Summary of South Thurston County License Plate Survey

Thurston Regional Planning Council
October 2007

THURSTON REGIONAL PLANNING COUNCIL (TRPC) is a 21-member intergovernmental board made up of local governmental jurisdictions within Thurston County, plus the Confederated Tribes of the Chehalis Reservation and the Nisqually Indian Tribe. The Council was established in 1967 under RCW 36.70.060, which authorized creation of regional planning councils.

TRPC's mission is to **"Provide Visionary Leadership on Regional Plans, Policies, and Issues."** The primary functions of TRPC are to develop regional plans and policies for **transportation** [as the federally recognized Metropolitan Planning Organization (MPO) and state recognized Regional Transportation Planning Organization (RTPO)], **growth management, environmental quality**, and other topics determined by the Council; provide **data and analysis to support local and regional decision making;** act as a "**convener**" to build **community consensus** on regional issues through information and citizen involvement; build **intergovernmental consensus** on regional plans, policies, and issues, and advocate local implementation; and provide **planning, historic preservation, and technical services** on a contractual basis.

This report was prepared as part of the Thurston Regional Planning Council's 2007 regional work program.

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Executive Summary

Results of the May 2005 South Thurston County License Plate Survey validated some previous regional transportation findings and added complexity to an emerging picture of rural mobility in this region.

First, survey data analysis validated initial conclusions first pointed to by the 2025 regional travel demand model. That is, the few north-south connections between south Thurston County and the north urban area are exhibiting very strong directional flows *into* the north urban area in the morning and *out of* that same area in the evening. This is characteristic of suburban traffic flows and based on existing and future land uses, can be expected to increase congestion pressures on rural roads well into the future. Travel patterns on Rainier Road, Old Highway 99, and SR 510 all exhibit this suburban commute flow characteristic.

Second, survey data analysis points to a relative balance of east-west traffic throughout the day on SR 507. This includes an approximate balance of traffic between Thurston County and Pierce County during both commute periods, as well as between Thurston County and Lewis County. It also seems to suggest a balance within the commerce corridor of Yelm, Rainier, and Tenino. In a greatly scaled back way, SR 507 traffic is mimicking the east-west balance exhibited in the more mature Lacey-Olympia-Tumwater commercial centers to the north.

Third, Yelm is a significant destination. Based on trip time characteristics this appears to apply to commute-type trips as well as non-commute trips like retail and commerce. Yelm is not only a destination for trips originating in Thurston County but it is a pull for trips originating in Pierce County. In fact, survey data suggests that for every two non-commute trips that leave Thurston County for Pierce County, three of those trips leave Pierce County for Yelm.

Fourth, southeast Thurston County is a major generator of trips. Those trips have a very pronounced directional flow to them, *out* of southeast Thurston County in the morning and *back* in the evening. Most of this flow is accommodated by a small handful of rural roads. Trip destinations determine whether they route through Rainier or Yelm or go directly to Pierce County via Vail Road. As those numbers increase it will place an increasing burden on rural roads as well as the small cities that have to accommodate these trips on their local networks.

Fifth, while it provides the most direct access to I-5, the Old Grand Mound – Tenino Highway is by far the most minor facility in terms of volume and suburban travel characteristics within the entire south county survey study area. It would appear that the location of that connection – midway between Tumwater and Chehalis – is such that I-5 does not yet generate the kind of travel demand that would be expected by such a direct connection. This is in contrast to other interstate connections throughout the region that are already at or near capacity.

The data generated by this survey provides a unique picture of south county traffic flows and route patterns. It also suggests just how ambitious an effort it was to cordon off these major rural facilities to capture such a multi-dimensional picture. There is an immense amount of data that will have value for projects and studies for several years to come.

At the same time, there are certain spatial gaps that render the data limited in value for some applications. Users and interested parties are encouraged to contact Thurston Regional Planning Council to discuss potential project applications and ways in which the data can be extracted for specific purposes. This report provides but a high level summary of some basic observations. The greatest value will come as the data are tailored and applied to particular studies and projects.

Thurston Regional Planning Council is grateful to its partners at the Washington State Department of Transportation – Olympic Region, and Thurston County Roads and Transportation Services for their support and assistance in this effort. Financial support was also provided by the Planning and Programming Service Center of the Washington State Department of Transportation. Public works and administrative staff in Bucoda, Rainier, Tenino, and Yelm also provided assistance with this effort.

Introduction

Analysis conducted for Thurston Regional Planning Council's 2025 *Regional Transportation Plan* (RTP) pointed to some emerging issues on the region's rural road network. First, strong directional patterns on the primary north-south roads suggested an increasingly suburban traffic character. These patterns reflected strong directional splits towards the Lacey-Olympia-Tumwater urban area in the morning period and away from it in the evening period. This directional split became even more pronounced in the 2025 forecast period. At the same time, RTP analysis highlighted growing levels of congestion on these roads based on current and future land use in rural Thurston County. Acceptable congestion is based on adopted rural level of service standards deemed appropriate for these types of roads. The long-range regional analyses suggested the need for a more focused look at rural traffic conditions in order to better understand and plan for current and future rural mobility needs.

While the RTP pointed to future needs, there are already several immediate planning and design efforts underway for facilities in or near rural Thurston County:

- WSDOT Olympic Region is in the design and right-of-way acquisition phases for the SR 510 – Yelm Loop, a new state facility connecting SR 510 and SR 507 that will reroute significant traffic volumes around the congested core of the City of Yelm.
- TRPC is conducting a feasibility study for a new alignment of Rainier Road at the City of Rainier that will provide for a more efficient connection at SR 507.
- WSDOT Olympic Region is in the design phase of the Cross-Base Highway, a new four-lane state highway that will provide new and easy access between I-5 and southeast Pierce and Thurston counties.

To facilitate these and future planning efforts in this part of the County, TRPC conducted a license plate survey in the summer of 2005. This survey was structured to collect information about travel routes and flow patterns in the south Thurston County. The survey primarily focused on movement around SR 507 and SR 510 – two of the principal travel corridors for south Thurston County.

This report summarizes the general findings of this survey. These findings are not exhaustive, however. The main purpose of this report is to promulgate the survey information, which in turn may generate ideas for potential applications.

Methodology

Basic traffic data is commonly collected from tube counters on state and local roads. This count data is useful for a variety of purposes. These point-location traffic counts, however, don't offer much insight into the general routes and flow patterns that describe area-wide traffic movement on the regional road network. One way of getting this more comprehensive data is to conduct road side surveys. This involves pulling drivers over to the side of the road to respond to a face-to-face survey instrument. While this can be effective, it is typically labor intensive, costly, and creates significant inconvenience for drivers. A non-intrusive alternative is to conduct a *license plate matching* survey.

A *license plate matching* survey is conducted by recording the license plates of vehicles entering and exiting a predetermined study area. Images of license plates are recorded using high speed, high resolution video cameras that are located at specific sites within the study area. This video footage is then digitally transferred on to a computer and is entered into a database. This results in a computer file of records that contain license plate numbers for every camera location, as well as key data like the time of day that each plate was captured. By matching the license plates at entry and exit points, general travel pattern and route information can be derived. Advanced Television Development Northwest, Inc. (ATD Northwest) was contracted to perform this data collection and assembly for the TRPC project.

TRPC worked with ATD Northwest to determine the strategic locations of the cameras. The study area and location of survey cameras are as shown in Figure 1. Note that traditional tube counters were also deployed on the survey day at appropriate locations. These tube count locations can also be seen in Figure 1.

The survey was conducted on May 25, 2005. Surveys were conducted at 6 intersections and 3 point-locations. A total of 32 cameras were used. Overall 264 hours of video footage was recorded and processed. The survey enabled the detailed evaluation of flows for 36 different travel lanes in rural Thurston County, including through movements, turning movements, and corridor flows by time of day.

Location ID	Location	Direction	Time
1	SR 510, east of Vail Rd	EB/WB	6am-10am and 3pm -6pm
	Vail Rd, south of SR 510	NB/SB	6am-10am and 3pm -6pm
2	SR 507, east of Creek St/Bald Hills Rd	EB/WB	6am-10am and 3pm -6pm
	SR 507, west of Creek St/Bald Hills Rd	EB/WB	6am-10am and 3pm -6pm
	Creek St, north of SR 507	NB/SB	6am-10am and 3pm -6pm
3	SR 510, north of Mud Run Rd	NB/SB	6am-10am and 3pm -6pm
4	SR 507, between Yelm and Rainier	EB/WB	6am-6pm
5	SR 507, between Rainier and Tenino	EB/WB	7am-6pm
6	Rainier Rd, north of 133rd Ave	NB/SB	6am-6pm
	133rd Ave, east of Rainier Rd	EB/WB	8am-6pm
7	Old Hwy 99, north of Sussex Ave	NB/SB	6am-10am and 3pm -6pm
	Sussex Ave, west of Old Hwy 99	EB/WB	6am-10am and 3pm -6pm
8	Grand Mound Tenino Hwy, west of SR 507	NB/SB	6am-10am and 3pm -6pm
	6th Ave W, east of SR 507	EB/WB	6am-10am and 3pm -6pm
9	SR 510, south of Yelm Hwy	NB/SB	6am-10am and 3pm -6pm
	Yelm Hwy, west of SR 510	EB/WB	6am-10am and 3pm -6pm

Table 1: Location and time periods of survey cameras

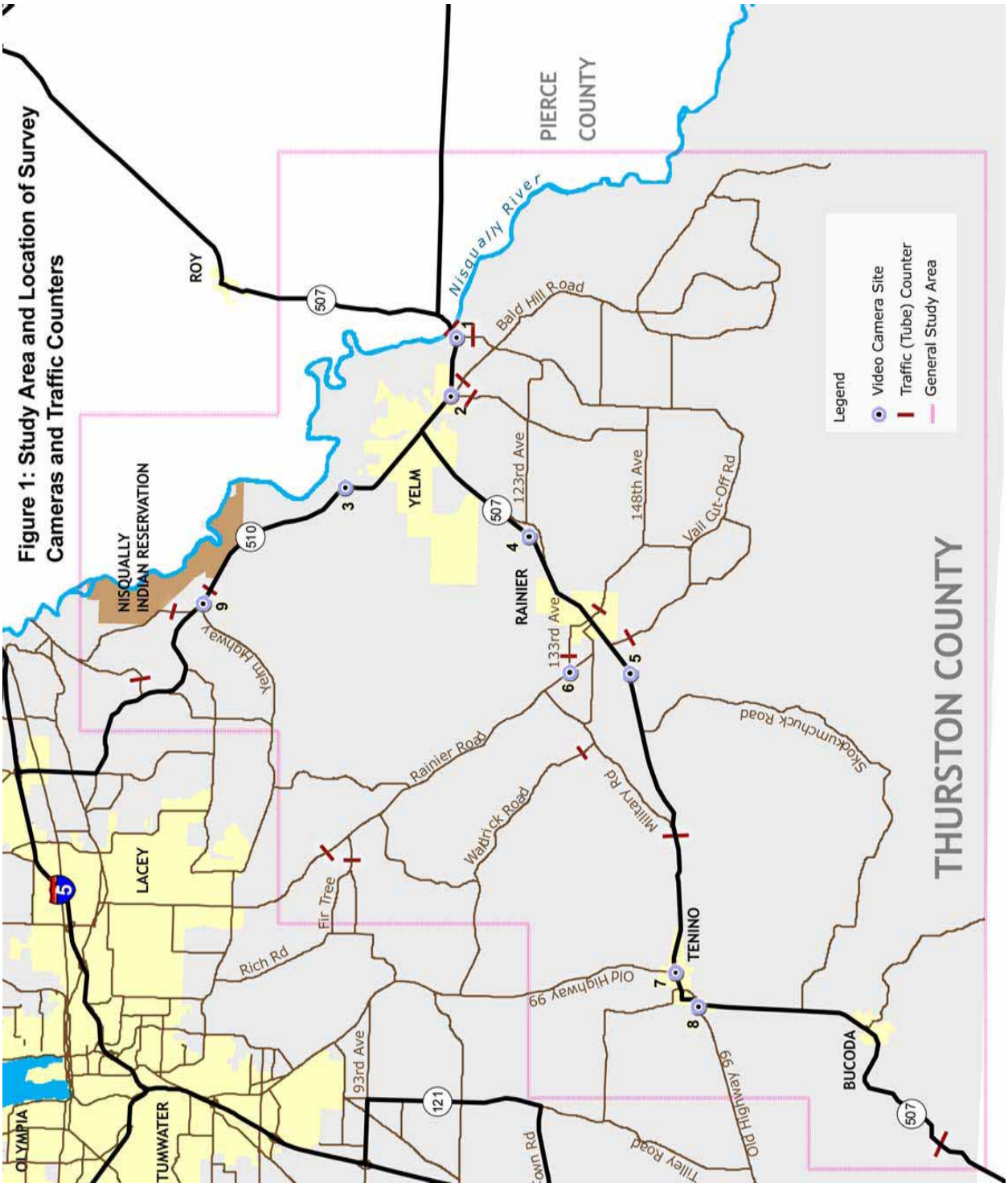
Figure 1: Study Area and Location of Survey Cameras and Traffic Counters
PIERCE COUNTY
THURSTON COUNTY
Nisqually River
ROY
NISQUALLY INDIAN RESERVATION
YELM
RAINIER
TENINO
BUCODA
LACEY
OLYMPIA
TUMWATER
Bald Hill Road
123rd Ave
148th Ave
Vail Cut-Off Rd
133rd Ave
Yelm Highway
Rainier Road
Skookumchuck Road
Military Rd
Wabrick Road
Fir Tree
Rich Rd
Old Highway 99
93rd Ave
Tilley Road
507
510
121
Legend
Video Camera Site
Traffic (Tube) Counter
General Study Area

