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MEMORANDUM

Date:	September 5, 2012
To:	Brandon Goldman, City of Ashland John McDonald, ODOT Region 3
From:	Anne Sylvester
Subject:	Existing Traffic Conditions
cc:	Jason Franklin
Project Number:	277-2395-082
Project Name:	Normal Avenue Neighborhood Plan

INTRODUCTION

The purpose of this memo is to summarize the analysis of existing traffic conditions in the Normal Avenue Neighborhood Plan study area is intended to supplement a memo prepared by City staff documenting existing land use, environmental, housing and transportation system characteristics for the project. Transportation characteristics that were described in the City's memo largely reflect recommendations in the City's Transportation System Plan (TSP) Update including the extension of Normal Avenue from the existing at-grade rail crossing north and east to intersect East Main Street, and the planned bicycle network and street classification system in the study area. The City's memo also provides a brief discussion of the existing Central Oregon and Pacific Railroad alignment in the study area and at-grade crossing with Normal Avenue, as well as existing transit service and traffic counts.

This memo includes four major sections, the first of which is this introduction. The second section describes the existing Normal Avenue Neighborhood Plan study area, while the third section describes characteristics of the existing transportation system including intersection layout, traffic control and traffic volumes. The fourth section presents traffic analysis methods and assumptions, along with key findings and conclusions.

The analysis documented in this memo focuses on:

- Analysis of existing traffic volumes and operational deficiencies at six study area intersections
- Volumes, patterns of use and safety concerns for non-automobile transportation including multi-modal levels of service
- Assessment of recent crash history at six study area intersections and along primary roadway segments

STUDY AREA

The study area for evaluating existing traffic conditions for the Normal Avenue Neighborhood Plan includes the area generally bounded by East Main Street on the north, Tolman Creek Road on the east, Ashland Street/Oregon Highway 66 on the south, and Walker Avenue on the west. The study area includes six primary intersections:

- Ashland Street at Walker Avenue (included in TSP Update)
- Ashland Street at Normal Avenue
- Ashland Street (Oregon Highway 66) at Tolman Creek Road (included in TSP Update)

- East Main Street at Walker Avenue (included in TSP Update)
- East Main Street at Clay Street
- East Main Street at Tolman Creek Road

EXISTING TRANSPORTATION SYSTEM

The existing transportation system in the study area includes two boulevards and four avenues as classified in the City's TSP Update. Boulevards include: East Main Street and Ashland Street. By definition "*boulevards provide access to major urban activity centers for pedestrians, bicyclists, transit users and motor vehicle users, and provide connections to regional traffic ways such as Interstate 5*". Ashland Street is a state highway (OR 66) from its intersection with Tolman Creek Road east through the I-5 interchange, and a city street to the west. It serves as one of the primary east/west connectors within Ashland. East Main Street also serves as an east/west connector road and abuts the edge of the Ashland Urban Growth Boundary along its northern frontage.

Avenues include: Walker Avenue, Normal Avenue, Clay Street and Tolman Creek Road. By definition "*avenues provide concentrated pedestrian, bicycle, and motor vehicle access from boulevards to neighborhoods, and to neighborhoods activity centers*".

Existing Intersections

As illustrated in Figure 1, the intersections of Ashland Street with Walker Avenue and Tolman Creek Road are currently signalized and have two east/west through lanes in each direction with left turn channelization. Tolman Creek Road has a single north/south through lane in each direction with left turn channelization at Ashland Street. Walker Street has a single north/south lane approach in each direction.

The intersection of Ashland Street with Normal Avenue has two through lanes and left turn channelization in the east/west (Ashland Street) direction. Normal Avenue has a single north/south approach lane in each direction. Normal Avenue is stop sign-controlled at its intersection with Ashland Street.

The intersections of East Main Street with Walker Avenue, Clay Street and Tolman Creek Road all have single lane approaches in each direction. East Main Street is a 40 mph through street without stop signs through the study area. Each of the side streets (Walker, Clay and Tolman Creek) is stop sign-controlled.

Existing Traffic Volumes

Figure 2 presents a summary of existing PM peak hour traffic volumes that have been seasonally adjusted to represent to 30th highest hourly volume for the year in which data was collected. Data for the intersections that were included in the TSP Update was obtained during September and October of 2009, while data for the other intersections in the study area was obtained during September of 2011 and April of 2012. Table 1 below summarizes intersection traffic data collection including jurisdiction, date of each count and the time period or duration covered by the count. With one exception, all counts were taken for 16 hours between 6 AM and 10 PM with data stratified into 15-minute increments during the morning and afternoon peak periods as noted below.

Table 1. Existing Intersection Traffic Count Data

Intersection	Included in TSP Update?	Jurisdiction	Date of Count	Duration of Count	Estimated Daily Volume
Ashland Street @ Walker Avenue	Yes	City	10/5/2009	4 hour	13,600[1]
Ashland Street @ Normal Avenue	No	City	9/26/2011	16 hour	13,400[2]
Ashland Street @ Tolman Creek Road	Yes	ODOT	9/16/2009	16 hour	12,600[3]
Main Street @ Walker Avenue	Yes	City	10/7/2009	16 hour	8,500[4]
Main Street @ Clay Street	No	City	4/4/2012	16 hour	7,200[5]
Main Street @ Tolman Creek Road	No	City	4/4/2012	16 hour	6,500[6]

[1] Along Ashland Street east of Walker Avenue, estimated from PM peak hour counts
[2] Along Ashland Street east of Normal Avenue
[3] Along Ashland Street west of Tolman Creek Road
[4] Along East Main Street west of Walker Street
[5] Along East Main Street west of Clay Street
[6] Along East Main Street west of Tolman Creek Road

During preparation of the TSP Update, an areawide PM peak hour was identified (4:15 to 5:15 PM) and all data in this table represents this time period. All intersection traffic counts included vehicular turning movements, pedestrian movements (with or without marked crosswalks), bicycles, and wheeled pedestrians (wheelchairs, skateboards, etc.). Traffic count data is presented in Appendix A, while calculations for seasonal adjustments are included in Appendix B.

Intersection Operational Standards

ODOT Facilities

One intersection in the Normal Avenue study area is under the jurisdiction of ODOT – OR 66 (Ashland Street) at Tolman Creek Road. OR 66 is designated as a District Highway from its intersection with Tolman Creek Road eastward through the I-5 interchange.

ODOT uses volume-to-capacity (v/c) ratio standards to assess traffic operations at intersections on state highway facilities. Table 6 of the Oregon Highway Plan (OHP) and Table 10-1 of the Oregon Highway Design Manual (HDM) provide the maximum v/c ratios for all signalized and unsignalized intersections outside of the Portland Metro area. The OHP ratios are used to evaluate existing and future no build conditions, while the HDM ratios are used to evaluate transportation system improvements on state highways. Based on its classification as a District Highway, the signalized intersection of OR 66 at Tolman Creek Road has an OHP v/c standard of 0.95 (based on revisions to the OHP adopted by the Oregon Transportation Commission in December of 2011 which became effective on January 1, 2012)[1]. Its relevant HDM v/c ratio is 0.80.

City of Ashland Facilities

The remaining five intersections in the study area are all under the jurisdiction of the City of Ashland. Based on discussion included in the TSP, the following operational standards were used:

- Level of service (LOS) D at signalized and all-way stop-controlled intersections if the v/c ratio is not higher than 1.00 for the sum of critical movements.
- LOS E for the poorest operating approach at two-way stop-controlled intersections. Approaches operating at a LOS F where a traffic signal is not warranted were also identified in the TSP.

A summary of the relevant operational standards for the five City intersections in the Normal Avenue study area is presented in Table 2 below.

Table 2. Operational Threshold for City Intersections

Intersection	Traffic Control	Threshold	Intersection	Traffic Control	Threshold
E. Main Street @ Walker Avenue *	TWSC	LOS "E"	E .Main Street @ Clay Street	TWSC	LOS "E"
Ashland Street @ Walker Avenue *	Signal	LOS "D"	E. Main Street @ Tolman Creek Road	TWSC	LOS "E"
Ashland @ Normal Avenue	TWSC	LOS "E"			

* Intersection included in TSP

Access Management Considerations

As noted in the TSP, spacing requirements for public roadways and private driveways can have a profound impact on transportation system operations, safety and land development. Access management strategies and implementation require careful consideration to balance the needs for access to developed land with the need to ensure movement of traffic in a safe and efficient manner. Access management generally becomes more stringent as the functional classification level of roadways increases and the corresponding importance of mobility increase.

[1] It should be noted that the TSP used the OHP v/c standards that were in place prior to the OTC's action in December of 2011. Consequently the v/c threshold cited in the TSP is 0.90.

The City of Ashland has a minimum driveway access spacing of 300 feet for boulevards like Ashland and East Main Streets, 100 feet for avenues like Walker Avenue, Clay Street and Tolman Creek Road, and 75 feet for lower order streets such as those that could be developed internal to the Normal Avenue Neighborhood Plan area. OR 66 east of Tolman Creek Road is under ODOT jurisdiction and state highway access spacing standards apply. ODOT and the City of Ashland have an agreement that OR 66 within the city limits is subject to the minimum spacing standards typically applied to District Highways. OR 66 within the City is subject to a minimum access spacing standard of 300 feet.

FINDINGS AND CONCLUSIONS

Intersection Operations Analysis Results

For consistency with the operations analysis conducted in for the Ashland TSP, Synchro 7 software was used to evaluate the performance of both signalized and unsignalized intersections in the study area. Table 3 summarizes existing PM peak hour operational performance for study area intersections. These results incorporate the intersection geometry and traffic control features illustrated in Figure 1 and the traffic volumes in Figure 2.

As indicated in Table 3, all study area intersections are expected to meet their applicable mobility standard. Detailed traffic operational worksheets can be found in Appendix C.

Table 3. Existing PM Peak Hour Operations Analysis Summary

Intersection	Operating Standard	Traffic Control	Worst Movement	PM Peak Hour		
				V/C [3]	Delay [2]	LOS [1]
Ashland Street at Walker Avenue	LOS D	Signal		0.45	12.4	B
Ashland Street at Normal Avenue	LOS E	Stop	SB	0.11	16.6	C
OR 66/Ashland Street at Tolman Creek Road	V/C= 0.95	Signal		0.63	29.2	C
E. Main Street at Walker Avenue	LOS E	Stop	NB	0.24	17.1	C
E. Main Street at Clay Street	LOS E	Stop	NB	0.16	15.9	C
E. Main Street at Tolman Creek Road	LOS E	Stop	NB	0.31	11.7	B

1. LOS = Level-Of-Service using 2000 Highway Capacity Manual (HCM) methodology.
2. Average Control Delay for an entire signalized intersection or the worst movement of an unsignalized intersection.
3. Volume-to-Capacity ratio of a signalized intersection or Worst Movement of an unsignalized intersection.

Traffic Queuing Analysis Results

Table 4 summarizes existing PM peak hour traffic queuing analysis results at the two signalized study area intersections. This information was extracted from the Ashland TSP. Worksheets are included in Appendix D.

Queuing results for the signalized intersection of Ashland Street at Walker Avenue show that for both left turn movements (eastbound and westbound) along Ashland Street there is sufficient space to meet vehicle queuing demand. At the intersection of OR 66/Ashland Street with Tolman Creek Road both the northbound and southbound left turn lanes generally can accommodate most PM peak hour vehicular demand. For the eastbound left turn lane on Ashland Street, a one or two vehicle spillover into the through lane is experienced for certain signal cycles during the PM peak hour. A more significant queuing problem occurs with the westbound left turn lane where queuing demand is more than double the available storage space.

Table 4. Existing PM Peak Hour Intersection Traffic Queuing

Intersection	Movement	Existing Vehicle Storage	PM Peak Hour Vehicle Queue
Ashland Street at Walker Avenue[1]	EB Left	100 ft	51 ft
	WB Left	100 ft	57 ft
OR 66/Ashland Street at Tolman Creek Road[1]	NB Left	100 ft	106 ft
	SB Left	100 ft	97 ft
	EB Left	100 ft	129 ft
	WB Left	100 ft	224 ft

1. Traffic queuing calculated using Synchro traffic operations software.

Multi-modal Levels of Service

A multi-modal level-of-service (MMLOS) analysis was conducted as part of the TSP in six major corridors in the city. Of relevance to the Normal Avenue Neighborhood Plan was the analysis conducted along: OR 66/Ashland Street, East Main Street, Walker Avenue and Tolman Creek Road. For this analysis, each corridor was divided into several short segments based on the location of major study intersections and changes in the roadway cross-section (e.g., the presence of sidewalks or bike lanes). The analysis was conducted in accordance with the methodology described in the National Cooperative Highway Research Program Report (NCHRP) 3-70 which has been included in the 2010 Highway Capacity Manual.

