4.3 TRANSPORTATION

Over the past several years, traffic has increased along the entire I-5 corridor from Portland, Oregon to Bellingham, Washington. Within the study area in southern Pierce County, traffic has also grown as regional commuter trips have expanded between Thurston, Pierce and King counties; JBLM and Camp Murray have expanded, and the communities of Lakewood, DuPont and Steilacoom have grown.

These area changes have added to the increased through traffic along I-5 in the vicinity of JBLM. Because of the presence of secure military bases on both sides of I-5, there are no routes for motorists to use without extended detours to bypass these bases. As a result, congestion along this segment of I-5 has become a daily occurrence and interchange ramp traffic backing onto the I-5 mainline is causing delays and safety issues.

The proposed Build Alternative consists of modifications to I-5 to enhance regional mobility and safety by addressing existing and expected near-term (2020) congestion on the highway mainline. The addition of mainline travel lanes is constrained by the width of the existing Berkeley Street and Thorne Lane interchange overcrossing structures. These structures currently accommodate only three travel lanes in each direction and must be widened to add a fourth lane in each direction, as proposed by the Build Alternative. The widening of the existing overcrossing structures required modifications to the ramp termini intersections and approach streets so that they operate as efficiently and safely as possible.

Traffic analysis for this EA evaluated both near-term (2020) transportation conditions along I-5 in the vicinity of JBLM, and also assessed how the Build Alternative would perform in 2040. Overall, analysis shows that the proposed interchange modifications at the Berkeley Street and Thorne Lane interchanges, together with adding both through and auxiliary lanes on I-5, would improve the safety and operation of the interstate and ramp intersections. The new interchanges, with associated highway widening, would maintain or improve operating conditions in 2020, and provide some 2040 operational benefits, especially in the northbound direction.

NOTE TO READER: *This EA provides a tiered environmental review. Chapter 4 evaluates the project specific environmental impacts associated with construction of the North Study Area Build Alternative (See Section 3.4 for description). Chapter 5 provides a corridor level discussion of the South Study Area (See Section 3.5). Specific project footprint improvements are not currently defined for the South Study Area.*

4.3.1 What Methods, Assumptions and Resources Were Considered in the Transportation Evaluation?

What Supportive Documents and Prior Studies Have Been Completed?

The I-5 JBLM Vicinity Congestion Relief Study was conducted from 2013 to 2015 and published two documents identifying, analyzing and evaluating proposed mainline, local street and Transportation Demand Management (TDM) improvements to reduce congestion and improve mobility in the I-5 corridor. These reports are:

- *I-5 JBLM Vicinity IJR and Environmental Documentation Phase 1 - I-5 Corridor Feasibility Study*, completed in January 2014 – this study identified and analyzed various mainline and interchange improvements to I-5 and selected two alternatives for further evaluation.
- *I-5 JBLM Vicinity Congestion Relief Study Phase 2 - Multimodal Alternatives Analysis and Updated Environmental Scan*, completed

in March 2015 – this study identified and evaluated over 180 improvements including local on-JBLM and off-JBLM public street improvements, transit alternatives, and transportation demand management approaches. The selected multimodal improvements were packaged with the mainline improvements. These alternative packages were then analyzed to determine a recommended set of improvements to be further evaluated in this environmental assessment and the corridor Interchange Justification Report (IJR).

In addition, as part of this EA analysis, a *Transportation Operations and Safety Technical Memorandum* was prepared. This report documents and supports the findings, conclusions and recommendations of this EA. It summarizes existing transportation conditions along the I-5 corridor, as well as future I-5 traffic operations with the No Build and Build Alternatives for an opening year (2020) and a design year (2040).

How Was the Transportation Study Area Determined?

The Project Corridor study area generally includes I-5 between Mounts Road (Exit 116) on the south and Gravelly Lake Drive (Exit 124) on the north and includes the roads that access, parallel or influence this facility. Within this study area, I-5 is a divided interstate highway with three through lanes in each direction south of Thorne Lane and four through lanes in each direction north of Thorne Lane. All lanes are unmanaged general purpose lanes. There are seven interchanges in this roughly eight-mile study area (Exits 124, 123, 122, 120, 119, 118 and 116).

While the Project Corridor study area boundary includes the entire I-5 corridor through the JBLM vicinity, implementation of improvements would occur in phases. Improvements in the North Study Area represent the Build Alternative and would be constructed first. The Build Alternative includes modifications to the I-5 mainline and interchanges between the vicinity of the Center Drive interchange (Exit 118) and the Gravelly Lake Drive interchange (Exit 124). Two primary interchanges would be reconstructed and four other study area interchanges would be influenced by the I-5 mainline improvements.

Primary Interchanges Rebuilt with the Build Alternative

- I-5/Berkeley Street interchange (Exit 122).
- I-5/Thorne Lane interchange (Exit 123).

Interchanges Influenced by the Build Alternative

- Center Drive interchange (Exit 118).
- Steilacoom-DuPont Road interchange (Exit 119).
- Main Gate (41st Division Drive) interchange (Exit 120).
- I-5/Gravelly Lake Drive interchange (Exit 124).

The geographic coverage of the Build Alternative footprint is illustrated in Figure 4.3-1. The southern portion of the study area (referred to as the South Study Area and located generally between Mounts Road and Steilacoom-DuPont Road) is identified for potential future improvements and is addressed in Chapter 5.