Cameras deployed at locations around the City of Rainier recorded data for the twelve hours from 6am to 6pm. For all other survey sites the data recording time was for six hours: three hours in the morning period - 6am to 9am, and three hours in the evening period - 3pm to 6pm.

One survey site experienced equipment malfunction. Survey cameras at Rainier Road and 133rd Avenue (Location 6) experienced an unknown malfunction for the first two hours in the morning period. Consequently, the data collection period for all six-hour cameras was extended to 10:00 a.m. to better coincide with the time period for the malfunctioning Location 6. This was the only malfunction incident throughout the survey period. Location and operation timings of the cameras are as shown in Table 1.

Terminology

A few terms are referenced throughout the analyses that merit some explanation in order to minimize confusion.

Directionality refers to the balance of traffic between opposing travel lanes. For example, a road might be said to have a strong directionality if in the morning period, for example, most of the traffic is flowing northbound while very little traffic is flowing southbound. In contrast, a road might be said to exhibit little directionality if there is an approximate balance between northbound and southbound movements during the morning time period. Strong directionality is frequently an indicator of suburban land use patterns where commute trips originate in a predominately residential area in the morning for destinations in remote employment centers. This creates a strong flow of traffic out of one area and into another. This flow tends to reverse itself in the evening with the return commute, again demonstrating a strong directional bias. Managing the operational efficiency of this type of traffic flow requires different strategies than managing operational efficiency of a more balanced traffic flow.

Analyses looked at inbound, outbound, and through traffic movements. For purposes of this report, **inbound traffic** refers to traffic that entered a designated part of the study area – typically a city – from some point outside. That is, the trip originated from outside the designated area and notably, stopped somewhere inside the study area. For example, a vehicle may have been captured *entering* Rainier on SR 507 from the vicinity of Tenino but it was not matched with any of the plates *leaving* Rainier. In this case it is assumed the trip ended at a destination within Rainier or its environs.

Conversely, **outbound traffic** originates somewhere within the designated area and is first captured exiting that area. Using Rainier again as an example, a vehicle may have first been captured *leaving* Rainier on SR 507 heading westbound towards Tenino. Since it was not recorded entering Rainier first, it is assumed that the trip originated somewhere within Rainier or its environs.

Inbound and outbound traffic is contrasted with **through traffic.** By matching recorded plates at camera locations around the cities it is possible to identify that traffic that is passing through a city or other designated area. This is particularly important traffic pattern information for the region's small rural cities for which "main street" is a state highway. Using the Rainier example, a vehicle may have first been recorded entering Rainier on SR 507 from the east and then shortly thereafter recorded leaving Rainier on Rainier Road heading north. The trip originated outside Rainier and it did not stop in Rainier, therefore it is designated as a through trip.

Trip purpose is an important factor in planning for and managing the region's mobility needs. Different trip purposes exhibit different characteristics. While a survey such as this cannot identify the trip purposes associated with each individual recorded plate, it does make basic assumptions about trip purpose based on some general characteristics. **Commute-type trips** exhibit traditional "leave in the morning, return in the evening" characteristics. It may also include some school trips, especially for high school students who drive to school. **Non-commute trips** exhibit different travel characteristics. Most notable is the characteristic of entering a city and then leaving the way it entered later, but not seven or eight hours later. It is likely that these are service or retail oriented trips. This information can be very useful for communities as they plan for mid-day traffic flows or look to more efficiently manage local circulation needs as well as the strong surge of commute traffic. Again, these terms are used very broadly in this report based on general travel characteristics. This license plate survey is not a replacement for the more comprehensive and statistically valid trip purpose data generated by a household travel survey.

License Plate Data Analysis

The license plate data obtained from the consultants was imported into an Access database to facilitate analysis of traffic movement in the study area.

A total of 72,744 vehicle plate images were captured by all of the survey cameras combined, of which 5,058 vehicle images were unreadable. This represented about 7% of the video images, leaving the survey with a 93% capture rate. Of the readable license plates (67,706) there were 23,905 unique vehicles.

The benefit of a survey like this over a wide area is that as vehicles make their trips in and out of the study area they are captured at multiple locations and times. This can be evaluated by matching the unique identifier each license plate represents between camera locations. This is helpful in understanding the character of traffic flows throughout the corridors.

Of the 23,905 unique vehicles, 8,586 vehicles were captured only once – that is, the plates were recorded at one location but could not be matched with recorded plates at another location. At the other end of the frequency range, 8 vehicles were captured more than 20 times over the course of the day as they wove in and out of the study area. The frequency distribution of number of times a plate was captured is shown in Figure 2.

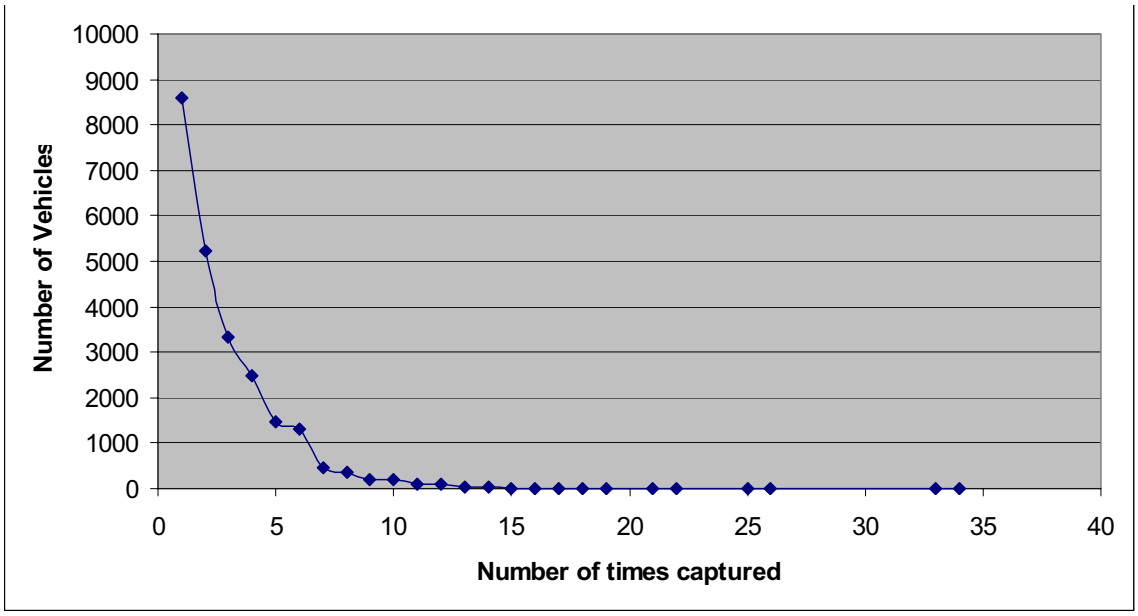

Figure 2: Frequency distribution of number of times a vehicle is captured.

The number of video images captured at each survey camera by time of day is shown in Table 2.

ID	Location	Direction	AM Images	PM Images
Location 1	SR 510, east of Vail Rd	EB	2208	2087
		WB	1805	2878
	Vail Rd, south of SR 510	NB	889	413
		SB	315	861
Location 2	SR 507, east of Creek St/Bald Hills Rd	EB	1222	1649
		WB	1499	1766
	SR 507, west of Creek St/Bald Hills Rd	EB	1576	2442
		WB	2510	2308
	Creek St, north of SR 507	NB	423	595
		SB	407	762
Location 3	SR 510, north of Mud Run Rd	NB	2103	1374
		SB	1123	2043
Location 4	SR 507, between Yelm and Rainier	EB	758	400
		WB	713	367
Location 5	SR 507, between Rainier and Tenino	EB	340	520
		WB	345	449
Location 6	Rainier Rd, north of 133rd Ave	NB	902	416
		SB	260	1033
	133rd Ave, east of Rainier Rd	EB	72	375
		WB	181	159
Location 7	Old Hwy 99, north of Sussex Ave	NB	1053	653
		SB	441	777
	Sussex Ave, west of Old Hwy 99	EB	1222	916
		WB	881	1633
Location 8	Grand Mound Tenino Hwy, west of SR 507	NB	392	320
		SB	254	441
	6th Ave W, east of SR 507	EB	889	897
		WB	649	1045
Location 9	SR 510, south of Yelm Hwy	NB	669	513
		SB	433	714
	Yelm Hwy, west of SR 510	EB	2136	1609
		WB	1300	2099

Table 2: Video counts at each camera location by time period

Directionality

This survey data validated the 2025 RTP findings about north-south directionality on rural roads. Rural roads that connect south Thurston County with the Lacey-Olympia-Tumwater urban area - SR510, Rainier Road, and Old Highway 99 from Tenino - showed very strong AM/PM directionality; that is, a very pronounced northbound flow in the morning and southbound flow in the evening. This suggests that a majority of the trips during these time periods are commute trips associated with a suburban land use pattern. Directionality was relatively more pronounced in the morning than the afternoon / evening period. This is likely explained by the tendency for morning trips to be more exclusively commute oriented whereas afternoon / evening trips include more shopping, school, and errand trips. Rainier Road exhibits much stronger directionality than the other north-south connectors.

The survey did reveal a very interesting *lack* of directionality on SR 507. East-west movement was relatively balanced, even between Thurston and adjacent counties.

a) SR507 at the Thurston County / Pierce County border exhibits characteristics more urban than rural. Strong directional traffic is usually noticed on rural Thurston County roads. However at the county border westbound and eastbound traffic was fairly balanced in both the AM and PM periods, although in the PM period there was slightly more westbound traffic entering Thurston County than eastbound traffic leaving for Pierce County.

b) What was not so clear in the 2025 RTP but which was very evident from the survey was that traffic on SR 507 between Rainier and Yelm is not directional. The same was true with the traffic on SR 507 between Rainier and Tenino. In other words, the traffic heading eastbound in the morning was roughly the same as traffic heading westbound. This was also true in the afternoon / evening time period. This may reflect the relationship in commerce and service activities between Yelm, Rainier, and Tenino. On a much smaller scale, SR 507 seems to mimic the east-west traffic flows between Lacey, Olympia, and Tumwater, where there is a clear balance in movement between those cities.

c) Traffic on SR 507 south of Tenino was also fairly balanced in both directions in both the AM and PM periods. There were some subtle weights of northbound AM traffic and southbound PM traffic but not clear enough to demarcate this as strongly directional.

d) The tube counts taken at Thurston and Lewis County border on SR 507 south of Bucoda did not show any clear directionality either.

