I-5 JBLM VICINITY CONGESTION RELIEF STUDY
TRAVEL PATTERNS AND CHARACTERISTICS

AUGUST 2014

Prepared for:

WSDOT

Lochner / SCJ Alliance

transpoGROUP

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LIST OF ABBREVIATIONS

- ACP – access control point commonly referred to as "gates"
- HHTS – household travel survey
- HOV 2 – high occupancy vehicle (2 people)
- HOV 3+ - high occupancy vehicle (3 or more people)
- IJR – interchange justification report
- JBLM – Joint Base Lewis-McChord
- LPR – license plate reader
- O-D – origin-destination
- SOV – single occupancy vehicle
- SR – state route
- TAZ – transportation analysis zone
- TDM – travel demand management
- TRPC – Thurston Regional Planning Council
- WSDOT – Washington State Department of Transportation

1. EXECUTIVE SUMMARY

Background and Purpose

Congestion along I-5 between the Thurston/Pierce County line and the SR 512 interchange has become a daily occurrence with heavy through volumes and a large number of vehicles getting on and off the freeway within this area. This mingling of "local" and regional traffic was documented in the *I-5 JBLM Congestion Feasibility Study Phase 1 Report* (January 2014).

Travel modeling analysis conducted for the I-5 JBLM Vicinity Phase 1 Corridor Plan Feasibility Study indicated that approximately 50 percent of the traffic on I-5 through the JBLM study area was regional through traffic, while the other 50 percent was local. A significant number of trips between study area interchanges were also identified.

Development of cost-effective solutions for the chronic congestion in this corridor has been hindered by an absence of data on specific trip patterns along the corridor. The purpose of the travel surveys documented in this report is to confirm, update, and refine our understanding of existing corridor travel patterns – not only by providing current information about the split between local and regional traffic on the freeway, but also by documenting the interaction of traffic using each of the study area interchanges. This report documents data gathered and surveys conducted to define these trip patterns.

How Were the Surveys Conducted?

The primary data collection effort undertaken as part of this study focused on refining our understanding of travel patterns within the I-5 JBLM corridor including:

1. What percent of all trips passed directly through the study area without stopping?
2. What percent of trips had either an origin or destination in the study area?
3. What percent of trips were made entirely within the study area, but relied on I-5 as the best or only reasonable travel route (referred to as "short trips")?

BlueMAC

BlueMAC detection units are devices that detect and record anonymous signals coming from nearby Bluetooth-enabled devices, including smart phones and vehicles. The location of the signal and the time it was recorded are captured and processed by matching identical signals. With this data, BlueMac units can capture patterns of travel between trip origins and destinations across large study areas using this anonymous data.

This data collection effort was conducted over a 2-week period in late January and early February of 2014, using a new technology called BlueMAC (see sidebar description). Forty-seven (47) BlueMAC units were placed along and around a 13-mile stretch of I-5 from Mounts Road to SR-512, at 9 interchanges, and at major JBLM gate entry and exit points. Additionally, vehicle occupancy was manually counted for one day at the five busiest JBLM gates to help determine the percentage of vehicles with one or more occupants.

This information is useful in understanding the extent of existing rideshare or vanpool use and for identifying possible future opportunities for enhanced Transportation Demand Management (TDM) or transit strategies.

What Did We Discover?

Based on the results of the BlueMac origin/destination surveys, several key observations can be made about travel patterns in the I-5 JBLM study area that confirm earlier analysis. For example:

1. During peak periods, approximately half the traffic on this segment of I-5 is regional and the other half is local.
2. Short-tripping results in up to 15 percent of the mainline traffic volumes.
3. There is a significant amount of interchange-to-interchange activity along the corridor.
4. JBLM gate-to-gate travel ranges between 1 to 6 percent of the mainline traffic volumes depending on segment.
5. Existing vehicle occupancy to/from JBLM is very low.

Of the trips entering the study area from the south during the AM peak period, 52 percent were through trips and 32 percent were destined to JBLM. Of the trips leaving the study area to the south during the PM peak period, 57 percent of trips were through trips and 23 percent were from JBLM. Travel to and from the north and northeast of the study area on I-5 and SR-512 is more distributed among multiple regional destinations. AM and PM peak period through trips on I-5 and SR-512 represented 53 to 59 percent of all trips. For travel to and from I-5 and SR-512 from the north of the study area, trips made to or from Lakewood represent between 13 and 27 percent of all trips.

In order to better understand the use of I-5 for local trips, on-ramp and off-ramp volumes and traffic patterns between interchanges were analyzed to see how many vehicles both entered and exited I-5 within the 9-mile study area. Particular attention was paid to trips traveling short distances on I-5 which are referred to as “short trips.” Due to the limited local street network it has been perceived that these short trips include travel between different parts of JBLM, commuters who live close to the base, residents running errands or employees that leave and return to the base during the day. Along with regional through trips, these “short trips” contribute significantly to existing congestion. One example of a “short trip” would be someone traveling from Madigan Amy Medical Center to Lewis North, which involves entering I-5 southbound and then immediately leaving the freeway at the first exit.

Of the four main I-5 interchanges in the JBLM vicinity (DuPont-Steilacoom Road, 41st Division Drive, Berkeley Street, and Thorne Lane) roughly 10 to 70 percent of the vehicles entering or exiting at these ramps are traveling short distances, depending on the specific location. This includes traffic to and from the cities of DuPont and Lakewood. These vehicles add to freeway congestion as they weave on and off of I-5. In spite of heavy peak period congestion in the corridor, the use of I-5 for these short trips confirms that there are limited viable

alternative routes. For example, during the PM peak hour 41 percent of the vehicles – or roughly 440 vehicles per hour – enter I-5 northbound at Thorne Lane and exit at Gravelly Lake Drive or Bridgeport Way.

As part of the one-day manual gate counts, vehicle occupancy was also collected on a typical weekday to determine the number of single-occupancy vehicles in the traffic stream versus vehicles with 2 or more persons. The vast majority of vehicles entering JBLM had a single occupant, with an average AM and PM peak period occupancy of 1.1 and 1.2 persons per vehicle, respectively. Of the vehicles with multiple occupants, the majority contained two people, with twice as many carpool vehicles in the afternoon compared to the morning.

How Do Travel Patterns and Characteristics Relate to the Larger Study?

As stated earlier, the purpose of this technical report is to describe the travel characteristics along I-5 in the JBLM vicinity, as well as travel to and from JBLM. This report is part of the larger *I-5 JBLM Vicinity Congestion Relief Study* that will lead to a corridor Interchange Justification Report and corresponding environmental documentation for the study area. This report is meant to supplement previous work by providing data (in tabular and graphic formats) that can help decision-makers better understand travel patterns within the study area and identify mobility solutions to the congestion that occurs daily along this segment of I-5.

2. INTRODUCTION

The purpose of this technical report is to describe the travel characteristics along I-5 in the JBLM vicinity, as well as travel to and from Joint Base Lewis-McChord (JBLM). This report is part of the larger I-5 JBLM Vicinity Congestion Relief Study that will lead to an Interchange Justification Report and corresponding environmental documentation for the study area. The type of documentation – i.e., Environmental Assessment or Environmental Impact Statement – is not yet determined for the study area.

The information summarized here has been assembled from recent data collection efforts along the I-5 JBLM corridor, as well as from a variety of previously completed studies in the project area. When summarized together, these results create a common understanding of current travel characteristics and patterns in the I-5 JBLM corridor. This report will serve as a resource for the Phase 2 Alternatives Analysis.

The report is organized into the following sections:

- Section 3: Summary of Past Studies
- Section 4: Summary of New Studies
- Section 5: Travel Characteristics in the Study Area
- Section 6: I-5 Travel Patterns
- Section 7: JBLM Travel Patterns

Sections 3 and 4 provide a high-level overview of the various study efforts that are the source of the travel information presented in the later chapters. Section 3 details past study efforts and Section 4 includes a summary of recently collected travel data for the study. The recently collected data includes:

- Origin-destination travel information through the study area, and
- Vehicle occupancy data at major JBLM gates.

Section 5 contains an overview of the study area and identifies the factors that contribute to travel demand in the JBLM vicinity, including employment and population growth. This section also includes data on why, when, and how people travel within the study area.

Section 6 illustrates regional travel patterns along I-5 and shows how they vary by time of day and day of week. Regional origin-destination patterns, I-5 mainline volumes, and interchange-to-interchange patterns are also provided in this section.

Section 7 provides a closer look at travel to and from JBLM. Regional travel patterns to and from JBLM Access Control Points (ACP) are discussed. This includes origin-destination patterns to JBLM ACPs, vehicle volumes entering and exiting JBLM, and trip characteristics on and between Lewis North, Lewis Main, and McChord Field.

Together, these sections provide a comprehensive overview of travel patterns along I-5 in the JBLM area and to/from JBLM.

3. REFERENCED TRAVEL STUDIES CONDUCTED BY OTHER AGENCIES

A range of travel information has been developed by recent study efforts in addition to the work undertaken during Phase 1 of the I-5 JBLM Vicinity Congestion Relief Study. Previous work conducted within the study area assists in providing an understanding of how people travel along the I-5 corridor, as well as within and around JBLM. Table 1 provides a high-level summary of both previous work and the work completed during Phase 1. Each study is discussed in further detail in the following sections.

3.1 PHASE 1 – CORRIDOR PLAN FEASIBILITY STUDY

In early 2014, WSDOT released the *Phase 1 - Corridor Plan Feasibility Study*, the first major deliverable of the I-5 JBLM Vicinity Congestion Relief Study. The purpose of this report was to create a framework plan to support identification of potential I-5 mainline and interchange improvements through the JBLM area. The *Phase 1 - Corridor Plan Feasibility Study* details the existing and future deficiencies along the corridor and establishes a framework for I-5 through the JBLM area to achieve the following set of objectives:

- Relieve congestion on I-5 within the study area
- Improve local and mainline system efficiency
- Enhance mobility
- Improve safety and operations
- Increase transit and Transportation Demand Management

The *Phase 1 – Corridor Plan Feasibility Study* is a resource for general background information about travel characteristics in the corridor. Information excerpted from this report, which was used to further illustrate the material presented in the following chapters, includes:

- Existing traffic data collected along I-5
- Existing traffic data collected at each of the JBLM Access Control Point (ACP)
- Public transit information within the study area

Table 1 – Summary of Previous Studies

Section	Study	Surveyed Region	Completed For	Year	Data Collected
3.1	Phase 1 – Corridor Feasibility Study	I-5 JBLM study area	WSDOT	2014	2013
3.2	Phase 1 – Traffic White Paper	I-5 JBLM study area	WSDOT	2014	Summary of other data
3.3	I-5 Origin-Destination Study	Thurston County	Thurston Regional Planning Council	2010	- License Plate O/D Pairs - Travel Survey Data
3.4	Household Travel Survey	Thurston County	Thurston Regional Planning Council	2013	- Daily Travel Diary (all trips within 24 hours)
3.5	JBLM Community Survey	JBLM Employees and Residents	South Sound Military & Community Partnership	2013	JBLM Specific Survey

This information is specifically used in Sections 6.2 and 6.3 of this report to provide a better understanding of how regional trips use and access I-5 in the vicinity of JBLM.

3.2 PHASE 1 – TRAFFIC WHITE PAPER

The *Phase 1 – Traffic White Paper* was written in early 2014 by the consultant team to provide a summary of the development and analysis of future travel forecasts in the I-5 JBLM study area, specifically pertaining to:

- Historical and current employment, population and travel characteristics in the vicinity of JBLM
- Existing traffic levels and patterns
- Actions that JBLM is currently taking to reduce travel demand, as well as potential future actions
- Assumptions necessary for the development of future travel forecasts

Information from the *Phase 1 – Traffic White Paper* used in this report consists primarily of the employment and population growth data presented in Section 5.1.

3.3 THURSTON REGIONAL PLANNING COUNCIL, I-5 LICENSE PLATE SURVEY (TRPC I-5 O-D STUDY)

In 2010, the Thurston Regional Planning Council (TRPC), the Metropolitan Planning Organization for Thurston County, conducted a license plate-based, origin-destination study for the I-5 corridor. This study provided a better understanding of how I-5 is used through Thurston County and the general origin-destination patterns that occur along the corridor.

The study area for this survey was bounded by:

- I-5 at Mounts Road near the Thurston County / Pierce County line
- I-5 at 93rd Avenue SW just south of Tumwater
- US-101 at Mud Bay Road west of Olympia

License plate reader cameras were installed at these three locations and operated for one day in October of 2010. The collected data was used to:

- Track vehicle movements into, out of, and through the study area boundaries on I-5 and US-101
- Categorize vehicles by classification
- Send written surveys to a subset of vehicle owners identified by license plates to obtain more information about trip purposes along I-5

Since the study primarily focused on Thurston County, only select pieces of data were incorporated into this report. The relevant data included I-5 vehicle occupancy rates at the I-5 / Mounts Road interchange at the Thurston / Pierce County line. This data is provided in Section 6.5.

3.4 THURSTON REGIONAL PLANNING COUNCIL HOUSEHOLD TRAVEL SURVEY (TRPC HHTS)

In 2013, TRPC completed a household travel survey (HHTS) of residents within Thurston County and southwest Pierce County in the vicinity of JBLM to better understand individual travel characteristics such as trip purpose, time of travel, number of travelers, travel mode, frequency of trips, etc. The survey included a diary of all trips taken over a 24-hour weekday period

for nearly 2,500 households (about one percent of the total population in the study area).

The survey identified residents of JBLM for "targeted sampling" resulting in 163 JBLM resident responses. The JBLM-specific survey asked for similar information, but included additional information unique to JBLM such as which JBLM ACP gate was used when entering or exiting the base.

The TRPC household travel survey provides important information for understanding trip purposes and characteristics that is best captured from these types of travel surveys. This information is provided in Sections 5.3 and 5.4 of this report.

3.5 JBLM COMMUNITY NEEDS SURVEY (JBLM SURVEY)

The Community Needs Assessment was conducted in 2013 to obtain data about the service-member populations on JBLM. The survey was administered and prepared by the South Sound Military & Community Partnership in close coordination with JBLM.

The survey was distributed to the entire JBLM employee population. The survey was also promoted using the South Sound Military and Communities Partnership, JBLM, and other social media outlets. An "all call" email was sent to individuals with a registered email address in the JBLM network.

The majority of the data collected from the survey pertains to issues other than transportation which can be broadly grouped into categories including demographic background, deployment status, household makeup, community needs, base travel, career plans and child care needs. Nine transportation related questions provide valuable insight into travel patterns to and from JBLM.

The survey provides important information such as mode split, time of arrival to the base, ACP preference, and ACP use throughout the day. This information is presented in Sections 7.3 and 7.4 of this report.

4. I-5 AND JBLM ORIGIN-DESTINATION AND VEHICLE OCCUPANCY STUDIES

Two additional data collection efforts were completed as part of the I-5 JBLM Vicinity Congestion Relief Study to fill in missing information or expand upon earlier information on travel characteristics in the study area. These efforts included gathering more comprehensive origin-destination information at both a regional corridor level and for individual JBLM gates. It also included collecting occupancy information for peak-direction vehicles entering or exiting JBLM ACPs. These studies are referred to throughout this report as:

- I-5 and JBLM Origin-Destination (O-D) Study
- JBLM ACP Vehicle Occupancy Study

These studies build from past work; providing either more detailed data or data that is specifically relevant to the JBLM study area. For example, the origin-destination study provides insight into the travel patterns along the I-5 corridor, and to and from JBLM. The origin-destination study includes detailed travel pattern information such as the use of I-5 for local trips, or how trips travel through or between the various parts of JBLM. The vehicle occupancy study evaluates the current carpool and vanpool market and how it varies by ACP.

The next two subsections describe these data sources in detail, while their results are discussed throughout the remainder of the report.

4.1 I-5 AND JBLM ORIGIN-DESTINATION STUDY (I-5 JBLM O-D STUDY)

In February 2014, forty-seven Bluetooth detection units (called BlueMAC) were installed along I-5 between milepost 114 and 127, along other major roadways, at JBLM gates, and within JBLM itself. These BlueMAC units record anonymous signals from nearby Bluetooth enabled devices (commonly installed in cell-phones and automobiles), and record the time at which the signal was received. By matching the signals recorded at multiple locations, a web-based software system is able to compute both travel times and O-D patterns. A sample BlueMAC unit is shown in Figure 1.

Figure 1 – BlueMAC Detection Unit

4.1.1 Study Area and Period

The forty-seven BlueMAC detectors were distributed across the study area, shown in Figure 2. The location of these BlueMAC readers can be grouped into four primary categories:

- I-5 Mainline – detects vehicles traveling along I-5
- I-5 Interchanges – detects vehicles entering or exiting the freeway
- JBLM ACPs – detects vehicles entering or exiting JBLM
- Study Cordon – detects vehicles traveling into or out of the study area along major travel routes

BlueMAC detection locations were identified to capture major traffic flows through the study area. These locations were selected to provide the necessary data to answer some of the outstanding questions about travel along I-5 in the JBLM area that was not previously surveyed or described in other reference material. The BlueMAC detection units operated 24-hours a day from January 27, 2014 to February 8, 2014.

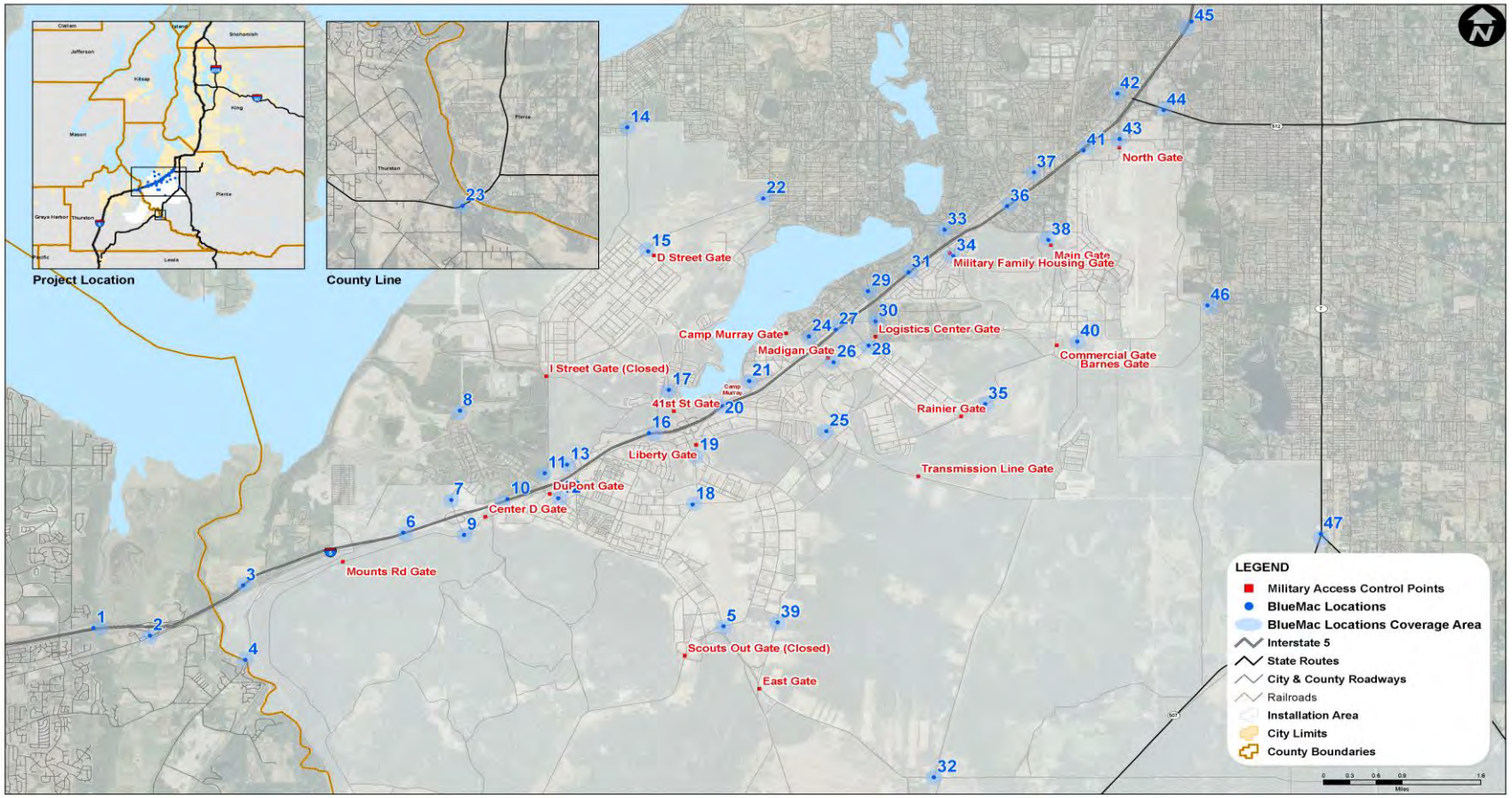

Figure 2 – BlueMAC Device Locations

4.1.2 Data Validation and Usefulness

To determine the prevalence of Bluetooth devices among the traveling public, several isolated locations with both BlueMAC detectors and traffic volume counts were analyzed to determine the percentage of vehicles with Bluetooth-enabled devices (referred to as the "penetration rate") within the study area. Penetration rates were found to range between 7.6 and 8.8 percent, meaning that an estimated one out of every twelve vehicles in the study area emitted a Bluetooth signal that the BlueMAC readers successfully recorded.

Over the duration of the study, 230,800 linked origin-destination trips were recorded among the 47 BlueMAC devices. This large sample of origin-destination trip data and penetration rate demonstrated that the origin-destination patterns calculated from this data are representative of "true" travel patterns. While this data was used to determine travel patterns, and therefore trip distribution in the study area, the penetration rate was not used on its own to compute vehicle volumes between particular locations.

After the data was found to be statistically significant, it was analyzed to provide three major insights into travel patterns within the study area:

1. **Regional trip distribution** – Trip distribution patterns at a regional level can be clearly documented by matching signals at detectors located near major regional destinations. In section 6.1, maps are presented detailing where trips terminate that start north of the study area (on I-5), south of the study area (on I-5), and on SR 512 east of the study area.
2. **Trip distribution to JBLM gates** – Trip distribution patterns to and from JBLM gates can be measured by matching signals that were detected at each JBLM gate. In Section 7.1, maps are presented that describe the origin or destination of trips that access JBLM ACPs.
3. **Short-tripping patterns** – By placing BlueMAC readers at each major entry and exit point along I-5, it was possible to measure the relative distribution of vehicles that use I-5 for short-tripping (i.e., exiting within 2 interchanges after entering I-5). This data is presented in Section 6.4.

4.1.3 Limitations

Since not all drivers own phones or vehicles with Bluetooth, or some own more than one Bluetooth enabled device, the data collected by the BlueMAC units must be viewed as a sample of the overall traveling public. Therefore, the Bluetooth data is only used to approximate distribution of travel in the JBLM vicinity. The only exception to this is along the I-5 corridor where all entrance and exits had BlueMAC devices, creating a "closed" system. This, in combination with detailed interchange volumes allowed for calculation of vehicle volumes between interchanges.

A related limitation using Bluetooth devices is that a signal may be detected at one BlueMAC device, but may not be detected again when passing a second BlueMAC device because of low signal strength or because the Bluetooth signal was no longer on. Tests indicate that this occurs to 12 to 28 percent of signals; however, because this drop off was assumed to occur randomly, it is not expected that this negatively impacts the results. Rather, it simply reduces the number of matched origin-destination pairs.