What Analysis Approach Was Used to Evaluate Transportation Conditions in the Study Area?

Existing and forecasted traffic data were analyzed to identify how the current transportation system is performing, how traffic levels are expected to grow in the future, and how the proposed improvements in the Build Alternative would impact expected traffic conditions. Traffic analysis was conducted for AM and PM peak hours and peak periods for the following years:

- 2013/2014 (existing base year).
- 2020 (anticipated year of opening).
- 2040 (long-term design year).

This subsection presents a short discussion on the process used to develop future year traffic forecasts and analyze the anticipated

traffic volumes resulting from the forecast process for both the I-5 mainline and key study area intersections.

DEVELOPMENT OF TRAFFIC FORECASTS

The travel forecasts for the I-5 JBLM Vicinity Congestion Relief Study were developed using a series of inter-related and complementary modeling tools that included a Macroscopic (Macro) Model, Mesoscopic (Meso) Model and Transit Sketch Planning Model. Each of the three modeling tools was developed and applied specifically for the study and used to evaluate the alternative improvement packages.

In developing these models, data was used from a variety of sources including both land use and transportation input. Land use assumptions for 2020 and 2040 were obtained from the Puget Sound Regional Council (PSRC), the Thurston Regional Planning Council (TRPC), Pierce County, and the cities of DuPont and Lakewood. Land uses on JBLM were represented by traffic volumes at each gate. Transportation input included 2013 traffic counts and intersection layouts to establish the existing conditions of the corridor.

***BlueMAC devices** 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 one can compute travel times and O/D patterns.*

In this evaluation, 2013 was used as the "existing" year. This data was enhanced with information documented in the *I-5 JBLM Vicinity Congestion Relief Study, Travel Patterns and Characteristics Memorandum* which summarized the origin/destination (O/D) data from forty-seven Bluetooth detection units (called BlueMAC devices and described in the sidebar) installed along I-5, at JBLM gates, and within the JBLM base itself. The land use and transportation system data (including gate counts) were used to forecast area traffic and assign vehicle trips to the No Build and Build Alternative transportation systems.

EVALUATION OF TRAFFIC OPERATIONS ALONG THE I-5 MAINLINE

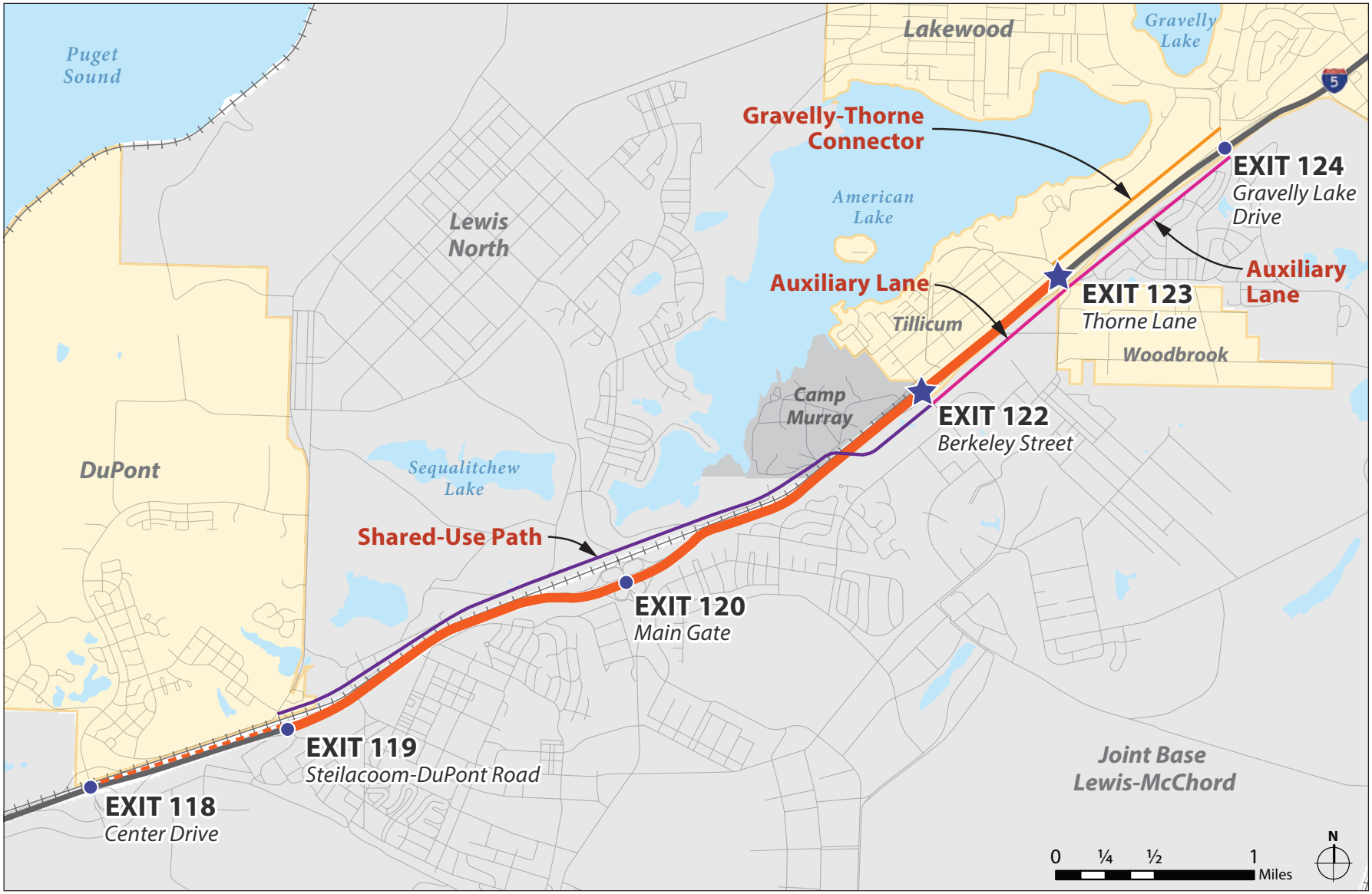
Because of corridor constraints, such as the close proximity of multiple entrance and exit points along I-5, slow travel speeds, frequent lane changes, and generally over-saturated traffic flow conditions, the traditional *Highway Capacity Manual* (HCM) level of service (LOS) method using vehicle density does not depict the actual congestion issues along the I-5 mainline, at merge and diverge locations, or through weaving areas. As a result, the method used to analyze mainline traffic along I-5 focused on WSDOT's *2007-2026 Highway System Plan*, which uses the relationship between traditional LOS and the percent of posted speed to determine the magnitude of congestion. This relationship is illustrated in the sidebar. Based on this method, speeds below 70 percent of posted speed are identified as LOS F.