All in all, the whole SR 507 corridor in Thurston County, from Lewis to Pierce County, is relatively balanced in its traffic flow. This is in stark contrast to the pronounced directionality of Rainier Road and the other north-south facilities.

Figure 3 depicts generalized movement in the rural area.

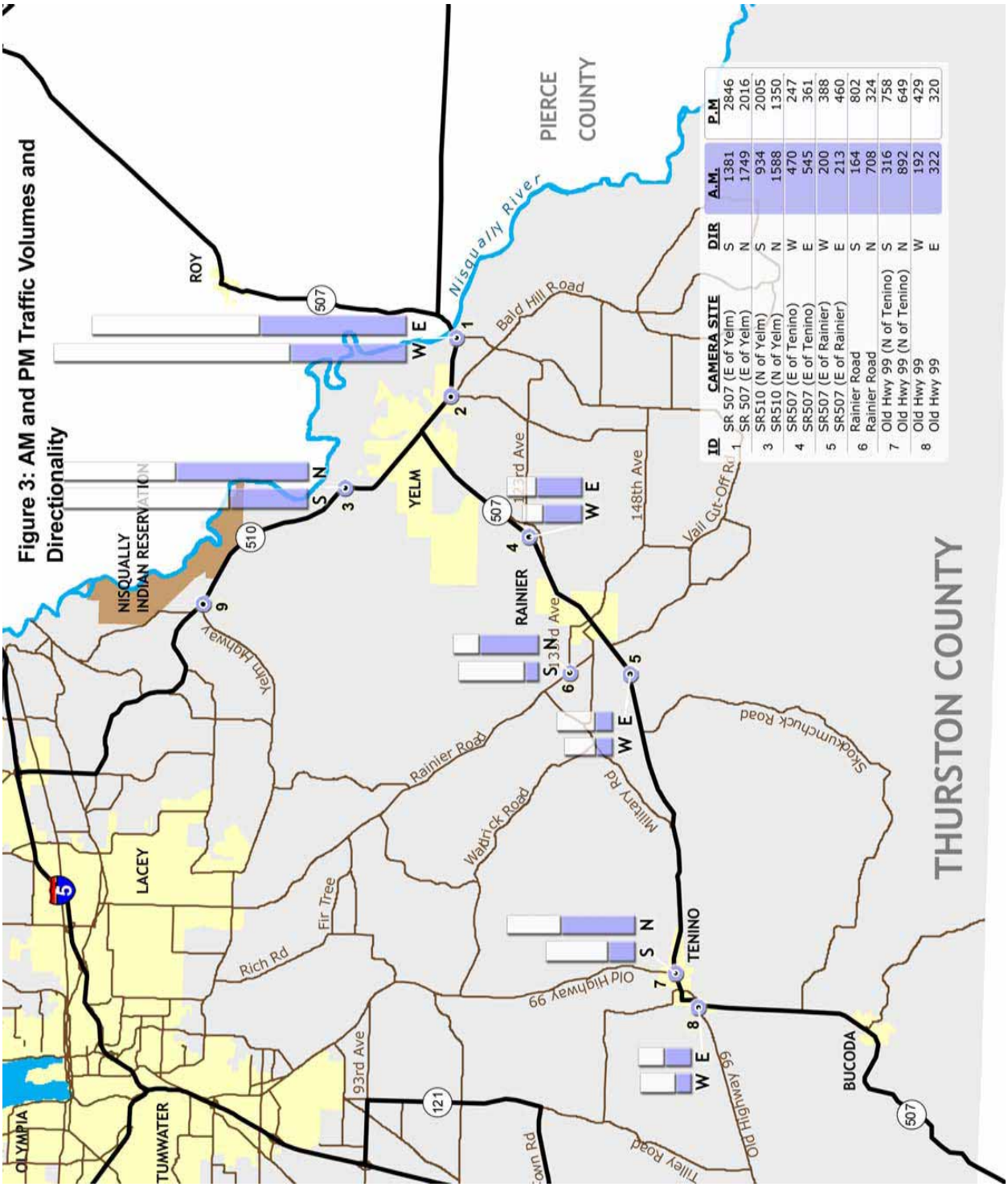
Figure 3: AM and PM Traffic Volumes and Directionality
PIERCE COUNTY
THURSTON COUNTY
ROY
YELM
RAINIER
TENINO
BUCODA
LACEY
OLYMPIA
TUMWATER
NISQUALLY INDIAN RESERVATION
Nisqually River
Bald Hill Road
123rd Ave
148th Ave
Vail Cut-Off Rd
93rd Ave
Rainier Road
Yelm Highway
Old Highway 99
Rich Rd
Fir Tree
Wabrick Road
Military Rd
Skookumchuck Road
Tilley Road
507
510
121
5
ID CAMERA SITE DIR A.M. P.M
1 SR 507 (E of Yelm) S 1381 2846
1 SR 507 (E of Yelm) N 1749 2016
3 SR510 (N of Yelm) S 934 2005
3 SR510 (N of Yelm) N 1588 1350
4 SR507 (E of Tenino) W 470 247
4 SR507 (E of Tenino) E 545 361
5 SR507 (E of Rainier) W 200 388
5 SR507 (E of Rainier) E 213 460
6 Rainier Road S 164 802
6 Rainier Road N 708 324
7 Old Hwy 99 (N of Tenino) S 316 758
7 Old Hwy 99 (N of Tenino) N 892 649
8 Old Hwy 99 W 192 429
8 Old Hwy 99 E 322 320

Thurston-Pierce Interaction

As noted previously there was a rough balance of traffic entering and leaving Thurston County at the Pierce County border, both in the morning and the evening.

In the three hour morning period from 6:00 to 9:00, more than 20% of the traffic entering Thurston County from Pierce passed through Yelm to continue northbound on SR 510 or westbound on SR 507. This accounted for about 300 of the almost 1,400 vehicles entering from Pierce County in the morning. However, most of the inbound trips from Pierce County were to destinations within Yelm.

Of the traffic leaving Thurston County for Pierce County, almost 30% of morning trips originated in southeast Thurston County and traveled via Vail Road to SR 507 before exiting the region.

Vail Road:

A strong directionality was noticed on Vail Rd, south of SR507 near the county border: northbound in the AM period and southbound traffic in the PM period. Most of this directionality was created by traffic going to or returning from Pierce County. Almost 30% of the traffic that left Thurston County in the AM period originated in southeast Thurston County and traveled via Vail Rd. About 15% of the traffic that entered Thurston County in the PM period traveled south on Vail Rd to destinations in southeast Thurston County. The directional nature of the flow at this location suggests that most of these trips were commute trips.

Non-commute Traffic:

There was a significant amount of short-duration *return traffic* noticed between the two counties. In the context of this report*, return traffic* is traffic that originated in one county and was observed returning back to that original county within three hours. This kind of traffic is most likely non-commute traffic.

In the PM period almost 15% of the traffic entering Thurston County returned to Pierce County within three hours. This was approximately the same percentage of traffic that originated in Thurston County for destinations in Pierce County and returned in three hours. Although these percentages were the same, there were more trips originating in Pierce County for non-commute destinations in Thurston County than there were trips originating in Thurston County for non-commute destinations in Pierce County. To be precise, for every three trips that originated in Pierce County for non-commute destinations in Thurston County there were only two trips that originated in Thurston County for non-commute destinations in Pierce County. Assuming that these are commercially-oriented trips this data suggests that Thurston County is a bigger economic draw for Pierce County residents than Pierce County is for Thurston County residents.

SR 510 and Yelm Highway

As mentioned previously, traffic on SR 510 flowed predominantly northbound in the AM period and southbound in the PM period. However, the PM period directionality was not as pronounced as AM period directionality.

The traffic on Yelm Highway was also directional: towards SR 510 (eastbound) in the AM period and away (westbound) in the PM period. This was somewhat surprising in that Yelm Highway is the primary east-west arterial connecting the directional north-south rural roads with the urban centers of Lacey, Olympia, and Tumwater

This may be due to the additional functionality of Yelm Highway. It connects the southern extremities of the urban growth areas of Lacey, Olympia, and Tumwater where suburban residential patterns are predominant. As such it may be providing an attractive alternate route to I-5 for trips originating in the south urban area bound for destinations in Pierce or King Counties, or for trips destined for the Yelm area or the east entrance to Fort Lewis. This would help explain the nature of the directionality exhibited by Yelm Highway at SR 510.

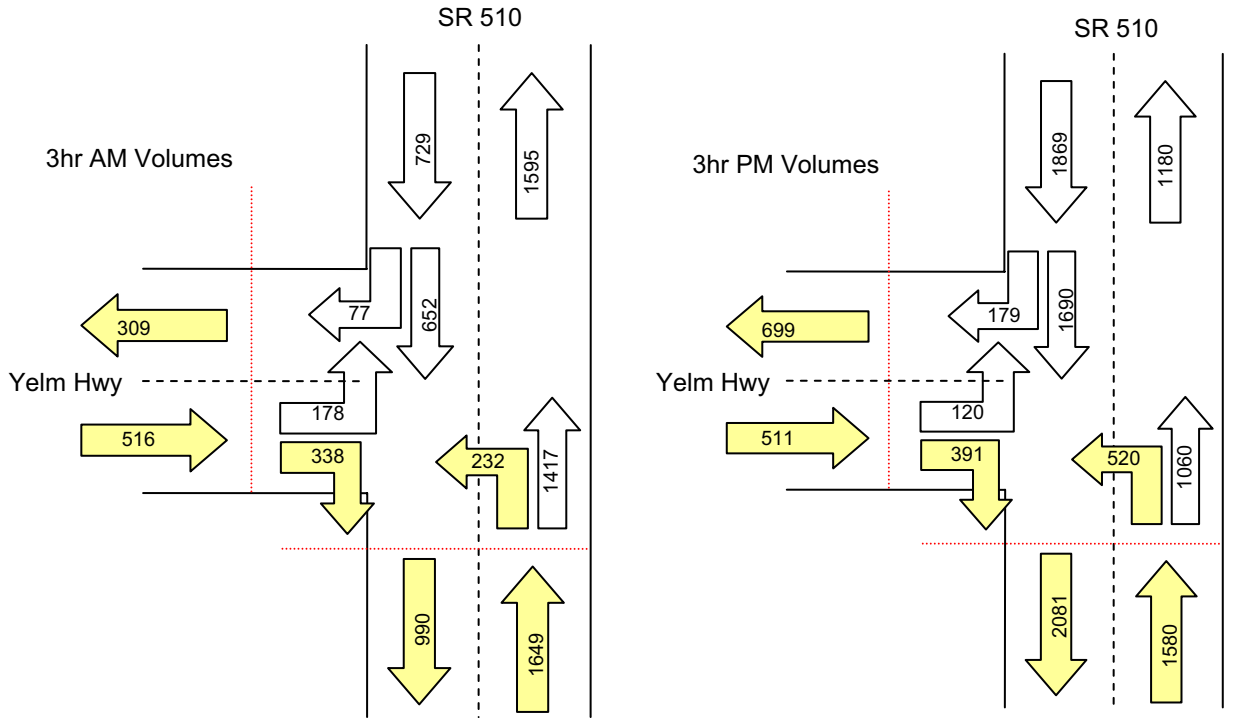

Figure 4: AM and PM traffic volumes at SR 510 and Yelm Highway

Notice in Figure 4 that in the AM period, more than 65% of eastbound traffic on Yelm Highway turned south on SR 510. Similarly, in the PM period, more than 60% of the westbound traffic on Yelm Highway originated somewhere south of this intersection, possibly from Yelm or the Nisqually Reservation's Red Wind Casino.