NCHRP 3-70 provides guidance in assessing traveler perceptions of the quality of service and performance of various travel modes along urban streets. The Ashland TSP includes results of MMLOS analysis under both existing and future no build conditions for auto, transit, bicycle, and pedestrian facilities by direction of travel. Graphics are provided in the TSP that illustrate key findings. Level-of-service differences along roadway corridors are typically attributable to such factors as the presence of a sidewalk or bike lane, or high traffic volumes at unsignalized side streets or driveways. Key findings from the TSP analysis are described below for the three corridors that are relevant to the Normal Avenue Neighborhood Plan. MMLOS worksheets are included in Appendix E. Analysis results are presented in Table 5.

Table 5. Multi-Modal Level-of-Service Analysis Results for Selected Corridors

				Multi-Modal Level-of-Service Results			
Street/Limits	**Limits**	**Direction**	**LOS Type**	**Auto**	**Transit**	**Bicycle**	**Pedestrian**
E. Main Street	Walker to Tolman	East	Segment	B	N/A	B	E
			Intersection			C	B
	Tolman to Walker	West	Segment	B	N/A	B	E
			Intersection			B	A
OR 66/Ashland Street	Walker to Tolman	East	Segment	B	C	A	C
			Intersection			B	B
	Tolman to Walker	West	Segment	B	C	A	C
			Intersection			B	B
Walker Street	Ashland to Iowa	North	Segment	B	C	A	B
			Intersection			A	B
	Iowa to Ashland	South	Segment	B	C	A	C
			Intersection			A	B
Walker Street	Iowa to E. Main	North	Segment	N	N/A	A	A
			Intersection			A	B
	E. Main to Iowa	South	Segment	B	N/A	A	B
			Intersection			A	A
Tolman Creek Road	Ashland to Main	North	Segment	B	C	A	D
			Intersection			A	C
	Main to Ashland	South	Segment	B	C	A	C
			Intersection			B	B

Auto

Auto level of service is primarily measured by the average speed over the length of the corridor and the average number of stops per mile. Traffic volume, heavy vehicle percentages, turning percentages, and peak hour factors area all inputs to the auto level of service, along with signal timing at signalized intersection and saturation flow rates. Auto level of service along the three major corridors in the vicinity of the Normal Avenue Neighborhood is LOS B.

Transit

The three primary performance measures that influence transit LOS results include access, wait time, and ride experience. Access is represented by the pedestrian level of service score and pedestrian access to bus stops along the corridor. Wait time and ride experience are affected by headways (e.g., frequency of transit service), and passenger per seat ratings. Analysis of transit LOS in the study area has been updated from the TSP to reflect more recent changes in RVTD service. Transit service is currently provided along Ashland Street, and Tolman Creek Road, but not along either Walker Avenue or East Main Street in the study area (service is provided to the

east of Tolman Creek Road). However, transit service is provided within one-quarter mile of the southern section of Walker Avenue so the results in Table 5 reflect this proximity. It should be noted that the transit LOS is biased towards the weekday PM peak hour when service is available. It does not take into account that service is not provided in the later evenings or on Sundays.

Pedestrians

There are two basic performance measures that influence the pedestrian LOS results within the MMLOS methodology. One is the feeling of security and quality of experience a pedestrian has walking alongside a roadway facility (e.g., presence and width of sidewalks). The second is the ability pedestrians have to safety and efficiently cross a major roadway. For the corridors in the study area, MMLOS results generally indicate that pedestrians would feel safe walking along Ashland Street, Tolman Creek Road, and Walker Avenue. There is a gap in the sidewalk along portions of Walker Avenue, but generally this road provides some accommodation for pedestrians. The narrowness of East Main Street and relatively high travel speeds make this corridor less attractive to pedestrians. MMLOS for pedestrians at the intersections of East Main Street with Tolman Creek Road and Walker Avenue are considered higher due to the limited crossing opportunities (north/south side streets only) and the fact that the side streets are stop-controlled. Opportunities to improve pedestrian LOS include adding sidewalks or pathways, providing landscape strips between sidewalks and adjacent roadways, increasing the width of existing sidewalks, and providing additional opportunities for pedestrians to safety and efficiently cross major roadways.

Bicyclists

Similar to the pedestrian LOS, there are two basic performance measures that influence the bicycle LOS results within the MMLOS analysis. One is the feeling of security and quality of experience a bicyclist has riding on a roadway facility (e.g., presence and width of bicycle lanes). The second is the frequency of conflicts with vehicle cross traffic (e.g., frequency of driveways or unsignalized intersections). MMLOS results for bicycle facilities indicate that bicycling along the key roadways in the study area is generally considered comfortable. There are existing bicycle lanes along Ashland Street, Tolman Creek Road and Walker Street, while East Main Street has a narrow roadway shoulder. Opportunities to improve LOS for bicyclists would be to add a wider shoulder and/or bike lanes along East Main Street, to buffer existing bicycle lanes from traffic, and/or to consolidate driveways wherever possible to reduce bike/auto conflicts.

Non-Automobile Transportation Analysis

This section summarizes key features of the active (largely bicycle and pedestrian) transportation system in the study area. Key destinations for these travel modes in the study area include Ashland Middle School and Walker Elementary School on the east side of Walker Avenue. There are also commercial shopping and business destinations along Ashland Street.

The following paragraphs present a summary of information abstracted from the TSP and supplemented by data collected for the Normal Avenue Neighborhood Plan. This information includes a discussion of pedestrian and bicycle activity in the study area, an assessment of existing risk for these modes including a discussion of crash experience, and network considerations in developing a well-connected and safe bicycle and pedestrian system.

Pedestrian System

<u>Pedestrian Volumes</u>

Based on data presented in the TSP, there is a relatively high level of pedestrian activity in the study area along Walker Avenue in the vicinity of Iowa Street. This activity is likely associated with the middle and elementary schools in the vicinity. A moderate level of pedestrian activity was also observed in the vicinity of Ashland Street near both Walker Avenue and Tolman Creek Road. Traffic counts taken for the Normal Avenue Plan indicate that there is a moderate level of pedestrian activity on Ashland Street at Normal Avenue, while light levels of pedestrian activity were observed along East Main Street.

<u>Pedestrian Risk Analysis</u>

The TSP included segment analysis of OR 66/Ashland Street. Along with OR 99, these two corridors showed a heavy concentration of crashes involving pedestrians. Table 6 summaries the findings of pedestrian-related crash

analysis along Ashland Street. This data permits a comparison of the pedestrian-involved crash rate with environmental factors including vehicular traffic volumes, sidewalk coverage, and signalized crossing density and coverage.

Table 6.Pedestrian Analysis of Ashland Street in Study Area

Segment			Crashes Involving Pedestrians (crashes/mi/year)	Traffic Volume[1] (vph)	Sidewalk Coverage[2] (%)	Signalized Crossing Density (cr/mi)	Signal Coverage (sig/mi)
Road	To	From					
OR 66 (Ashland St)	Siskiyou Blvd	Clay St	0.6	1,100	80%	1.0	20%
OR 66 (Ashland St)	Clay St	Boundary	1.0	1,250	65%	1.7	7%

[1] Weekday PM peak hour traffic volumes (3:15-4:15 PM) collected in September/October 2009.
[2] Sidewalk coverage calculation determined by presence of sidewalks of both sides of the street.

While the pedestrian crash experience along Ashland Street in and near the study area is less than the rate experienced along sections of Siskiyou Boulevard, the eastern portion of the study area still experienced a rate of one crash involving a pedestrian per mile for each of the ten years included in the crash analysis. A review of data indicated that there appears to be a concentration of pedestrian-related crashes near the intersection of Ashland Street with Tolman Creek Road and along the section of roadway east of Normal Avenue.

Pedestrian Network

As a part of the TSP, network and locational deficiencies in the pedestrian network was assessed through a desktop inspection of the existing roadway system. This assessment determined that there are a number of gaps in the pedestrian system along the City's major streets. Of particular significance to the Normal Avenue Plan study area are existing gaps along Walker Avenue, Clay Street and on the Ashland Street crossing over I-5.

Bicycle System

Bicycle Volumes

Based on data presented in the TSP, there is a relatively high level of bicycle activity in the study area along Walker Avenue in the vicinity of East Main Street and of Iowa Street. This activity is likely associated with the middle and elementary schools in the vicinity. A moderate level of pedestrian activity was also observed in the vicinity of Ashland Street near Walker Avenue. Traffic counts taken for the Normal Avenue Plan indicate that there is very little bicycle activity along Ashland Street near Normal Avenue or along East Main Street.

Bicycle Risk Analysis

The TSP also included segment analysis of OR 66/Ashland Street. Along with OR 99, these two corridors showed a heavy concentration of crashes involving bicyclists. Table 7 summaries the findings of bicyclist-related crash analysis along Ashland Street. This data permits a comparison of the bicyclist-involved crash rate with bicycle traffic volumes, vehicular traffic volumes, bike lane coverage (this does not include shared use roadways), and signalized crossing density and coverage.

Table 7. Bicycle Analysis of Ashland Street in Study Area

Segment			Crashes Involving Cyclists (crashes/mi/year)	Bike Volume[1] (bph)	Traffic Volume[1] (vph)	Bike Lane Coverage (%)	Signalized Crossing Density (cr/mi)	Signal Coverage (sig/mi)
Road	To	From						
OR 66 (Ashland St)	Siskiyou Blvd	Clay St	1.1	14	1,100	100%	1.0	20%
OR 66 (Ashland St)	Clay St	Boundary	1.0	3	1,250	50%	1.7	7%

[1] Weekday PM peak hour traffic volumes (3:15-4:15 PM) collected in September/October 2009.

While the bicyclist crash experience along Ashland Street in and near the study area is less than the rate experienced along sections of Siskiyou Boulevard, the study area still experienced a rate of at least one crash involving a bicyclist per mile for each of the ten years included in the crash analysis. A review of data indicated

that there appears to be a concentration of bicyclist-related crashes near the intersection of Ashland Street with Walker Avenue, along the section of roadway east of Normal Avenue, and near Tolman Creek Road.

Bicycle Network

The bicycling network in Ashland largely relies on the existing street system which provides both east/west and north/south mobility through and connecting to the study area. In addition, approximately 23 percent of the citywide cycling system includes shared use paths or greenway trails. The shared use path adjacent to the rail corridor between Tolman Creek Road and 6th Street provides a backbone for the bicycle network in and through the study area. In addition, there are on-street bike lanes on East Main Street (roadway shoulders), OR 66/Ashland Street, Tolman Creek Road, and Walker Avenue.

Crash Analysis

Crash analysis was conducted using data from the Ashland TSP, augmented by data from ODOT and the City's GIS files. Within the Normal Avenue Neighborhood Plan study area, the TSP includes roadway segment crash analysis for two boulevards (OR 66/Ashland Street and East Main Street) and one avenue (Walker Street). The TSP also includes intersection analysis at three of the six intersections evaluated in the study area. The remaining three intersections were studied based on data provided by the City. Key findings and conclusions are summarized below.

Roadway Segment Crash Analysis

In the TSP, roadway crash analysis for the two boulevards - Ashland and East Main Streets – was organized into discrete segments of varying lengths based on where the roadway cross-section and/or character changed. Within the study area only one segment for each boulevard is relevant. For avenues such as Walker Street, the TSP considered only a single segment because the cross-section and character of these streets changed minimally over their length. Table 8 summarizes the crash types for the study area street segments, while Table 9 presents crash rates. Roadway segment crash rates were calculated as crashes per million vehicle miles traveled (MVMT). Appendix F presents segment crash analysis results.

Table 8. Crash Severity Statistics for Segment Crash Data Analysis

Roadway	Extents	Length (miles)	Fatal	Injury	PDO	Unknown	Total
Boulevards							
OR 66 (Ashland Street)	OR 99 to Tolman Creek Road	1.04	0	11	36	0	47
E. Main Street	Walker Avenue to OR 66	1.78	0	2	6	0	8
Avenue							
Walker Avenue	Entire	1.13	0	5	28	1	34

Note 1: PDO means Property Damage Only
Note 2: Crash statistics above include crashes involving pedestrians and bicycles, if applicable.

As noted in the TSP, typically segments with the highest frequency of crashes are those generally known to carry the most vehicular traffic and/or are segments of longer lengths. For example, the frequency of crashes on OR 66/Ashland Street is noticeably higher than the frequency of crashes on East Main Street. The frequency of crashes along Walker Avenue is high in comparison to its volume.

Table 9. Roadway Segment Crash Rates

Roadway	Extents	Length (miles)	Daily Volume	Crash Rate (Crashes/MVMT[1] Segment Specific	Crash Rate (Crashes/MVMT[1] ODOT Facility by Type[2]
Boulevards					
OR 66 (Ashland Street)	OR 99 to Tolman Creek Road	1.04	12,000	0.86	2.02
E. Main Street	Walker Avenue to OR 66	1.78	3,500	0.29	2.27
Avenue					
Walker Avenue	Entire	1.13	3,100	2.22	1.56

[1] Crash statistics above include crashes involving pedestrians and bicycles, if applicable.
[2] ODOT crash rates by facility type are the 2009 Crash Rates by Jurisdiction and Function Classifications. The crash rates shown above are those occurring on an urban highway system for Principal Arterials (2.02), and Minor Arterials (2.27).