The analyses of traffic along I-5 were conducted using output from the Meso Model developed specifically for this study. This model is capable of analyzing freeway operations between intersections and

Comparison of Level of Service (LOS) to Percent of Posted Speed

Level of Service	Relationship to Posted Speed
A	Not defined; would be above posted speed 60+ mph
B	Above posted speed 60+ mph
C	100% of posted speed 60 mph
D	Above 85% of posted speed to posted speed 52 mph to 60 mph
E	70% to 85% of posted speed 42 mph to 51 mph
F	Below 70% of posted speed below 42 mph

Source: 2007-2026 Highway System Plan, WSDOT



Existing I-5 Mainline
Existing Interchange

NORTH STUDY AREA – BUILD ALTERNATIVE

Add One Lane Each Direction
Restripe to Create One New Southbound Lane
Shared-Use Path
Auxiliary Lane
Gravelly-Thorne Connector
Rebuild Interchange

Figure 4.3-1
Proposed Build Alternative

interchanges, including weaving sections and multiple vehicle classes, and provided the most efficient tool to assess various freeway and interchange layout options. The performance measures selected to evaluate traffic conditions along I-5 included magnitude of travel demand that could be satisfied, travel speeds, hours of congestion, and travel times.

EVALUATION OF TRAFFIC OPERATIONS AT KEY INTERSECTIONS

Intersection operations at or within the vicinity of Build Alternative interchanges were analyzed using data outputs from both the Macro and the Meso Models. This data was processed and evaluated using Synchro software for signalized and non-signalized intersections and Sidra software for roundabouts, in accordance with the HCM. Intersection analysis at other interchanges in the study area that could be influenced by the Build Alternative were analyzed using travel model output directly from the Meso model to reflect the currently undefined nature of potential improvements at these locations.

4.3.2 What Are Existing Transportation Conditions in the Study Area?

What Are Characteristics of the Existing Study Area Transportation System?

I-5 is the main north-south route through western Washington. It is classified as part of the National Highway System (NHS) and is a Highway of Statewide Significance (HSS). It is a principal route for the movement of people, goods, services, and the military on a statewide basis and is a key link in the trade-dependent Washington state economy.

As shown in Figure 4.3-2, within the study vicinity, I-5 connects the Olympia/Lacey/Tumwater area to the south with the Tacoma area to the north. In the study area, I-5 passes through JBLM and serves as its principal access route, as well as connecting to Camp Murray, the cities of DuPont and Lakewood, and the town of Steilacoom. Due to the location of the secure military facilities on both sides of the freeway and the proximity of the corridor to Puget Sound, there are few alternatives to using I-5 in the study area.

I-5 is a divided highway with three 12-foot through lanes in each direction south of the Thorne Lane interchange, and four 12-foot through lanes in each direction north of the Thorne Lane interchange. Shoulder width ranges from two feet to 10 feet. I-5 crosses JBLM on an easement granted by the United States Department of Defense. While WSDOT has operational and management responsibility for the freeway, the fact that I-5 is located on property owned by another agency has implications that affect the development of future roadway improvements. This relates both to the procedural steps involved in acquiring additional space for highway widening, and to the lack of realistic alternative routes for travel in this corridor.

In addition to the seven interchanges along I-5 in the vicinity of JBLM, there are two other I-5 crossings within the study area:

- Over a railroad spur that serves JBLM, north of the Center Drive interchange.
- Over Pendleton Avenue, north of the Steilacoom -DuPont Road interchange.

Pendleton Avenue is a surface street on JBLM that connects Lewis Main (on the east) with Lewis North (on the west), which are separated by I-5. Please see the *I-5 JBLM Vicinity IJR and Environmental Documentation Phase 1 – Corridor Feasibility Study* report for further information about the existing freeway.