About 8% of the east-bound traffic on Yelm Highway was destined for Pierce County, while 15% of the west-bound traffic on Yelm Highway originated in Pierce County.

City of Yelm

Three survey site locations were established for the city of Yelm to record the key entry and exit points into the city: SR510 near the north city limits, SR507 towards Rainier, and Five Corners near the southeast city limits. Inbound, outbound, and through traffic for city of Yelm is depicted in Figures 5 and 6.

Volumes:

Among the three survey locations, Five Corners carried more traffic in both the AM and PM periods than did either of the other two locations. SR 507 had the lowest volumes of the three survey sites.

Directionality:

The most pronounced directionality at the three site locations was observed on SR 510 north of Yelm, where northbound traffic was dominant in the AM period and southbound traffic was dominant in the PM period. The AM period traffic at Five Corners was primarily northbound although not as strongly directional as was observed at the SR 510 location. This directionality at Five Corners did not reverse itself in the PM period as might be expected. This may mean that the directionality at this location created by commute trips was diluted somewhat by non-commute trips. Non-commute trips like shopping and service errands are typically more prevalent in the PM period than the AM period and can offset strong directional commute patterns, especially in commercial areas such as the city center of Yelm.

Inbound and Outbound Traffic*:*

The majority of AM inbound trips bound for Yelm (Figure 5) originated in Pierce County. Inbound trips recorded at the SR 507 location between Rainier and Yelm were significantly lower than those recorded at the other two locations. The majority of PM inbound trips also originated in Pierce County, although those recorded at the SR 510 camera north of the City were also significant.

The majority of outbound traffic originating in Yelm in the morning traveled via SR 510 to destinations north (Figure 6). While a significant share of the outbound trips in the PM period were also for destinations north of the city via SR 510, by far the vast majority of trips originating in Yelm were bound for destinations east and southeast of the city.

Through Movement:

SR 507 survey site between Rainier and Yelm (location 4):

More than 30% of the traffic in the AM period at this camera location passed through Yelm. Most of these were through trips going to destinations in the Five Corners vicinity or beyond.

SR 510 survey site north of Yelm (location 3):

More than 30% of the traffic at this location passed through Yelm in both AM and PM periods. Most of this through traffic went through Five Corners as well.

Consistently through out the AM and PM survey periods, around 60% of the traffic at this survey location was Yelm-based traffic.

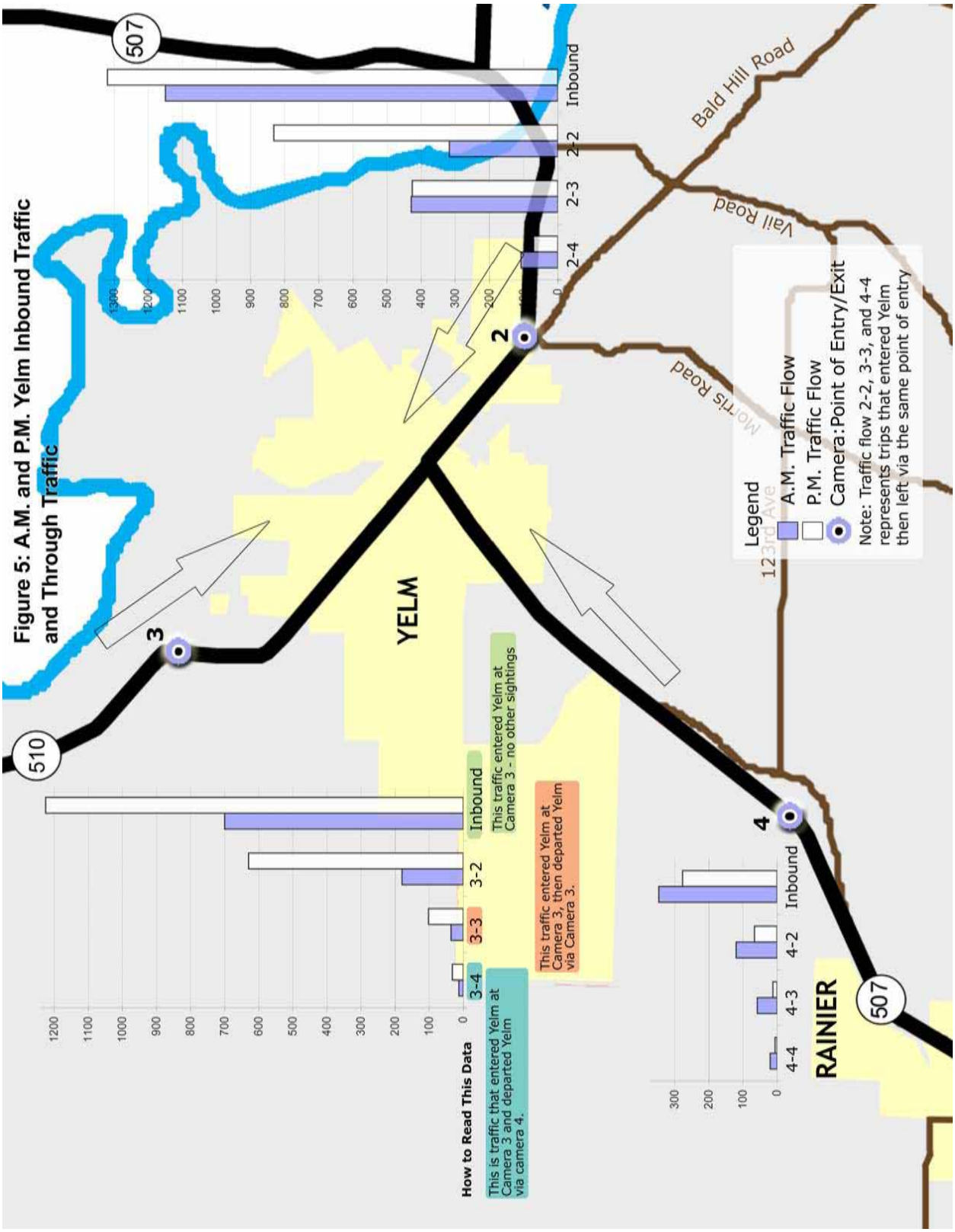
Figure 5: A.M. and P.M. Yelm Inbound Traffic and Through Traffic
YELM
RAINIER
507
510
Bald Hill Road
Vail Road
McTis Road
3rd Ave
Legend
A.M. Traffic Flow
P.M. Traffic Flow
Camera:Point of Entry/Exit
Note: Traffic flow 2-2, 3-3, and 4-4 represents trips that entered Yelm then left via the same point of entry
How to Read This Data
This is traffic that entered Yelm at Camera 3 and departed Yelm via camera 4.
This traffic entered Yelm at Camera 3, then departed Yelm via Camera 3.
This traffic entered Yelm at Camera 3 - no other sightings
Inbound
3-2
3-3
3-4
4-2
4-3
4-4
2-2
2-3
2-4

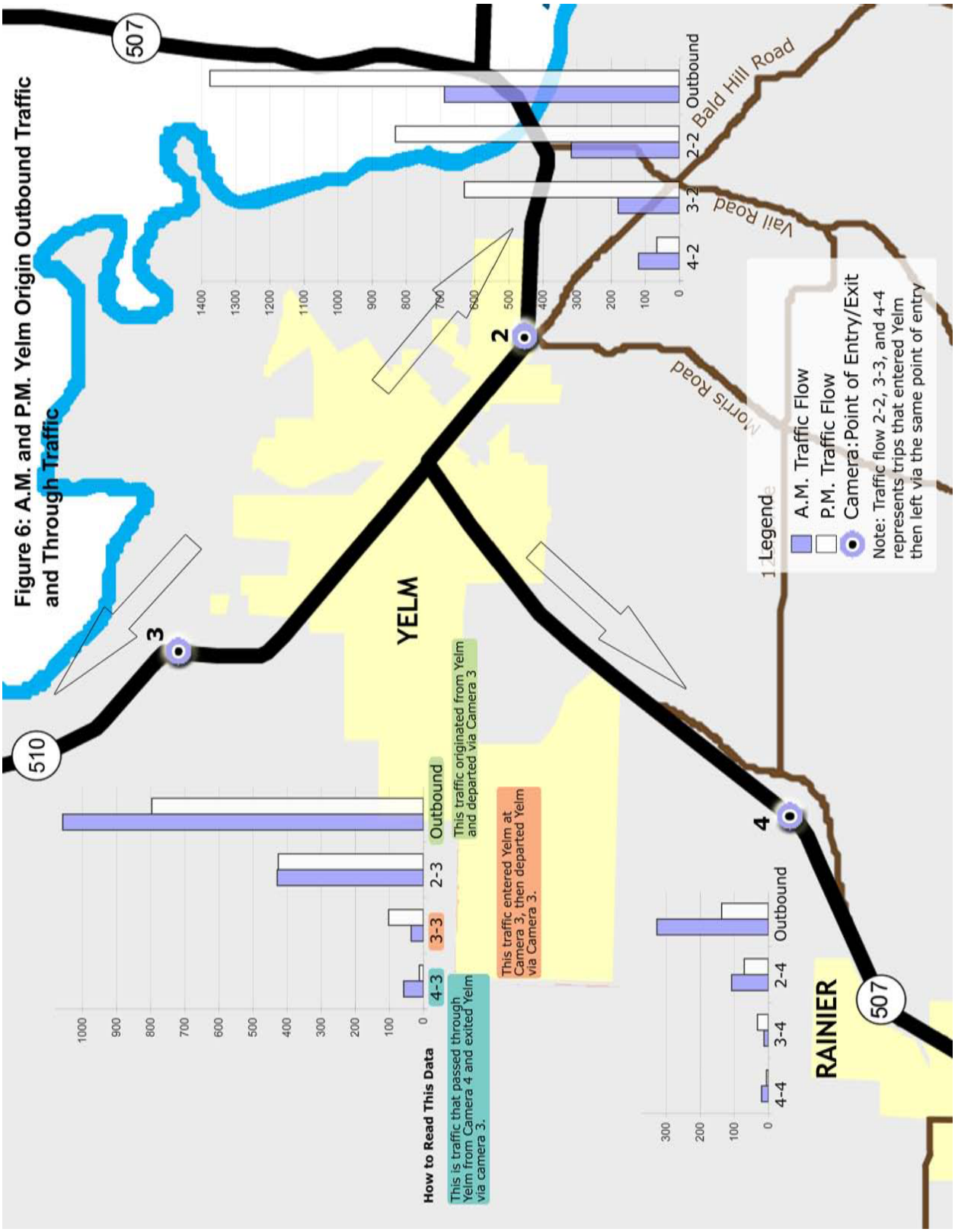
Figure 6: A.M. and P.M. Yelm Origin Outbound Traffic and Through Traffic
YELM
RAINIER
507
510
Bald Hill Road
Vail Road
Morris Road
2
3
4
Legend
A.M. Traffic Flow
P.M. Traffic Flow
Camera:Point of Entry/Exit
Note: Traffic flow 2-2, 3-3, and 4-4 represents trips that entered Yelm then left via the same point of entry
2-2 Outbound
3-3
4-2
How to Read This Data
This is traffic that passed through Yelm from Camera 4 and exited Yelm via camera 3.
This traffic originated from Yelm and departed via Camera 3
This traffic entered Yelm at Camera 3, then departed Yelm via Camera 3.
2-3 Outbound
4-3
2-4 Outbound
3-4
4-4

Five Corners survey site east of Yelm (location 2):

About 25% of trips recorded at this site in the morning were through trips. The majority of those trips traveled north via SR 510 although the share traveling westbound via SR 507 was also sizeable. In the PM period the difference between northbound through traffic destined for SR 510 versus SR 507 was much more dominant. Almost 90% of through traffic captured in the PM period at the Five Corners location was bound for destinations north of the city via SR 510.