In the instance of both Ashland Street and East Main Street, the specific crash rates were less than the ODOT statewide crash types for the facility type. This indicates that these segments are performing better than their statewide peer facilities in terms of frequency of crashes relative to the traffic volume their carry.

Based on systemwide analysis in the TSP, the most common crash type reported is rear-end collisions. On avenues, the most common crash type reported is collisions with parked cars. The majority of segment crashes on the selected boulevards and avenues studied in the TSP are property-damage only crashes (80.6 percent on boulevards and 90.2 percent on selected higher crash avenues). Walker Avenue has a crash rate higher than the statewide average for facilities of its type which indicates that it has a potential to reduce crashes. 82 percent of the crashes reported along Walker Avenue are property damage only crashes with the most common crash type being a collision with a parked vehicle.

Intersection Crash Data Analysis

Crash analysis was performed for the six study area intersections, three of which had been analyzed as part of the TSP. The critical rate method was used in this analysis. This method involves a comparison between the crash rate calculated for an intersection and its critical crash rate. Crash rates for intersections were calculated on an annualized basis per million entering vehicles (MEV). Critical crash rates for an intersection are calculated using a weighted value for all similar intersections in the city. The comparison of intersection crash rates with their critical crash rates can then be used the identify locations where further safety analysis should be conducted. For purposes of this analysis, citywide critical crash rates for signalized and two-way stop controlled intersections from the TSP were used in developing intersection-specific critical crash rates. The observed crash rate and critical crash rate for each study area intersection is summarized in Table 10.

Table 10. Study Intersection Crash Rates and Critical Crash Rates

Study Intersection	Crash Rate	Critical Crash Rate	Exceeds Critical Rate?
Ashland Street at Walker Avenue	0.15	0.30	--
Ashland Street at Normal Avenue	0.16	0.40	--
OR 66'/Ashland Street at Tolman Creek Road	0.29	0.28	Yes
E. Main Street at Walker Avenue	0.12	0.43	--
E. Main Street at Clay Street	0.00	0.45	--
E. Main Street at Tolman Creek Road	0.08	0.47	--

As shown in Table 10, the intersection of OR 66/Ashland Street with Tolman Creek Road exceeds its critical crash rate. A more detailed review of the reported crashes at this intersection was conducted for the TSP to determine potential contributing factors, as well as potential countermeasures for reducing crashes.

OR 66 at Tolman Creek Road is a signalized intersection. The physical characteristics of the intersection, trends from ODOT crash data and potential countermeasures were discussed in the TSP and are reiterated below.

The basic physical characteristics of the intersection are:

- OR 66 has a five-lane basic cross-section on approach to the intersection.
- There are exclusive left-turn lanes on all four approaches at the intersection.
- Right-turns are served by shared through/right turn lanes on all four approaches.
- Marked crosswalks are present on all four approaches.

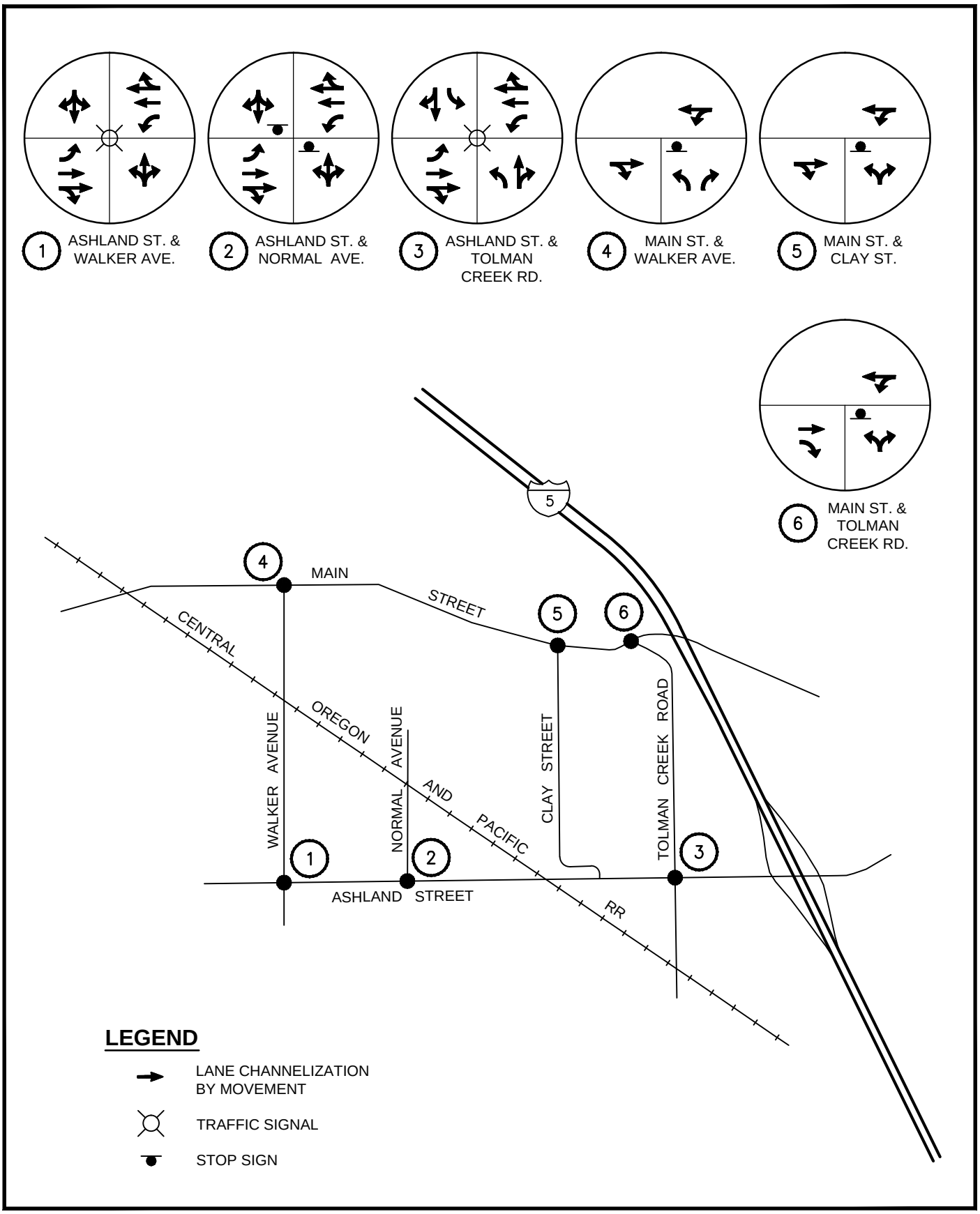
The exhibit below is an aerial view of the intersection from Google Earth illustrating the physical characteristics noted above. This exhibit was extracted from the TSP.

OR 66/Tolman Creek Road

In reviewing the ODOT crash data in more detail, the following trends were identified:

- Crashes tended to be rear end, angle or turning collisions.
- The majority of rear end crashes occurred when motorists failed to stop or were following too close to vehicles in front of them.
- The majority of turning crashes occurred when motorists turned from the wrong lane.
- The majority of angle crashes occurred when motorists disregarded the traffic signal control and/or were distracted or inattentive.

According to the TSP, the existing intersection layout does not exhibit obvious opportunities for improvement. The types of crashes reported for the intersection tend to be consistent with the types expected to occur at signalized intersections. One potential countermeasure would be to install automated enforcement such as red-light running cameras, which tend to reduce crashes associated with disregarding traffic signals. However, red light enforcement cameras have also been found to increase rear end crashes. Therefore, additional information regarding why motorists are currently failing (and historically have failed) to stop to avoid other stopped vehicles would be helpful in determining whether or not red-light enforcement cameras would be appropriate for this intersection, as well as what other countermeasures could be considered.



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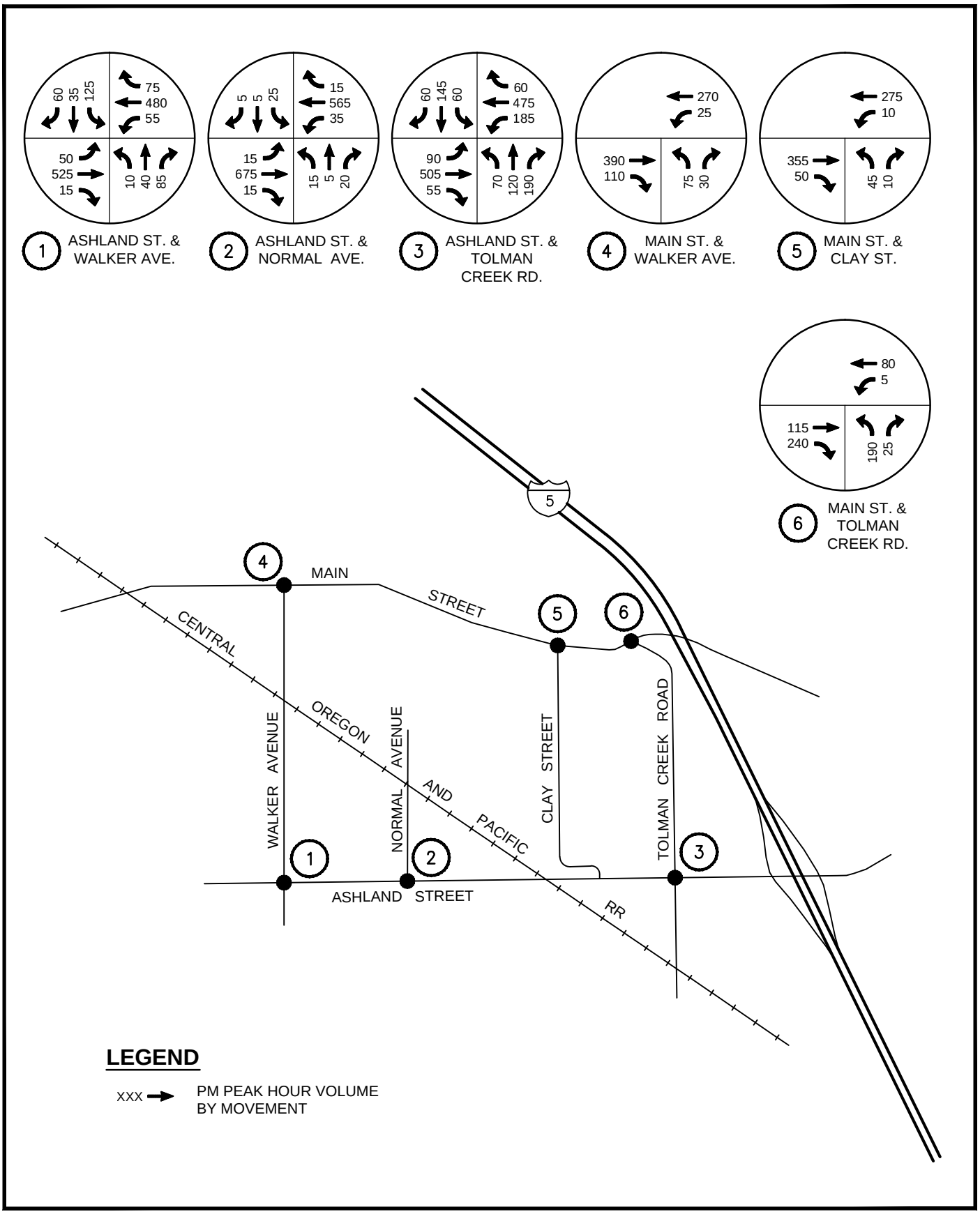
NOT TO SCALE

Figure 1
Existing Lane Configuration and Traffic Control
NORMAL AVENUE NEIGHBORHOOD PLAN



Parametrix DATE: August 30, 2012 FILE: PO2395082F-02

N

NOT TO SCALE

Figure 2
Existing Weekday PM Peak Hour Traffic Volumes
NORMAL AVENUE NEIGHBORHOOD PLAN

APPENDIX A

Existing Intersection Turning Movement Counts

Transportation Development Division
Transportation System Monitoring Unit
Vehicular Volume