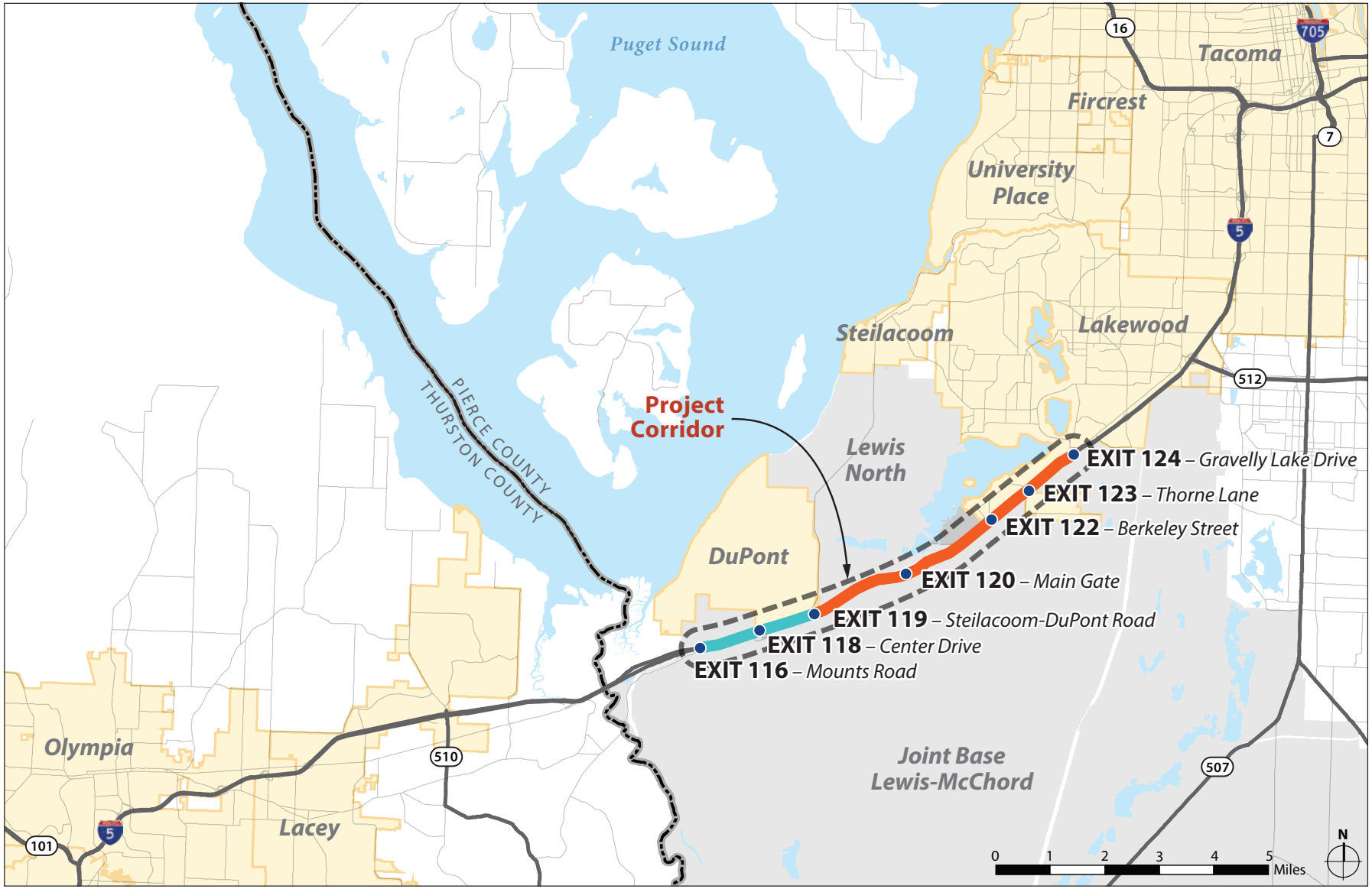


Figure 4.3-2
Project Vicinity Map

What Are Existing Traffic Volumes and Levels of Congestion along I-5?