City of Rainier

Three survey locations were established for the city of Rainier. To collect data necessary for a feasibility study these three locations were surveyed for a 12-hour time period, from 6am to 6pm. Cameras on 133rd Avenue (location 6), just east of Rainier Rd malfunctioned in the first two hours of the survey. This reduced the data available for analysis to the 8am to 6pm time period.

It is worth noting that origins and destinations south of Rainier are included as a part of the Rainier environs if those locations were accessed via Vail Cut-Off Road or Algyers Road. The survey was limited in the number of camera locations that could be established and the decision was made to select two sites on SR 507 on either side of the city and the significant Rainier Road site. The effect of this bracketing of the city is to overstate somewhat the trips originating or terminating in the city and understate somewhat the through-trips that originate outside the city limits.

***Volumes**:*

Although it is not a state highway, Rainier Road carried significant volumes of traffic during both the morning and afternoon survey periods. While the highest volumes overall were recorded on SR 507 between Rainier and Yelm in the AM period (location 4), Rainier Road carried the next highest volumes in the AM period and the highest volumes in the PM period.

In the PM period, traffic volumes on SR 507 west of the city (location 5) were higher than that east of the city (location 4).

Traffic volumes in the PM period were higher at all locations than volumes in the AM period.

Directionality:

Very strong directionality on Rainier Road (location 6) was observed for northbound travel in the AM period and southbound travel in the PM period. Rainier Road exhibited the strongest AM / PM directional flows of any of the survey sites. Although it's directional, most of the traffic at this location was from Rainier or its environs - more than 80%. Only 15 % of the northbound AM vehicles at this location are from SR507. This would suggest that most traffic originating west of SR 507 uses Military Road to access Rainier Road. However, manual traffic counts at Rainier Road and Military Road did not reveal much northbound traffic turning left onto Rainier Road from Military Road during the period of this survey.

As noted earlier, SR 507 exhibits very little directionality in either the AM or PM periods.

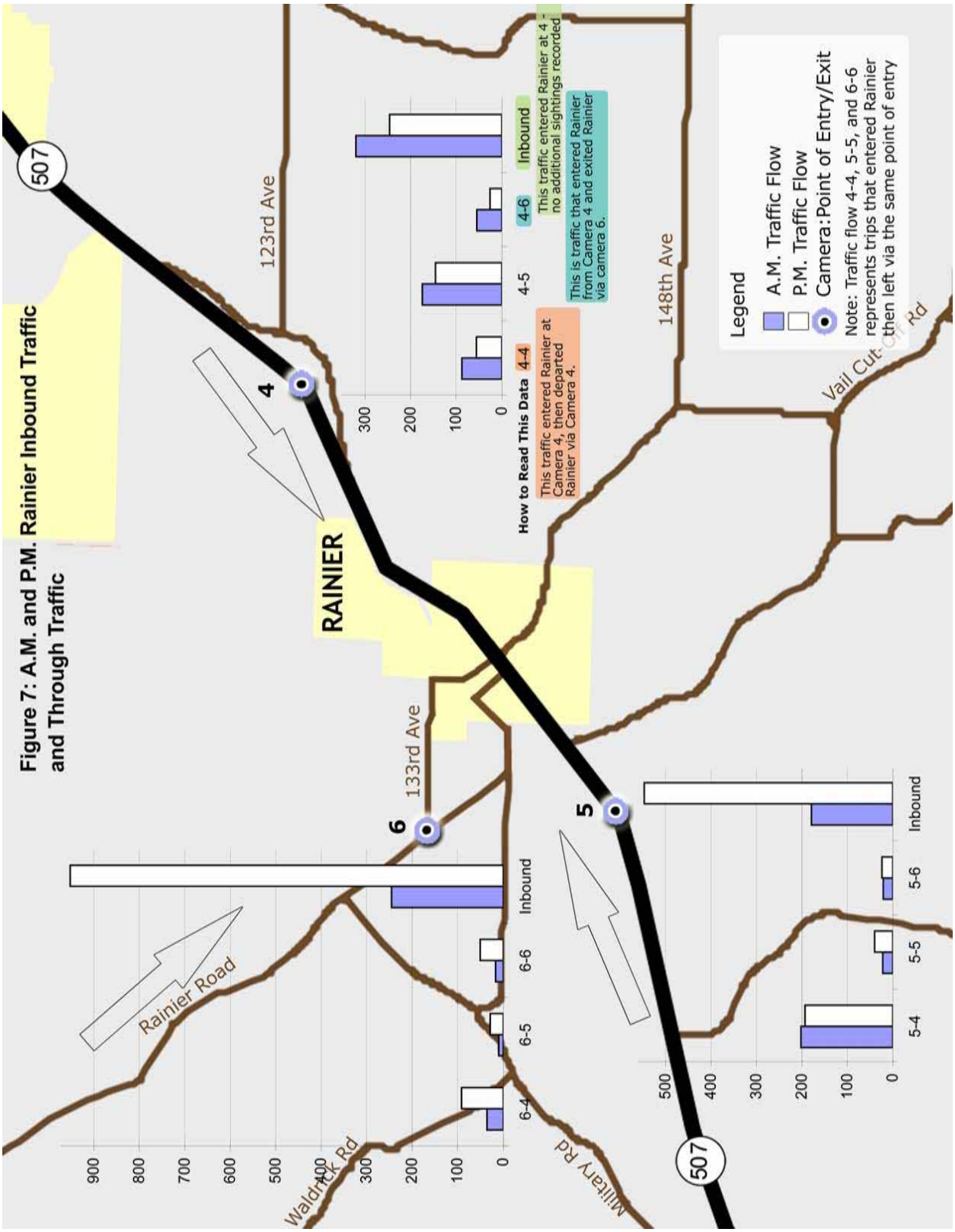
Figure 7: A.M. and P.M. Rainier Inbound Traffic and Through Traffic
RAINIER
507
123rd Ave
133rd Ave
148th Ave
Vail Cut-off Rd
Rainier Road
Waldrick Rd
Military Rd
4
5
6
Legend
A.M. Traffic Flow
P.M. Traffic Flow
Camera:Point of Entry/Exit
Note: Traffic flow 4-4, 5-5, and 6-6 represents trips that entered Rainier then left via the same point of entry
How to Read This Data
4-4
This traffic entered Rainier at Camera 4, then departed Rainier via Camera 4.
4-5
This is traffic that entered Rainier from Camera 4 and exited Rainier via camera 6.
4-6
This traffic entered Rainier at 4 - no additional sightings recorded
Inbound
6-4
6-5
6-6
5-4
5-5
5-6
0
100
200
300
400
500
600
700
800
900

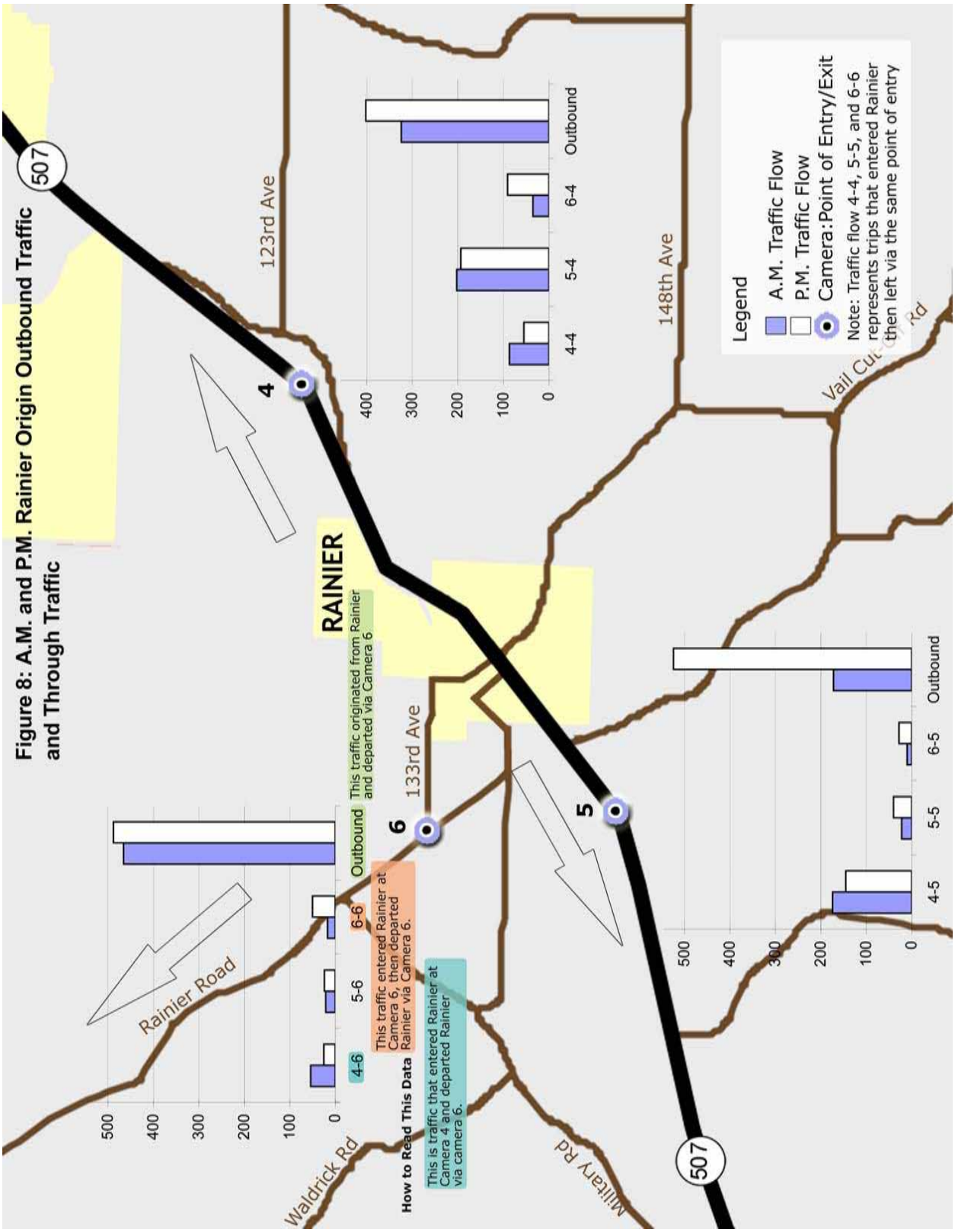
Figure 8: A.M. and P.M. Rainier Origin Outbound Traffic and Through Traffic
RAINIER
Rainier Road
Waldrick Rd
123rd Ave
133rd Ave
148th Ave
Military Rd
Vail Cut-off Rd
507
4
5
6
Legend
A.M. Traffic Flow
P.M. Traffic Flow
Camera:Point of Entry/Exit
Note: Traffic flow 4-4, 5-5, and 6-6 represents trips that entered Rainier then left via the same point of entry
How to Read This Data
This is traffic that entered Rainier at Camera 4 and departed Rainier via camera 6.
This traffic entered Rainier at Camera 6, then departed Rainier via Camera 6.
This traffic originated from Rainier and departed via Camera 6
4-6
5-6
6-6
Outbound
0
100
200
300
400
500
4-4
5-4
6-4
4-5
5-5
6-5

***Inbound and Outbound Traffic**:*

AM inbound traffic (Figure 7) was primarily from Yelm although all three locations recorded a significant share of inbound traffic. PM inbound traffic was primarily from the north urban area via Rainier Road but traffic from SR 507 west of the city (location 5) was also considerable. Differences between the three survey locations were much more pronounced in the PM period than the AM period.