Time settings

Date: 10/5/2009
Hours: 2:00 PM-6:00 PM
Weather: Clear

Source

Site Number: 15332009
Vehicle Type: Vehicles
Crossing Flow: Pedestrians

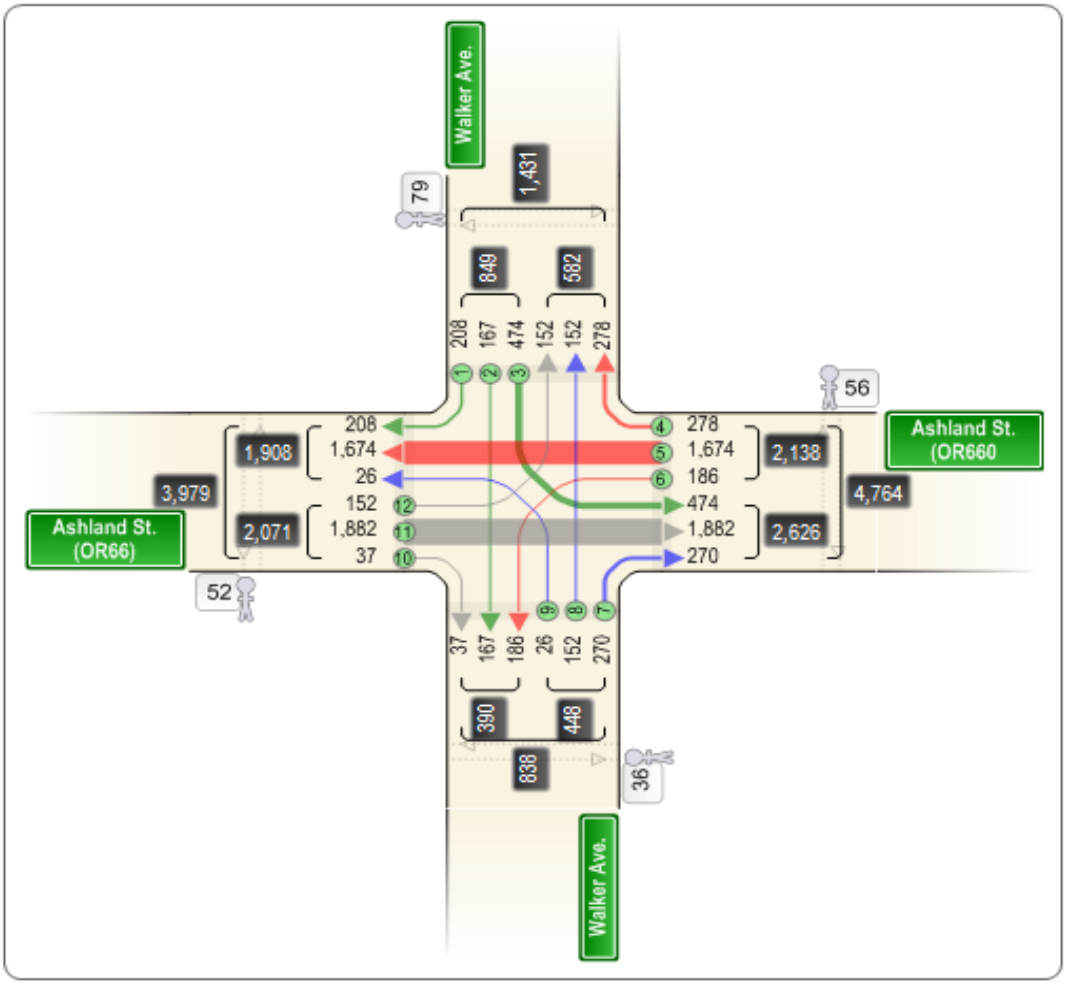
Source Description

Location Description: Ashland St.(OR66) @ Walker Ave.

4hr count 2-6P

32 bicyclists with helmets

County: Jackson
City: Ashland



Transportation Development Division
Transportation System Monitoring Unit
Vehicular Volume

Time settings

Date: 9/26/2011
Hours: 6:00 AM-10:00 PM
Weather: Clear

Source

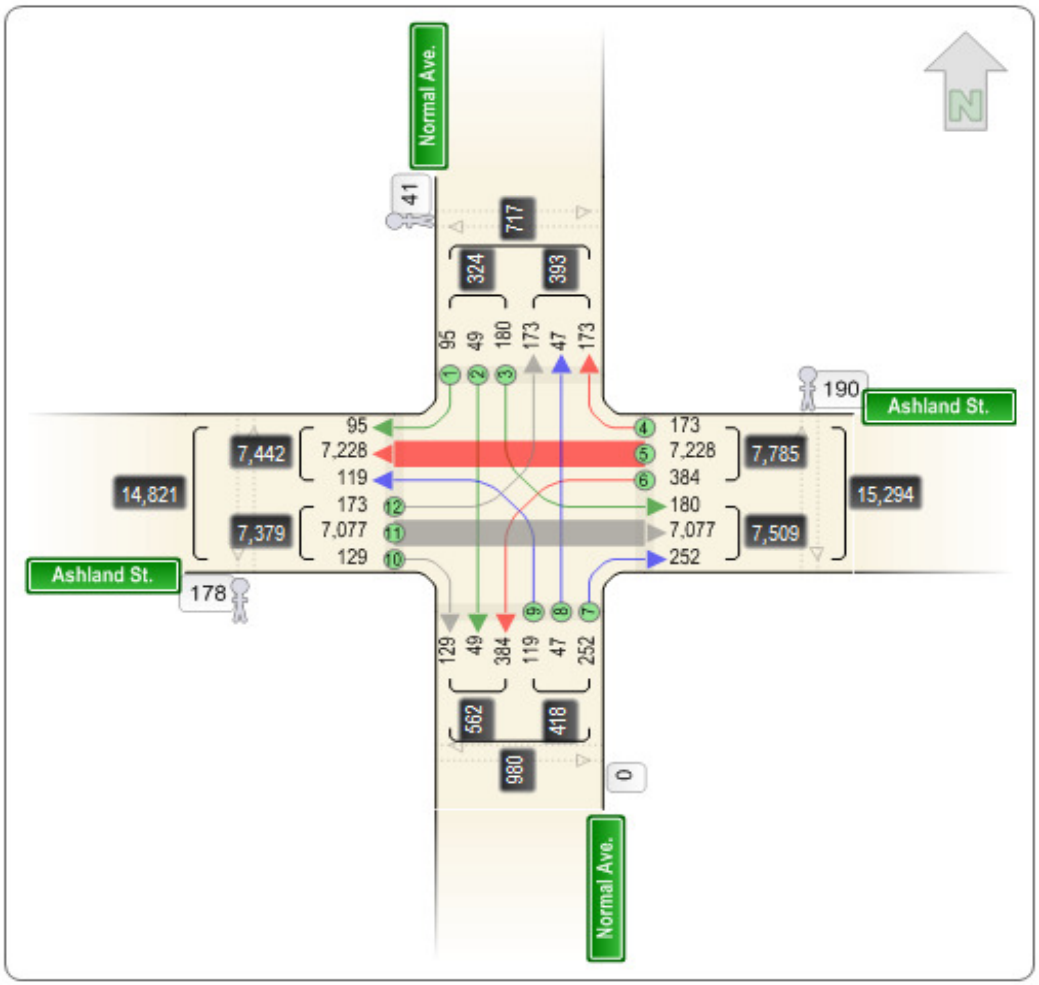
Site Number: 15082011
Street Number: 8059
Vehicle Type: Vehicles
Crossing Flow: Pedestrians

Source Description

Location Description: Ashland St. @ Normal Ave

bicyclists with helmets =
north leg = 12
east leg = 58
south leg = 18
west leg = 44

County: Jackson
City: Ashland



Transportation Development Division
Transportation System Monitoring Unit
Vehicular Volume

Time settings

Date: 9/16/2009
Hours: 6:00 AM-10:00 PM
Weather: Clear

Source

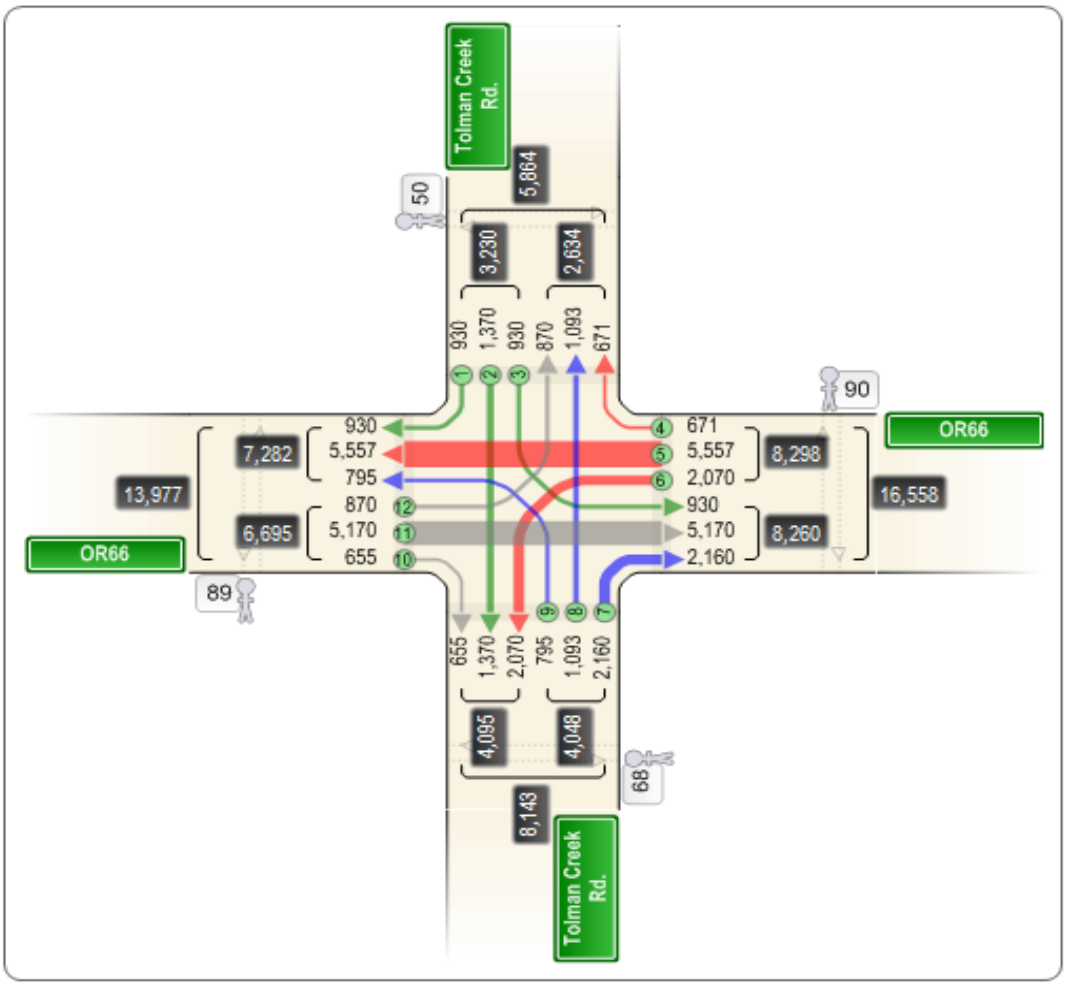
Site Number: 15112009
Mile Point: 1.04
Street Number: 021
Vehicle Type: Vehicles
Crossing Flow: Pedestrians

Source Description

Location Description: OR66 @ Tolman Creek Rd.

site 1601-west leg
91 bicyclists with helmets

County: Jackson
City: Ashland



Transportation Development Division
Transportation System Monitoring Unit
Vehicular Volume

Time settings

Date: 10/7/2009
Hours: 6:00 AM-10:00 PM
Weather: Clear

Source

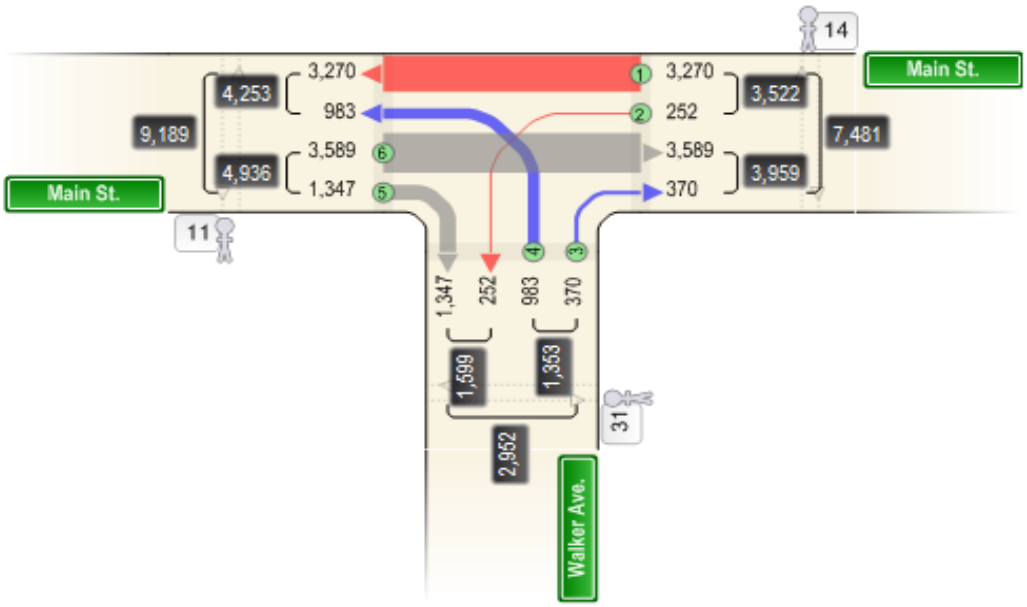
Site Number: 15022009
Vehicle Type: Vehicles
Crossing Flow: Pedestrians