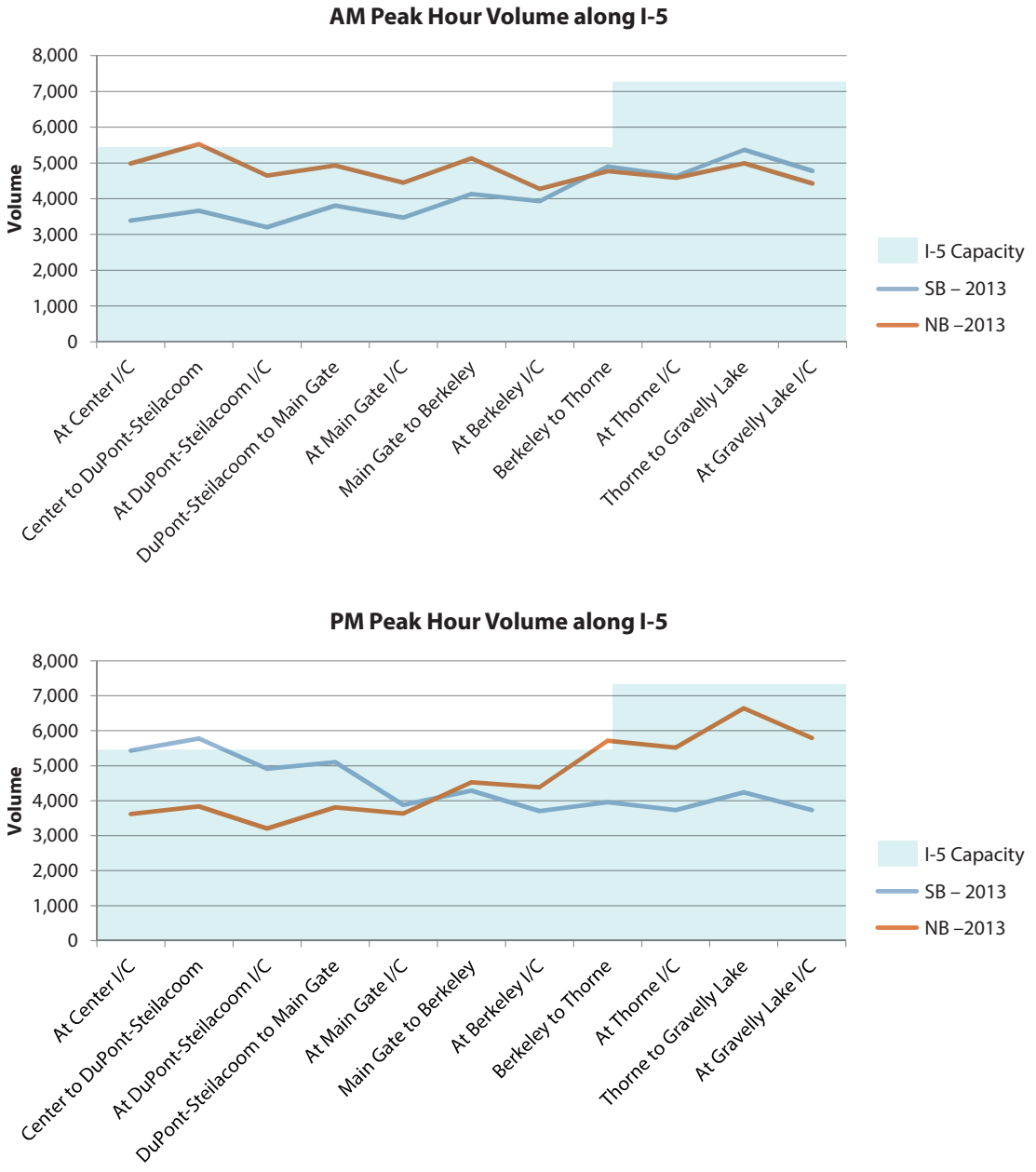
I-5 TRAFFIC VOLUMES

Based on existing traffic counts collected in 2013, two-way AM and PM peak hour traffic volumes along the I-5 corridor ranged from approximately 7,800 vehicles to 10,900 vehicles. Figure 4.3-3 shows the AM and PM peak hour vehicle trips on I-5 by direction. Using a per lane capacity of 1,800 vehicles per hour, the three-lane section has a practical capacity of 5,400 vehicles and the four-lane section has a practical capacity of 7,200 vehicles (indicated by the shaded areas on the charts). It is important to note that because of the slow speeds, stop-and-go traffic, and frequent lane changes, the actual volume that can be accommodated is below the practical capacity of I-5.

> ***I-5 Corridor:*** *For these analyses, refers to the I-5 corridor in the vicinity of JBLM extending from Gravelly Lake Drive interchange on the north to the Center Drive interchange on the south.*

During the AM peak hour, the northbound lanes are at or near capacity from Center Drive to Thorne Lane. During the PM peak hour, the southbound lanes are at or near capacity south of the Main Gate interchange and the northbound lanes are at or near capacity between Berkeley Street and Thorne Lane. This level of traffic volume along the I-5 corridor, together with the reduction in southbound

Figure 4.3-3 *2013 AM & PM Peak Hour Volume Along I-5 – Center Drive to Gravelly Lake Drive*



travel lanes at Thorne Lane, creates lane turbulence and congestion that:

- Reduces gap distance between vehicles.
- Makes it more difficult for drivers to change lanes safely, causing drivers to slow down or even stop.
- Results in more rear-end and sideswipe collisions through this portion of I-5.

I-5 TRAVEL DEMAND

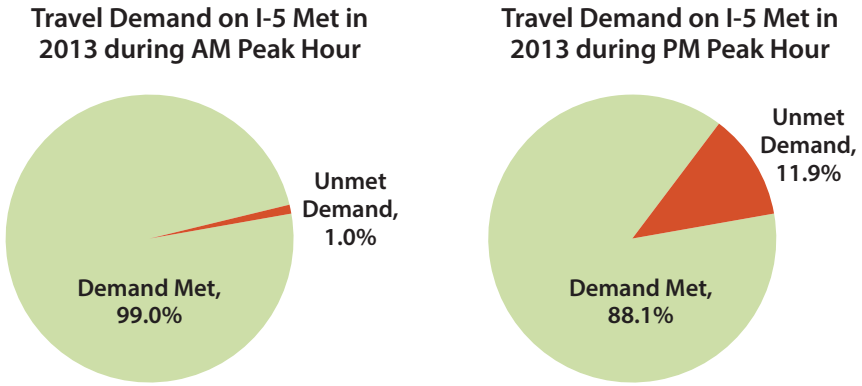
Since the last widening of I-5 through the project area in 1975, there have been significant increases in traffic volumes and accompanying congestion along I-5 in the JBLM vicinity. This growth is associated with increased through traffic, local community development and JBLM commute patterns. As shown in Figure 4.3-4 and based on output from the study area travel model, over 88 percent of PM peak hour travel demand could use I-5 in the 2013 analysis base year. This means that approximately 12 percent of the persons who wanted to travel on I-5 during the PM peak hour could not do so because there was insufficient physical space for them to get on the highway. These trips likely spread into the hours adjacent to the PM peak, lengthening the overall multi-hour peak period.