4.2 JBLM ACP VEHICLE OCCUPANCY STUDY

(ACP VEHICLE OCCUPANCY STUDY)

To improve the level of detail and confidence in data related to travel modes accessing JBLM, peak-direction occupancy counts of vehicles entering and exiting the base were conducted. The number of occupants was manually counted by data collection technicians located outside selected ACPs.

Vehicle occupancy counts were conducted on February 12, 2014 from 6:30AM to 8:30AM in the morning and 3:30PM to 6:30PM in the afternoon at Liberty Gate, DuPont Gate, 41st Division Drive Gate, McChord Main Gate, and Madigan Gate. These five ACPs have the highest vehicle volumes along the I-5 JBLM corridor and on a typical weekday process approximately 70 percent of vehicles entering and existing JBLM.

Vehicle occupancy counts were collected by lane in 15-minute increments and were aggregated to calculate the average vehicle occupancy for each ACP, as well as to identify the number and percentage of carpool vehicles at each ACP.

This data can be used in several ways. For example, it can validate mode split data in the travel demand model developed for the I-5 JBLM Vicinity Congestion Relief Study. Coupled with traffic count data, this information will also be useful in analyzing travel demand and the operations of ACP access and interchange design alternatives. Finally, this data demonstrates where the carpool/vanpool market is already strongest.

5. STUDY AREA AND TRAVEL CHARACTERISTICS

This section describes the area included in the I-5 JBLM Congestion Relief Study and summarizes which factors are contributing to travel demand in the area. It also provides a high level overview of the general characteristics of trips within the study area.

5.1 WHAT ARE THE BOUNDARIES OF THE STUDY AREA?

The I-5 JBLM Congestion Relief Study includes an area that extends along I-5 in Pierce County from the Mounts Road interchange (Exit 116) near the Thurston County line on the south boundary, to the SR-512 interchange (Exit 127) in Lakewood on the north boundary. The I-5 JBLM corridor within the study area includes nine interchanges, with four focus interchanges at DuPont-Steilacoom Road (Exit 119), 41st Division Drive/Main Gate (Exit 120), Berkeley Street (Exit 122), and Thorne Lane (Exit 123), as shown in Figure 3.

These nine interchanges are located in close proximity to each other, as are several JBLM ACPs and local streets. The names of the interchanges, streets and ACPs are frequently used interchangeably as described in Table 2.

Table 2 - Interchange, Street and Gate Relationships

Exit Number	Side	Street Name	Gate Name (Abbreviation)
Exit 116 – Mounts Road	West	Mounts Road	-
	East	Old Pacific Highway SE	Mounts Road Gate
Exit 118 – Center Drive	West	Center Drive	-
	East	Center Drive	Center Drive Gate
Exit 119 – DuPont-Steilacoom Road	West	DuPont-Steilacoom Road	I Street Gate
	East	Clark Road	DuPont Gate
Exit 120 - 41st Division Drive/Main Gate	West	41st Division Drive	41st Division Gate
	East	41st Division	Liberty Gate
Exit 122 – Berkeley Street	West	Berkeley Street SW	Camp Murray Gate
	East	Jackson Avenue	Madigan Gate (MAMG)
Exit 123 – Thorne Lane	West	N Thorne Lane SW	-
	East	Murray Road SW	Logistics Center Gate
Exit 124 – Gravelly Lake Drive	West	Gravelly Lake Drive SW	-
	East	Woodbrook Road SW	Military Family Housing Gate
Exit 125 – Bridgeport Way	West	Bridgeport Way SW	-
	East	Bridgeport Way SW	McChord Main Gate
Exit 127 - SR-512	West	S Tacoma Way	-
	East	SR-512	-

Figure 3 – Study Area

(Phase 1 – Corridor Feasibility Study)

5.2 WHAT IS CONTRIBUTING TO THE TRAVEL DEMAND?

From 2003 to 2010, the regional population in Pierce and Thurston Counties grew between 8 and 17 percent, respectively. The population of Pierce County grew at a rate of 1.2 percent annually, with Thurston County growing nearly twice that rate at 2.3 percent annually. The number of employees also grew during that same time in both counties, at a slightly slower rate compared to population growth. Pierce County grew at 1.0 percent and Thurston County grew at 1.2 percent.

Growth related to JBLM has been an important component of the population and employment growth in the two-county areas. Between 2003 and 2010, JBLM related population and employment has seen a large increase. Population and employment can change dramatically at the base due to decisions at the national level. External factors related to Department of Defense decisions, on-base consolidation, troop realignments and changes in troop deployment can all create large changes in base population.

JBLM related population increased by 40,000 people from 2003 to 2010. Over this time period direct employment grew by 15,000 people. This represents a 5.3 percent annual growth rate for both JBLM related population and employment. Table 3 highlights the historical job and population growth within the study area.

Compared to regional population and employment growth over the seven year period, JBLM related growth represents 33 percent of the two-county population growth, and 61 percent of the two-county employment growth. Increased demand on area streets and highways has accompanied this population and employment growth.

Table 3 – Job and Population Growth in Study Area

JBLM Related Population and Employment (1)	2003	2010	Net Change	Percent Change	Annualized Growth Rate
Related Population	91,530	131,501	+39,971	+43.7%	+5.3%
Related Employment	35,331	50,587	+15,256	+43.2%	+5.3%
Regional Population (2)					
Pierce	733,700	795,225	+61,525	+8.4%	+1.2%
Thurston	214,800	252,264	+37,464	+17.4%	+2.3%
Totals	948,500	1,047,489	+98,989	+10.4%	+1.4%
Regional Employment (3)					
Pierce	246,200	263,300	+17,100	+6.9%	+1.0%
Thurston	89,700	97,500	+7,800	+8.7%	+1.2%
Totals	335,900	360,800	+24,900	+7.4%	+1.0%

(1)Source: JBLM Growth Coordination Plan, 2010.
(2) Source: 2003 data from WA Office of Financial Management, 2010 data from U.S. Census.
(3) Source: Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2003 and 2010.

5.3 WHY AND WHEN DO PEOPLE TRAVEL?

Understanding why, when, where and how people travel is important to understanding whether changes to the transportation system or its operations can address the objectives of the I-5 JBLM Vicinity Congestion Relief Study (i.e., to reduce congestion and improve mobility in the I-5 JBLM corridor). In the JBLM vicinity, the TRPC Household Travel Survey is the best source of information that helps answer these questions.

The data that are referenced in this chapter were selected for their relevance to travel patterns within and through the study area. While the data includes all of Thurston County and portions of Pierce County in the JBLM vicinity, it does not specifically focus on the I-5 JBLM corridor. Therefore, the information presented provides a general overview of travel characteristics in the study area, without specific detail near JBLM.

5.3.1 Trip Purpose

Figure 4 illustrates the distribution of trips summarized by major trip purpose or type. The five most common trip type categories include:

- Home – Trips to or from home
- Work – Trips to or from work
- Shopping – Trips to or from shopping
- School/College – Trips to or from school
- Other – Remainder of trips (catch all category)

By grouping all trips into these general categories, the overall breakdown of trip by type can be better understood. For example, the most common type of trips (28 percent of the total) is trips that start or end at home from somewhere other than work, shopping or school.

Home-based work trips (direct commute trips) represent 15 percent of all reported trips, and work-based other (commute trips to a non-home destination) represent 13 percent of all trips. Nine percent of trips are made directly between home and shopping, and 7 percent of trips made are between home and school. All other trips are grouped into the other-based other trip category and are estimated to be 25 percent of all trip making.

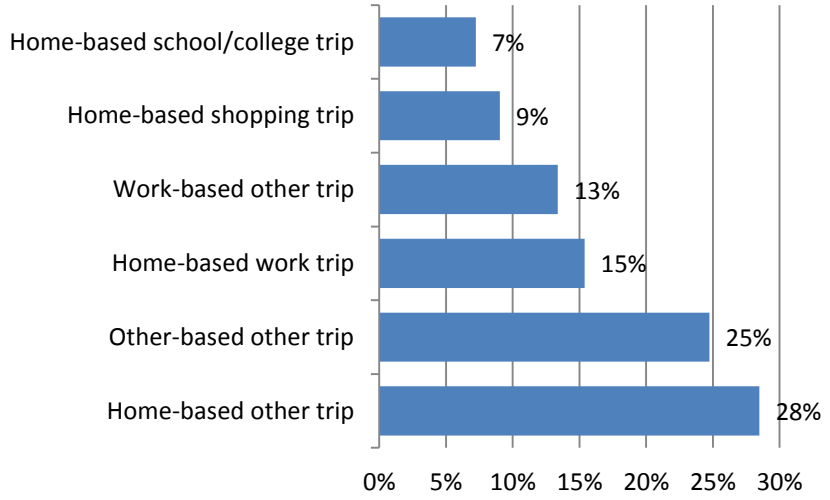

Figure 4 – Trip Purpose

(TRPC HHTS)

5.3.2 Time of Trips

Figure 5 illustrates trip start and end times. The household travel survey asked respondents to provide travel information

for the weekday, which indicated that the highest concentration of travel occurs in the AM and PM peak periods.

The time periods which have more trips starting than ending indicates an hour where travel demand on the transportation system increased; whereas more trips ending than starting indicates the hours where travel demand decreased.

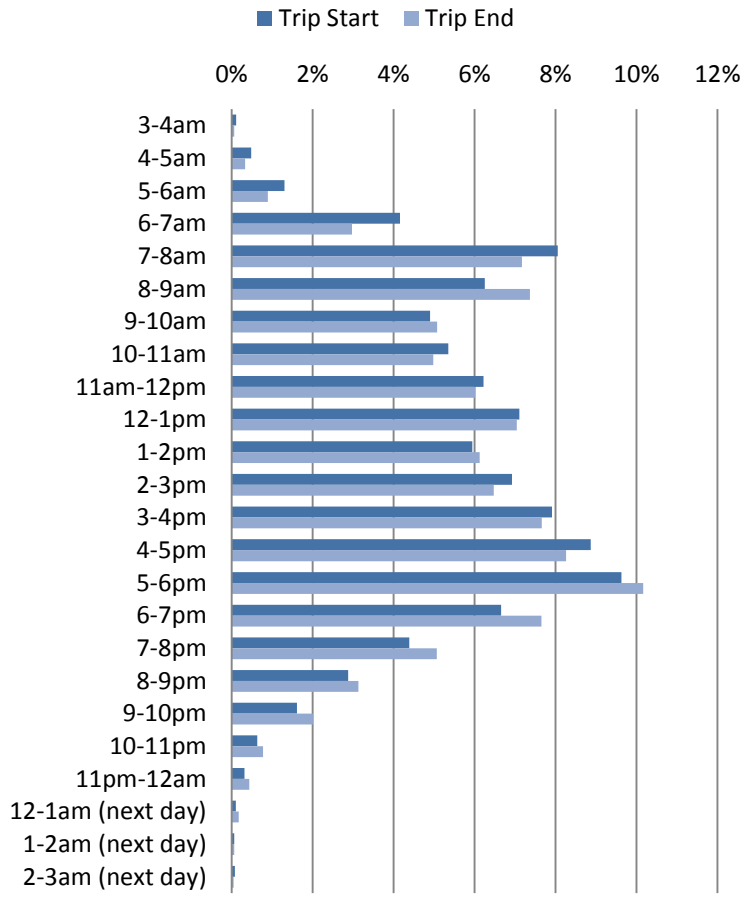

Figure 5 – Trip Start and End Times

(TRPC HHTS)

5.4 HOW DO PEOPLE TRAVEL?

5.4.1 Mode of Travel

Figure 6 indicates the mode of travel taken by each individual who participated in the survey. The vast majority of travel throughout the day occurred by motor vehicle, with 52 percent of trips using single occupancy vehicles. Additionally, 31 percent of trips were made in vehicles with two or more people. This information is representative of Thurston County and southwest Pierce County, and not necessarily consistent with the actual mode share along I-5 or to/from JBLM. It provides a general context of what is occurring on a regional level.

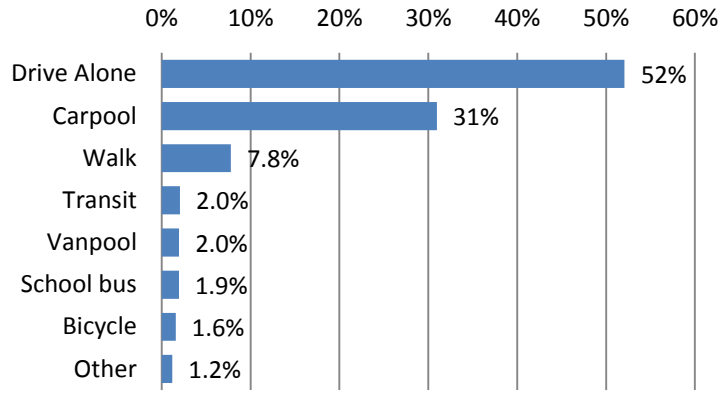

Figure 6 – Regional Mode Split

(TRPC HHTS)

5.4.2 Carpool Rates and Characteristics

Figure 7 and Figure 8 provide a more detailed breakdown of carpool trips. Of the carpool trips identified in Figure 7, 85 percent of the trips began at home and 13 percent began at another location. Carpool trips beginning at a park and ride lot make up less than one percent of carpool trips.

Similarly, Figure 8 shows the proportion of overall trips which had 2 or more household or non-household members. The graph shows that 22 percent of overall trips included one household member in addition to the driver. Six percent included two household members in addition to the driver.

Figure 8 also shows that 13 percent of all trips carried one non-household member in addition to the driver. Four percent carried two non-household members in addition to the driver. These percentages are not mutually exclusive and do not add up to 100 percent.

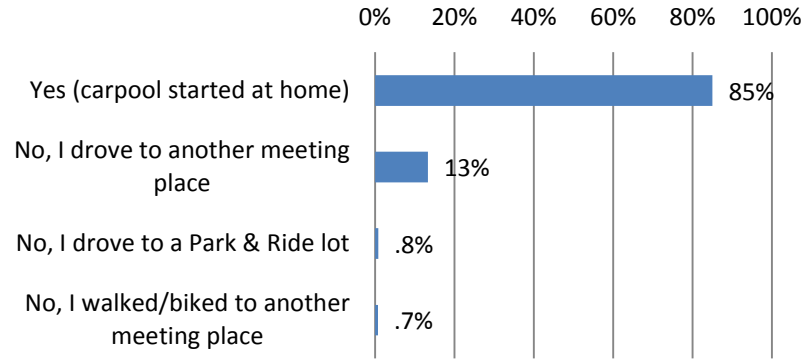

Figure 7 – Carpool Start Location

(TRPC HHTS)

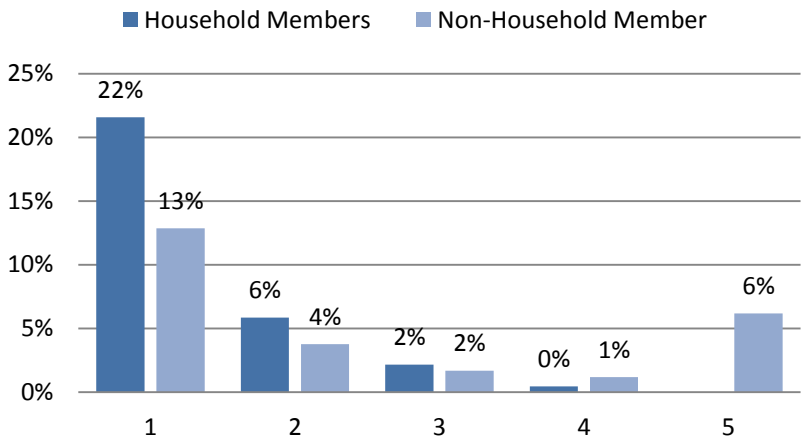

Figure 8 – Household vs Non-household Members per Trip

(TRPC HHTS)

6. I-5 TRAVEL PATTERNS

Identifying the major origin-destination patterns and traffic volume trends through the study area provides an important baseline for evaluating and measuring potential benefits and impacts of various improvement alternatives. Additionally, understanding regional traffic patterns is important for developing travel demand models and other analytical tools to better reflect existing travel behavior, and in turn reasonably forecast future travel patterns. Information about regional traffic patterns related to I-5 and SR 512 are presented first in this chapter, including their respective origin-destination patterns and volume trends (hourly and daily). Following this discussion is a description of the traffic patterns at the four primary study interchanges.

6.1 WHERE ARE REGIONAL TRIPS STARTING AND ENDING?

The majority of regional trips enter or exit the study area from I-5 to the north, I-5 to the south, and SR 512 from the east. This section details regional traffic patterns as they relate to these major study access points. This information is based on data collected as part of this project.

For each of the three regional access locations, several origin-destination maps are presented. First, travel distribution patterns for the weekday AM and PM peak period are discussed. This map shows how traffic flows into the study area in the morning, with the reverse flow of traffic leaving the study area in the afternoon. The second set of maps show daily traffic distribution patterns including both weekday and weekend time periods.

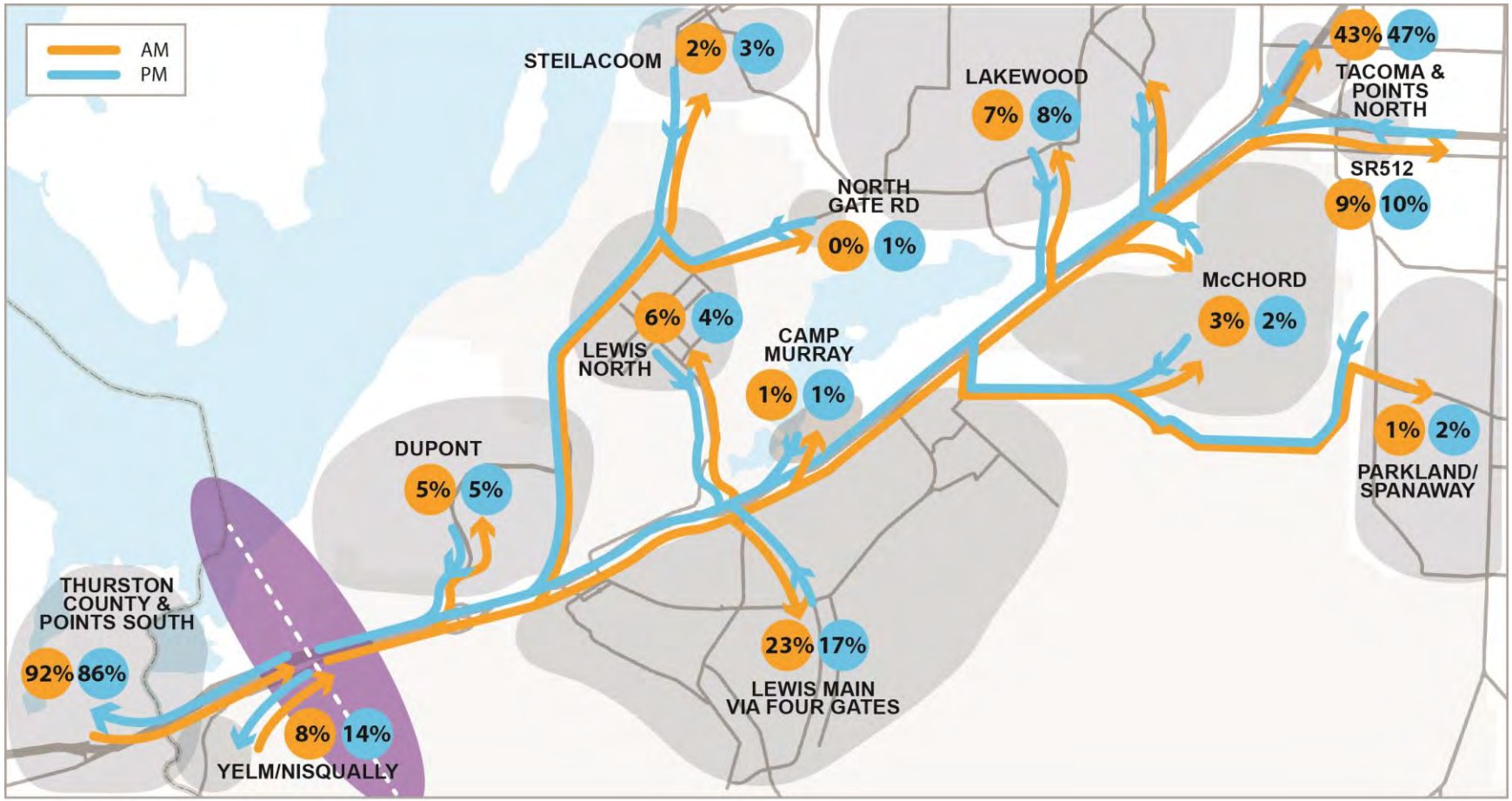

Figure 9 – Thurston/Pierce County Line Trip Distribution (Weekday AM & PM Peak Periods)

Figure 9 shows the trip distribution for vehicles crossing the Thurston / Pierce County line for the weekday AM and PM peak periods. The dashed line indicates a "screenline" with trip distribution on each side of the screenline adding up to 100 percent.

AM peak period (6 to 9AM) northbound trips are displayed in gold and PM peak period (3 to 6PM) southbound trips are displayed in blue. In the AM peak, 52 percent of all trips crossing the screenline heading northbound continue through the study area to a points north on I-5 or northeast on SR 512. Trips to JBLM make up 32 percent of trips.

In the PM peak, 57 percent of all trips crossing the screenline in a southbound direction originate on I-5 and SR 512 to the north of the study area, while 23 percent originate at JBLM.