Source Description

Location Description: Main St. @ Walker Ave.

bicyclists waering helmets = 70

County: Jackson
City: Ashland



Transportation Development Division
Transportation System Monitoring Unit
Vehicular Volume

Time settings

Date: 4/4/2012
Hours: 6:00 AM-10:00 PM
Weather: Cloudy

Source

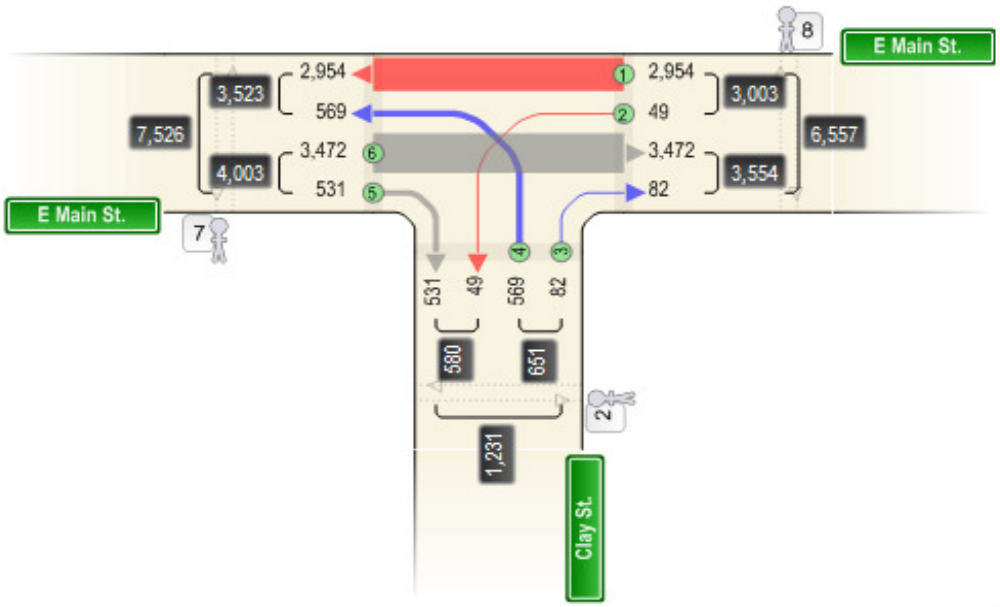
Site Number: 15022012
Street Number: 3758
Vehicle Type: Vehicles
Crossing Flow: Pedestrians

Source Description

Location Description: E Main St. @ Clay St.
expanded 6-10A 2-7P

bicyclists with helmets
east leg = 8
west leg = 8

County: Jackson
City: Ashland



Transportation Development Division
Transportation System Monitoring Unit
Vehicular Volume

Time settings

Date: 4/4/2012
Hours: 6:00 AM-10:00 PM
Weather: Cloudy

Source

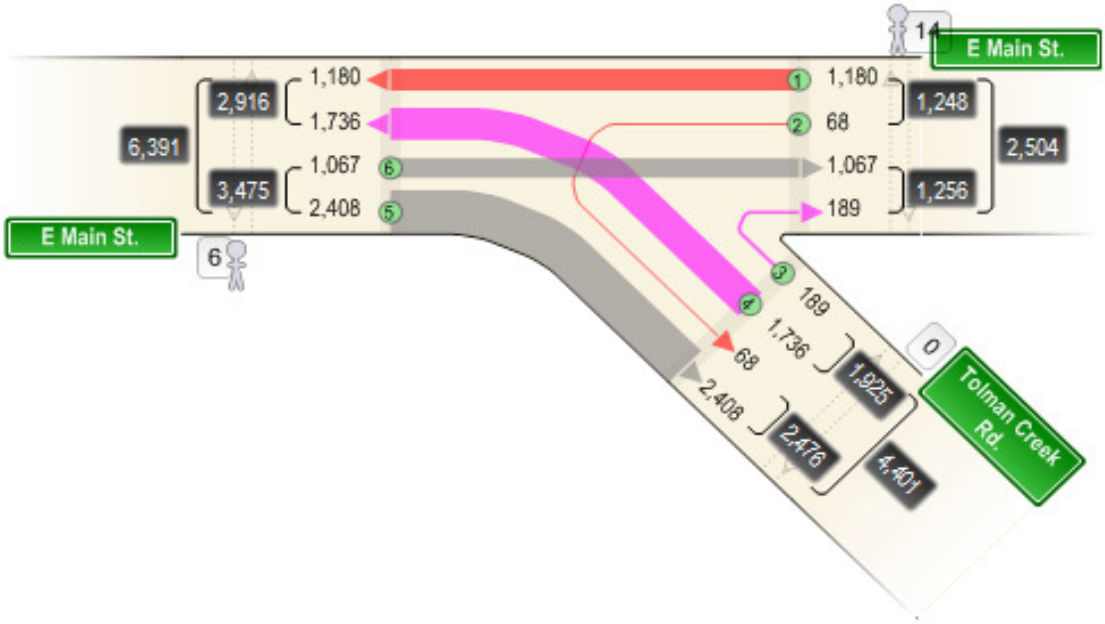
Site Number: 15012012
Street Number: 3758
Vehicle Type: Vehicles
Crossing Flow: Pedestrians

Source Description

Location Description: E Main St. @ Tolman Creek Rd.

bicyclists with helmets =
west leg = 10
east leg = 10
volume only when dark

County: Jackson
City: Ashland



APPENDIX B

Seasonally Adjusted Intersection Traffic Counts

Turning Movement Count
60 Minute Data

INTNAME	INTID	DATE	TIME	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Totals
Ashland Street at Normal Avenue	1	9/26/2011	4:15 PM - 5:15 PM	13	4	18	21	5	6	16	621	13	34	517	13	1281
Main Street at Tolman CreekRoad	2	4/4/2012	4:15 PM - 5:15 PM	164	0	23	0	0	0	0	100	210	4	71	0	572
Main Street at Clay Street	3	4/4/2012	4:15 PM - 5:15 PM	41	0	7	0	0	0	0	308	45	7	237	0	645
	24		0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25		0	0	0	0	0	0	0	0	0	0	0	0	0	0
	30		0	0	0	0	0	0	0	0	0	0	6	0	0	6
	32		0	0	0	0	0	0	0	0	0	0	0	0	0	0

Turning Movement Count
60 Minute Data - Seaonally Adjusted

INTNAME	INTID	DATE	TIME	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Totals
Ashland Street at Normal Avenue	1	9/26/2011	4:15 PM - 5:15 PM	14	4	20	23	5	7	17	677	14	37	564	14	1396
Main Street at Tolman CreekRoad	2	4/4/2012	4:15 PM - 5:15 PM	189	0	26	0	0	0	0	115	242	5	82	0	658
Main Street at Clay Street	3	4/4/2012	4:15 PM - 5:15 PM	47	0	8	0	0	0	0	354	52	8	273	0	742
	24	1/0/1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	25	1/0/1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	30	1/0/1900	0	0	0	0	0	0	0	0	0	0	6	0	0	6
	32	1/0/1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Intersection Name

Ashland Street & Normal Avenue

Lanes													
Dir	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Volume	16	621	13	34	517	13	13	4	18	21	5	6	
Adj Volume	17	677	14	37	564	14	14	4	20	23	5	7	1.09
PHF		0.94			0.94			0.94			0.94		
T%		0.0%			0.0%			0.0%			0.0%		

Completed: 8/15/2012
By: ALS

	^					Peak Hour:	4:15 PM - 5:15 PM	
	|					Count Date:	9/26/11	
	N		**SBR**	**SBT**	**SBL**			
		Trucks ⇨	0	0	0			
	Trucks	**Total ⇩**	6	5	21	**Total**	Trucks	
EBL	0	16				13	0	**WBR**
EBT	0	621				517	0	**WBT**
EBR	0	13				34	0	**WBL**
		Total⇨	13	4	18	**Total**		
		Trucks⇨	0	0	0			
			NBL	**NBT**	**NBR**			

Intersection Name

Main Street & Tolman Creek Road

Lanes													
Dir	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Volume	0	100	210	4	71	0	164	0	23	0	0	0	
Adj Volume	0	115	242	5	82	0	189	0	26	0	0	0	1.15
PHF		0.90			0.90			0.90			0.00		
T%		0.3%			1.3%			0.0%			#DIV/0!		

Completed: 8/15/2012
By: ALS

	^					Peak Hour:	4:15 PM - 5:15 PM	
	|					Count Date:	4/4/12	
	N		**SBR**	**SBT**	**SBL**			
		Trucks ⇨	0	0	0			
	Trucks	**Total ⇩**	0	0	0	**Total**	Trucks	
EBL	0	0				0	0	**WBR**
EBT	1	100				71	1	**WBT**
EBR	0	210				4	0	**WBL**
		Total⇨	164	0	23	**Total**		
		Trucks⇨	0	0	0			
			NBL	**NBT**	**NBR**			

Intersection Name

Main Street & Clay Street

Lanes													
Dir	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Volume	0	308	45	7	237	0	41	0	7	0	0	0	
Adj Volume	0	354	52	8	273	0	47	0	8	0	0	0	1.15
PHF		0.87			0.87			0.87			0.00		
T%		0.0%			0.0%			0.0%			#DIV/0!		

Completed: 8/15/2012
By: ALS

	^					Peak Hour:	4:15 PM - 5:15 PM	
	|					Count Date:	4/4/12	
	N		**SBR**	**SBT**	**SBL**			
		Trucks ⇨	0	0	0			
	Trucks	**Total ⇩**	0	0	0	**Total**	Trucks	
EBL	0	0				0	0	**WBR**
EBT	0	308				237	0	**WBT**
EBR	0	45				7	0	**WBL**
		Total⇨	41	0	7	**Total**		
		Trucks⇨	0	0	0			
			NBL	**NBT**	**NBR**			

Summary of All Turning Movements by Intersection - 2011 and 2012

	Ashland & Normal	Main & Tolman Creek	Main & Clay	Total by Time Period	Forward One-Hour Total
3:00 - 3:15	354	154	136	644	2538
3:15 - 3:30	344	179	162	685	2575
3:30 - 3:45	321	164	141	626	2510
3:45 - 4:00	293	155	135	583	2494
4:00 - 4:15	312	198	171	681	2497
4:15 - 4:30	304	164	152	620	2498
4:30 - 4:45	339	149	122	610	2537
4:45 - 5:00	301	152	133	586	2480
5:00 - 5:15	337	180	165	682	2390
5:15 - 5:30	323	178	158	659	n/a
5:30 - 5:45	301	127	125	553	n/a
5:45 - 6:00	255	131	110	496	n/a
PHF	0.94	0.90	0.87		
	1281	645	572		