I-5 TRAVEL SPEEDS AND CONGESTION

Average travel speed along the I-5 corridor is a factor that WSDOT uses to illustrate congestion. WSDOT's 2007-2026 Highway System Plan uses 70 percent of posted speed (42 mph on I-5) to signify when congestion occurs at level of service (LOS) F. As can be observed from Figure 4.3-5, travel speeds in 2013 along I-5 in the PM peak hour are below 42 mph through most of the project area.

In the southbound direction, average PM speeds are below 42 mph from Gravelly Lake Drive to Steilacoom-DuPont Road, with the segment from Thorne Lane to Main Gate being near 20 mph. In the northbound direction, average PM speeds are below 42 mph between Steilacoom-DuPont Road and Thorne Lane. These slow average speeds signify that several areas along I-5 in the JBLM vicinity have slow moving vehicles with periods of stop-and-go traffic. Travel speeds in 2013 along I-5 in the AM peak hour are typically above 42 mph.

Figure 4.3-4 *Peak Hour Travel Demand Met Along I-5 – Center Drive to Gravelly Lake Drive*

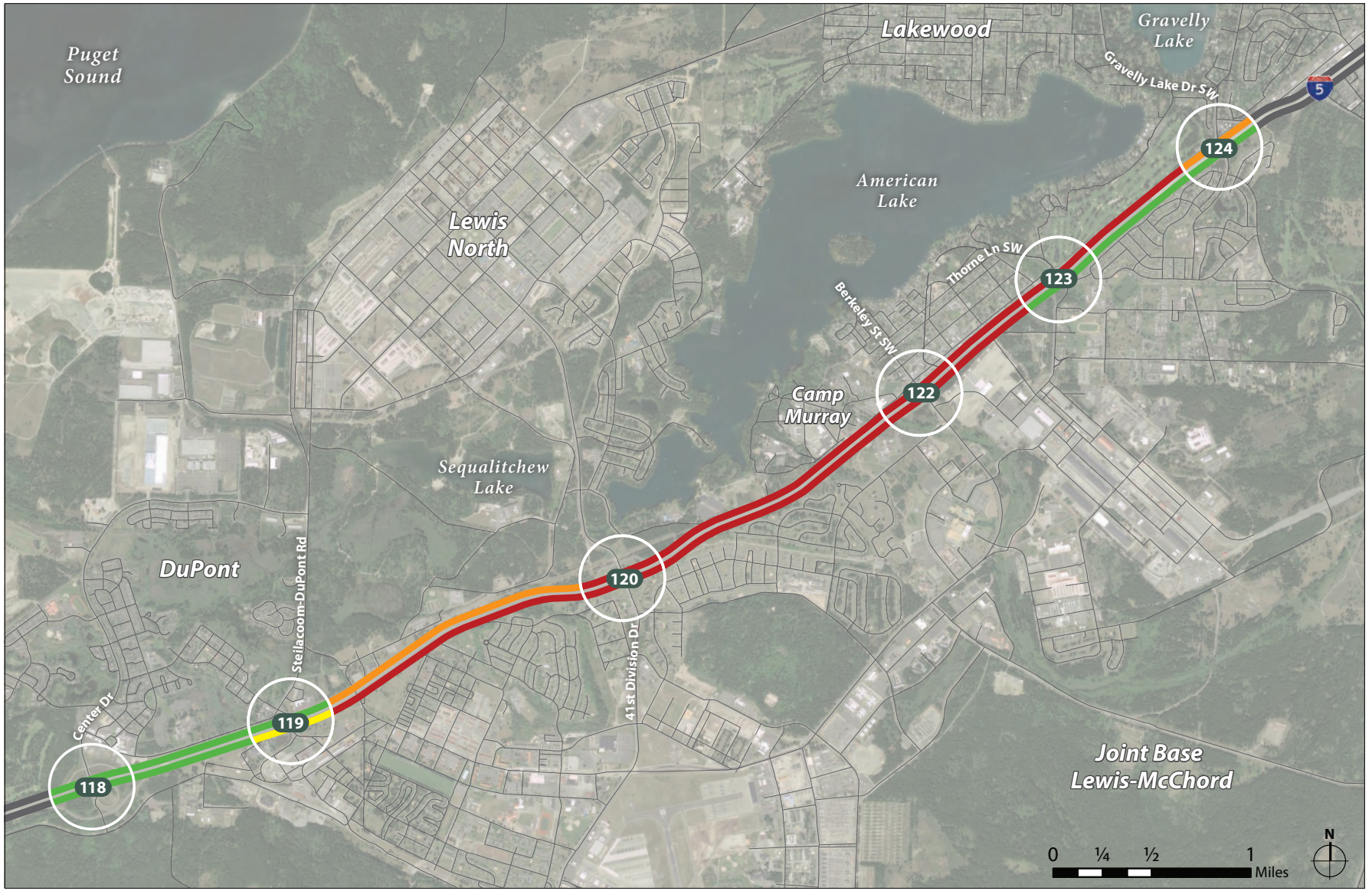


I-5 HOURS OF CONGESTION

The change in speeds and durations of slow speeds along I-5 are illustrated in the Congestion Contour diagrams from the Meso Model, shown in Figure 4.3-6. These diagrams illustrate the length of time that the speeds along I-5 would be less than 42 mph, signifying the hours of congestion. In 2013, congestion during the PM peak period lasted for about three hours (i.e., from about 4 pm to 6:30 pm southbound and 3:30 pm to 6:30 pm northbound).