AM outbound traffic (Figure 8) was primarily towards the Lacey-Olympia urban area. PM outbound traffic was fairly balanced in all directions with a slight predominance of westbound traffic via SR 507.

Through Movement:

SR 507, east of Rainier (location 4):

Eastbound traffic volumes were higher in the PM period than westbound volumes.

Through traffic accounted for about 35% of volumes in both the AM and PM periods.

SR 507, west of Rainier (location 5):

Through trips accounted for about 50% of trips captured in the AM period. They accounted for only about 25% of trips in the PM period.

Through trips recorded at this location were predominately associated with SR 507. Fewer than 5% of the through trips recorded at this location traveled via Rainier Road.

Rainier Rd, North of city of Rainier (location 6):

The data suggests that through trips account for very little of the traffic on Rainier Road. However, the earlier note about survey locations and limited camera availability may have significant bearing on this finding. Traffic originating in southeast Thurston County and traveling into Rainier by way of Algyers Road or the Vail Cut-Off Road was depicted as traffic originating within Rainier. Additional detailed analysis is needed to distinguish the volumes originating in rural Thurston County versus those originating in the city of Rainier proper before drawing final conclusions about through traffic on Rainier Road.

City of Tenino (Figures 9 & 10)

Two survey sites were established for the City of Tenino: one at Old Highway 99 and Sussex Ave intersection at the eastern limits of the city (location 7), and the other at Grand Mound Highway and SR 507 intersection just west of the city (location 8). The survey time for these cameras was from 6am to 10am in the morning and 3pm to 6pm in the evening.

The analysis for Tenino was not as comprehensive as it was for other cities as the cameras around Tenino were not completely enclosing access points into or out of the city. As a result, the study did not generate enough information to analyze inbound and outbound traffic with any confidence.

Volumes:

Of the locations recorded, the Grand Mound-Tenino Highway (location 8) connecting Tenino and SR 507 to Interstate 5 is the minor leg in terms of volumes. This was true for both AM and PM periods. In fact, with the exception of 133rd Avenue at Rainier Road, this was the minor leg for the entire study area. Sussex Avenue, which is also SR 507, recorded the largest volumes.

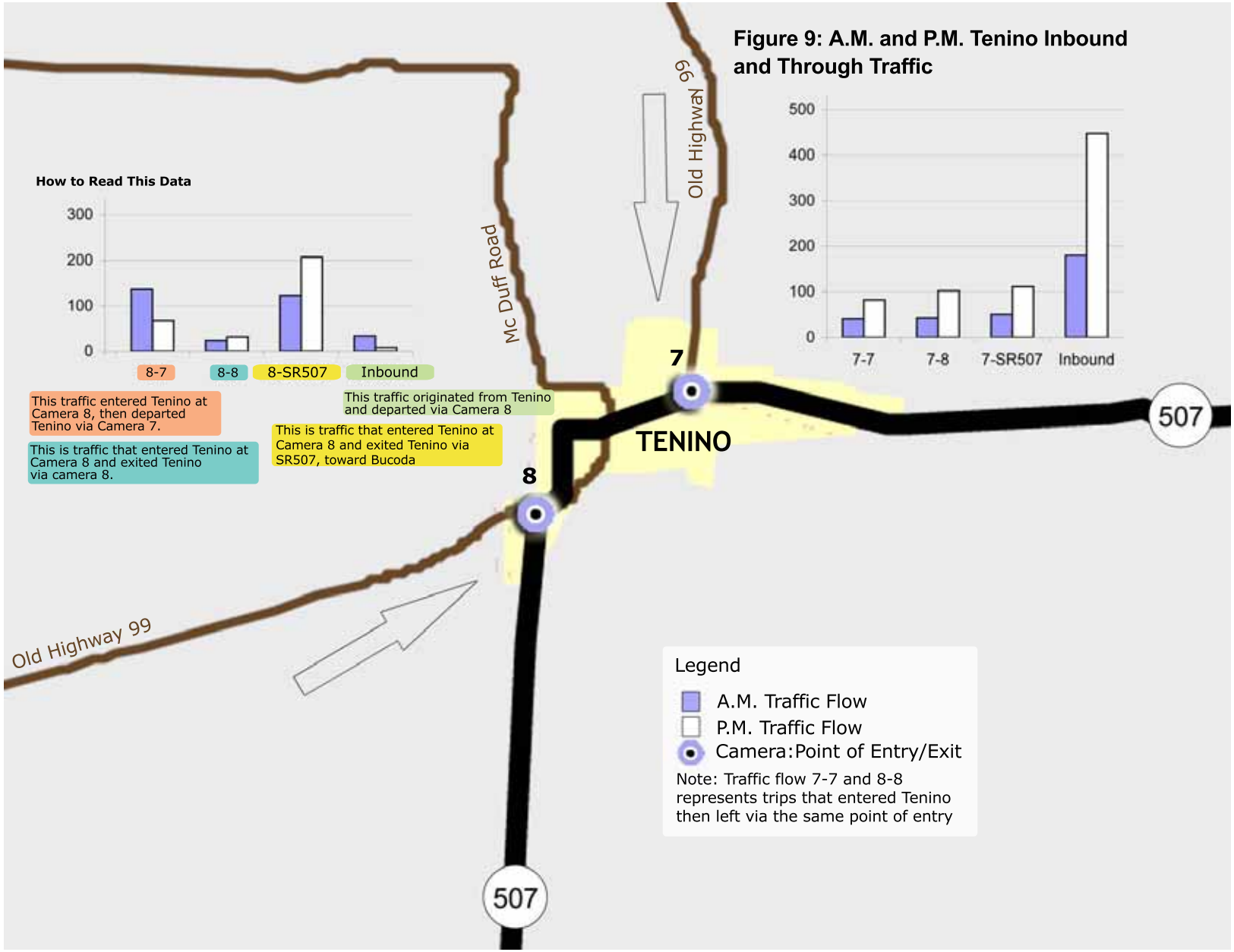
Figure 9: A.M. and P.M. Tenino Inbound and Through Traffic
How to Read This Data
300
200
100
0
8-7
8-8
8-SR507
Inbound
This traffic entered Tenino at Camera 8, then departed Tenino via Camera 7.
This is traffic that entered Tenino at Camera 8 and exited Tenino via camera 8.
This is traffic that entered Tenino at Camera 8 and exited Tenino via SR507, toward Bucoda
This traffic originated from Tenino and departed via Camera 8
Mc Duff Road
Old Highway 99
7
8
TENINO
507
Old Highway 99
507
500
400
300
200
100
0
7-7
7-8
7-SR507
Inbound
Legend
A.M. Traffic Flow
P.M. Traffic Flow
Camera:Point of Entry/Exit
Note: Traffic flow 7-7 and 8-8 represents trips that entered Tenino then left via the same point of entry

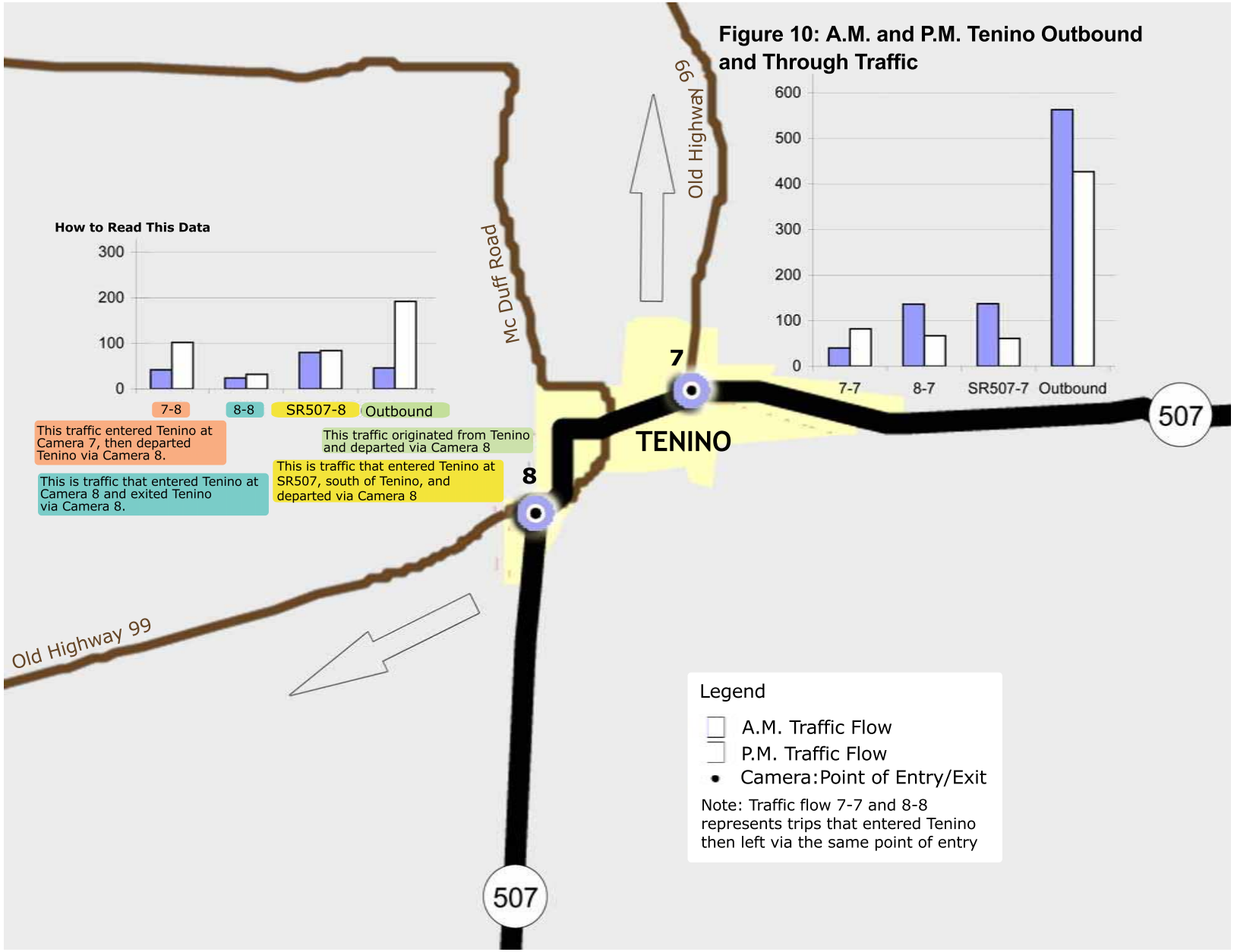
Figure 10: A.M. and P.M. Tenino Outbound and Through Traffic
How to Read This Data
300
200
100
0
7-8
8-8
SR507-8
Outbound
This traffic entered Tenino at Camera 7, then departed Tenino via Camera 8.
This traffic originated from Tenino and departed via Camera 8
This is traffic that entered Tenino at Camera 8 and exited Tenino via Camera 8.
This is traffic that entered Tenino at SR507, south of Tenino, and departed via Camera 8
Mc Duff Road
Old Highway 99
Old Highway 99
7
8
TENINO
507
507
600
500
400
300
200
100
0
7-7
8-7
SR507-7
Outbound
Legend
A.M. Traffic Flow
P.M. Traffic Flow
Camera:Point of Entry/Exit
Note: Traffic flow 7-7 and 8-8 represents trips that entered Tenino then left via the same point of entry

Directionality:

In the three hour AM peak period from 6am to 9am, Old Highway 99 exhibited strong northbound directionality. Old Highway 99 provides direct access to major employment centers in Tumwater, as well as access to Interstate 5 and to destinations in downtown Olympia. This linkage would support a strong commute flow from this part of the region. However, this location did not exhibit the same strong reverse directionality in the three hour PM peak period from 3pm to 6pm. While the reason for this minimal directionality is unclear, it is likely that non-commute trips such as shopping, services, and other errands in the business center of this city is diluting the strongly directional characteristics of the typical commute flow.