APPENDIX C

Existing Traffic Operations Analysis Worksheets

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	49	524	13	57	481	73	9	39	83	124	34	60
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (ft)	100		0	100		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99	1.00		1.00	0.99			0.99			0.99	
Frt		0.996			0.980			0.914			0.963	
Flt Protected	0.950			0.950				0.997			0.972	
Satd. Flow (prot)	1630	3246	0	1614	3237	0	0	1495	0	0	1601	0
Flt Permitted	0.950			0.950				0.977			0.797	
Satd. Flow (perm)	1615	3246	0	1610	3237	0	0	1464	0	0	1308	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			21			87			22	
Link Speed (mph)		30			30			25			25	
Link Distance (ft)		1002			4493			689			1808	
Travel Time (s)		22.8			102.1			18.8			49.3	
Confl. Peds. (#/hr)	10		3	3		10	12		9	9		12
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	2%	2%	0%	3%	0%	1%	0%	3%	7%	2%	0%	2%
Adj. Flow (vph)	52	552	14	60	506	77	9	41	87	131	36	63
Shared Lane Traffic (%)												
Lane Group Flow (vph)	52	566	0	60	583	0	0	137	0	0	230	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane		Yes			Yes							
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (mph)	15		15	15		15	15		15	15		15
Number of Detectors	2	1		2	2		1	1		1	1	
Detector Template	Left			Left	Thru		Left			Left		
Leading Detector (ft)	78	183		78	223		20	18		20	18	
Trailing Detector (ft)	72	177		72	107		0	2		0	2	
Detector 1 Position(ft)	2	177		2	107		0	2		0	2	
Detector 1 Size(ft)	6	6		6	6		20	16		20	16	
Detector 1 Type	Call	Extend		Call	Extend		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)	72			72	217							
Detector 2 Size(ft)	6			6	6							
Detector 2 Type	Extend			Extend	Extend							
Detector 2 Channel												
Detector 2 Extend (s)	0.0			0.0	0.0							
Turn Type	Prot			Prot			Perm			Perm		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8			4		
Detector Phase	5	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	3.0	10.0		3.0	10.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	6.0	26.0		6.0	26.0		34.0	34.0		34.0	34.0	
Total Split (s)	25.0	39.0	0.0	20.0	34.0	0.0	29.0	29.0	0.0	29.0	29.0	0.0
Total Split (%)	28.4%	44.3%	0.0%	22.7%	38.6%	0.0%	33.0%	33.0%	0.0%	33.0%	33.0%	0.0%
Maximum Green (s)	22.0	35.0		17.0	30.0		25.0	25.0		25.0	25.0	
Yellow Time (s)	3.0	4.0		3.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	2.5	4.9		2.5	4.9		2.5	2.5		2.5	2.5	
Minimum Gap (s)	1.5	4.9		1.5	4.9		1.5	1.5		1.5	1.5	
Time Before Reduce (s)	5.0	0.0		5.0	0.0		5.0	5.0		5.0	5.0	
Time To Reduce (s)	10.0	0.0		10.0	0.0		10.0	10.0		10.0	10.0	
Recall Mode	None	Min		None	Min		None	None		None	None	
Walk Time (s)		10.0			10.0		10.0	10.0		10.0	10.0	
Flash Dont Walk (s)		12.0			12.0		20.0	20.0		20.0	20.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effct Green (s)	5.4	17.2		5.7	17.4			14.0			14.0	
Actuated g/C Ratio	0.12	0.38		0.13	0.39			0.31			0.31	
v/c Ratio	0.27	0.46		0.30	0.46			0.27			0.55	
Control Delay	27.3	13.9		27.2	13.3			8.2			18.8	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	27.3	13.9		27.2	13.3			8.2			18.8	
LOS	C	B		C	B			A			B	
Approach Delay		15.0			14.6			8.2			18.8	
Approach LOS		B			B			A			B	

Intersection Summary

Area Type: Other
Cycle Length: 88
Actuated Cycle Length: 45
Natural Cycle: 70
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.55
Intersection Signal Delay: 14.8 — Intersection LOS: B
Intersection Capacity Utilization 64.6% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 22: OR-66 & Walker Ave

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	49	524	13	57	481	73	9	39	83	124	34	60
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	4.0		3.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	0.98			0.91			0.96	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.97	
Satd. Flow (prot)	1630	3247		1614	3242			1498			1601	
Flt Permitted	0.95	1.00		0.95	1.00			0.98			0.80	
Satd. Flow (perm)	1630	3247		1614	3242			1469			1312	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	52	552	14	60	506	77	9	41	87	131	36	63
RTOR Reduction (vph)	0	2	0	0	13	0	0	60	0	0	15	0
Lane Group Flow (vph)	52	564	0	60	570	0	0	77	0	0	215	0
Confl. Peds. (#/hr)	10		3	3		10	12		9	9		12
Heavy Vehicles (%)	2%	2%	0%	3%	0%	1%	0%	3%	7%	2%	0%	2%
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8			4		
Actuated Green, G (s)	3.1	17.2		3.3	17.4			14.0			14.0	
Effective Green, g (s)	3.1	17.2		3.3	17.4			14.0			14.0	
Actuated g/C Ratio	0.07	0.38		0.07	0.38			0.31			0.31	
Clearance Time (s)	3.0	4.0		3.0	4.0			4.0			4.0	
Vehicle Extension (s)	2.5	4.9		2.5	4.9			2.5			2.5	
Lane Grp Cap (vph)	111	1227		117	1240			452			404	
v/s Ratio Prot	0.03	0.17		c0.04	c0.18							
v/s Ratio Perm								0.05			c0.16	
v/c Ratio	0.47	0.46		0.51	0.46			0.17			0.53	
Uniform Delay, d1	20.4	10.7		20.3	10.5			11.5			13.0	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	2.3	0.6		2.8	0.5			0.1			1.0	
Delay (s)	22.7	11.2		23.1	11.1			11.6			14.1	
Level of Service	C	B		C	B			B			B	
Approach Delay (s)		12.2			12.2			11.6			14.1	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	12.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	45.5	Sum of lost time (s)	7.0
Intersection Capacity Utilization	64.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	17	677	14	37	564	14	14	4	20	23	5	7
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt		0.997			0.996			0.929			0.974	
Flt Protected	0.950			0.950				0.982			0.968	
Satd. Flow (prot)	1662	3315	0	1662	3312	0	0	1596	0	0	1650	0
Flt Permitted	0.950			0.950				0.982			0.968	
Satd. Flow (perm)	1662	3315	0	1662	3312	0	0	1596	0	0	1650	0
Link Speed (mph)		30			30			25			25	
Link Distance (ft)		1382			3124			301			709	
Travel Time (s)		31.4			71.0			8.2			19.3	
Confl. Peds. (#/hr)			17			23						4
Confl. Bikes (#/hr)			16			6						1
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	18	720	15	39	600	15	15	4	21	24	5	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	18	735	0	39	615	0	0	40	0	0	36	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane		Yes			Yes							
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 39.1%	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 (veh/h)	17	677	14	37	564	14	14	4	20	23	5	7
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	18	720	15	39	600	15	15	4	21	24	5	7
Pedestrians		4						17			23	
Lane Width (ft)		12.0						12.0			12.0	
Walking Speed (ft/s)		4.0						4.0			4.0	
Percent Blockage		0						1			2	
Right turn flare (veh)												
Median type		TWLTL			TWLTL							
Median storage veh)		2			2							
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	638			752			1174	1497	385	1129	1497	334
vC1, stage 1 conf vol							781	781		709	709	
vC2, stage 2 conf vol							393	717		420	788	
vCu, unblocked vol	638			752			1174	1497	385	1129	1497	334
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)							6.5	5.5		6.5	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			95			95	99	97	92	98	99
cM capacity (veh/h)	937			854			307	292	611	318	282	652

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	18	480	255	39	400	215	40	37
Volume Left	18	0	0	39	0	0	15	24
Volume Right	0	0	15	0	0	15	21	7
cSH	937	1700	1700	854	1700	1700	413	347
Volume to Capacity	0.02	0.28	0.15	0.05	0.24	0.13	0.10	0.11
Queue Length 95th (ft)	1	0	0	4	0	0	8	9
Control Delay (s)	8.9	0.0	0.0	9.4	0.0	0.0	14.7	16.6
Lane LOS	A			A			B	C
Approach Delay (s)	0.2			0.6			14.7	16.6
Approach LOS							B	C

Intersection Summary				
Average Delay	1.2			
Intersection Capacity Utilization	39.1%	ICU Level of Service	A	
Analysis Period (min)	15			

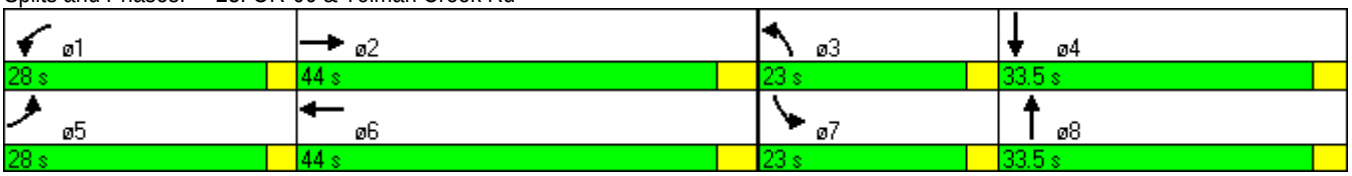
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	506	54	184	473	61	70	121	190	62	143	62
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Storage Length (ft)	100		0	100		0	100		0	100		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99	1.00		0.99	1.00		0.99	0.98		0.99	0.99	
Frt		0.986			0.983			0.908			0.955	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1662	3213	0	1630	3218	0	1662	1544	0	1614	1632	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1648	3213	0	1619	3218	0	1645	1544	0	1599	1632	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9			11			58			16	
Link Speed (mph)		35			35			25			25	
Link Distance (ft)		4493			703			1154			868	
Travel Time (s)		87.5			13.7			31.5			23.7	
Confl. Peds. (#/hr)	6		5	5		6	10		10	10		10
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	0%	1%	8%	2%	1%	2%	0%	0%	2%	3%	1%	3%
Adj. Flow (vph)	100	562	60	204	526	68	78	134	211	69	159	69
Shared Lane Traffic (%)												
Lane Group Flow (vph)	100	622	0	204	594	0	78	345	0	69	228	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane		Yes			Yes							
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (mph)	15		15	15		15	15		15	15		15
Number of Detectors	2	2		2	2		1	1		1	1	
Detector Template	Left	Thru		Left	Thru							
Leading Detector (ft)	78	223		78	223		18	18		18	18	
Trailing Detector (ft)	72	107		72	107		2	2		2	2	
Detector 1 Position(ft)	2	107		2	107		2	2		2	2	
Detector 1 Size(ft)	6	6		6	6		16	16		16	16	
Detector 1 Type	Call	Extend		Call	Extend		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)	72	217		72	217							
Detector 2 Size(ft)	6	6		6	6							
Detector 2 Type	Extend	Extend		Extend	Extend							
Detector 2 Channel												
Detector 2 Extend (s)	0.0	0.0		0.0	0.0							
Turn Type	Prot			Prot			Prot			Prot		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Detector Phase	5	2		1	6		3	8		7	4	
Switch Phase												
Minimum Initial (s)	3.0	10.0		3.0	10.0		3.0	5.0		3.0	5.0	
Minimum Split (s)	6.0	24.0		6.0	24.0		6.0	28.5		6.0	30.5	
Total Split (s)	28.0	44.0	0.0	28.0	44.0	0.0	23.0	33.5	0.0	23.0	33.5	0.0
Total Split (%)	21.8%	34.2%	0.0%	21.8%	34.2%	0.0%	17.9%	26.1%	0.0%	17.9%	26.1%	0.0%
Maximum Green (s)	25.0	40.0		25.0	40.0		20.0	30.0		20.0	30.0	
Yellow Time (s)	3.0	4.0		3.0	4.0		3.0	3.5		3.0	3.5	
All-Red Time (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	4.0	4.0	3.0	4.0	4.0	3.0	3.5	4.0	3.0	3.5	4.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	2.5	5.2		2.5	5.2		2.5	2.5		2.5	2.5	
Minimum Gap (s)	1.0	3.2		1.0	3.2		1.0	1.0		1.0	1.0	
Time Before Reduce (s)	5.0	10.0		5.0	10.0		5.0	5.0		5.0	5.0	
Time To Reduce (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Recall Mode	None	Min		None	Min		None	None		None	None	
Walk Time (s)		7.0			7.0			7.0			7.0	
Flash Dont Walk (s)		13.0			13.0			18.0			20.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effct Green (s)	9.6	25.2		15.5	34.1		9.7	23.2		9.3	22.8	
Actuated g/C Ratio	0.11	0.30		0.18	0.40		0.11	0.27		0.11	0.27	
v/c Ratio	0.53	0.65		0.69	0.46		0.41	0.75		0.39	0.51	
Control Delay	53.3	32.0		49.9	23.4		49.1	37.9		49.6	33.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	53.3	32.0		49.9	23.4		49.1	37.9		49.6	33.2	
LOS	D	C		D	C		D	D		D	C	
Approach Delay		35.0			30.2			40.0			37.0	
Approach LOS		C			C			D			D	