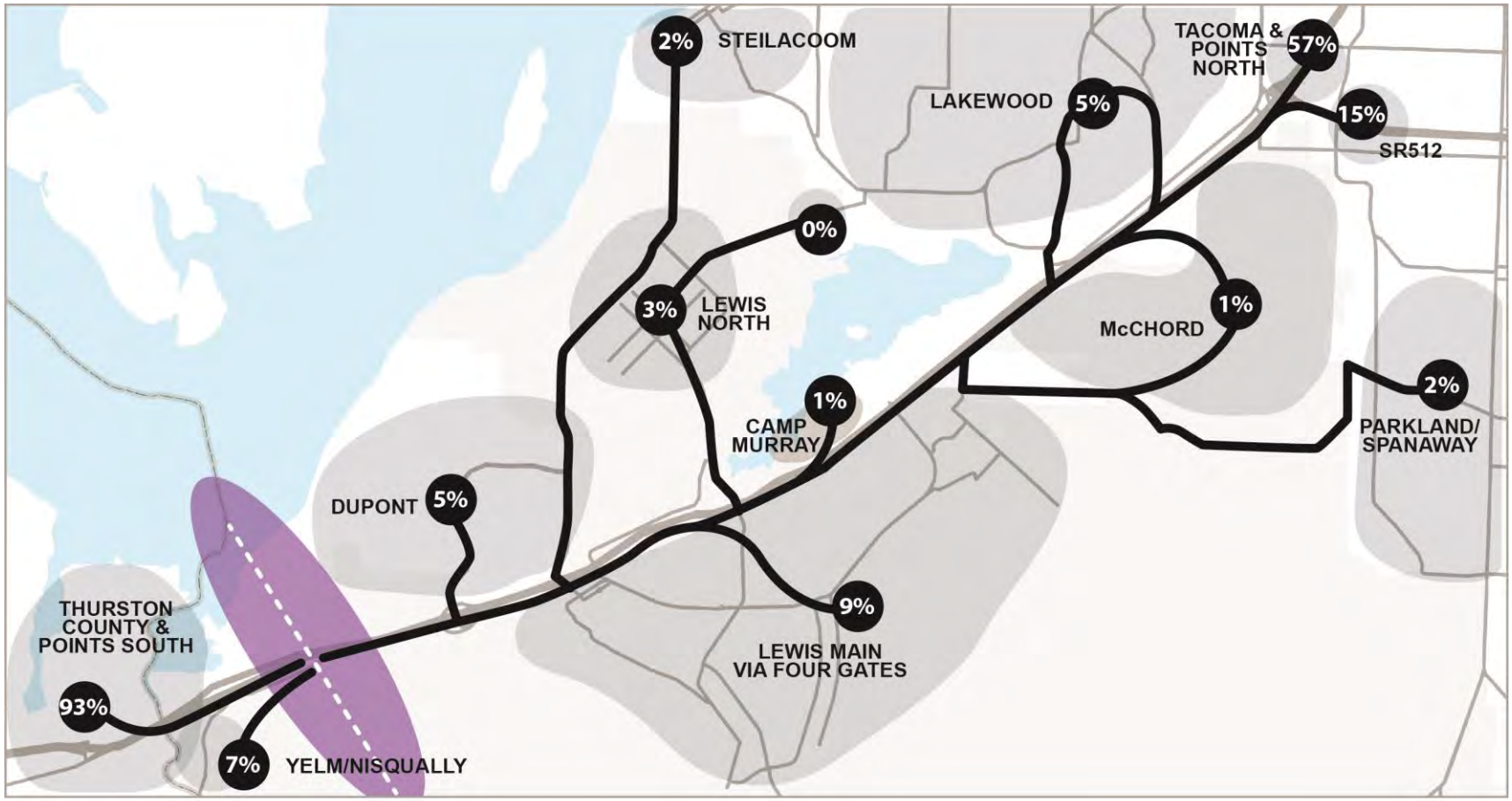

Figure 10 – Thurston/Pierce County Line Trip Distribution (Weekday)

Figure 10 shows the daily weekday trip distribution for trips crossing the Thurston/Pierce County line. South of the screenline, 93 percent of trips that pass the screenline start or end in Thurston County or points south and 7 percent start or end in Yelm or south Lacey.

North of the screenline, 72 percent of trips move through the study area to/from I-5 or SR 512. Trips oriented to JBLM areas represent 13 percent. Compared to the AM and PM peak periods shown in Figure 9, the number of regional trips traveling through the corridor is much larger. JBLM contributes 20 to 30 percent of the trips crossing the screenline during peak periods, but less than 15 percent for daily trips.

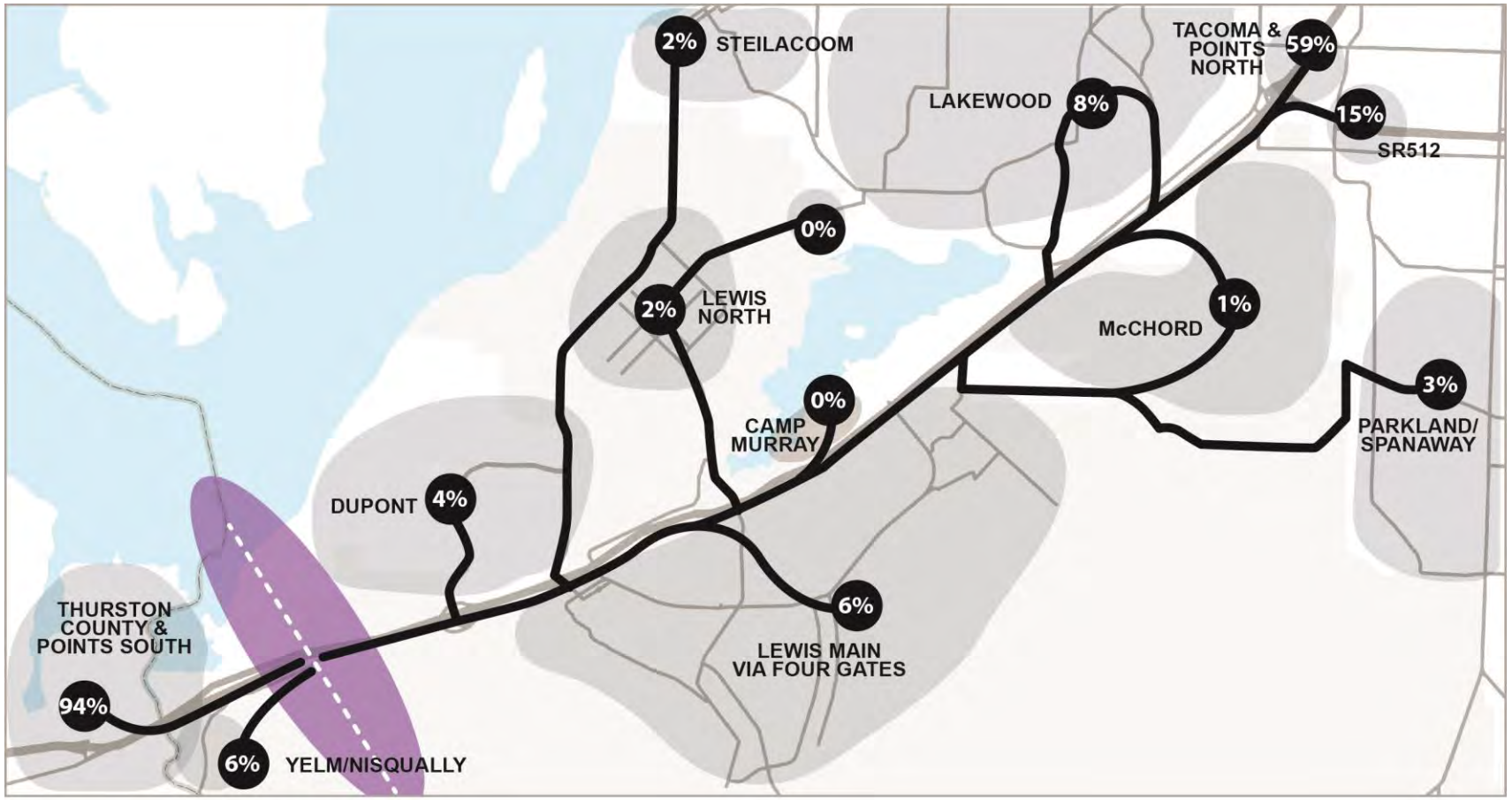

Figure 11 – Thurston/Pierce County Line Trip Distribution (Weekend)

Figure 11 shows the daily weekend trip distribution crossing the Thurston/Pierce County line. The weekend trip distribution is similar to the weekday trip distribution as shown in Figure 10.

The main difference between the daily weekday and weekend trip distribution is that there are fewer JBLM trips on a weekend days (9 percent compared to 13 percent). Trips oriented to Lakewood and I-5 to the north represents a larger share of the weekend travel.

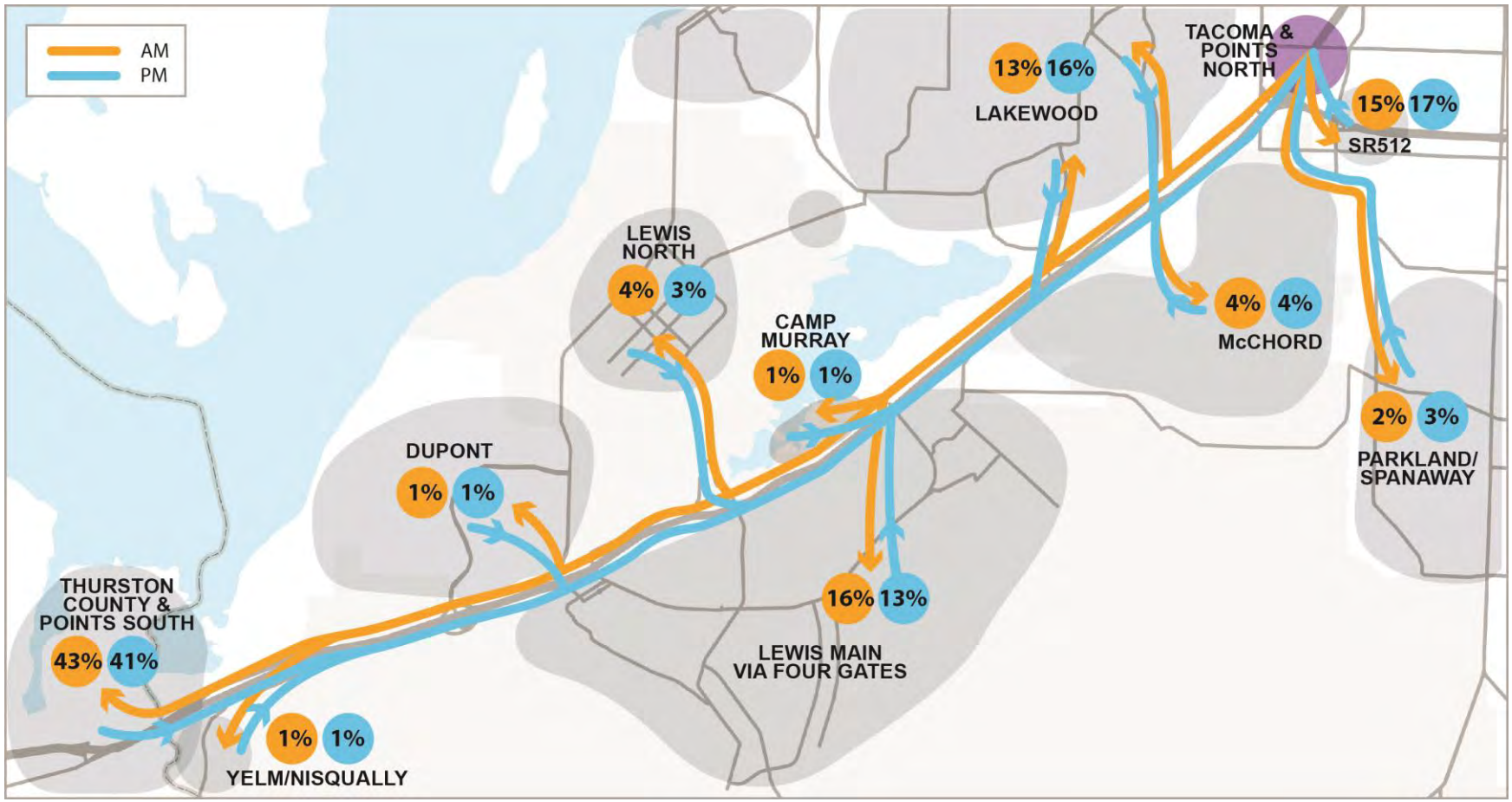

Figure 12 – Tacoma and Points North Trip Distribution (Weekday AM & PM Peak Periods)

Figure 12 shows the trip distribution for vehicles associated with Tacoma and points north of SR 512 for the weekday AM and PM peak periods. AM peak period (6 to 9AM) southbound trips are displayed in gold, and PM peak period (3 to 6PM) northbound trips are displayed in blue.

In the AM peak, 44 percent of all trips moving southbound continue through the study area to Thurston County or points south while 24 percent are trips oriented to JBLM.

In the PM peak, 42 percent of all trips moving northbound originate from Thurston County or points south, while 20 percent originate from JBLM.

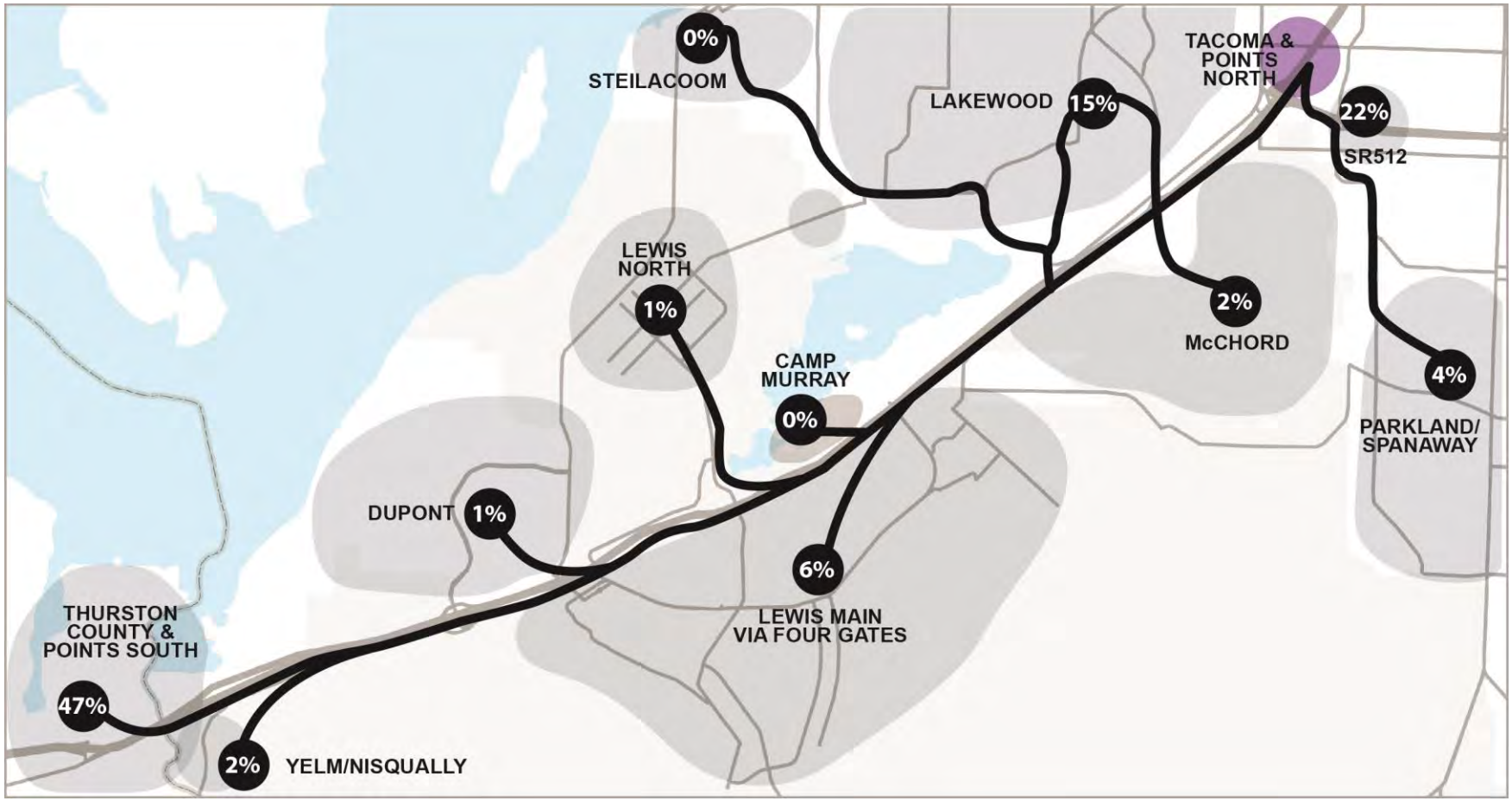

Figure 13 – Tacoma and Points North Trip Distribution (Weekday)

Figure 13 shows the daily weekday trip distribution for trips associated with Tacoma and points north of SR 512. During weekday periods, 49 percent of trips travel through the corridor to Thurston County or points south. The JBLM trips represent only 9 percent of total trips.

Compared to the AM and PM peak periods shown in Figure 12, the regional trips traveling all the way through the corridor is slightly larger. JBLM contributes 20 to 25 percent of the trips during peak periods, but less than 10 percent for daily trips.

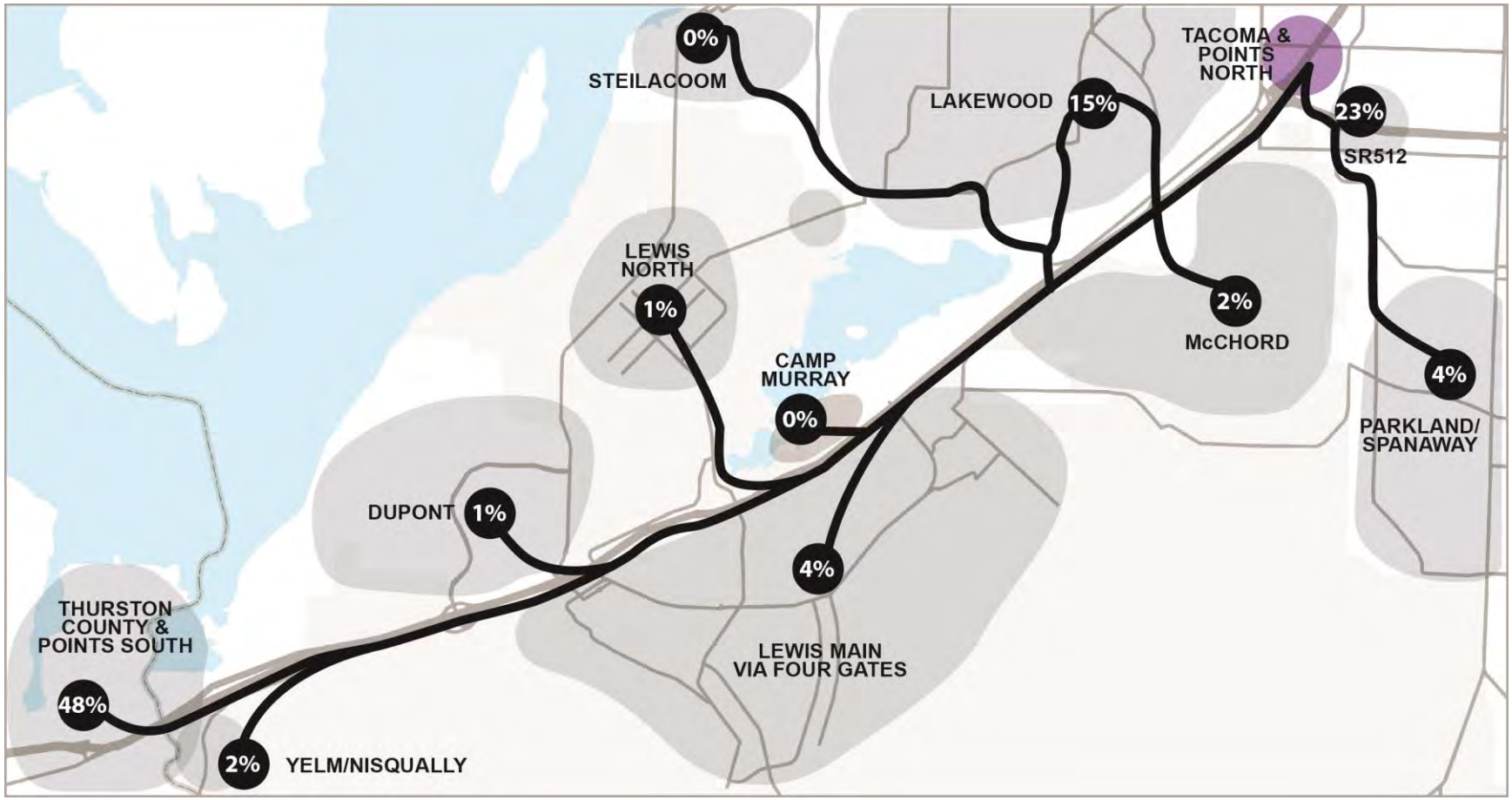

Figure 14 – Tacoma and Points North Trip Distribution (Weekend)

Figure 14 shows the daily weekend trip distribution associated with Tacoma and points north of SR 512. The weekend trip distribution is similar to the weekday trip distribution as shown in Figure 13. Most percentages change by 2 percent or less; however, there is less of a concentration of traffic entering and exiting the corridor through the study area during the peak periods.

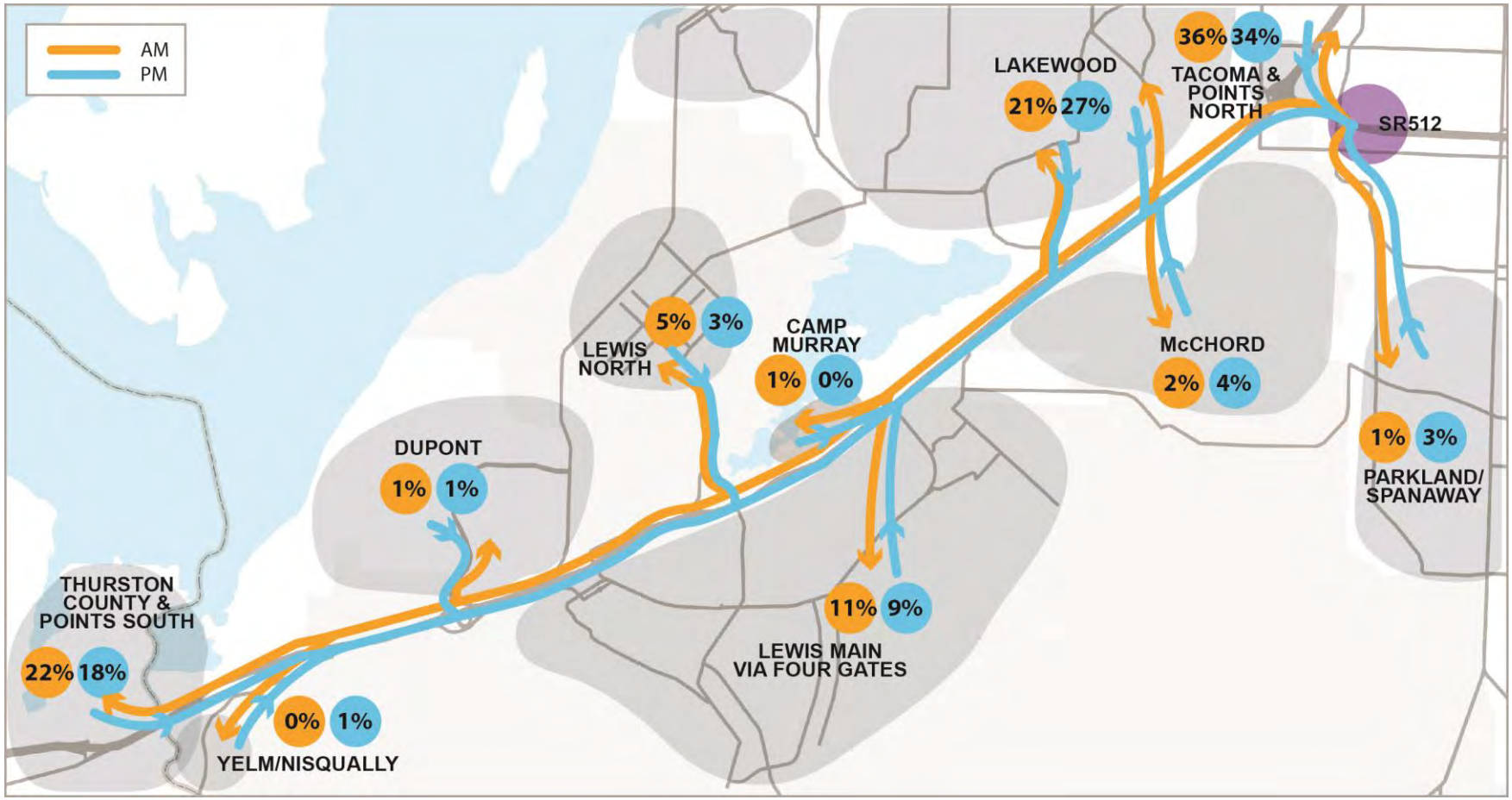

Figure 15 – SR 512 Trip Distribution (Weekday AM & PM Peak Periods)

Figure 15 shows the trip distribution for vehicles associated with SR 512 east of I-5 for the weekday AM and PM peak periods. AM peak period (6 to 9AM) northbound trips are displayed in gold and PM peak period (3 to 6PM) southbound trips are displayed in blue.