I-5 TRAVEL TIMES

A comparison of travel times along I-5 between SR 510 (Marvin Road) in Lacey and SR 512 in Lakewood was made using output from the



MAINLINE I-5 SPEED

- > 51 mph
- 42 - 51 mph
- 36 - 41 mph
- 20 - 35 mph
- < 20 mph

INTERCHANGES

- 118 Center Drive interchange
- 119 Steilacoom-DuPont Road interchange
- 120 Main Gate interchange
- 122 Berkeley Street interchange
- 123 Thorne Lane interchange
- 124 Gravelly Lake Drive interchange

Figure 4.3-5
2013 PM Peak Hour Travel Speeds Along I-5 in Project Corridor

Meso Model. Traveling along I-5 between SR 510 and SR 512 at the posted speed limit would normally take about 14.5 minutes to cover the 14.5 miles between the two interchanges. Table 4.3-1 shows existing peak period travel times along I-5. During the PM peak hours, travel times along I-5 are approximately double AM travel times.

What Factors Affect Existing Traffic Conditions Along I-5?

Traffic volumes along I-5 in the vicinity of JBLM have increased over the past three decades to the point where congested (stop-and-go) traffic has become commonplace. There are several factors that affect traffic operations along I-5 and contribute to the chronic traffic congestion in the JBLM vicinity. These factors include:

- **Existing and growing traffic demand** and associated congestion during peak periods of the day along I-5 and at study area interchanges. Between 1986 and 2014, daily traffic volumes on I-5 in the study area increased by 76 percent, from just over 68,000 vehicles to over 121,000 vehicles. This growth is associated with increased through traffic, local community development, and JBLM commute patterns. These higher traffic volumes reduce the gap distances between vehicles, make it more difficult for drivers to change lanes safely and to recover from traffic crashes, and cause drivers to slow down or stop as other drivers try to change lanes with smaller gaps.
- **Few alternate routes** through the secure military installations, along with environmental and right of way constraints, limit opportunities to travel between Thurston County and Tacoma/ Seattle.
- **Physical limitations** and constraints of I-5 through the study area including:
  - Change in the number of traffic lanes on I-5 at the Thorne Lane interchange (eight lanes north of Thorne Lane, six lanes south of Thorne Lane).
  - Several closely spaced I-5 interchanges (six) over a short distance (6.7 miles) between the Center Drive interchange and the Gravelly Lake Drive interchange.
  - Physical limitations of the interchanges with narrow bridges that constrain opportunities to increase highway capacity.
  - Adjacent rail line that limits highway improvement options.
- **Heavy on- and off-ramp volumes** at the interchanges between Center Drive and Gravelly Lake Drive. Entering and exiting traffic represents about half of the total traffic along I-5 in the study area. This traffic competes with high through traffic volumes, resulting in substantial weaving and merging activity.
- **Vehicle trips using I-5 for local and short distance travel** in the project area. Because of the secure military installations, I-5 is the main, and essentially only, traffic artery through the area for public through trips, regional trips and short trips.As a result, several locations have a heavy volume of trips that begin or end within the Project limits (i.e., short trips), competing for freeway space with regional and through traffic.Further information about these trip patterns can be found in the *I-5 JBLM Vicinity Congestion Relief Study, Travel Patterns and Characteristics* report dated August, 2014.

What Are Existing Traffic Volumes and Levels of Congestion at and Near I-5 Interchanges?

BUILD ALTERNATIVE INTERCHANGES

Existing 2013 intersection analyses at the I-5 interchanges (Thorne Lane and Berkeley Street) were conducted using the Synchro software, and the results are presented in Table 4.3-2.

Figure 4.3-6 *2013 PM Peak Period Average Travel Speeds Along I-5 – Nisqually to SR 512*