A similar pattern was noticed on the Grand Mound-Tenino Highway although it was less pronounced. There was a minor predominance of eastbound traffic in the AM period, however, in the PM period a reversal of the trend was not as pronounced.

SR 507 south of Tenino exhibited well-balanced northbound and southbound traffic in both AM and PM periods, similar to other locations on this corridor.

Through Movement:

Old Highway 99 (location 7):

In the three hour AM time period from 6am to 9am, 15% of the northbound traffic on Old Highway 99 was northbound SR 507 traffic originating from the vicinity of Bucoda or south. Another 15% of the northbound Old Highway 99 traffic was from Grand Mound-Tenino Highway. Overall, around 34% of the northbound Old Highway 99 traffic was generated from points west or south of the city. The rest of the traffic (66%) was generated from within the City of Tenino or its environs.

In the PM three hour period – 3pm to 6pm – a similar pattern was observed for southbound traffic. Thirty percent of the southbound traffic passed through Tenino and split almost evenly between Grand Mound-Tenino Highway and SR 507. The rest of the traffic, roughly 70% of the volume, was headed to destinations within Tenino or its environs.

Additional Data

Tube Counts

On the day of the survey the Washington State Department of Transportation (WSDOT) and Thurston County collected traffic volumes using traditional tube counters along the fringes of the survey area to substantiate and augment the license plate data. The location of these tube counts is shown in Figure 1.

Depending on the nature of the data request and application, specific counts can be pulled and aligned with the license plate survey data to present a somewhat more detailed analysis of movements, time of day, and vehicle classifications. Those interested in obtaining this detailed analysis should contact TRPC for more information.

Place of Registration

After acquiring the database from the consultants, TRPC extracted a list of license plates and obtained registered addresses of the vehicles through the Department of Licensing. These addresses were geo-coded for a spatial perspective using Geographic Information System (GIS) tools. Geo-coding is a process of pinning an address on a map. Geographical distribution of registered addresses can be seen in the figure below.

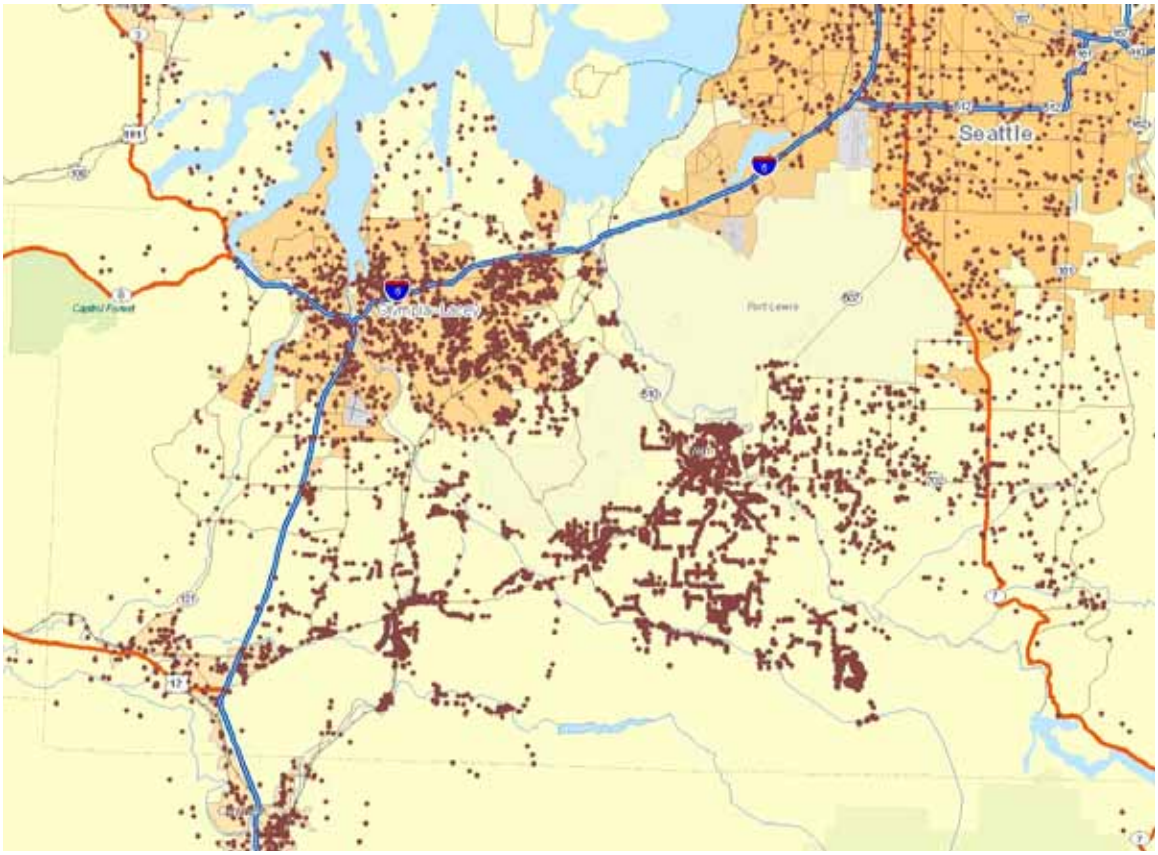

Figure 11: Distribution of geo-coded registered addresses.

The spatial distribution of the license plates was much more dispersed than what was originally anticipated for this analysis. Therefore certain analysis methodologies that were devised before the survey couldn't be performed as they rendered results that were too extraordinary to be seriously considered. However, these methodologies are being updated to utilize this geo-coded data as much as possible. For the purpose of this report a broad, summary outlook of this data is presented.

Out of the 23,905 readable license plates, 21,081 of them were completely legible and void of any errors. Of these legible license plates, 65% of the vehicle plates matched with Department of Licensing (DOL) records of addresses within the state, 27% of the vehicles were registered outside of the State and the rest of the vehicles (8%) did not match with DOL's database. The high percentage of out of state license plates may be due to the proximity of the Fort Lewis and McCord military bases and the nature of their employment base.

Of all the license plates that found a registered address match in DOL's database, 19,582 – or 47% of the vehicles – were registered in Thurston County. Another 12% were registered in Pierce County, 4% in King County, and 2% in Lewis County. It should be noted that plate registrations were found for most of the states in the country.

Three camera locations that are close to the county borders were selected for tabulating vehicle registration: SR 507 east of Vail Rd (location 1), SR 510 south of Yelm Highway (location 9), and SR 507 east of Grand Mound Highway (location 8). The distribution of vehicle registrations for these three locations among the surrounding counties is shown in the table below.

County of Vehicle Registration	Video Survey Stations											
	SR 507 E of Vail Rd (Location 1)				SR 510 S of Yelm Hwy (Location 9)				SR 507 E of Grand Mound Hwy (Location 8)			
	EB		WB		NB		SB		EB		WB	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
King	3%	4%	4%	3%	3%	3%	3%	3%	3%	2%	4%	2%
Pierce	11%	40%	43%	20%	11%	9%	9%	12%	3%	7%	10%	3%
Thurston	51%	20%	14%	41%	49%	59%	62%	52%	44%	51%	46%	46%
Lewis	<1%	<1%	<1%	1%	<1%	<1%	<1%	<1%	13%	5%	4%	14%
WA State	70%	69%	66%	71%	65%	79%	80%	70%	70%	70%	68%	71%

Table 3: Place of vehicle registration by county

The eastbound traffic on SR 507 just east of Vail Rd had more Thurston County registered vehicles in the AM period than in the PM period (see the highlighted text in table 3). This trend was in the reverse order for westbound traffic – more Thurston County registered vehicles in the PM period than in AM period. This was likely due to commute trips from Thurston County that entered Pierce County in the AM period and returned to Thurston County in the PM period. Notice this similar trend for Pierce County registered vehicles as well – westbound traffic in the AM period (43%) and eastbound traffic in the PM period (40%).

Other Observations

This survey was very unique. It was the first such survey for south Thurston County. In addition, the use of 32 cameras to survey 9 different locations was a first for the entire region. It provided a benchmark for current traffic patterns and can be used to compare or monitor future traffic trends/surveys in the region. It is anticipated that the data from this survey will substantiate many planning efforts in the south county area.

Although this survey doesn't make any direct connection with household information, it will still be useful in updating the Thurston Regional Travel Demand Model. The main application of this survey will be in validating the model estimated volumes/routes as well as some calibration in the south county area.

As with any first effort, unanticipated situations and experiences arise. For example, it was anticipated that vehicle travel times would be a useful product that could be used to estimate corridor delay. The times at which vehicles entered and left the study area are recorded as part of this survey. It was anticipated that these times could be used in calculating the travel times at different times of the day and for different routes.

However, because each of the 32 camera clocks were not synchronized it made this type of analysis fairly unreliable. A statistical analysis may still be possible at a future time but no results are included in this report.

Another factor that arose was the complexity of manipulating data from 32 cameras to obtain a reliable and understandable portrait of traffic patterns. This study was very ambitious in its scope, even though the volumes at any one location were not overwhelming. The intent was to create a multi-dimensional picture of flows and to a great extent this study was successful although reporting such data-intensive findings is challenging.

However, despite the comprehensive scope of the study there were still unbracketed entries / exits in the study area that created holes in the findings. It is likely that some user will have a potential application for which these data will fall short because of these gaps in coverage.

All in all this was a very useful survey that fully supports a wide variety of regional and local project needs, as well as partially supports many other applications. It is anticipated that the data will have a long shelf life and be called upon for several years to provide detail about south Thurston County traffic patterns.

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Appendix – Turning Movements

Turning movements for six intersection camera locations are shown in the figures below. The shaded arrows represent the turning movements captured by cameras, and the rest show computed volumes.

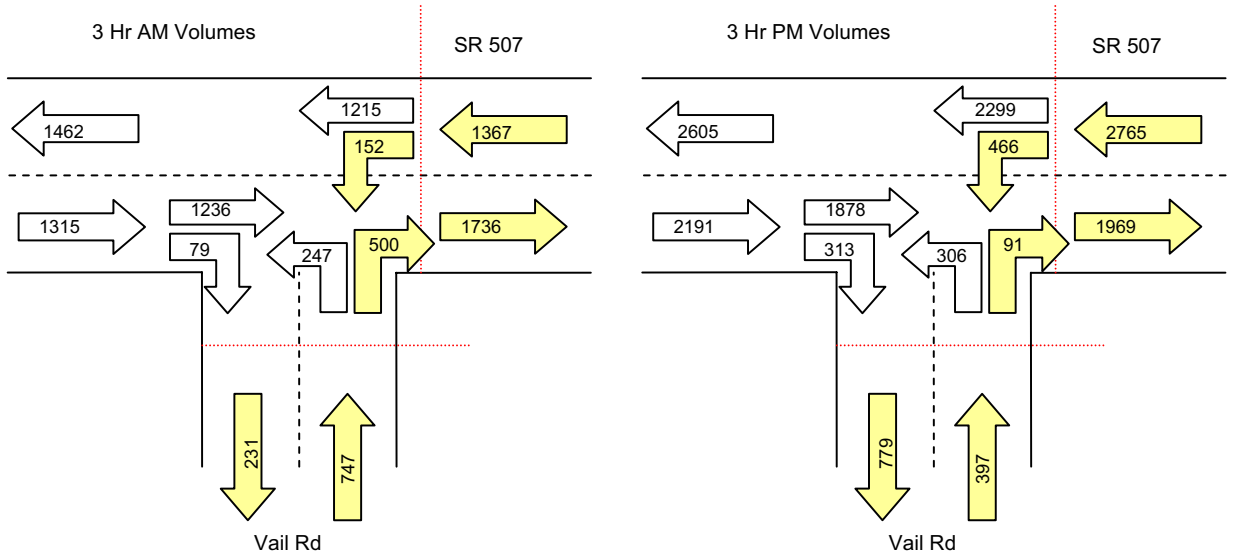

Figure A.1: Three hour AM and PM volumes for SR 507 and Vail Rd (location 1)