In the AM peak, 22 percent of all trips heading southbound from SR 512 continue through the study area to Thurston County or points south, while 18 percent are trips oriented to JBLM.

In the PM peak, 19 percent of all trips heading east on SR 512 originate in Thurston County or points south, while 16 percent originate in JBLM.

Unlike Figure 9 and Figure 12, the percentages for JBLM do not substantively change between peak hours.

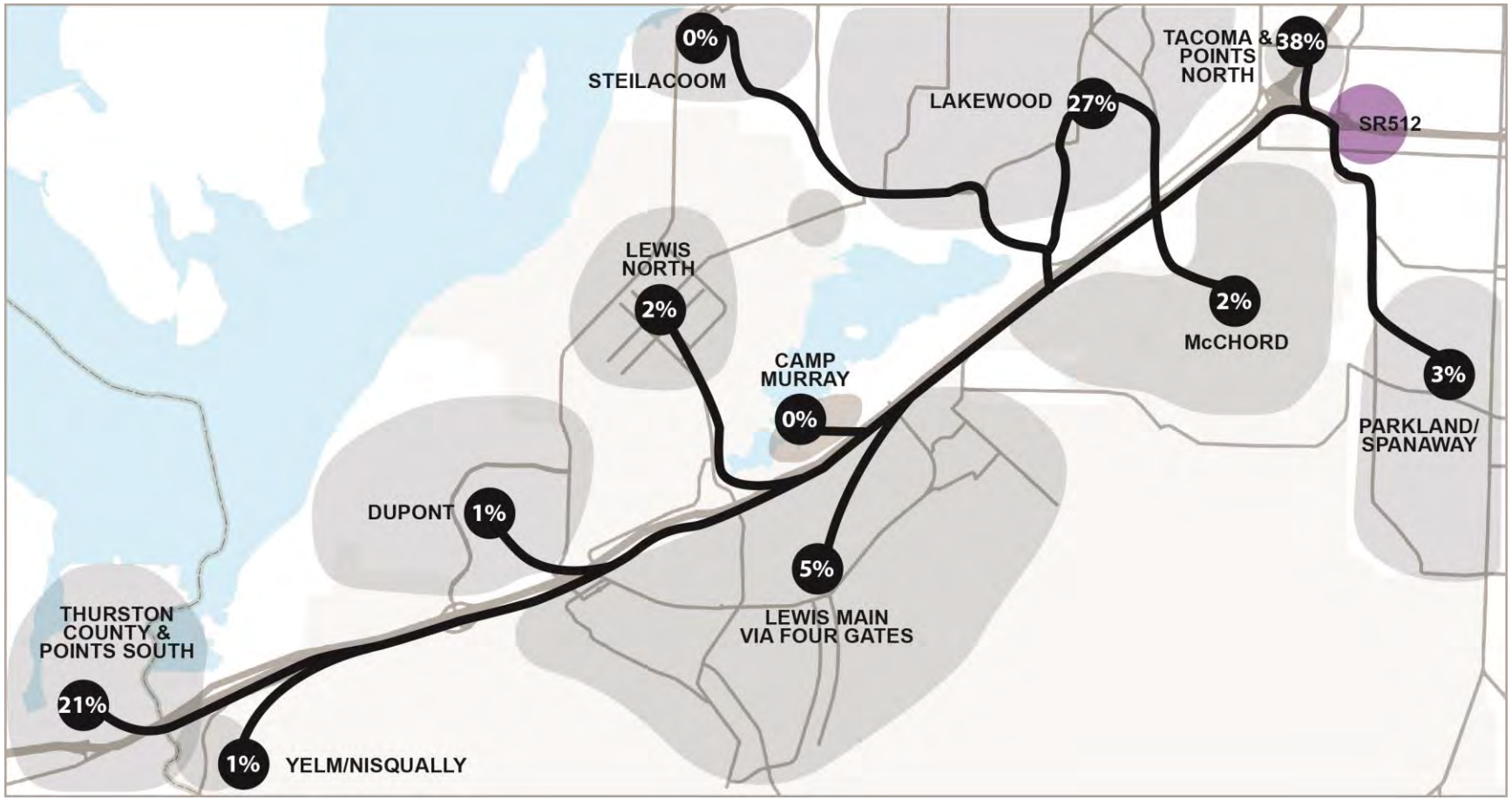

Figure 16 – SR 512 Trip Distribution (Weekday)

Figure 16 shows the daily weekday trip distribution for trips associated with SR 512 east of I-5. During weekday periods, 22 percent of vehicles travel through the corridor to Thurston County or points south. JBLM trips represent 9 percent of total trips.

Compared to the AM and PM peak periods shown in Figure 15, the percentage of regional trips traveling through the entire I-5 corridor is about the same. JBLM contributes 15 to 20 percent of the trips during peak periods, but less than 10 percent of the total daily trips.

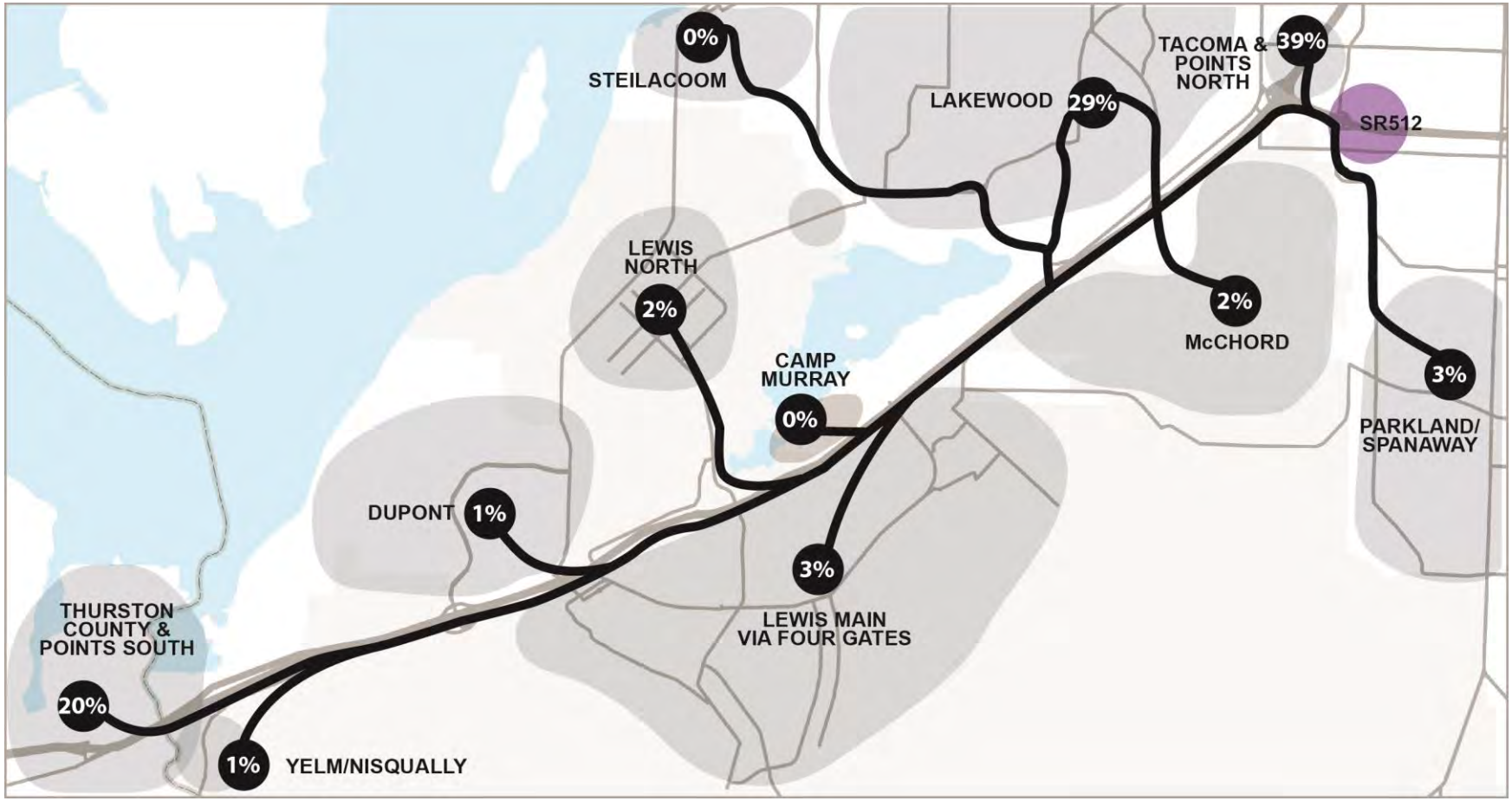

Figure 17 – SR 512 Trip Distribution (Weekend)

Figure 17 shows the daily weekend trip distribution associated with Tacoma and points north of SR 512. The weekend trip distribution is similar to the weekday trip distribution as shown in Figure 16. Most of the trip distribution changes are 2 percent or less.

6.2 HOW DO REGIONAL TRIPS USE THE I-5 CORRIDOR?

This section highlights regional travel patterns associated with I-5 travel volumes throughout the day, week, and at spot locations along the I-5 corridor.

6.2.1 I-5 Traffic Volumes by Day of Week

Figure 18 provides an average of I-5 mainline traffic volumes between January 1 and February 28, 2013 at a WSDOT permanent count location just north of the Center Drive interchange (Exit 118). The average daily weekday volume (both directions) ranges from a total of 110,000 to 125,000 vehicles per day, depending on the day of the week.

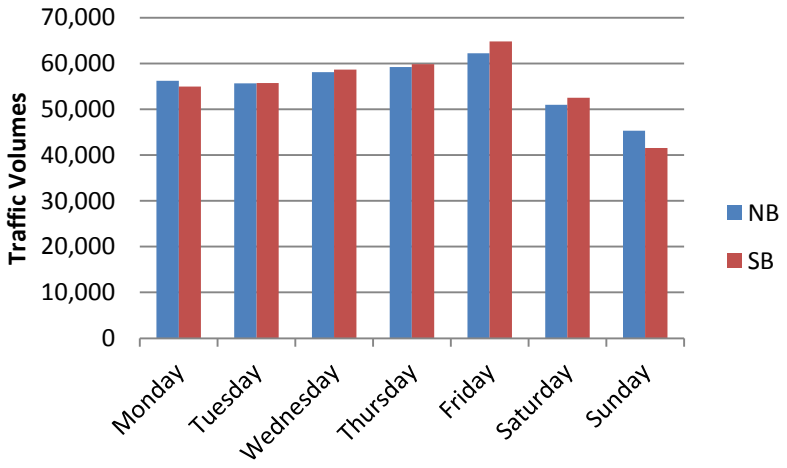

Figure 18 – I-5 Mainline Traffic Volumes by Day of Week

(*Phase 1 – Corridor Feasibility Study)*

Traffic volumes are highest at the end of the week, with Friday consistently being the busiest day along I-5. Mainline volumes are generally evenly split between northbound and southbound throughout the week. Weekend volumes are lower than weekday volumes, with Sunday volumes being the lowest.

6.2.2 I-5 Traffic Volumes by Time of Day

Figure 19 provides average weekday volumes (Tuesday to Thursday) and average weekend volumes (Saturday and Sunday) by time of day for I-5 for the same time period as the data in Figure 18.

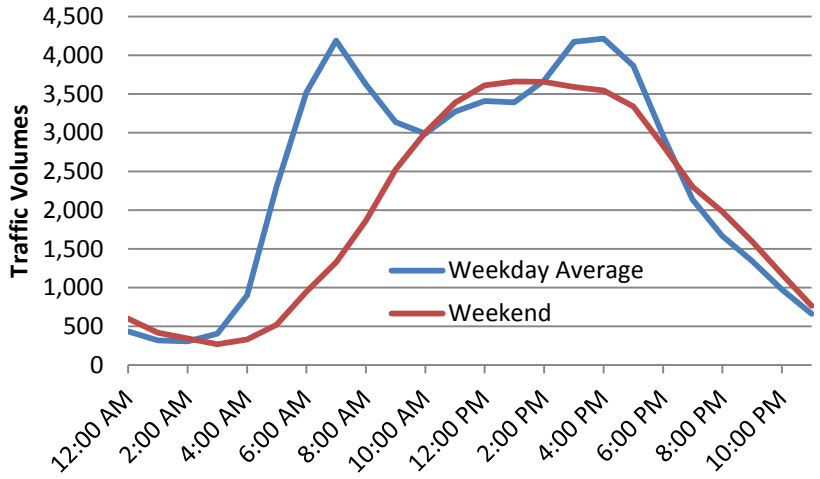

Figure 19 – I-5 Mainline Vehicle Volumes by Time of Day

(2013 WSDOT I-5 Counts)

During weekdays, the AM and PM peak periods experience the traditional peaks in traffic volumes usually associated with commuter traffic patterns. Weekend volumes are generally lower, with traffic volumes peaking during the midday (11 AM to 5 PM) period. These patterns are consistent with high volume roadways in urban or suburban areas.

6.2.3 I-5 Traffic Volumes by Location

Figure 20 provides weekday AM peak hour traffic volumes at various locations along the I-5 mainline within the study area.

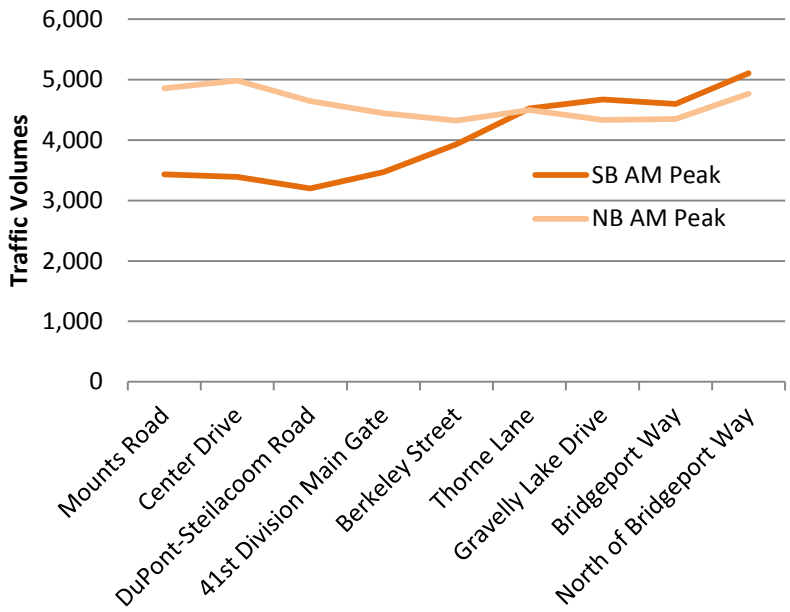

Figure 20 – Weekday AM Peak Hour I-5 Traffic Volumes

(Phase I – Corridor Feasibility Study)

Northbound volumes are fairly constant between 4,200 and 5,000 vehicles per hour. Southbound volumes vary more by location, ranging from 3,100 to just over 5,000 vehicles per hour. Southbound vehicle volumes are highest at the north end of the study area and lowest in the south end of the study area.

This indicates that in the northbound direction, vehicles exiting I-5 in the study area are offset by vehicles entering I-5. In the southbound direction this same dynamic does not occur to the same extent.

Figure 21 provides weekday average PM peak hour volumes at various locations along I-5 within the study area.

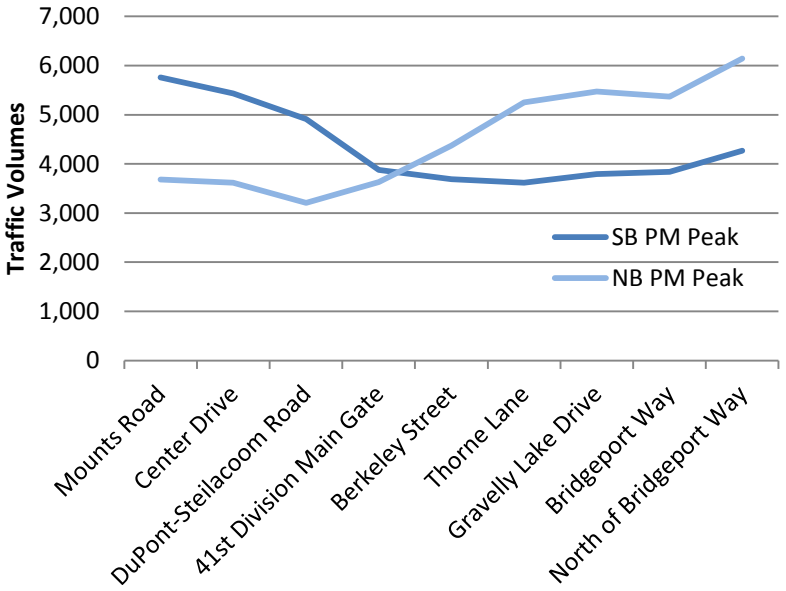

Figure 21 – Weekday PM Peak Hour I-5 Traffic Volumes

(Phase I – Corridor Feasibility Study)

The PM peak hour volumes show a heavy outbound flow of vehicles away from the major JBLM gates in the study area.

Unlike the AM peak hour, northbound volumes do not hold constant through the study area but vary by location. Northbound vehicle volumes are higher at the northern end of the corridor compared to the southern end of the corridor, with volumes demonstrating the same general pattern as southbound AM peak.

Southbound vehicle volume is higher at the southern end of the corridor compared to the northern end of the corridor, with the

lowest volumes in the middle section of the study area. This trend could be due to frequent and heavy congestion, effectively reducing the roadway capacity.

6.3 HOW DO REGIONAL TRIPS ACCESS I-5?

This section provides further data on northbound and southbound weekday vehicle volumes entering or exiting I-5 within the study area.

Figure 22 provides a breakdown of ramp entrance and exit volumes during the AM peak hour on I-5 northbound. Overall, entering and exiting ramp volumes throughout the corridor are roughly equal; however, individual ramp volumes are not balanced.

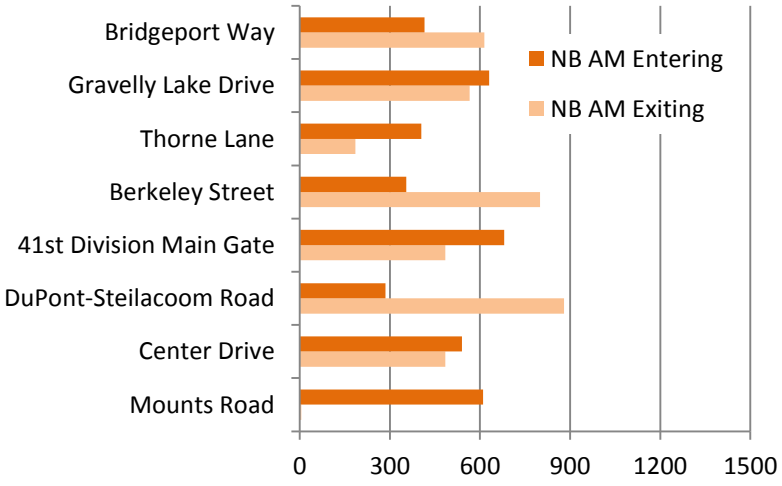

Figure 22 – Northbound AM Peak Hour Ramp Volumes

(Phase I – Corridor Feasibility Study)

The DuPont-Steilacoom Road and Berkeley Street interchanges serve the largest number of exiting vehicles with the smallest number of entering vehicles. The Mounts Road interchange has the largest imbalance of entering vehicles compared to existing vehicles, with the Thorne Lane interchange and 41st Division Main Gate also showing an imbalance of entering vehicles.

Figure 23 provides a breakdown comparison of ramp entrance and exit volumes during the PM peak hour on I-5 in the northbound direction. In contrast to the AM peak hour, during the PM peak there are many more vehicles entering the freeway than exiting at the major interchanges in the study area.

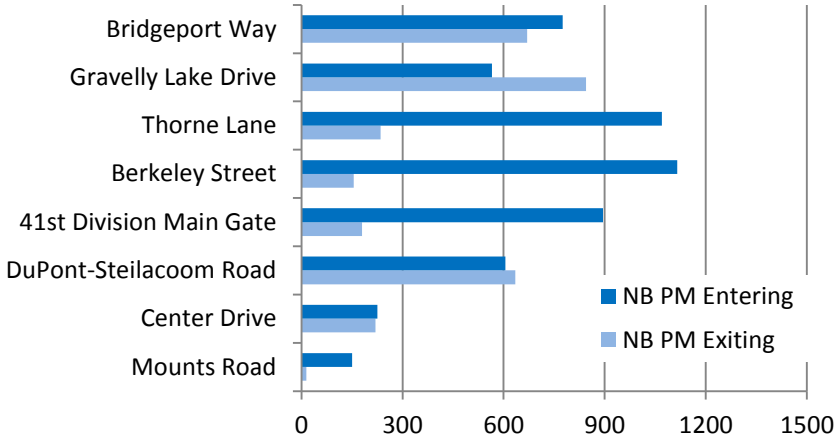

Figure 23 – Northbound PM Peak Hour Ramp Volumes

(Phase I – Corridor Feasibility Study)

Figure 24 provides a breakdown of ramp entrance and exit volumes in the AM peak period for vehicles traveling in the southbound direction. Exit volumes are greater in the southbound direction in the AM peak. Berkeley Street, Thorne Lane and Main Gate locations experience the highest off-ramp volumes.

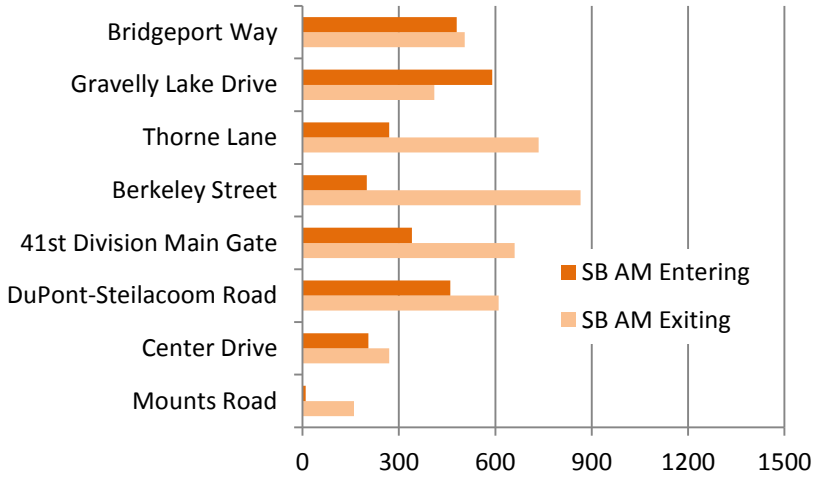

Figure 24 – Southbound AM Peak Hour Ramp Volumes

(Phase 1 – Corridor Feasibility Study)

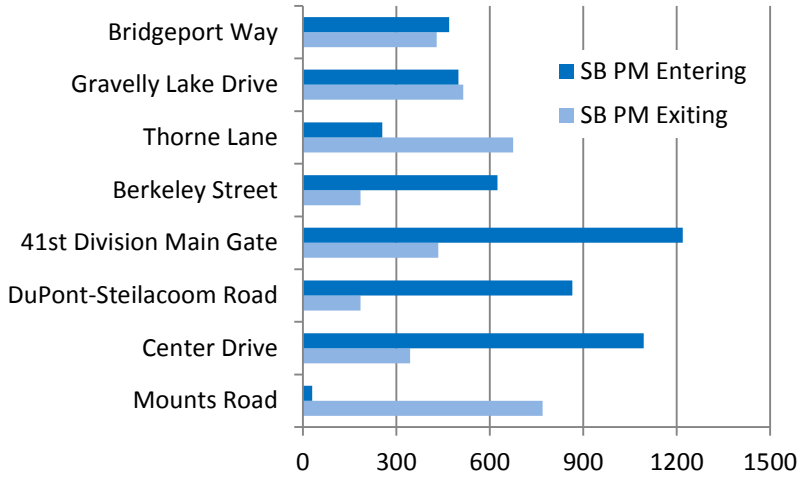

Figure 25 – Southbound PM Peak Hour Ramp Volumes

(Phase 1 – Corridor Feasibility Study)

Figure 25 provides a breakdown of ramp entrance and exit volumes in the PM peak period for vehicles traveling in the southbound direction. In contrast with Figure 24, in the PM peak there are about 1,500 more vehicles entering I-5 than exiting in the study area.

