor	0.999	0.997	1.000	0.991
Flow Rate, Entry (vph)	120	31	464	599
Capacity, Entry (vph)	617	701	1085	993
Volume to Capacity Ratio	0.194	0.044	0.428	0.604
Control Delay (sec/veh)	8.2	5.6	7.9	12.0
Level of Service	A	A	A	B
95th-Percentile Queue (veh)	1	0	2	4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	210	425	230	235	225	175	1500	135	220	1970	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	4.0		4.5	4.5	4.5	4.0	4.0	4.5	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00		0.98	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1894	1615		1854	1599	1805	3610	1594	3467	3610	1615
Flt Permitted		0.25	1.00		0.39	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		478	1615		749	1599	1805	3610	1594	3467	3610	1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	16	219	443	240	245	234	182	1562	141	229	2052	36
RTOR Reduction (vph)	0	0	167	0	0	150	0	0	30	0	0	12
Lane Group Flow (vph)	0	235	276	0	485	84	182	1562	111	229	2052	24
Confl. Bikes (#/hr)									2			
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%	0%	0%	0%	1%	0%	0%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		20.0	20.0		19.5	19.5	14.5	58.7	58.7	29.7	73.9	73.9
Effective Green, g (s)		20.0	22.0		21.5	21.5	15.0	60.7	60.7	30.2	75.9	75.9
Actuated g/C Ratio		0.16	0.18		0.17	0.17	0.12	0.48	0.48	0.24	0.61	0.61
Clearance Time (s)		6.0	6.0		6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)		2.5	2.5		2.5	2.5	3.0	5.4	5.4	3.5	5.4	5.4
Lane Grp Cap (vph)		76	283		128	274	216	1747	772	835	2185	978
v/s Ratio Prot							0.10	c0.43		0.07	c0.57	
v/s Ratio Perm		0.49	0.17		c0.65	0.05			0.07			0.01
v/c Ratio		3.09	0.97		3.79	0.31	0.84	0.89	0.14	0.27	0.94	0.02
Uniform Delay, d1		52.7	51.4		52.0	45.4	54.0	29.4	17.9	38.7	22.6	9.9
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		975.2	46.0		1273.9	0.5	24.6	6.9	0.2	0.2	9.0	0.0
Delay (s)		1027.9	97.4		1325.9	45.9	78.7	36.3	18.1	38.9	31.6	9.9
Level of Service		F	F		F	D	E	D	B	D	C	A
Approach Delay (s)		419.9			909.3			39.0			32.0	
Approach LOS		F			F			D			C	

Intersection Summary			
HCM Average Control Delay	194.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.49		
Actuated Cycle Length (s)	125.4	Sum of lost time (s)	12.5
Intersection Capacity Utilization	117.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	25	1715	2170	70	75	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.95	0.95		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1805	3505	3559		1805	1615
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1805	3505	3559		1805	1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	26	1786	2260	73	78	57
RTOR Reduction (vph)	0	0	2	0	0	51
Lane Group Flow (vph)	26	1786	2331	0	78	6
Heavy Vehicles (%)	0%	3%	1%	0%	0%	0%
Turn Type	Prot	NA	NA		NA	Perm
Protected Phases	7	4	8		6	
Permitted Phases						6
Actuated Green, G (s)	1.5	63.8	58.3		8.7	8.7
Effective Green, g (s)	1.5	63.8	58.3		8.7	8.7
Actuated g/C Ratio	0.02	0.79	0.72		0.11	0.11
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	34	2778	2578		195	175
v/s Ratio Prot	0.01	c0.51	c0.66		c0.04	
v/s Ratio Perm						0.00
v/c Ratio	0.76	0.64	0.90		0.40	0.04
Uniform Delay, d1	39.3	3.5	8.9		33.5	32.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	66.1	0.5	5.0		1.3	0.1
Delay (s)	105.4	4.0	13.8		34.8	32.2
Level of Service	F	A	B		C	C
Approach Delay (s)		5.5	13.8		33.7	
Approach LOS		A	B		C	

Intersection Summary			
HCM Average Control Delay	10.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	80.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	210	425	230	235	225	175	1500	135	220	1970	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	6.0	4.0	2.0	4.5	4.5	4.5	4.0	4.0	4.5	4.0	4.0
Lane Util. Factor	1.00	1.00	0.88	0.97	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	1900	2842	3502	1900	1599	1805	3610	1594	3467	3610	1615
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1805	1900	2842	3502	1900	1599	1805	3610	1594	3467	3610	1615
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	16	219	443	240	245	234	182	1562	141	229	2052	36
RTOR Reduction (vph)	0	0	257	0	0	189	0	0	29	0	0	11
Lane Group Flow (vph)	16	219	186	240	245	45	182	1562	112	229	2052	25
Confl. Bikes (#/hr)									2			
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%	0%	0%	0%	1%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	3.1	21.4	21.4	8.0	25.8	25.8	15.0	76.2	76.2	19.8	81.0	81.0
Effective Green, g (s)	5.1	21.4	23.4	10.0	27.8	27.8	15.5	78.2	78.2	20.3	83.0	83.0
Actuated g/C Ratio	0.03	0.15	0.16	0.07	0.19	0.19	0.11	0.53	0.53	0.14	0.57	0.57
Clearance Time (s)	4.0	6.0	6.0	4.0	6.5	6.5	5.0	6.0	6.0	5.0	6.0	6.0
Vehicle Extension (s)	3.0	2.5	2.5	3.0	2.5	2.5	3.0	5.4	5.4	3.5	5.4	5.4
Lane Grp Cap (vph)	63	278	454	239	361	304	191	1928	851	481	2047	916
v/s Ratio Prot	0.01	0.12		c0.07	c0.13		c0.10	0.43		0.07	c0.57	
v/s Ratio Perm			0.07			0.03			0.07			0.02
v/c Ratio	0.25	0.79	0.41	1.00	0.68	0.15	0.95	0.81	0.13	0.48	1.00	0.03
Uniform Delay, d1	68.8	60.3	55.3	68.2	55.1	49.4	65.1	28.0	17.1	58.1	31.7	13.9
Progression 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
Incremental Delay, d2	2.1	13.3	0.4	59.3	4.6	0.2	51.3	3.1	0.2	0.9	20.5	0.0
Delay (s)	70.9	73.6	55.7	127.5	59.7	49.6	116.4	31.1	17.2	59.0	52.2	14.0
Level of Service	E	E	E	F	E	D	F	C	B	E	D	B
Approach Delay (s)		61.8			79.0			38.3			52.3	
Approach LOS		E			E			D			D	

Intersection Summary			
HCM Average Control Delay	52.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	146.4	Sum of lost time (s)	10.5
Intersection Capacity Utilization	97.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Oregon Department of Transportation

Transportation Development Branch

Transportation Planning Analysis Unit

Preliminary Traffic Signal Warrant Analysis[1]

Major Street:	Highway 99W	**Minor Street:**	New Access
Project:	Sherwood Elwert Connectivity	**City/County:**	Sherwood
Year:	2035	**Alternative:**	Option 4 (Full Access)

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
	100 percent of standard warrants				
X	70 percent of standard warrants[2]				

Preliminary Signal Warrant Calculation

	Street	Number of Lanes	Warrant Volumes	Approach Volumes	Warrant Met
Case A	Major	2	7400	40300	N
	Minor	1	1850	1250	
Case B	Major	2	11100	40300	Y
	Minor	1	950	1250	

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.