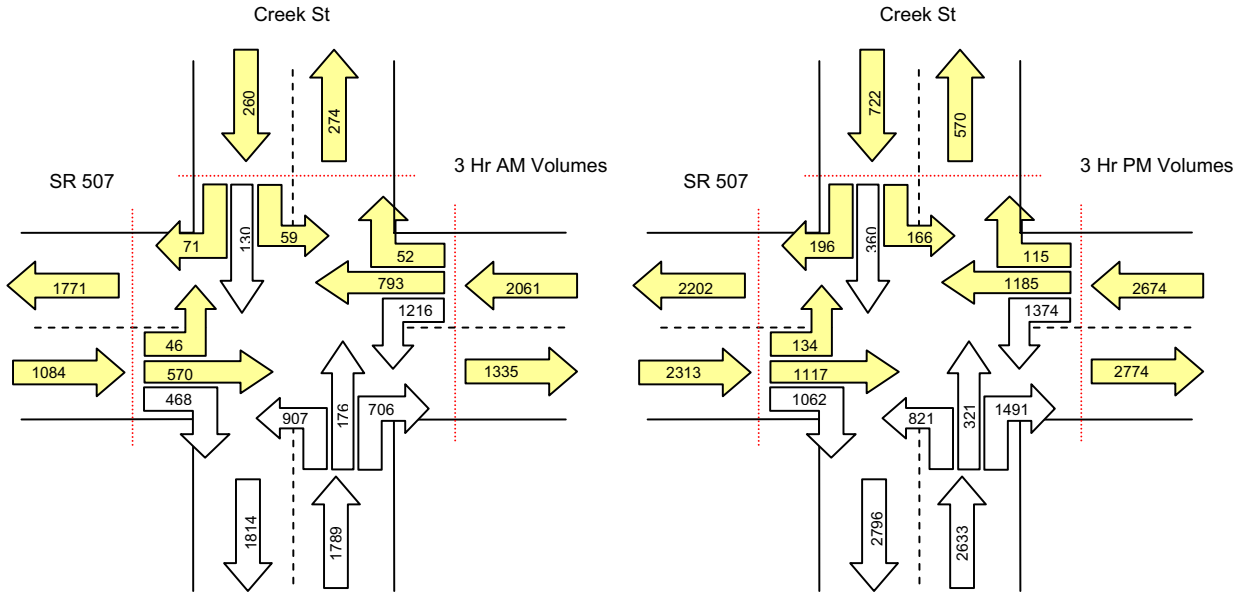

Figure A.2: Three hour AM and PM volumes for SR 507 and Creek St/Bald Hills Rd (location 2)

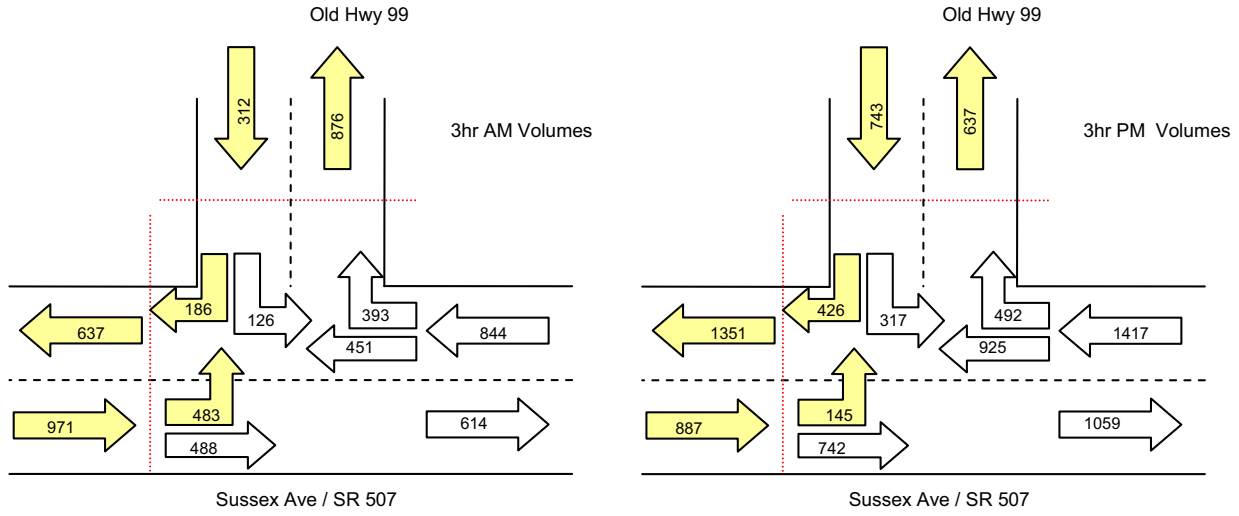

Figure A.3: Three hour AM and PM volumes for SR 507 and Old Highway 99 (location 7)

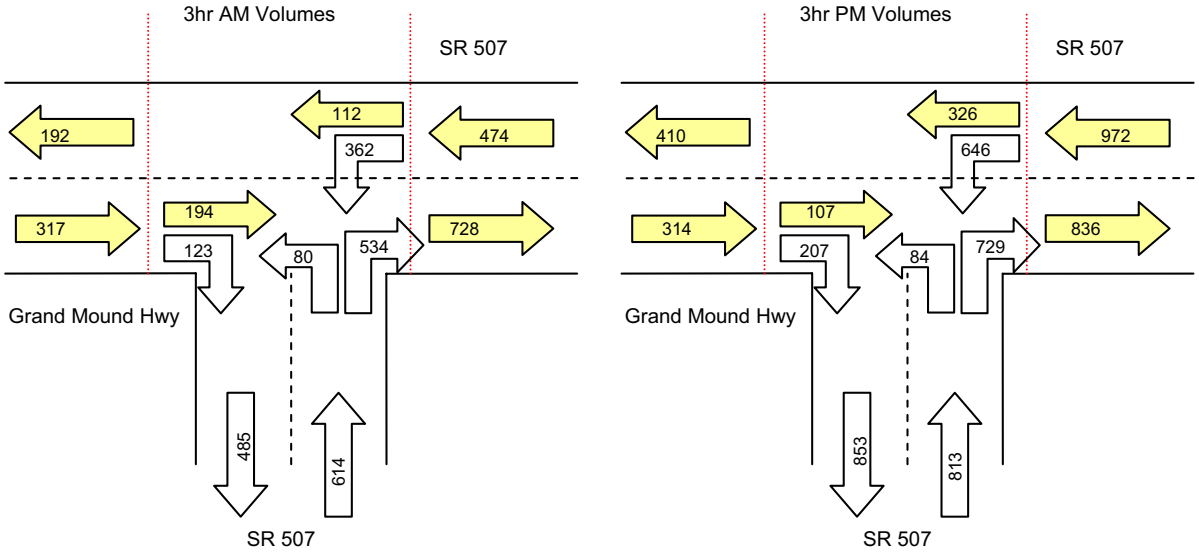

Figure A.4: Three hour AM and PM volumes for SR 507 and Grand Mound Tenino Hwy (location 8)

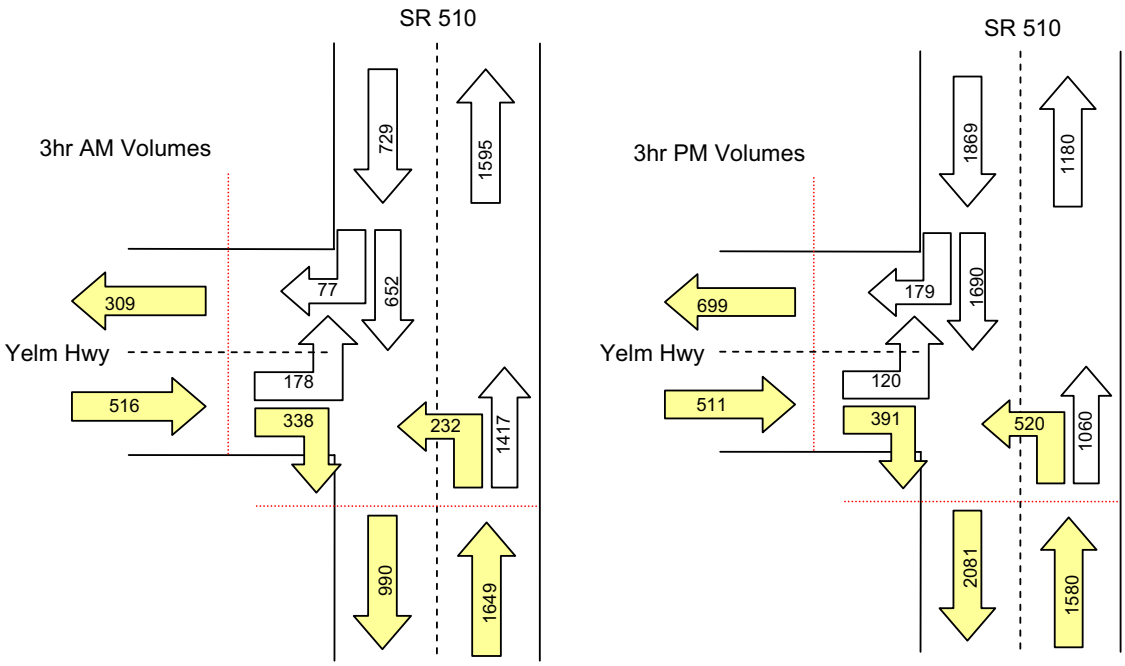

Figure A.5: Three hour AM and PM volumes for SR 510 and Yelm Highway intersection (location 9)

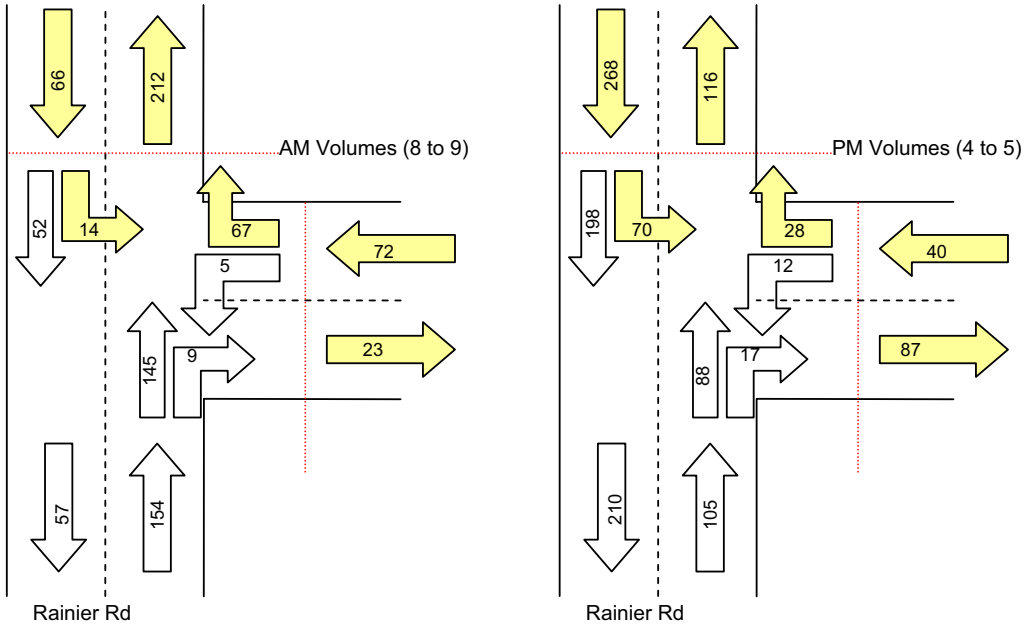

Figure A.6: One hour AM and PM volumes for Rainier Rd and 133rd Ave SE (location 6)