Entering vehicle volumes are highest at 41st Division/Main Gate, Center Drive and DuPont-Steilacoom Road interchanges, and also have high ration of entering traffic compared to exiting traffic.

6.4 HOW IS I-5 USED FOR LOCAL AND ON-BASE TRIPS?

The following maps and figures describe how I-5 is used for local travel in the study area. When the freeway is used as a local connection, the term "short-tripping" is often used and refers to trips that exit within two or fewer interchanges upon entering I-5.

6.4.1 DuPont-Steilacoom Road (Exit 119) Interchange

Figure 26 shows trip distribution patterns for vehicles exiting I-5 at DuPont-Steilacoom Road during the AM peak hour (7:15 AM to 8:15 AM) and the PM peak hour (4:30 PM to 5:30 PM).

During the AM peak hour the majority of northbound and southbound vehicles exiting at DuPont-Steilacoom Road travel from beyond the study area. Shorter distance travel on I-5, which can be considered "local" in nature, also makes up a large number of trips between some interchanges. In the northbound direction 158 and 138 vehicles travel from Mounts Road and Center Drive intersections and exit at DuPont-Steilacoom Road. In the southbound direction this local travel on I-5 is lower.

In the PM peak hour the majority of northbound exiting traffic still comes from beyond the study area, but the number and proportion of traffic coming from Center Drive increases.

Figure 27 shows interchange to interchange trip distribution patterns for vehicles entering I-5 at DuPont-Steilacoom Road during the AM peak hour and the PM peak hours. In the AM peak, southbound travel is generally beyond the study area, while northbound travel is more distributed. Of the 285 vehicles that enter I-5 Northbound from DuPont-Steilacoom Road, 135 of those vehicles are shown to exit I-5 in one or two exits at 41st Division Drive or Berkeley Street.

Onramp volumes in the PM peak hour are roughly twice AM peak hour volumes. Local travel southbound is higher than AM travel, with approximately 234 out of the estimated 865 southbound onramp trips traveling just one or two interchanges before exiting I-5.

6.4.2 41st Division Drive/Main Gate (Exit 120) Interchange

Figure 28 shows trip distribution patterns for vehicles exiting I-5 at 41st Division Drive during the AM peak hour and the PM peak hour. AM peak hour volumes are higher than PM peak hour volumes with southbound exiting volumes larger than northbound exiting volumes.

During the AM peak hour an estimated 159 of the 485 vehicles exiting I-5 Northbound at 41st Division Drive traveled two or fewer interchanges. This number increases to 270 vehicles if Mounts Road is added. During the PM peak hour an estimated 99 out of the total 435 vehicles existing I-5 southbound at 41st Division Drive enter I-5 one interchange away at Berkeley Street.

Figure 29 shows trip distribution patterns for vehicles entering I-5 at 41st Division Drive during the AM peak period and the PM peak hour. PM peak hour interchange volumes overall are roughly twice AM peak hour volumes, with more trips beyond the study area. This reflects the regional nature of trips leaving JBLM in the PM peak hour.

In the AM peak hour 56 percent (188 vehicles) traveling southbound and 35 percent (243 vehicles) traveling northbound travel one or two interchanges before exiting. In the PM peak

hour the majority of trips entering I-5 at 41st Division Drive travel beyond the study area.

6.4.3 Berkeley Street (Exit 122) Interchange

Figure 30 shows trip distribution patterns for vehicles exiting I-5 at Berkeley Street during the AM peak hour and the PM peak hour. Northbound and southbound vehicles volumes exiting I-5 are roughly the same during the AM or PM peak hour.

AM peak hour traffic exiting at Berkeley Street from I-5 northbound comes from a large variety of locations particularly from the Center Drive interchange and to the south. Southbound traffic primarily comes from Gravelly Lake Drive and Bridgeport Way or from beyond the study area.

PM peak hour traffic volumes are much lower than AM volumes. Northbound exiting volumes in the PM peak are mostly local with 114 of the total 155 vehicles exiting at Berkeley Street traveling on I-5 for just one or two interchanges.

Figure 31 shows trips distribution patterns from Berkeley Street in the AM and PM peak hour. In general PM peak hour volumes are two to three times larger than AM peak hours. PM peak hour travel for this interchange also has a larger percentage of trips traveling beyond the study area in the PM peak as compared to the AM peak. This trend is consistent with other interchanges which are major access or egress points for JBLM.

In the AM peak hour, roughly half or 96 of the overall 200 trips entering I-5 southbound from Berkeley Street exit one interchange south at 41st Division Drive. This pattern is less prevalent in the PM peak hour.

6.4.4 Thorne Lane (Exit 123) Interchange

Figure 32 shows trip distribution patterns to Thorne Lane during the AM and PM peak hour. Southbound off-ramp volumes in the AM and PM peak hour are roughly the same. Northbound off-ramp volumes in the AM and PM peak hour are also roughly the same with similar trip distribution patterns.

Data shows that a large proportion of travel on I-5 to Thorne Lane is local travel from Gravelly Lake Drive and Bridgeport Way on the west side of I-5. In the AM peak 319 (43 percent) of the 735 southbound vehicles exiting at Thorne Lane is estimated to originate at these two interchanges. In the PM peak both the number and percentage of vehicles increase with 381 (56 percent) of 675 vehicles also originating at these two interchanges.

Figure 33 shows AM and PM peak hour trip distribution patterns from Throne Lane. Southbound onramp volumes in the AM peak hour are fairly disperse among interchanges and beyond the study area, with PM travel more weighted toward travel beyond the study area. In the northbound direction, onramp volumes are roughly split in half between local travel to Gravelly Lake Drive/Bridgeport Way and travel beyond the study area. In the PM peak hour 419 of the 1,070 vehicles entering I-5 northbound from Thorne Lane exit after one or two interchanges.