Intersection Summary

Area Type: Other
Cycle Length: 128.5
Actuated Cycle Length: 85.2
Natural Cycle: 75
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 34.5 Intersection LOS: C
Intersection Capacity Utilization 65.6% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 23: OR-66 & Tolman Creek Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	506	54	184	473	61	70	121	190	62	143	62
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	3.0	4.0		3.0	4.0		3.0	3.5		3.0	3.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.98		1.00	0.91		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1662	3213		1630	3220		1662	1549		1614	1634	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1662	3213		1630	3220		1662	1549		1614	1634	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	100	562	60	204	526	68	78	134	211	69	159	69
RTOR Reduction (vph)	0	6	0	0	7	0	0	42	0	0	12	0
Lane Group Flow (vph)	100	616	0	204	587	0	78	303	0	69	216	0
Confl. Peds. (#/hr)	6		5	5		6	10		10	10		10
Heavy Vehicles (%)	0%	1%	8%	2%	1%	2%	0%	0%	2%	3%	1%	3%
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	7.8	26.4		15.5	34.1		7.6	23.2		7.3	22.9	
Effective Green, g (s)	7.8	26.4		15.5	34.1		7.6	23.2		7.3	22.9	
Actuated g/C Ratio	0.09	0.31		0.18	0.40		0.09	0.27		0.08	0.27	
Clearance Time (s)	3.0	4.0		3.0	4.0		3.0	3.5		3.0	3.5	
Vehicle Extension (s)	2.5	5.2		2.5	5.2		2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	151	987		294	1278		147	418		137	436	
v/s Ratio Prot	0.06	c0.19		c0.13	0.18		c0.05	c0.20		0.04	0.13	
v/s Ratio Perm												
v/c Ratio	0.66	0.62		0.69	0.46		0.53	0.72		0.50	0.50	
Uniform Delay, d1	37.8	25.5		33.0	19.1		37.4	28.4		37.6	26.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	9.4	1.8		6.4	0.6		2.8	5.7		2.1	0.6	
Delay (s)	47.2	27.3		39.4	19.7		40.3	34.2		39.7	27.3	
Level of Service	D	C		D	B		D	C		D	C	
Approach Delay (s)		30.1			24.7			35.3			30.2	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM Average Control Delay	29.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	85.9	Sum of lost time (s)	10.0
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	388	110	25	271	76	28
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Storage Length (ft)		0	0		0	100
Storage Lanes		0	0		1	1
Taper Length (ft)		25	25		25	25
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.970					0.850
Flt Protected				0.996	0.950	
Satd. Flow (prot)	1596	0	0	1647	1614	1293
Flt Permitted				0.996	0.950	
Satd. Flow (perm)	1596	0	0	1647	1614	1293
Link Speed (mph)	25			40	25	
Link Distance (ft)	1205			775	1627	
Travel Time (s)	32.9			13.2	44.4	
Confl. Peds. (#/hr)		1	1		1	8
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	7%	4%	4%	6%	3%	15%
Adj. Flow (vph)	413	117	27	288	81	30
Shared Lane Traffic (%)						
Lane Group Flow (vph)	530	0	0	315	81	30
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (mph)		15	15		15	15
Sign Control	Free			Free	Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 51.3%		ICU Level of Service A	
Analysis Period (min) 15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	388	110	25	271	76	28
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	413	117	27	288	81	30
Pedestrians	1			8	1	
Lane Width (ft)	12.0			12.0	12.0	
Walking Speed (ft/s)	4.0			4.0	4.0	
Percent Blockage	0			1	0	
Right turn flare (veh)						4
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			531		815	480
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			531		815	480
tC, single (s)			4.1		6.4	6.4
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.4
p0 queue free %			97		76	95
cM capacity (veh/h)			1026		336	556

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	530	315	111
Volume Left	0	27	81
Volume Right	117	0	30
cSH	1700	1026	460
Volume to Capacity	0.31	0.03	0.24
Queue Length 95th (ft)	0	2	23
Control Delay (s)	0.0	1.0	17.1
Lane LOS		A	C
Approach Delay (s)	0.0	1.0	17.1
Approach LOS			C

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	51.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	354	52	8	273	47	8
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.983				0.981	
Flt Protected				0.999	0.959	
Satd. Flow (prot)	1720	0	0	1748	1646	0
Flt Permitted				0.999	0.959	
Satd. Flow (perm)	1720	0	0	1748	1646	0
Link Speed (mph)	40			40	25	
Link Distance (ft)	581			677	1193	
Travel Time (s)	9.9			11.5	32.5	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	407	60	9	314	54	9
Shared Lane Traffic (%)						
Lane Group Flow (vph)	467	0	0	323	63	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 33.7%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	354	52	8	273	47	8
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	407	60	9	314	54	9
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			467		769	437
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			467		769	437
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		85	99
cM capacity (veh/h)			1105		369	624

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	467	323	63
Volume Left	0	9	54
Volume Right	60	0	9
cSH	1700	1105	392
Volume to Capacity	0.27	0.01	0.16
Queue Length 95th (ft)	0	1	14
Control Delay (s)	0.0	0.3	15.9
Lane LOS		A	C
Approach Delay (s)	0.0	0.3	15.9
Approach LOS			C

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	33.7%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (vph)	115	242	5	82	189	26
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Storage Length (ft)		50	0		0	0
Storage Lanes		1	0		1	0
Taper Length (ft)		25	25		25	25
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt		0.850			0.984	
Flt Protected				0.997	0.958	
Satd. Flow (prot)	1750	1488	0	1727	1650	0
Flt Permitted				0.997	0.958	
Satd. Flow (perm)	1750	1488	0	1727	1650	0
Link Speed (mph)	40			40	25	
Link Distance (ft)	191			247	540	
Travel Time (s)	3.3			4.2	14.7	
Confl. Peds. (#/hr)		1				
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	0%	0%	1%	1%	0%	0%
Adj. Flow (vph)	128	269	6	91	210	29
Shared Lane Traffic (%)						
Lane Group Flow (vph)	128	269	0	97	239	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.11	1.11	1.11	1.11	1.11	1.11
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 28.9%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBT	EBR	WBL	WBT	NWL	NWR
Lane Configurations						
Volume (veh/h)	115	242	5	82	189	26
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	128	269	6	91	210	29
Pedestrians					1	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			398		231	129
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			398		231	129
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		72	97
cM capacity (veh/h)			1165		757	926

Direction, Lane #	EB 1	EB 2	WB 1	NW 1
Volume Total	128	269	97	239
Volume Left	0	0	6	210
Volume Right	0	269	0	29
cSH	1700	1700	1165	774
Volume to Capacity	0.08	0.16	0.00	0.31
Queue Length 95th (ft)	0	0	0	33
Control Delay (s)	0.0	0.0	0.5	11.7
Lane LOS			A	B
Approach Delay (s)	0.0		0.5	11.7
Approach LOS				B

Intersection Summary			
Average Delay	3.9		
Intersection Capacity Utilization	28.9%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX D

Existing Traffic Queuing at Signalized Intersections

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	52	566	60	583	137	230
v/c Ratio	0.27	0.46	0.30	0.46	0.27	0.55
Control Delay	27.3	13.9	27.2	13.3	8.2	18.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.3	13.9	27.2	13.3	8.2	18.8
Queue Length 50th (ft)	13	59	15	58	9	45
Queue Length 95th (ft)	51	141	57	139	48	128
Internal Link Dist (ft)		922		4413	609	1728
Turn Bay Length (ft)	100		100			
Base Capacity (vph)	907	2543	694	2364	958	835
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.22	0.09	0.25	0.14	0.28

Intersection Summary

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	100	622	204	594	78	345	69	228
v/c Ratio	0.53	0.65	0.69	0.46	0.41	0.75	0.39	0.51
Control Delay	53.3	32.0	49.9	23.4	49.1	37.9	49.6	33.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.3	32.0	49.9	23.4	49.1	37.9	49.6	33.2
Queue Length 50th (ft)	54	157	108	132	41	144	37	98
Queue Length 95th (ft)	129	276	224	230	106	#356	97	226
Internal Link Dist (ft)		4413		623		1074		788
Turn Bay Length (ft)	100		100		100		100	
Base Capacity (vph)	547	1697	537	1730	438	645	425	654
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.37	0.38	0.34	0.18	0.53	0.16	0.35

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

APPENDIX E

Multi-Modal Level of Service Analysis

Multimodal Level of Service for Urban Streets

Results

Street: OR66 (Ashland Street)

Date: 40522

Limits: OR99 (Siskyou Boulevard) to Tolman Creek Road

Observer: MJB

Analysis Direction:	EB
(Down Direction on this Sheet)	

Auto LOS Model:	NCHRP 3-70 Stops Model

Siskyou

1004 ft
35 mph
1069 vph
2 lanes

Seg. #1

Seg 1	Score	Seg LOS	Int LOS
Auto	2.14	B	N/A
Transit	2.98	C	N/A
Bike	3.91	A	B
Ped	3.03	C	B

Walker

4508 ft
35 mph
1086 vph
2 lanes

Seg. #2

Seg 2	Score	Seg LOS	Int LOS
Auto	2.14	B	N/A
Transit	3.00	C	N/A
Bike	4.11	A	B
Ped	3.17	C	B

Tolman Creek

0 ft
0 mph
0 vph
0 lanes

Seg. #3

Seg 3	Score	Seg LOS	Int LOS
Auto	N/A	#N/A	N/A
Transit	#DIV/0!	N/A	N/A
Bike	#DIV/0!	#DIV/0!	D
Ped	#DIV/0!	A	#DIV/0!

0

0 ft
0 mph
0 vph
0 lanes

Seg. #4

Seg 4	Score	Seg LOS	Int LOS
Auto	N/A	#N/A	N/A
Transit	#DIV/0!	N/A	N/A
Bike	#DIV/0!	#DIV/0!	D
Ped	#DIV/0!	A	#DIV/0!

0

0 ft
0 mph
0 vph
0 lanes

Seg. #5

Seg 5	Score	Seg LOS	Int LOS
Auto	N/A	#N/A	N/A
Transit	#DIV/0!	N/A	N/A
Bike	#DIV/0!	#DIV/0!	D
Ped	#DIV/0!	A	#DIV/0!

0

Street	Score	LOS
Auto	2.14	B
Transit	2.99	C
Bike	4.07	D
Ped	3.14	C

Multimodal Level of Service for Urban Streets

Results

Street: OR66 (Ashland Street)

Date: 40522

Limits: Tolman Creek Road to OR99 (Siskyou Boulevard

Observer: MJB

Analysis Direction:	WB

(Down Direction on this Sheet)

Auto LOS Model:	NCHRP 3-70 Stops Model

Tolman Creek

4508 ft
35 mph
1112 vph
2 lanes

Seg. #1

Seg 1	Score	Seg LOS	Int LOS
Auto	2.14	B	N/A
Transit	2.99	C	N/A
Bike	3.87	A	B
Ped	3.13	C	B

Walker

1004 ft
30 mph
0 vph
2 lanes

Seg. #2

Seg 2	Score	Seg LOS	Int LOS
Auto	2.14	B	N/A
Transit	2.99	C	N/A
Bike	3.42	A	B
Ped	3.15	B	C

Siskyou

0 ft
0 mph
0 vph
0 lanes

Seg. #3

Seg 3	Score	Seg LOS	Int LOS
Auto	N/A	#N/A	N/A
Transit	#DIV/0!	N/A	N/A
Bike	#DIV/0!	#DIV/0!	D
Ped	#DIV/0!	A	#DIV/0!

0

0 ft
0 mph
0 vph
0 lanes

Seg. #4

Seg 4	Score	Seg LOS	Int LOS
Auto	N/A	#N/A	N/A
Transit	#DIV/0!	N/A	N/A
Bike	#DIV/0!	#DIV/0!	D
Ped	#DIV/0!	A	#DIV/0!

0

0 ft
0 mph
0 vph
0 lanes

Seg. #5

Seg 5	Score	Seg LOS	Int LOS
Auto	N/A	#N/A	N/A
Transit	#DIV/0!	N/A	N/A
Bike	#DIV/0!	#DIV/0!	D
Ped	#DIV/0!	A	#DIV/0!

0

Street	Score	LOS
Auto	2.14	B
Transit	2.99	C
Bike	3.79	D
Ped	3.13	C

Multimodal Level of Service for Urban Streets

Results

Street: E Main Street

Date: 40522

Limits: OR99 (Siskyou Boulevard) to OR66 (Ashland Street)

Observer: MJB

Analysis Direction:	EB
(Down Direction on this Sheet)	

Auto LOS Model:	NCHRP 3-70 Stops Model

OR99

2842 ft
25 mph
581 vph
1 lanes

Seg. #1

Seg 1	Score	Seg LOS	Int LOS
Auto	2.14	B	N/A
Transit	#DIV/0!	N/A	N/A
Bike	4.41	B	B
Ped	2.97	B	B

Mountain

3031 ft
25 mph
700 vph
1 lanes

Seg. #2

Seg 2	Score	Seg LOS	Int LOS
Auto	2.34	B	N/A
Transit	#DIV/0!	N/A	N/A
Bike	3.85	A	B
Ped	3.23	D	B

Walker

4232 ft
40 mph
590 vph
1 lanes

Seg. #3

Seg 3	Score	Seg LOS	Int LOS
Auto	2.34	B	N/A
Transit	#DIV/0!	N/A	N/A
Bike	4.20	B	C
Ped	3.53	E	B

Tolman Creek

5157 ft
45 mph
11 vph
2 lanes

Seg. #4

Seg 4	Score	Seg LOS	Int LOS
Auto	2.14	B	N/A
Transit	4.03	D	N/A
Bike	2.95	A	A
Ped	3.02	C	B

Ashland Street

0 ft
0 mph
0 vph
0 lanes

Seg. #5

Seg 5	Score	Seg LOS	Int LOS
Auto	N/A	#N/A	N/A
Transit	#DIV/0!	N/A	N/A
Bike	#DIV/0!	#DIV/0!	D
Ped	#DIV/0!	A	#DIV/0!