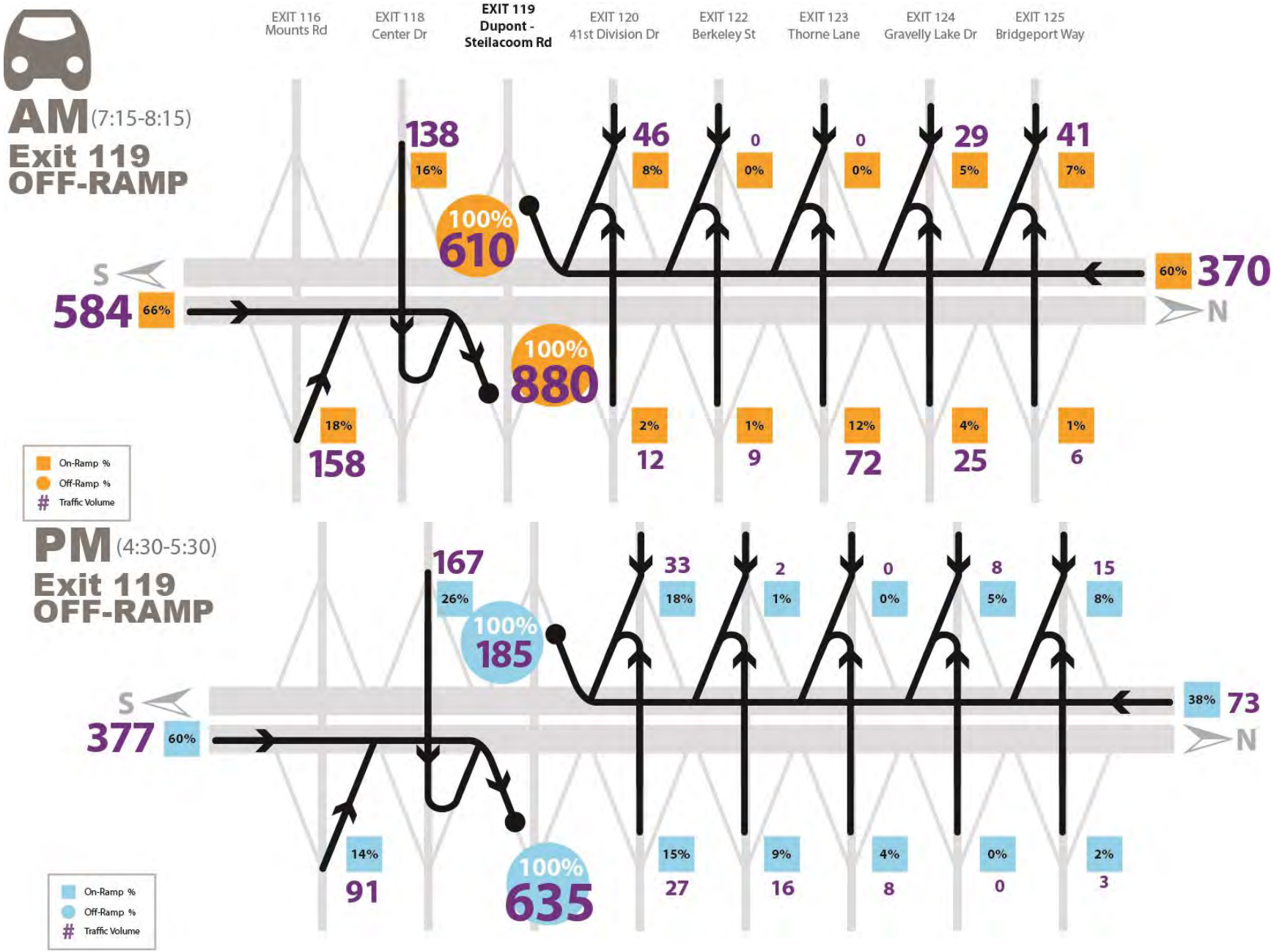

Figure 26 – DuPont-Steilacoom Road Off-Ramp Travel Patterns

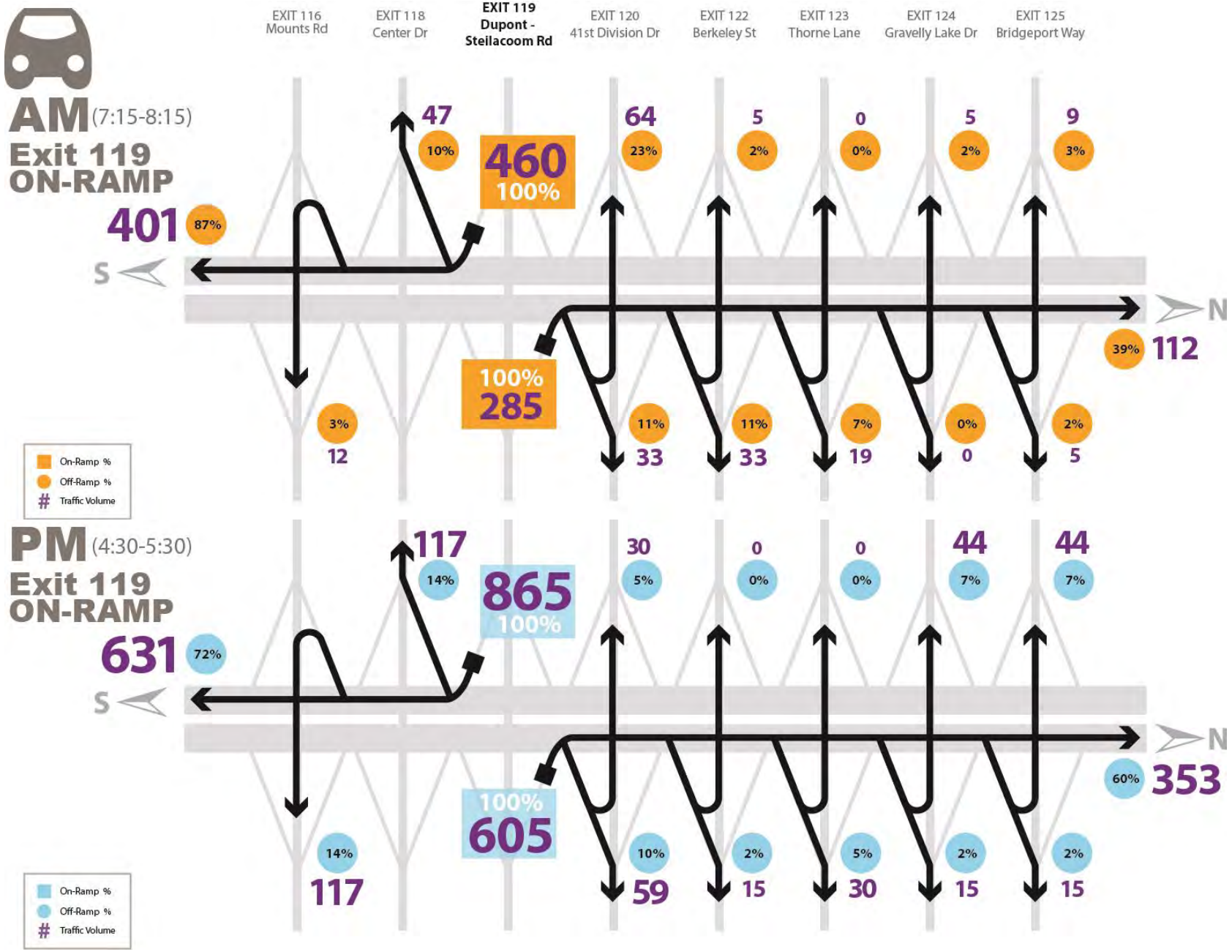

Figure 27 – DuPont-Steilacoom Road On-Ramp Travel Patterns

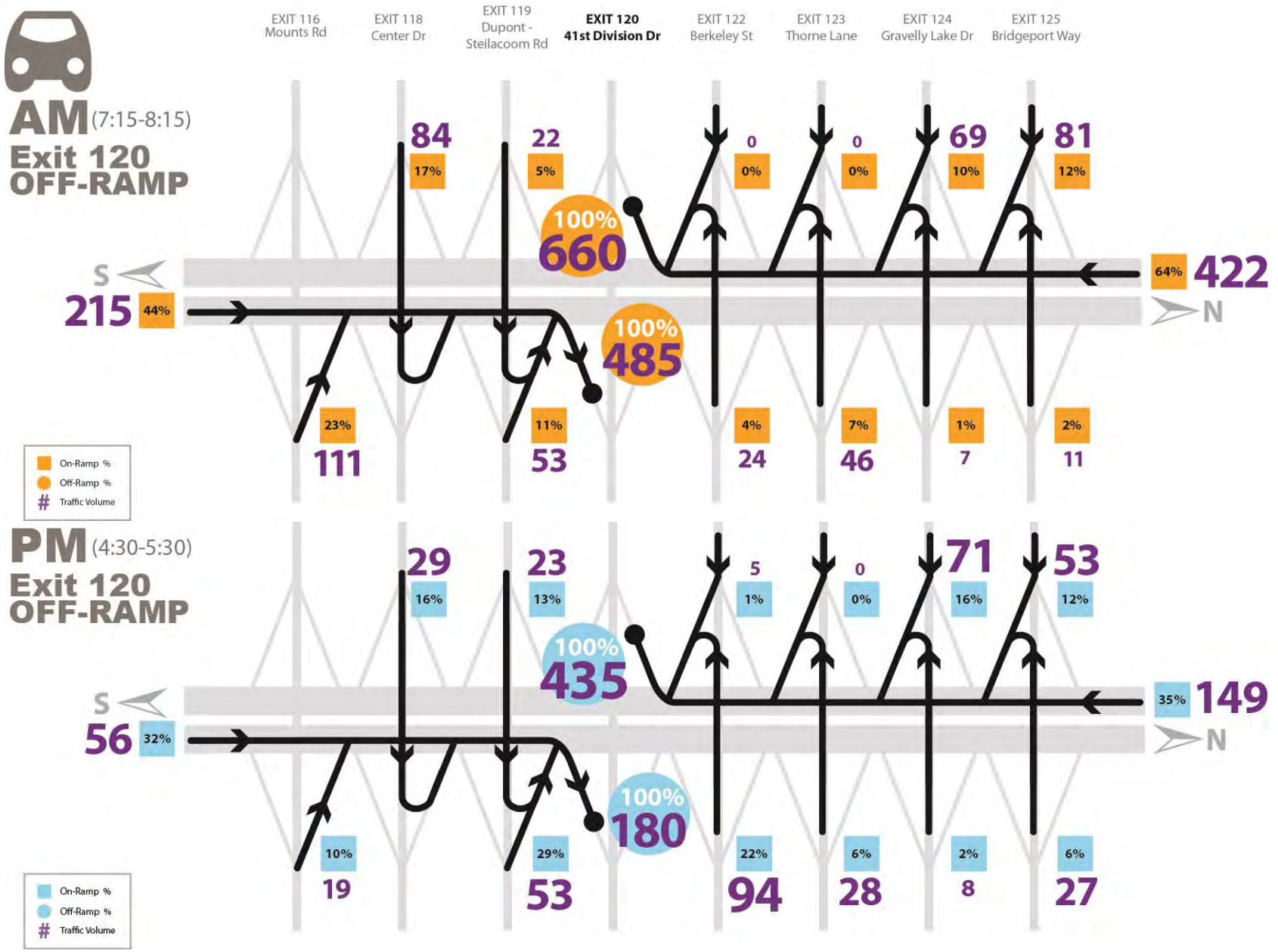

Figure 28 – 41st Division Drive Off-Ramp Travel Patterns

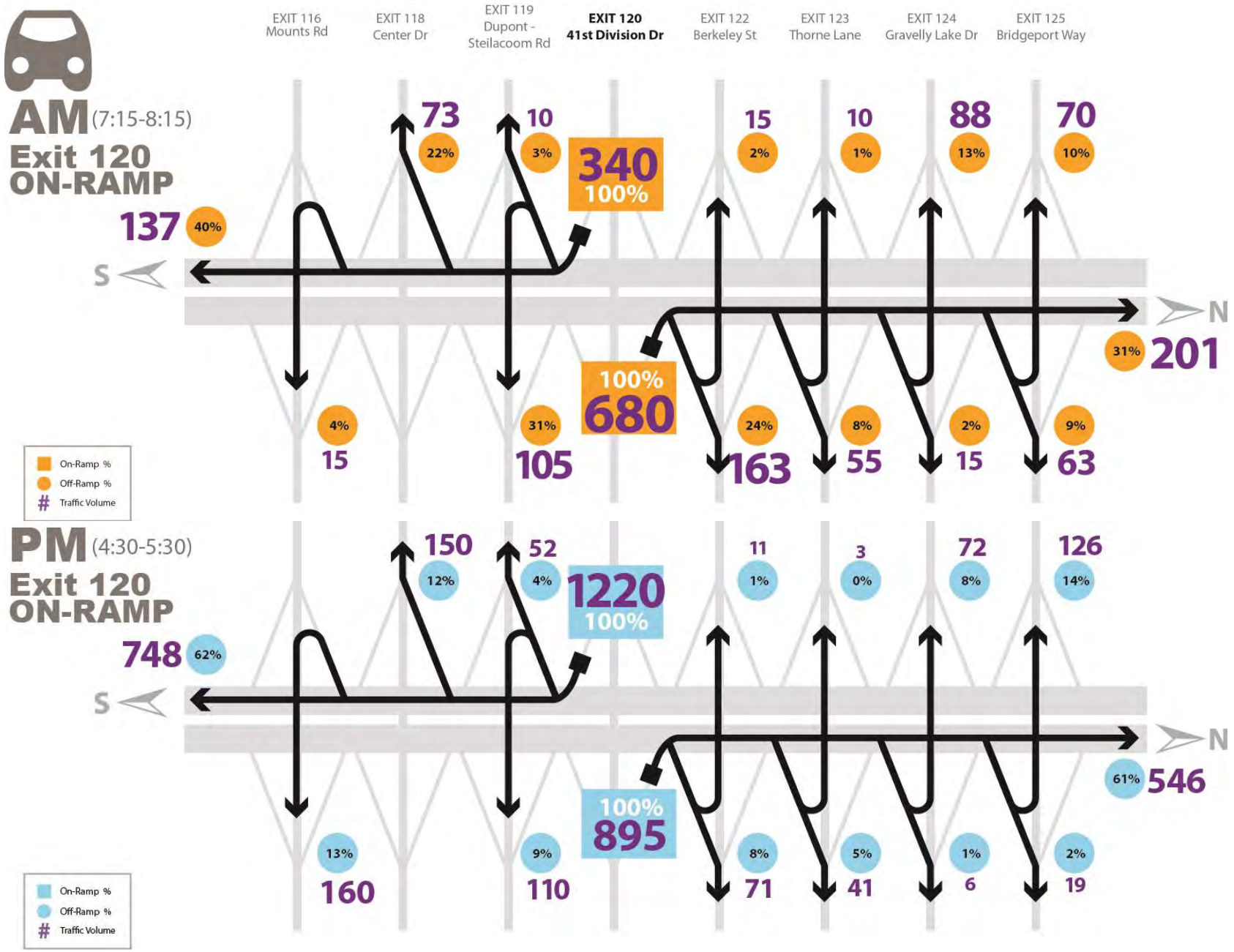

Figure 29 – 41st Division Drive On-Ramp Travel Patterns

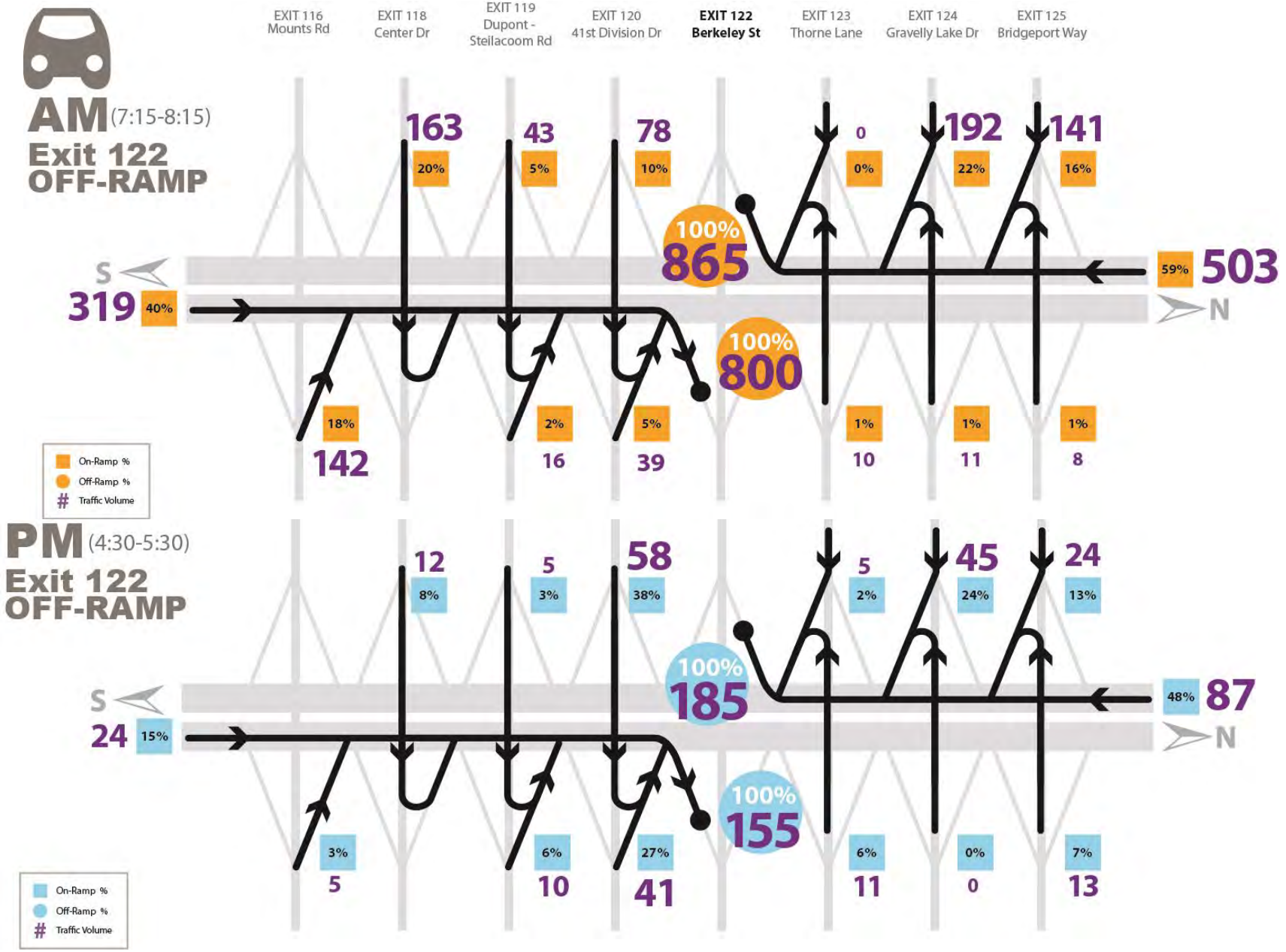

Figure 30 – Berkeley Street Off-Ramp Travel Patterns

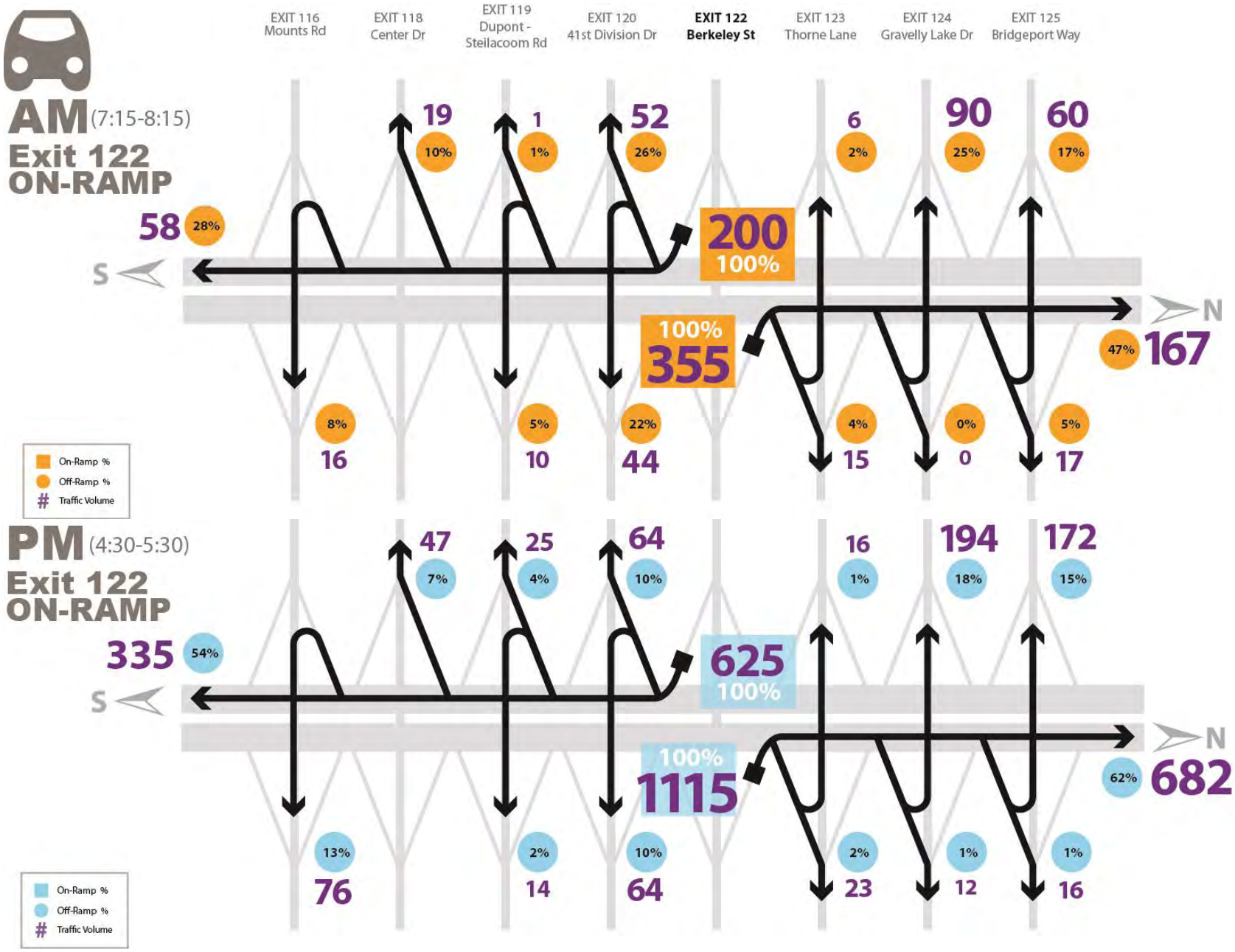

Figure 31 – Berkeley Street On-Ramp Travel Patterns

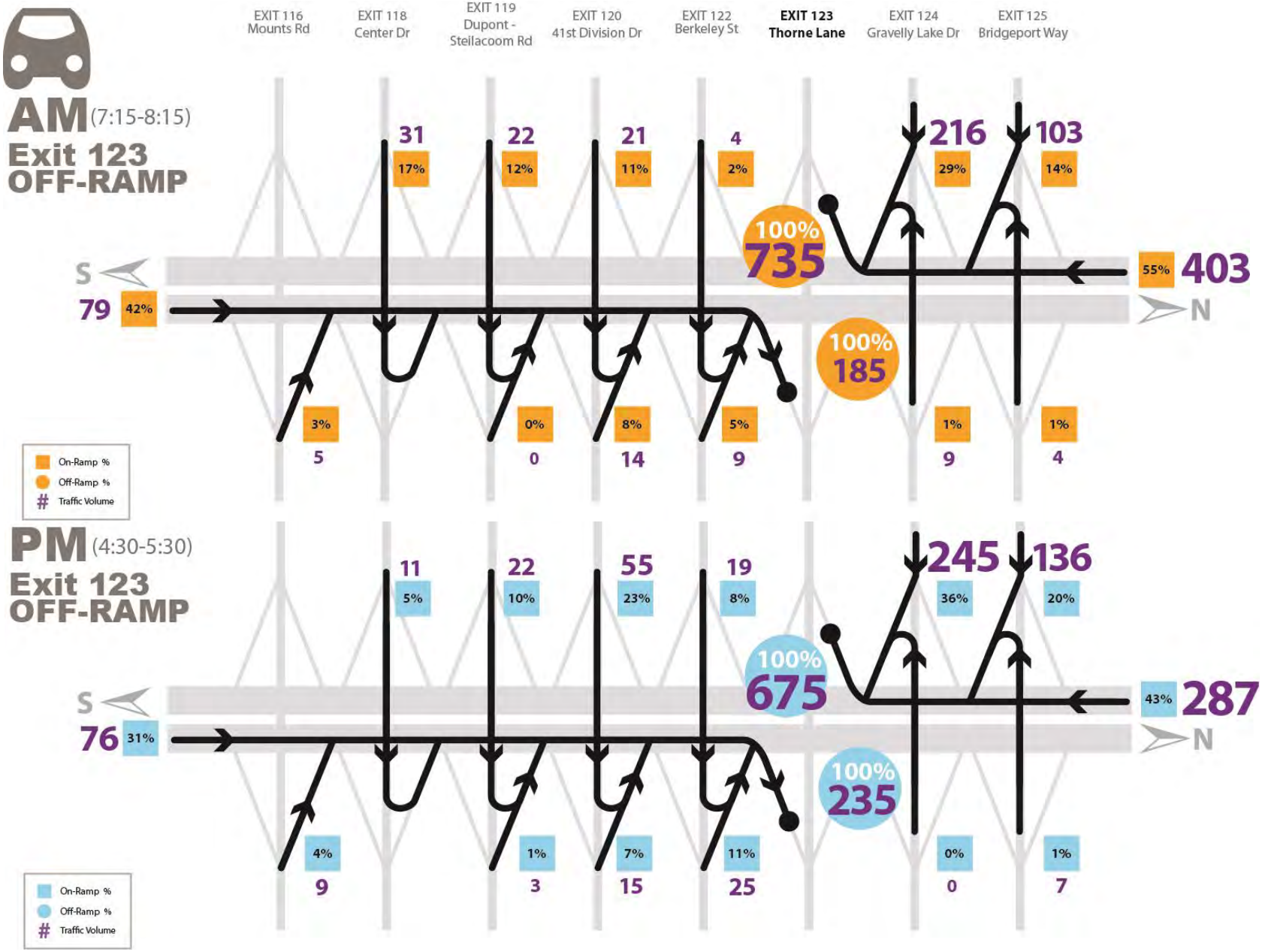

Figure 32 – Thorne Lane Off-Ramp Travel Patterns

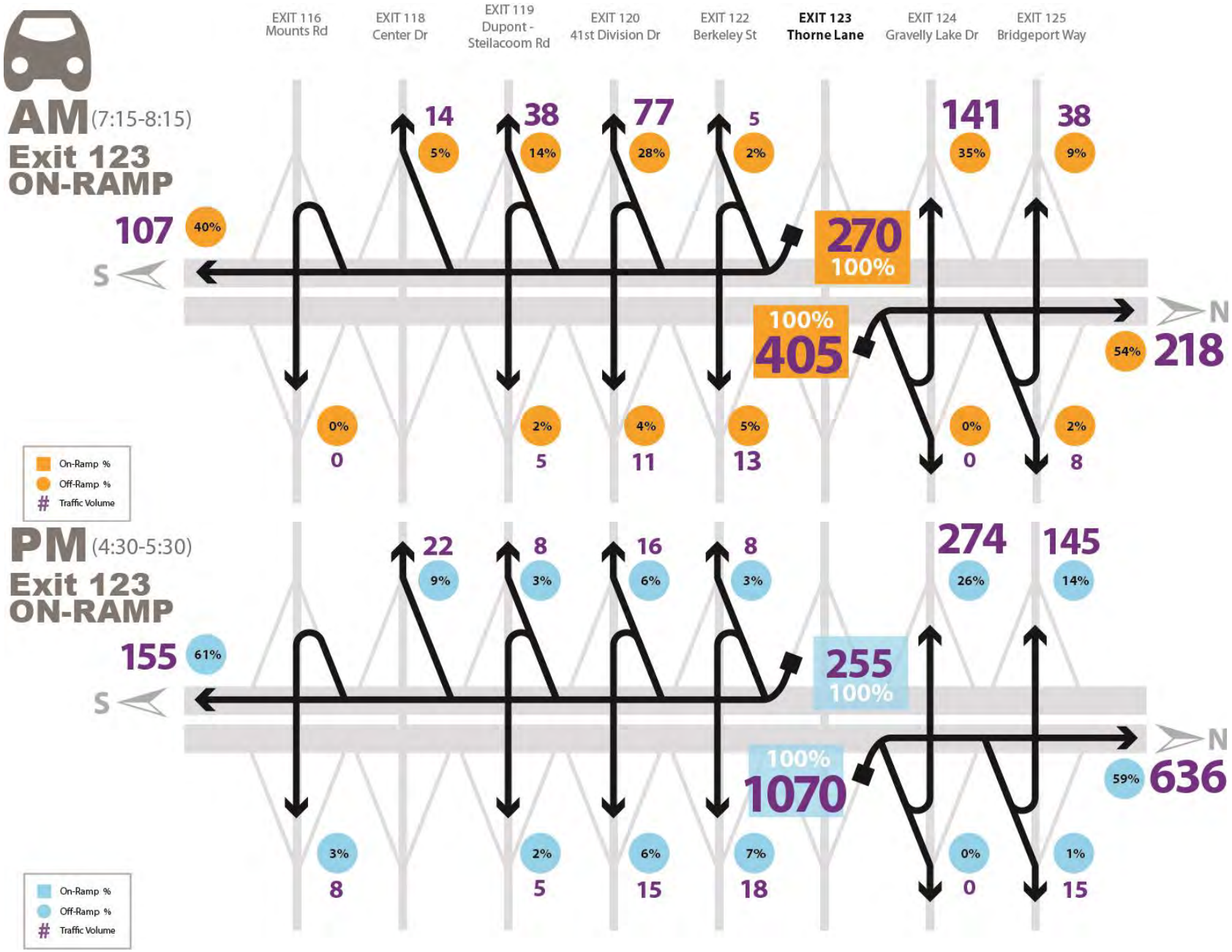

Figure 33 – Thorne Lane On-Ramp Travel Patterns

6.5 WHAT MODES ARE REGIONAL TRAVELERS USING?

6.5.1 Vehicle Occupancy on I-5

Figure 34 displays the reported vehicle occupancy rates that were collected as part of the TRPC I-5 O-D Study for the AM peak period (6 to 9:30 AM). Vehicle license plate numbers were captured on I-5 at the Mounts Road interchange, and travel survey questionnaires were sent to vehicle owners to obtain additional travel behavior information.

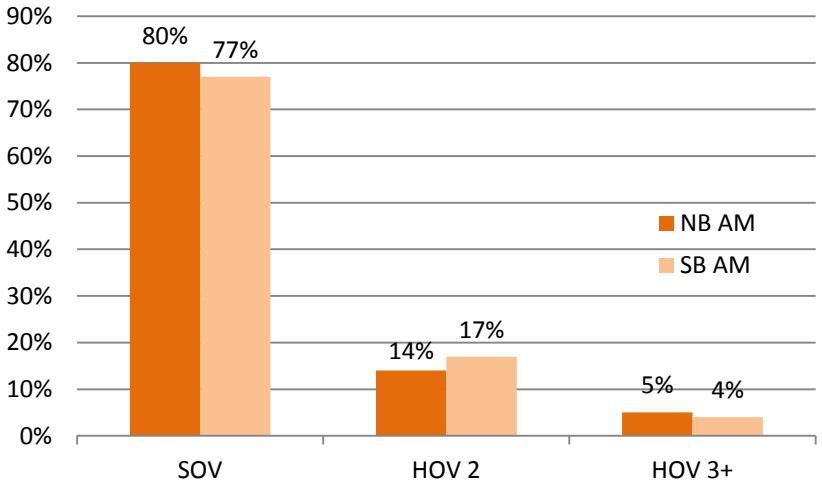

Figure 34 – AM Peak Period I-5 Vehicle Occupancy Rates

(TRPC I-5 O-D Study)

Based on the results of the 2010 study, during the AM peak period 80 percent of the respondents traveling northbound indicated they were traveling alone, which is referred to as a single occupant vehicle (SOV). Of the respondents traveling south, a slightly smaller percentage, 77 percent, reported traveling in a SOV. Fourteen percent of northbound vehicles carried two persons (HOV 2) with a larger proportion, 17 percent, heading southbound. Vehicles with 3 or more passengers are reported separately as HOV 3+ and include vanpools and buses. Both northbound and southbound HOV 3+ constitutes 5 percent or less of total traffic volumes.

Responses from the survey also show that 71 percent of vehicles traveling northbound in the AM peak hour are commuters traveling from work to home, while 58 percent of southbound vehicles are commuters.

Figure 35 reports the same vehicle occupancy data for the PM peak period (2:30 to 6 PM). Vehicles traveling southbound are more likely to be an SOV than vehicles traveling northbound. Compared to the AM peak period, SOV rates in the PM peak period are lower with a larger difference between SOV rates for northbound and southbound travel. HOV 3+ rates are higher in the PM peak by 2 percent for both directions of travel.

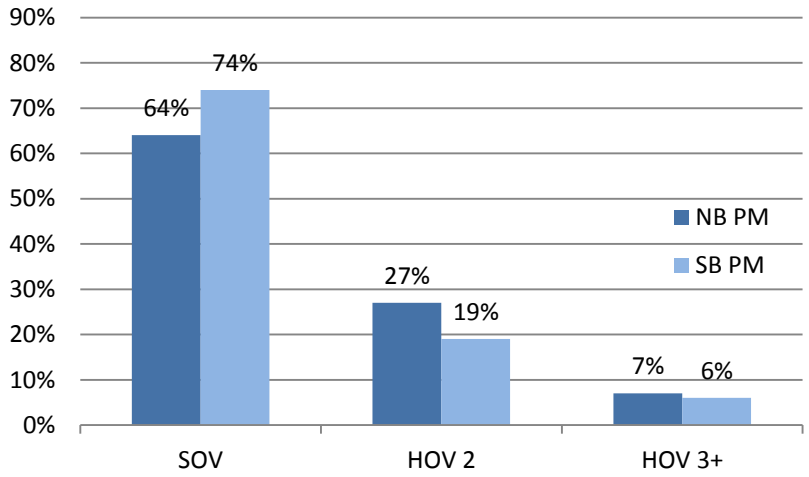

Figure 35 – PM Peak Period I-5 Vehicle Occupancy Rates

(TRPC I-5 O-D Study)

These findings contrast the TRPC Household Travel Survey data, which includes non-commute and non-peak period trips, and found that 52 percent of all travelers drive alone and 31 percent carpool (see Section 5.4.1).

This relationship is not unexpected since commute trips on I-5 (northbound in AM, southbound in PM) are most likely to have lower vehicle occupancy than non-commute trips. This trend is seen, particularly in the PM peak, where SOV trips are 10 percent higher in the southbound peak commute direction compared to the northbound direction.

6.5.2 Regional Transit Routes and Facilities

Figure 36 presents a map of the transit routes primarily showing regional commuter routes that travel through the study area as well as park and ride lots and transit center facilities where residents can access regional transit service. Additionally, Table 4 provides information relating to transit service details such as route number, destination, span of service and bus headways (i.e., frequency of bus service).

The study area is served by six regional, commuter-oriented transit routes along I-5 operated by Intercity Transit and Sound Transit. These routes primarily operate only during peak periods and in the peak direction of travel and are designed to serve riders who work standard 40-hour work schedules. Table 4 highlights the major service characteristics of these routes.

Table 4 – I-5 Regional Transit Routes in the Study Area

Route Number	Destinations	Headways
603	Olympia to Tacoma	~30 min (PM Peak) ~1 hour (off peak)
605	Tacoma to Olympia	~20 min (PM peak) ~90 min (off peak)
609	Tumwater to SR 512 P&R	30 min (AM peak) 30 min (PM peak)
	SR 512 P&R to Tumwater	~30 min (PM peak) ~60 min (off peak)
612	Olympia to Tacoma	-
620*	Olympia to Tacoma	60 / 90 minutes
592	Seattle to Olympia	30 min

* indicates weekend only service

Note: Local transit service provided by Pierce Transit or JBLM is discussed in Section 7.4.4.

Below, Table 5 provides ridership numbers for the I-5 regional bus routes serving the study area in the PM peak period.

Table 5 – Weekday PM Peak Period (3-6 PM) I-5 Regional Transit Ridership

		Number of Buses		Ridership	
Agency	Route	NB	SB	NB	SB
Intercity Transit	Route 603	5		159	
	Route 605		3		76
	Route 609	4	4	27	
	Route 612	1		28	
Sound Transit	Route 592		8		232

Note: Local transit service provided by Pierce Transit or JBLM is discussed in Section 7.4.4.

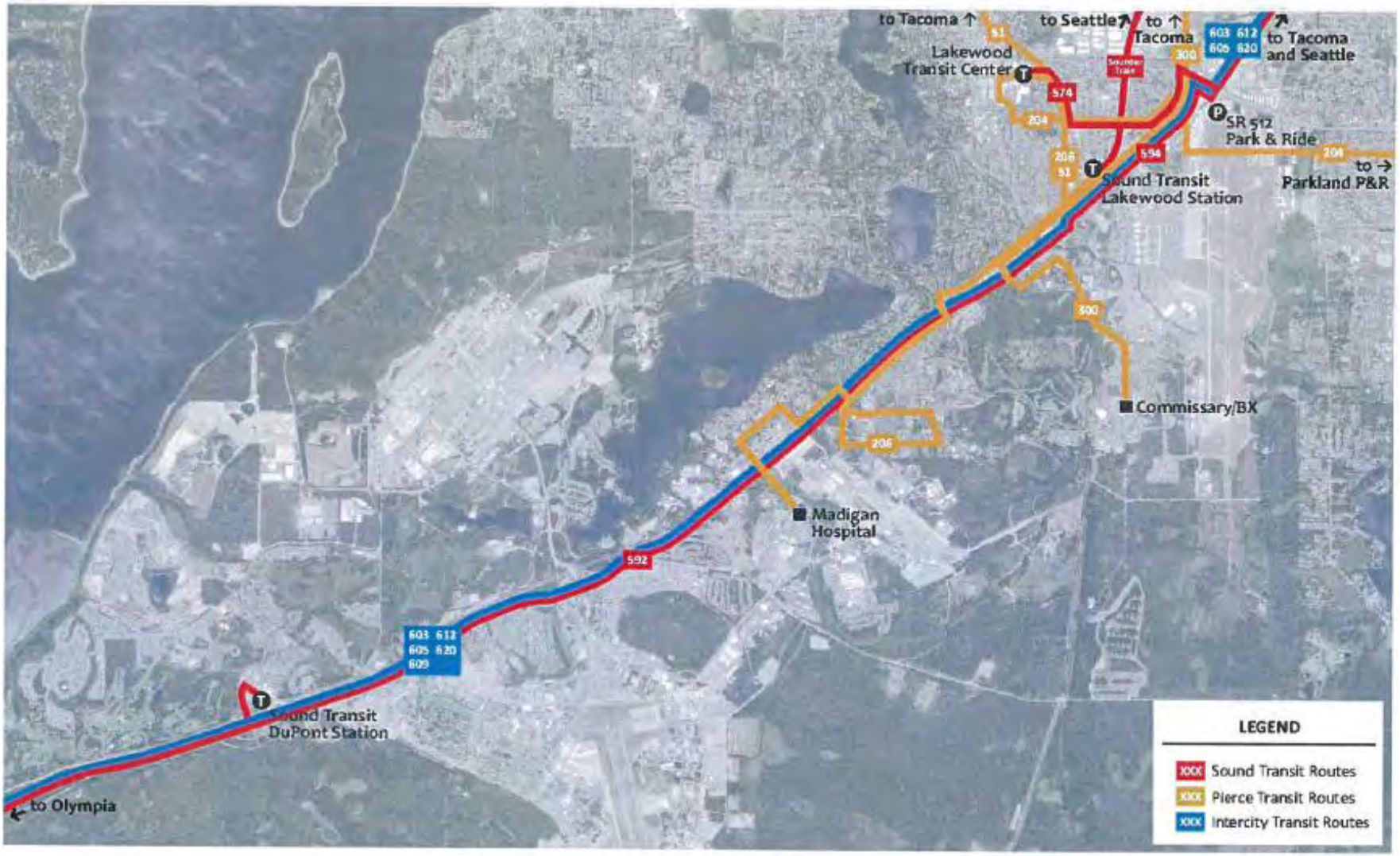

Figure 36 – Transit Routes and Facilities within the Study Area

(Phase 1 – Corridor Feasibility Study)

7. JBLM TRAVEL PATTERNS

Although traffic volumes into and out of JBLM as well as on the surrounding roadways have been previously collected and documented as part of the *I-5 JBLM Phase 1 - Corridor Plan Feasibility Study,* the pattern of trip distribution to and from JBLM were not well understood. Origin-destination data was compiled at major base access control points (ACPs) to better understand these patterns.

Base travel patterns are somewhat different than typical travel patterns due to the unique requirements of active-duty military service and security requirements. Trips to and from JBLM and Camp Murray must travel through approximately one of 20 ACPs to access the either installation. In general, ACPs concentrate traffic volumes in specific areas or around interchanges. Preferred ACPs may be avoided based on delays, so alternate gates may be used.

7.1 WHERE AND HOW DO PEOPLE COMMUTE TO AND FROM JBLM?

The following subsections include AM (6:00 to 9:00 AM) and PM (3:00 to 6:00 PM) peak period regional trip patterns from the major JBLM ACPs. The trip patterns are presented in the following maps.

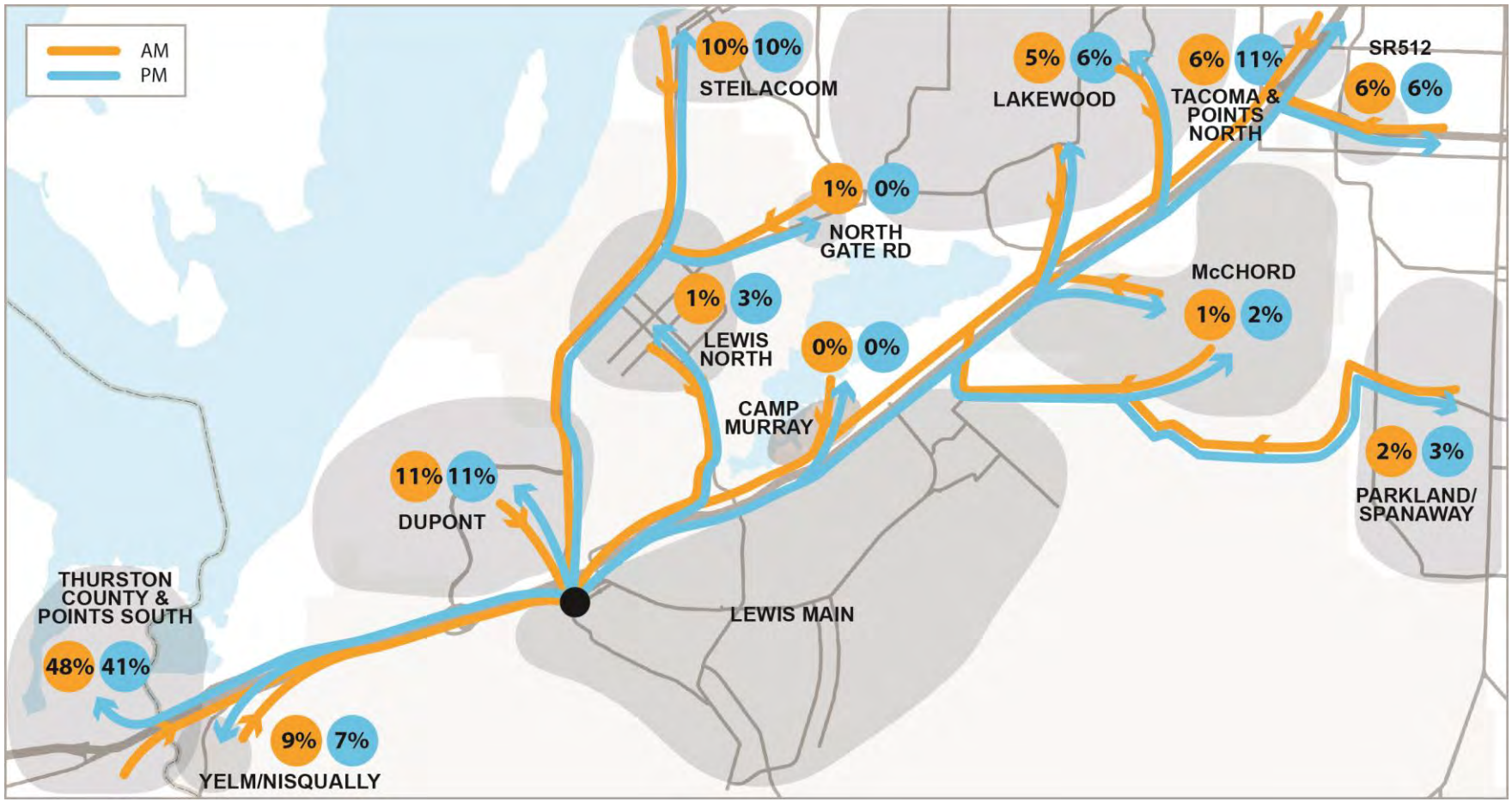

Figure 37 – DuPont Gate Trip Distribution (Weekday AM & PM Peak)

Figure 37 shows trip distribution to DuPont Gate which is located on the southeast side of the DuPont-Steilacoom Road (Exit 119) interchange. AM peak period (6 to 9 AM) travel to DuPont Gate is mapped in orange and represents northbound travel, and PM peak period (3 to 6 PM) travel from DuPont Gate is mapped in blue and represents southbound travel.

In the AM peak period, 68 percent of trips that enter at DuPont Gate originate from points south of JBLM including Thurston County, DuPont, or Yelm/Nisqually (48, 11, and 9 percent, respectively).

During the PM peak period, trip distribution from DuPont Gate is similar to the AM peak period but travel to Thurston County, Yelm and points south drops 9 percentage points, while travel to Tacoma and points north increases by 5 percentage points.

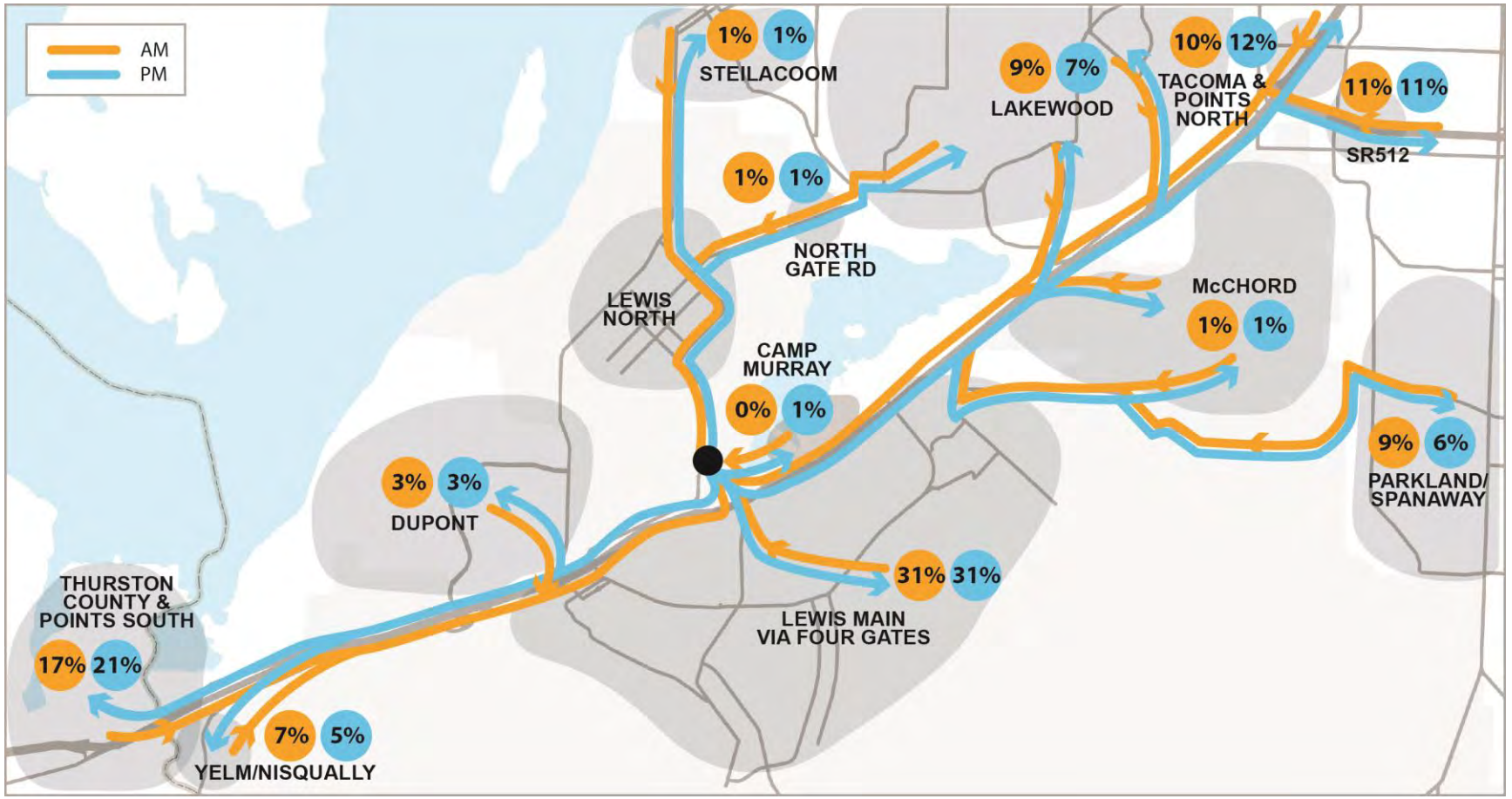

Figure 38 – 41st Division Drive Gate Trip Distribution (Weekday AM & PM Peak)

Figure 38 shows trip distribution to the 41st Division Drive Gate (Lewis North). In the AM peak period, 27 percent of all trips that enter at the 41st Division Drive Gate originate from points south of JBLM, including Thurston County, DuPont, or Yelm/Nisqually (17, 7 and 3 percent, respectively).

During the PM peak period, trip distribution from the 41st Division Drive Gate is similar to the AM peak period.

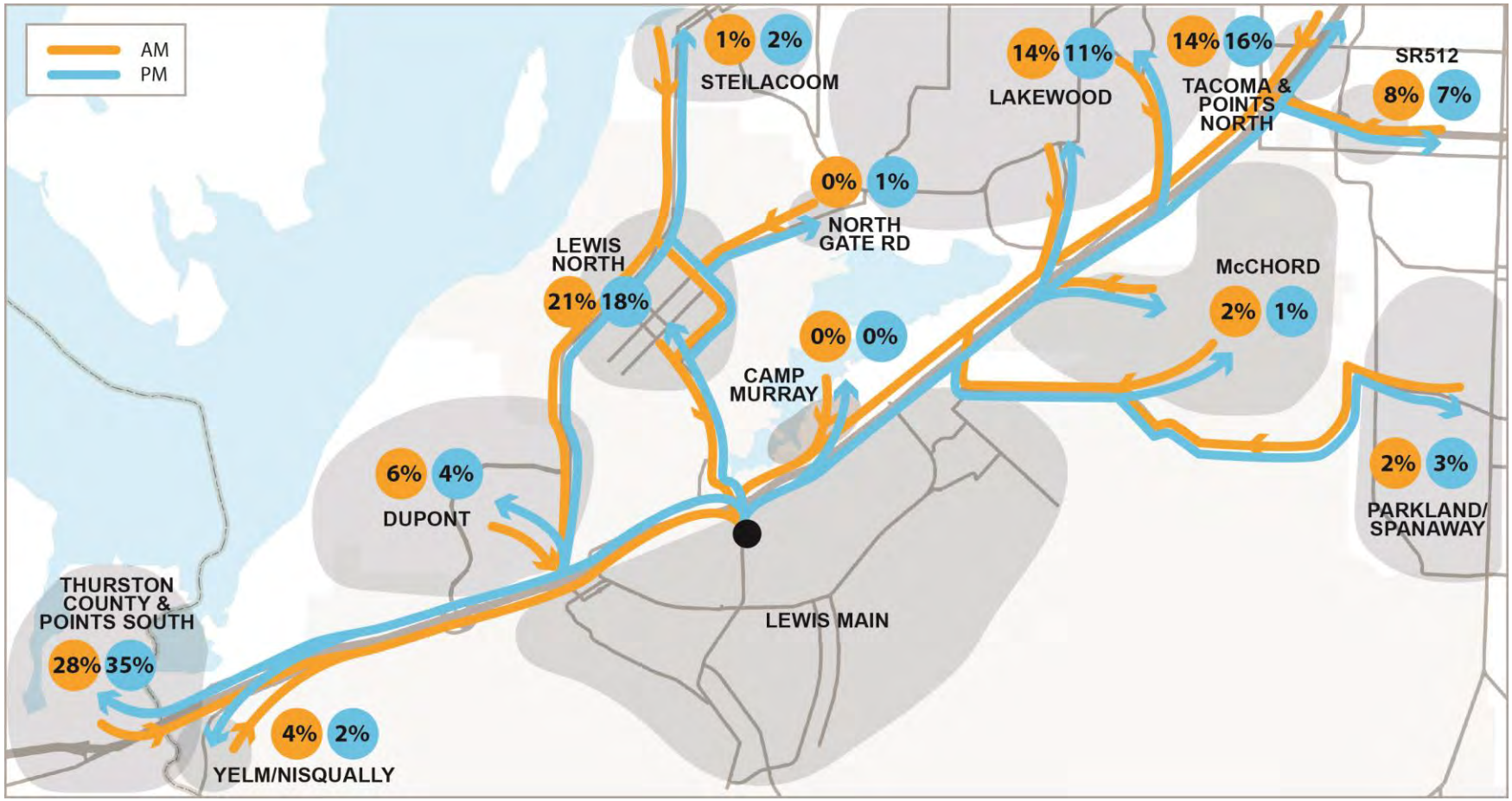

Figure 39 – Liberty Gate Trip Distribution (Weekday AM & PM Peak)

Figure 39 shows trip distribution to the Liberty Gate (Lewis Main). In the AM peak period, 38 percent of trips that enter at Liberty Gate originate from points south of JBLM, including Thurston County, DuPont, or Yelm/Nisqually (28, 4, and 6 percent, respectively).

During the PM peak period, trip distribution from Liberty Gate is similar to the AM peak period; however, many more PM peak trips are oriented to Thurston County and points south, suggesting that AM commuting trips are entering Lewis Main through a different ACP.

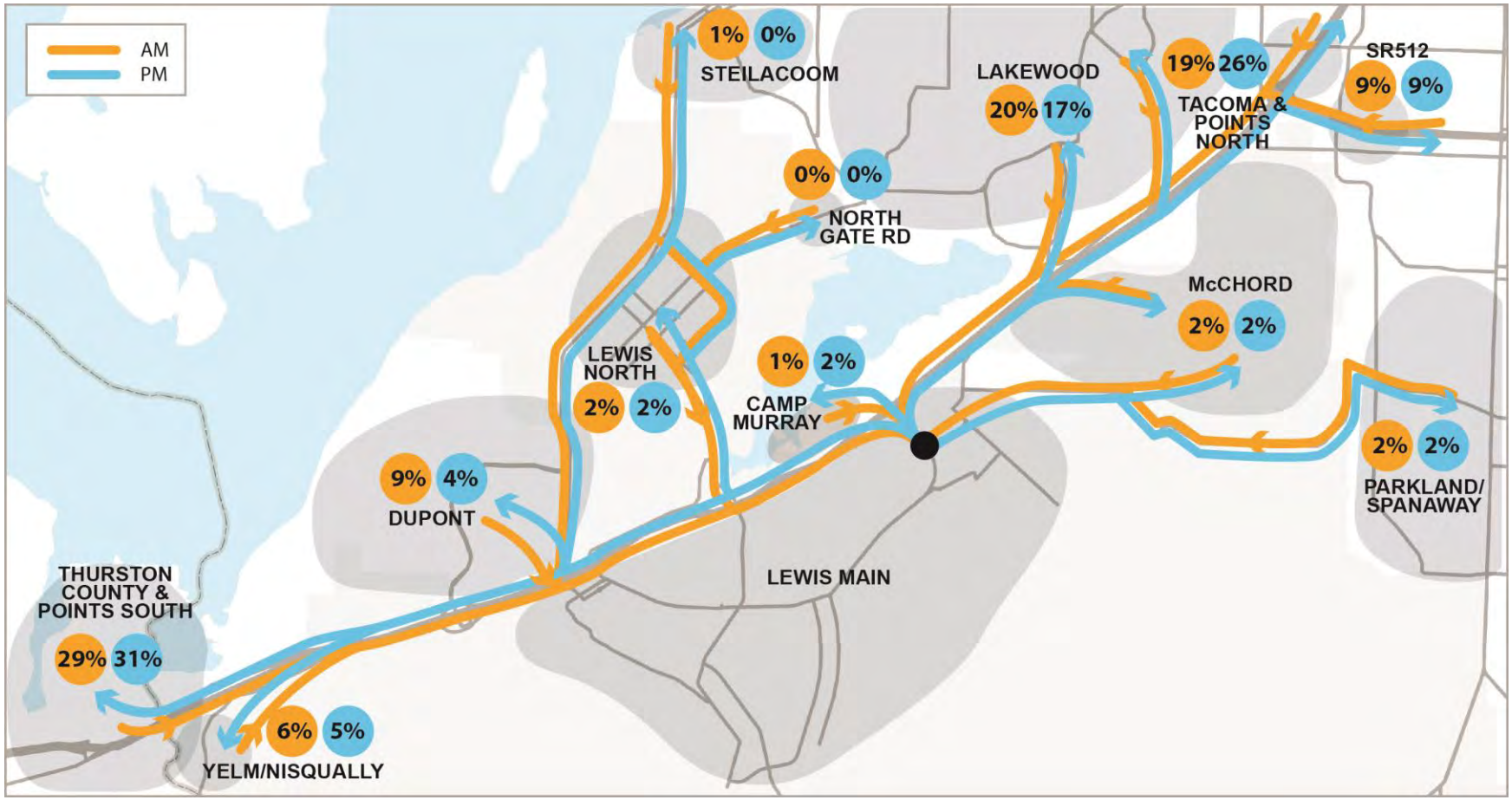

Figure 40 – Madigan Gate Trip Distribution (Weekday AM & PM Peak)

Figure 40 shows trip distribution to the Madigan Gate (Lewis Main). In the AM peak period, 44 percent of trips that enter at Madigan Gate originate from points to the south of JBLM, including Thurston County, DuPont, or Yelm/Nisqually (29, 9, and 6 percent, respectively). Approximately 39 percent of the trips entering the gate during the AM peak period originate from Lakewood, Tacoma, and points north of SR 512.

During the PM peak period, trip distribution from Madigan Gate is similar to the AM peak period. The percent of trips to the City of DuPont, Tacoma and points north differ substantially, suggesting that the trips oriented to these areas may use different ACPs depending on the time of day.

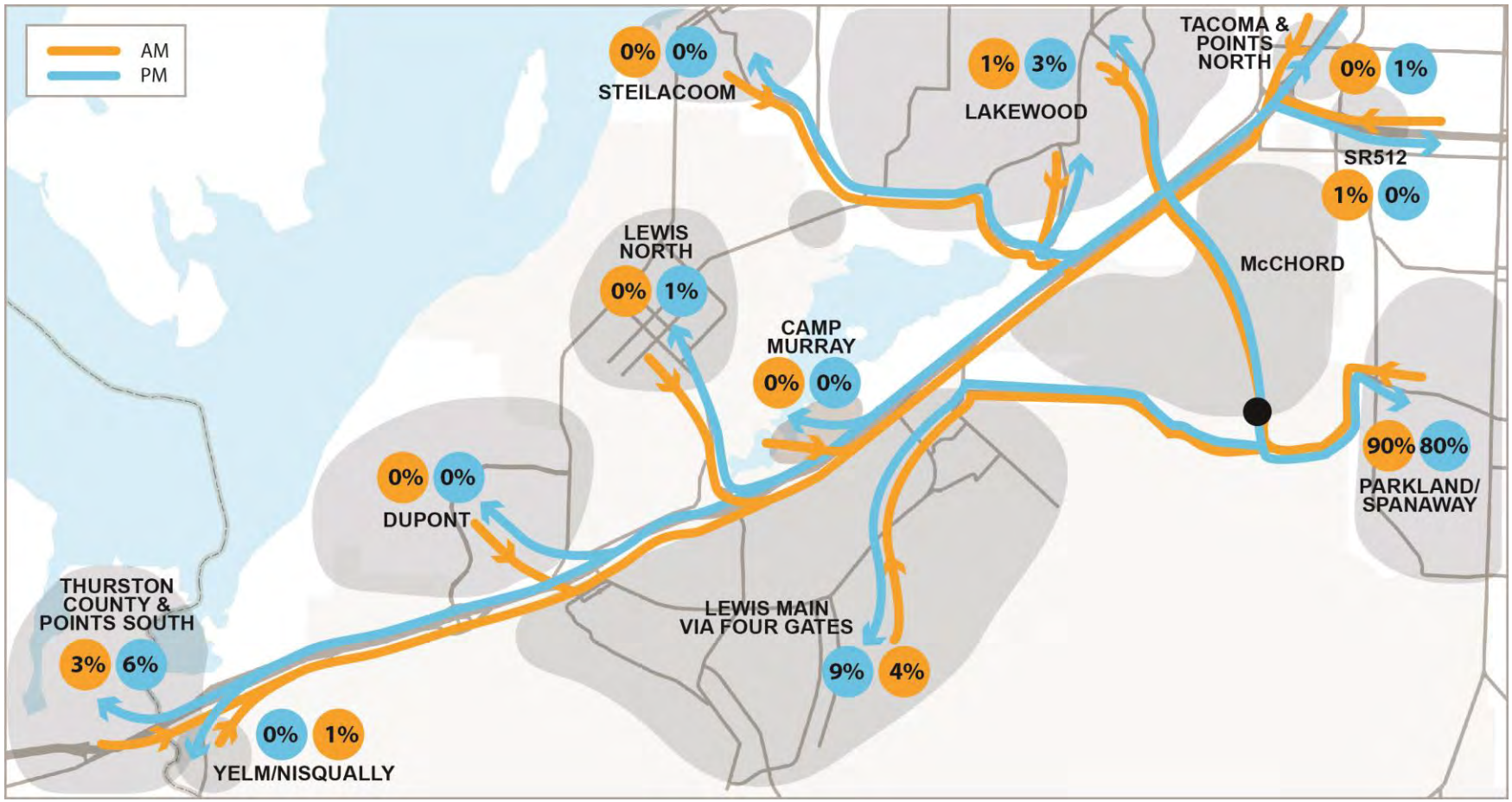

Figure 41 – Barnes Gate Trip Distribution (Weekday AM & PM Peak)

Figure 41 shows trip distribution to the Barnes Gate (McChord South). In the AM peak period, 4 percent of trips that enter at Barnes Gate originate from points south of JBLM, including Thurston County. Most the traffic is oriented to areas in east Pierce County (90 percent) such as Parkland and Spanaway.