0

Street	Score	LOS
Auto	2.24	B
Transit	1.36	A
Bike	3.75	D
Ped	3.20	C

Multimodal Level of Service for Urban Streets

Results

Street: E Main Street

Date: 40522

Limits: OR66 (Ashland Street) to OR99 (Lithia way)

Observer: MJB

Analysis Direction:	WB
(Down Direction on this Sheet)	

Auto LOS Model: NCHRP 3-70 Stops Model

Ashland

5157 ft
45 mph
693 vph
2 lanes

Seg. #1

Seg 1	Score	Seg LOS	Int LOS
Auto	2.34	B	N/A
Transit	4.06	D	N/A
Bike	3.75	C	A
Ped	3.21	D	A

Tollman Creek

4232 ft
40 mph
693 vph
1 lanes

Seg. #2

Seg 2	Score	Seg LOS	Int LOS
Auto	2.34	B	N/A
Transit	#DIV/0!	N/A	N/A
Bike	3.90	B	B
Ped	3.45	E	A

Walker

3031 ft
25 mph
673 vph
1 lanes

Seg. #3

Seg 3	Score	Seg LOS	Int LOS
Auto	2.14	B	N/A
Transit	#DIV/0!	N/A	N/A
Bike	4.20	A	C
Ped	3.35	D	B

Mountain

2842 ft
25 mph
0 vph
1 lanes

Seg. #4

Seg 4	Score	Seg LOS	Int LOS
Auto	2.34	B	N/A
Transit	#DIV/0!	N/A	N/A
Bike	4.08	B	B
Ped	2.72	B	B

Lithia

0 ft
0 mph
0 vph
0 lanes

Seg. #5

Seg 5	Score	Seg LOS	Int LOS
Auto	N/A	#N/A	N/A
Transit	#DIV/0!	N/A	N/A
Bike	#DIV/0!	#DIV/0!	D
Ped	#DIV/0!	A	#DIV/0!

0

Street	Score	LOS
Auto	2.29	B
Transit	1.37	A
Bike	3.94	D
Ped	3.21	C

Multimodal Level of Service for Urban Streets

Results

Street: Tolman Creek Road

Date: 40522

Limits: E Main Street to Ashland Street

Observer: EMF

Analysis Direction:	NB
(Down Direction on this Sheet)	

Auto LOS Model:	NCHRP 3-70 Stops Model

Siskiyou Blvd

2510 ft
25 mph
339 vph
1 lanes

Seg. #1

Seg 1	Score	Seg LOS	Int LOS
Auto	2.34	B	N/A
Transit	2.85	C	N/A
Bike	3.98	A	A
Ped	2.18	B	B

Mistletoe Rd

1110 ft
25 mph
192 vph
1 lanes

Seg. #2

Seg 2	Score	Seg LOS	Int LOS
Auto	2.14	B	N/A
Transit	2.91	C	N/A
Bike	3.61	A	A
Ped	2.58	B	B

Ashland St

2925 ft
25 mph
0 vph
1 lanes

Seg. #3

Seg 3	Score	Seg LOS	Int LOS
Auto	2.34	B	N/A
Transit	2.94	C	N/A
Bike	3.37	A	A
Ped	2.78	D	C

E Main Street

0 ft
0 mph
0 vph
0 lanes

Seg. #4

Seg 4	Score	Seg LOS	Int LOS
Auto	N/A	#N/A	N/A
Transit	#DIV/0!	N/A	N/A
Bike	#DIV/0!	#DIV/0!	D
Ped	#DIV/0!	A	#DIV/0!

0

0 ft
0 mph
0 vph
0 lanes

Seg. #5

Seg 5	Score	Seg LOS	Int LOS
Auto	N/A	#N/A	N/A
Transit	#DIV/0!	N/A	N/A
Bike	#DIV/0!	#DIV/0!	D
Ped	#DIV/0!	A	#DIV/0!

0

Street	Score	LOS
Auto	2.27	B
Transit	2.90	C
Bike	3.65	D
Ped	2.52	B

Multimodal Level of Service for Urban Streets

Results

Street: Tolman Creek Road

Date: 40522

Limits: E Main Street to Ashland Street

Observer: EMF

Analysis Direction:	SB
(Down Direction on this Sheet)	

Auto LOS Model: NCHRP 3-70 Stops Model

E Main Street

2925 ft
25 mph
327 vph
1 lanes

Seg. #1

Seg 1	Score	Seg LOS	Int LOS
Auto	2.14	B	N/A
Transit	2.97	C	N/A
Bike	3.90	A	B
Ped	3.02	C	B

Ashland Street

1110 ft
25 mph
499 vph
1 lanes

Seg. #2

Seg 2	Score	Seg LOS	Int LOS
Auto	2.34	B	N/A
Transit	2.90	C	N/A
Bike	3.20	A	A
Ped	2.52	B	B

Mistletoe Rd

2510 ft
25 mph
71 vph
1 lanes

Seg. #3

Seg 3	Score	Seg LOS	Int LOS
Auto	2.34	B	N/A
Transit	2.87	C	N/A
Bike	3.95	B	B
Ped	2.27	B	B

Siskiyou Blvd

0 ft
0 mph
0 vph
0 lanes

Seg. #4

Seg 4	Score	Seg LOS	Int LOS
Auto	N/A	#N/A	N/A
Transit	#DIV/0!	N/A	N/A
Bike	#DIV/0!	#DIV/0!	D
Ped	#DIV/0!	A	#DIV/0!

0

0 ft
0 mph
0 vph
0 lanes

Seg. #5

Seg 5	Score	Seg LOS	Int LOS
Auto	N/A	#N/A	N/A
Transit	#DIV/0!	N/A	N/A
Bike	#DIV/0!	#DIV/0!	D
Ped	#DIV/0!	A	#DIV/0!

0

Street	Score	LOS
Auto	2.27	B
Transit	2.92	C
Bike	3.80	D
Ped	2.65	B

Multimodal Level of Service for Urban Streets

Results

Street: Walker Avenue

Date: 40522

Limits: Full Length

Observer: EMF

Analysis Direction:	NB
(Down Direction on this Sheet)	
Auto LOS Model:	NCHRP 3-70 Stops Model

Southern End

2365 ft
25 mph
109 vph
1 lanes

Seg. #1

Seg 1	Score	Seg LOS	Int LOS
Auto	2.34	B	N/A
Transit	2.88	C	N/A
Bike	4.38	A	A
Ped	2.38	B	B

Siskiyou Blvd

665 ft
25 mph
112 vph
1 lanes

Seg. #2

Seg 2	Score	Seg LOS	Int LOS
Auto	2.34	B	N/A
Transit	2.92	C	N/A
Bike	3.38	A	A
Ped	2.67	C	B

Ashland St

1795 ft
25 mph
242 vph
1 lanes

Seg. #3

Seg 3	Score	Seg LOS	Int LOS
Auto	2.34	B	N/A
Transit	2.86	C	N/A
Bike	4.28	A	A
Ped	2.22	B	B

Iowa St

1635 ft
25 mph
0 vph
1 lanes

Seg. #4

Seg 4	Score	Seg LOS	Int LOS
Auto	2.34	B	N/A
Transit	#DIV/0!	N/A	N/A
Bike	3.72	A	A
Ped	2.25	A	B

E Main St

0 ft
0 mph
0 vph
0 lanes

Seg. #5

Seg 5	Score	Seg LOS	Int LOS
Auto	N/A	#N/A	N/A
Transit	#DIV/0!	N/A	N/A
Bike	#DIV/0!	#DIV/0!	D
Ped	#DIV/0!	A	#DIV/0!

0

Street	Score	LOS
Auto	2.34	B
Transit	2.15	B
Bike	4.08	D
Ped	2.33	B

Multimodal Level of Service for Urban Streets

Results

Street: Walker Avenue

Date: 40522

Limits: Full Length

Observer: EMF

Analysis Direction:	SB
(Down Direction on this Sheet)	
Auto LOS Model:	NCHRP 3-70 Stops Model

E Main St

1635 ft
25 mph
327 vph
1 lanes

Seg. #1

Seg 1	Score	Seg LOS	Int LOS
Auto	2.34	B	N/A
Transit	#DIV/0!	N/A	N/A
Bike	3.05	A	A
Ped	2.15	B	A

Iowa St

1795 ft
25 mph
60 vph
1 lanes

Seg. #2

Seg 2	Score	Seg LOS	Int LOS
Auto	2.34	B	N/A
Transit	2.92	C	N/A
Bike	3.40	A	A
Ped	2.67	C	B

Ashland St

665 ft
25 mph
80 vph
1 lanes

Seg. #3

Seg 3	Score	Seg LOS	Int LOS
Auto	2.34	B	N/A
Transit	2.89	C	N/A
Bike	3.64	A	A
Ped	2.42	C	B

Siskiyou Blvd

2365 ft
25 mph
0 vph
1 lanes

Seg. #4

Seg 4	Score	Seg LOS	Int LOS
Auto	2.34	B	N/A
Transit	#DIV/0!	N/A	N/A
Bike	2.75	A	A
Ped	#DIV/0!	B	#DIV/0!

Southern End

0 ft
0 mph
0 vph
0 lanes

Seg. #5

Seg 5	Score	Seg LOS	Int LOS
Auto	N/A	#N/A	N/A
Transit	#DIV/0!	N/A	N/A
Bike	#DIV/0!	#DIV/0!	D
Ped	#DIV/0!	A	#DIV/0!

0

Street	Score	LOS
Auto	2.34	B
Transit	1.11	A
Bike	3.10	C
Ped	1.53	A

APPENDIX F

Roadway Segment and Intersection Crash Analysis

Intersection Crash Rate Calculator

Intersection	Peak Hour Vol.	Daily Vol.	10-Year TEV	10-Year MEV	Crash Total	Crash/Year	Intersection Type	Crash Rate	Critical Rate	Over Critical?
Ashland/Walker	1,499	14,990	54713500	54.7	8	0.8	1	0.15	0.30	-
Ashland/Normal	1,396	13,960	50954000	51.0	8	1.6	2	0.16	0.40	-
Ashland/Tolman Creek	1,919	19,190	70043500	70.0	20	2	1	0.29	0.28	Yes
E. Main/Walker	937	9,370	34200500	34.2	4	0.4	2	0.12	0.43	-
E. Main/Clay	742	7,420	27083000	27.1	0	0	2	0.00	0.45	-
E. Main/Tolman Creek	659	6,590	24053500	24.1	2	0.4	2	0.08	0.47	-

Daily Volumes: Peak Hour / 0.10
10-Year TEV: Daily Volume x 365 x 10
10-Year MEV: 10-Year Volume / 1,000,000
Crash/Year: Crash Total / 10
Crash Rate: Crash Total / 10-Year MEV
Critical Rate: Average Crash Rate per Intersection Type x (1.645 + (Sq Root of (Average Crash Rate per Intersection Type/10-Year MEV)) + (1/(2 * 10-Year MEV))

Weighted average crash rate for reference population

Signalized	1	0.19
Two-Way Stop	2	0.27

Intersection Crash Analysis from TSP

Intersection:	OR 66/Tolman Creek Road		Mile Post	
Vehicles Entering Intersection =		1,919		
Number of Crashes =		20		
Time Period =		10		
Crash Rate =	1,919	20 / 365	1,000,000 / 10	**2.86** *Crashes/MEV*
Intersection:	OR 66/Walker Street		Mile Post	
Vehicles Entering Intersection =		1,499		
Number of Crashes =		8		
Time Period =		10		
Crash Rate =	1,499	8 / 365	1,000,000 / 10	**1.46** *Crashes/MEV*
Intersection:	E Main Street/Walker Avenue		Mile Post	
Vehicles Entering Intersection =		937		
Number of Crashes =		0		
Time Period =		10		
Crash Rate =	937	0 / 365	1,000,000 / 10	**0.00** *Crashes/MEV*

Roadway Segment Crash Analysis from TSP

Street Name:	**E Main Street**					
From:	Walker Avenue	Mile Post				
To:	OR 66	Mile Post				
Average Daily Traffic =		3,500				
Length of Segment (miles) =		1.78				
Number of Crashes =		8				
Time Period (years) =		12				
Crash Rate =		8	1,000,000			**0.29** *Crashes/MVM*
	3,500	365	12	1.78		

Street Name:	**OR 66**					
From:	OR 99	Mile Post				
To:	Tolman Creek Road	Mile Post				
Average Daily Traffic =		12,000				
Length of Segment (miles) =		1.04				
Number of Crashes =		47				
Time Period (years) =		12				
Crash Rate =		47	1,000,000			**0.86** *Crashes/MVM*
	12,000	365	12	1.04		

Street Name:	**Walker Avenue**					
From:	E Main Street	Mile Post				
To:	Peachey Road	Mile Post				
Average Daily Traffic =		3,100				
Length of Segment (miles) =		1.13				
Number of Crashes =		34				
Time Period (years) =		12				
Crash Rate =		34	1,000,000			**2.22** *Crashes/MVM*
	3,100	365	12	1.13		