During the PM peak period, trip distribution from Barnes Gate is similar to the AM peak period. There may be a small amount of Thurston County and Lewis Main trips diverting to the Barnes Gate because the percentages are higher.

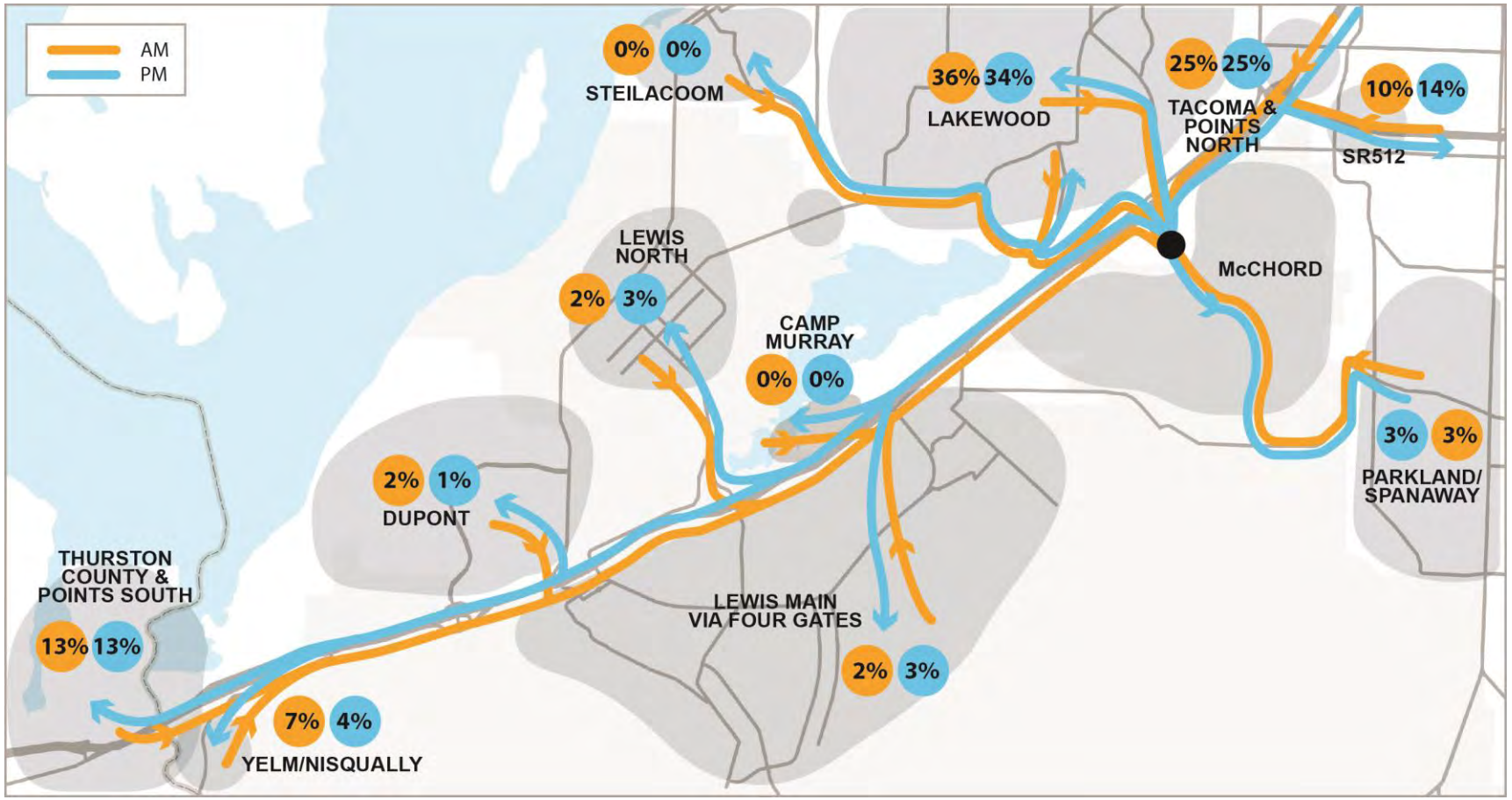

Figure 42 – McChord Main Gate Trip Distribution (Weekday AM & PM Peak)

Figure 42 shows trip distribution to the McChord Main Gate. In the AM peak period, 22 percent of trips that enter at McChord Main Gate originate from points south of JBLM, including Thurston County, DuPont, or Yelm/Nisqually (13, 7, and 2 percent, respectively). The highest proportion of traffic is oriented to nearby Lakewood (36 percent) or Tacoma and points north (25 percent).

During the PM peak period, trip distribution from McChord Main Gate is similar to the AM peak period.

7.2 HOW MANY PEOPLE TRAVEL TO JBLM?

7.2.1 Inbound and Outbound Volumes by Time of Day

To support the JBLM travel demand model update, hourly traffic counts were gathered at all JBLM ACPs over a three day period. Outbound traffic counts, including vehicle classification counts, were collected as part of the project near ACPs in early 2013.

Inbound traffic counts were provided by JBLM staff based on ACP records for the time periods that match outbound traffic counts. Counts for the 41st Street Gate, Liberty Gate, and Madigan Gate were based on observations in mid-February 2013. Counts at the remaining JBLM ACPs were based on observations in late March 2013. This data source is referenced in this report as *2013 JBLM Gate Counts*.

These counts were used to identify the number of daily trips as well as peak period trips that travel between different areas within JBLM. Figure 43 details entry and exit volumes from all JBLM ACPs by time of day for an average weekday (based on data from February 2013).

ACP entry volumes peak between 5 and 7 AM, with exit volumes peaking between 3 and 5 PM. Entry volumes are spread throughout the morning while exit volumes are more narrowly focused. The staggered arrival period in the AM is likely due to active duty members arriving to participate in physical training early in the morning before work.

Both exit and entry volumes experience a midday spike, led by an increase in exiting volumes during the 10 AM to Noon hours, and followed by an inbound elevation in entry volumes. This is likely due to the number of JBLM employees who travel off base for lunch or other appointments.

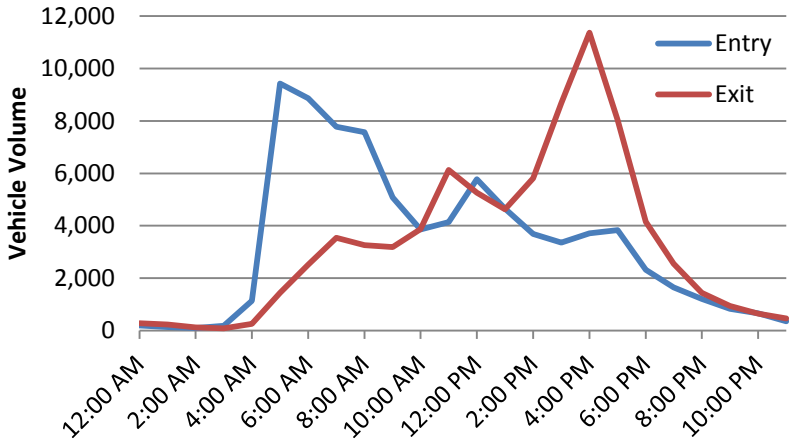

Figure 43 – JBLM ACP Volumes by Time of Day

(2013 JBLM Weekday Gate Counts)

7.2.2 Weekday vs Weekend Entries by Time of Day

Figure 44 presents the average number of vehicles entering JBLM ACPs by time of day for both weekdays and weekends.

As expected, the number of vehicles entering JBLM is greater during weekdays than during weekends, with weekday vehicle entries being consistently higher throughout the day except for the late evening and early morning hours. Weekday arrival volumes are at their highest during normal AM peak periods, while weekend arrival volumes peak between noon and 2 PM.

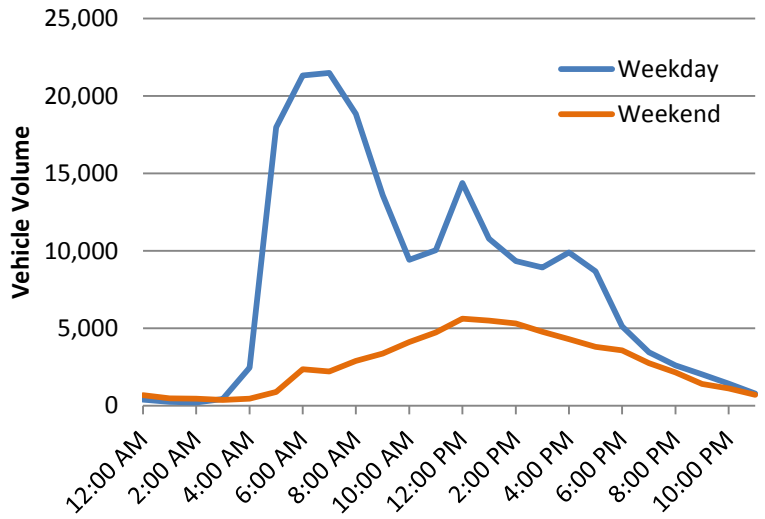

Figure 44 –JBLM ACP Entry Volume Comparison

(2013 JBLM Gate Counts)

7.3 WHICH ACPS ARE MOST USED?

Figure 45 details the average weekday daily entry and exit volumes per JBLM ACPs.

Lewis Main experiences the largest entry and exit volumes, with Liberty, Madigan, and DuPont Gates being the most used entry and exit points. Entry and exit volumes are fairly balanced for all Camp Murray, Lewis North and McChord ACPs; however, the DuPont Gate processes a larger inbound traffic volume while the Center Drive Gate only processes outbound traffic. This reflects ACP operations which allow exiting vehicles to use the Center Drive Gate from 3 to 6 PM.

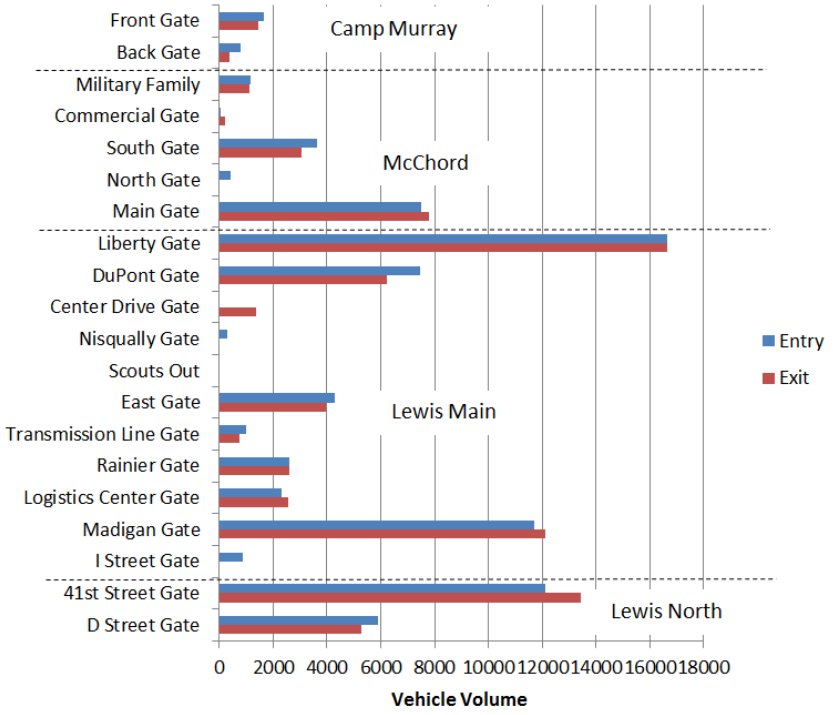

Figure 45 – Weekday Daily ACP Volumes

(2013 JBLM Gate Counts)

7.4 HOW DO PEOPLE TRAVEL ON OR BETWEEN BASES?

7.4.1 Mode Split Traveling to JBLM

The self-reported mode split for JBLM employees and residents from the *2013 JBLM Community Survey* is detailed in Figure 46 below. Trips made by auto, truck or motorcycle make up the vast majority of travel modes on JBLM, with vanpool or transit trips representing just over 2 percent of total trips.

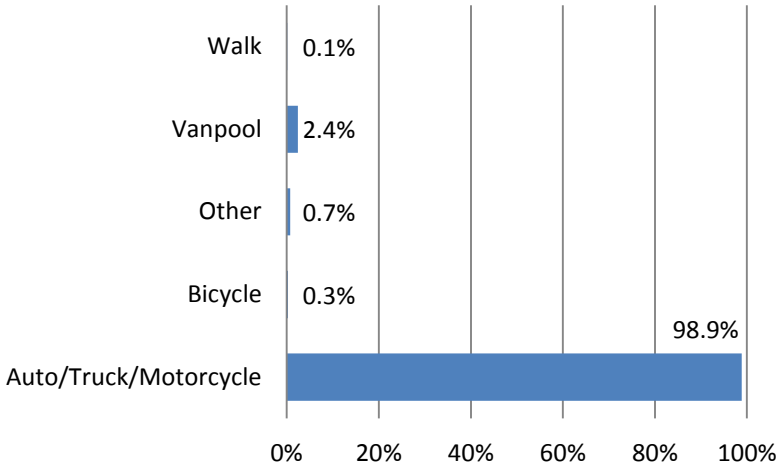

Figure 46 – Mode Split to JBLM

(JBLM Community Survey)

7.4.2 Daily Trip Trends

Figure 47 details the number of off-Base trips made by JBLM employees once they have arrived on base. One trip "to and from base" means one round trip from the base between initially arriving in the morning and departing in the evening.

About 27 percent of JBLM employees reported leaving and returning to base at least once a day not including their daily commute. Additionally, 13 percent of JBLM employees reported leaving and returning twice a day, with 3 percent of employees doing so 3 or more times a day.

As mentioned earlier, some service members who arrive early to JBLM for physical training (PT) return home to shower and prepare for their work day back on base, resulting in multiple trips to and from JBLM each day.

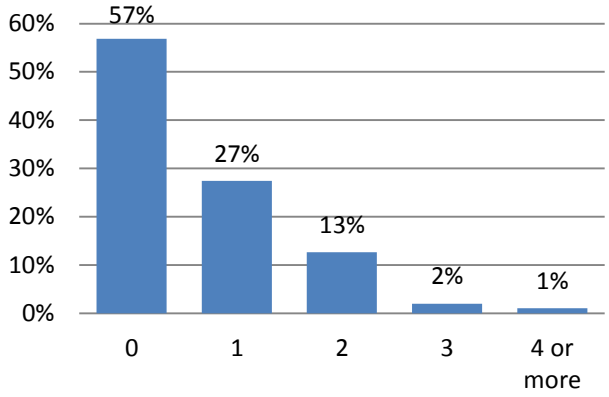

Figure 47 – Trips To and From Base per Day (Once on Base)

(JBLM Community Survey)

Figure 48 illustrates how often JBLM residents travel off base as reported in the *2013 JBLM Community Survey*. The survey shows that of those who live on base, 53 percent of residents leave base between two to four days a week, with 16 percent leaving 7 days a week, and roughly 15 percent leaving 1 or fewer days a week.

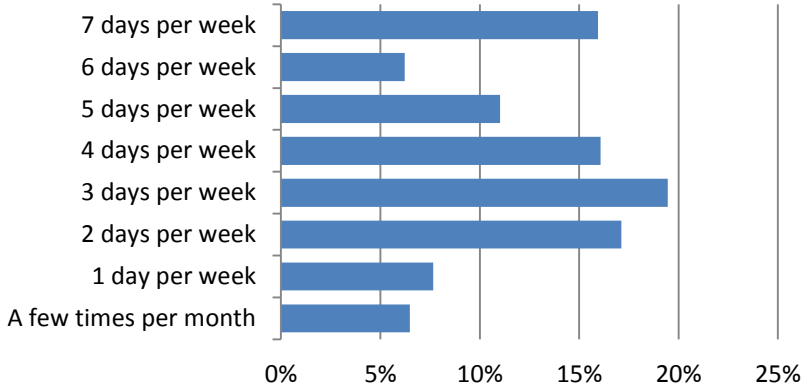

Figure 48 – How often JBLM Residents Travel off Base

(JBLM Community Survey)

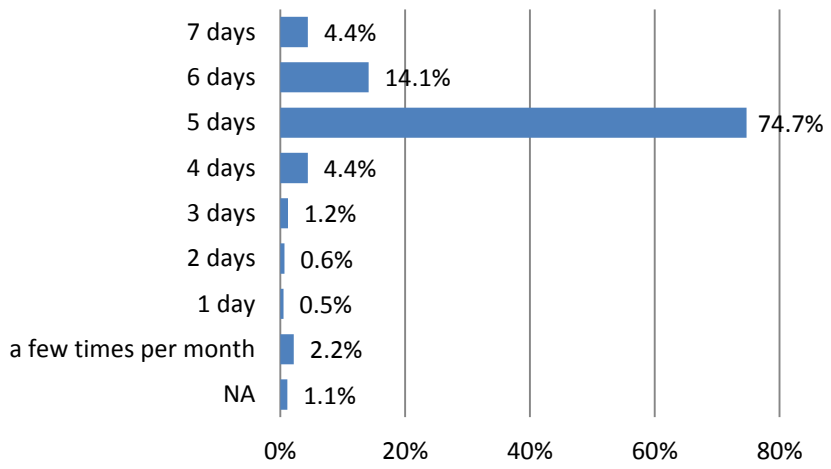

Figure 49 – Days per Week Traveled to JBLM by Employees

(JBLM Community Survey)

7.4.3 Average Auto Occupancy at ACPs

Average auto occupancy counts, including single occupancy vehicles (SOV), two person high occupancy vehicles (HOV 2) and 3 and more person carpools (HOV 3+ and vanpool) from the 2014 vehicle occupancy study conducted at the major JBLM ACPs are summarized in Figure 50. Orange hues denote trips in the AM peak (6:30 to 8:30 AM), while blue hues denote trips in the PM peak (3:30 to 6:30 PM).

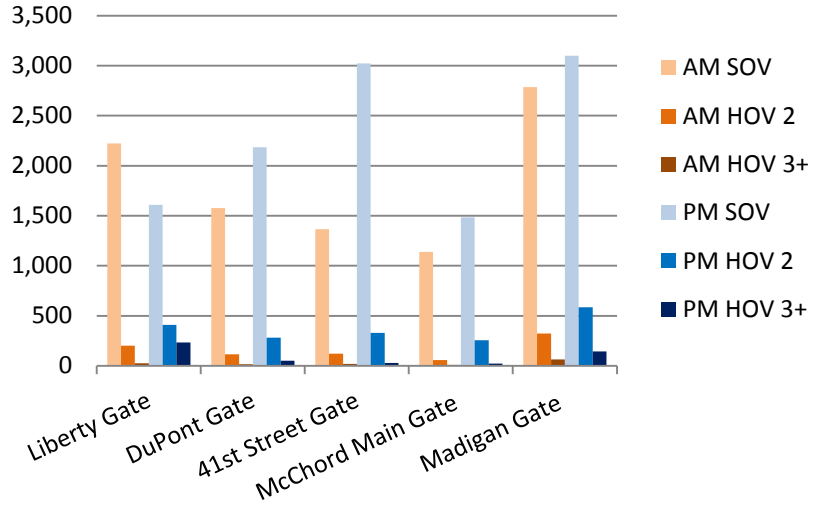

Figure 50 – Inbound Occupancy of Vehicles by ACP

(Gate Vehicle Occupancy Study)

SOV trips account for the majority of trips into all ACPs for both AM and PM peak periods, with vehicle volumes higher in the PM peak for all ACPs excluding Liberty Gate.

Two person HOV trips account for the majority of carpool trips into JBLM during both the AM and PM peak periods. HOV trips into JBLM are roughly two to four times higher in the PM peak period than in the AM peak period. Madigan Gate has the largest number of carpool trips into JBLM in the AM and PM peak periods of all ACPs; however, Liberty ACP experiences the largest number of HOV 3+ trips.

7.4.4 Local Transit Routes Serving JBLM

In addition to the six regional commuter transit routes operating on I-5 through the study area discussed in Section 6.5.2, two local routes operated by Pierce Transit serve JBLM with eight stop locations (see Figure 51). These routes primarily operate off-base, but travel into Lewis Main to serve the Madigan Army Medical Center and into McChord to serve the Commissary. Table 6 contains details about this existing transit service including ridership.

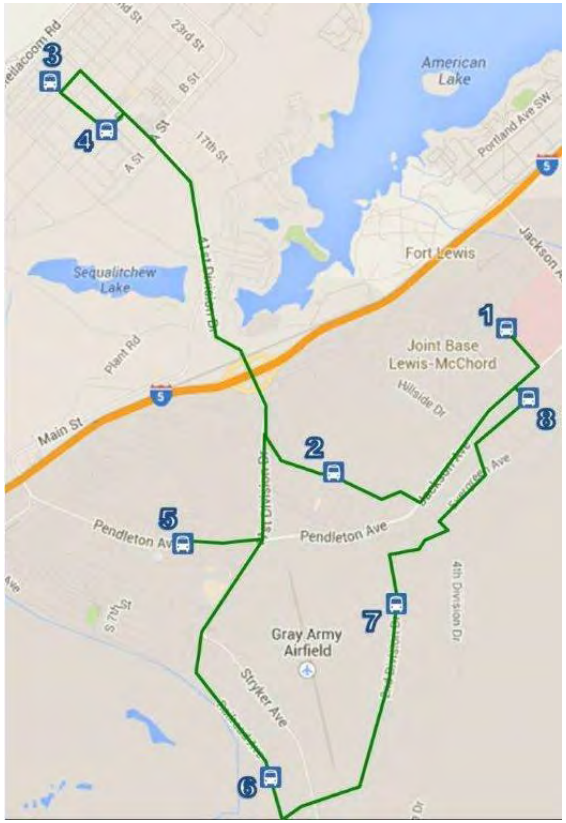

Figure 51 – JBLM Shuttle Routes

(JBLM)

In addition to these two routes, JBLM operates two on-Base duty shuttle routes, shown in Figure 51. These routes operate between Lewis North, Gray Army Airfield and Madigan Army Medical Center serving nine stops.

Table 6 – Transit Routes Serving JBLM

Route	Route	Service Hours	Headway (Weekdays)	Stops in Study Area	Ridership (3 – 6 PM)
206	Madigan Hospital to Lakewood	5:30 am to 9:00 pm	30 minutes	Madigan Hospital	260
300	McChord Commissary to Tacoma	6:30 am to 9:00 pm	30 minutes	McChord Commissary	270
Orange Route	Madigan to Soldiers Fieldhouse	7:00 am to 8:00 pm	30 minutes	7 stops	-
Purple Route	Hawk to Madigan	7:00 am to 8:00 pm	60 minutes	8 stops	-