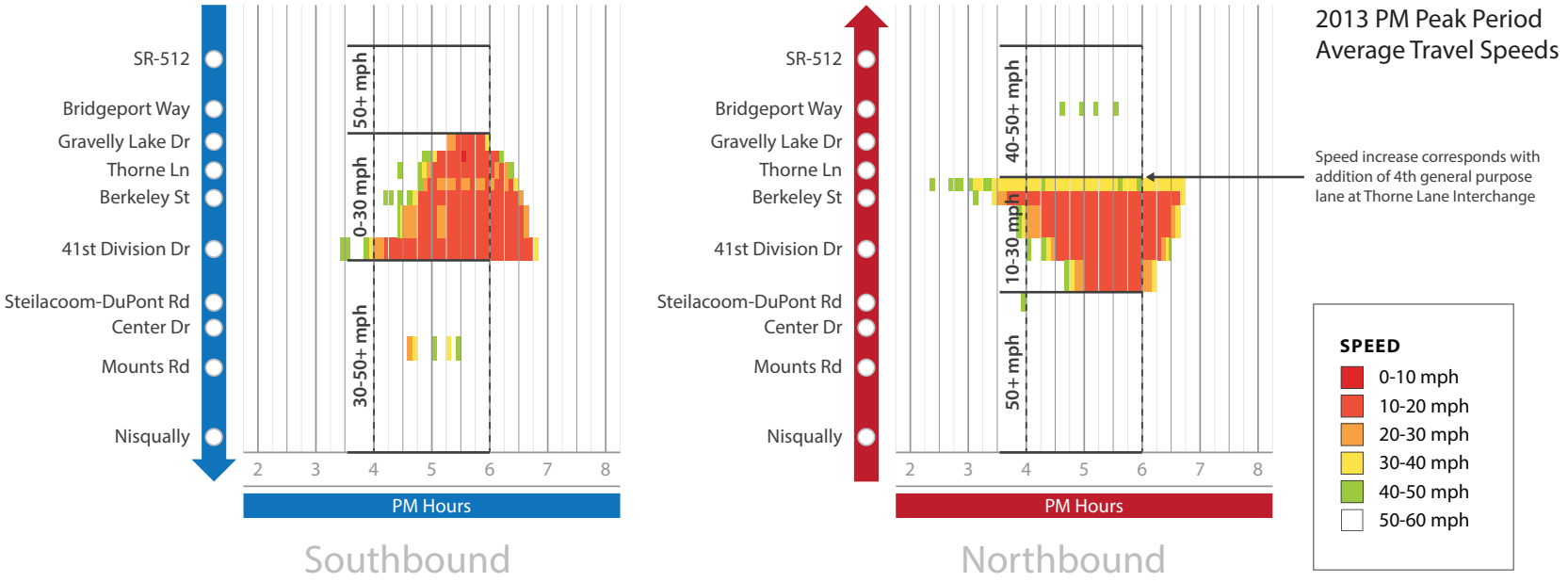


Table 4.3-1 *2013 Travel Times Along I-5 Between SR 510 and SR 512 Ramps*

	AM Peak		PM Peak	
Year	**Northbound**	**Southbound**	**Northbound**	**Southbound**
2013 Existing	14.5	14.5	24-25[1]	25-30[1]

Note: Posted speed would result in a total corridor travel time of 14.5 minutes
1 5:00-6:00 pm

The analyses show that during the AM peak hour the following intersections are operating below LOS D:

- I-5 southbound (SB) Ramps / Berkeley Street.
- I-5 southbound (SB) Ramps / Thorne Lane.
- I-5 northbound (NB) Ramps / Thorne Lane.

During the PM peak hour, the following intersection operates below LOS D:

- I-5 northbound (NB) Ramps / Thorne Lane.

As interim measures to address these deficiencies, WSDOT and the City of Lakewood have implemented several improvements. In 2014, WSDOT added an auxiliary lane on southbound I-5 between Thorne Lane and Berkeley Street, as well as ramp meters in 2015 to improve operations along I-5 and at the interchanges. The City of Lakewood is planning an additional improvement at the Berkeley Street interchange as part of the Madigan Access Improvement Project. This Madigan Access Project, which will open in 2016, is an interim measure to address existing capacity and intersection deficiencies.

Level of Service (LOS): *LOS is a qualitative measure that describes traffic operational conditions, with LOS A having minimal delay at intersections to LOS F representing the worst (extreme traffic congestion and long delays at intersections).*

ADJACENT INTERCHANGES THAT COULD BE AFFECTED BY THE BUILD ALTERNATIVE

2013 intersection analyses at other I-5 interchanges in the vicinity of the Build Alternative were also conducted using the Synchro software, and the results are presented in Table 4.3-3. The analyses show that during the AM peak hour all intersections operate at LOS D or better.

During the PM peak hour, the following intersections operate below LOS D:

Table 4.3-2 *Summary of 2013 Peak Hour Intersection Delays and Levels of Service at Build Alternative Interchanges ***

	2013 Existing			
	AM		PM	
Intersection*	**Avg Delay**	**LOS**	**Avg Delay**	**LOS**
I-5 NB Ramps / Berkeley Street (Signal Control)	25.7 sec.	C	29.7 sec.	C
I-5 SB Ramps / Berkeley Street (Signal Control)	**69.2 sec.**	**E**	54.0 sec.	D
Berkeley Street / Union Avenue (4-Way Stop Control)	10.6 sec.	B	12.1 sec.	B
I-5 NB Ramps / Thorne Lane (Signal Control)	**56.9 sec.**	**E**	**71.2 sec.**	**E**
I-5 SB Ramps / Thorne Lane (Signal Control)	**58.7 sec.**	**E**	49.1 sec.	D
Thorne Lane / Union Avenue (2-Way Stop Control)	9.6 sec.	B	11.1 sec.	B

*Notes * Signalized & non-signalized intersections analyzed using Synchro software. Please note that the Synchro analysis does not account for on-ramp back-ups from the ramp meter or freeway.*
*** LOS E and LOS F values shown in bold.*

- I-5 NB Ramps / Center Drive.
- I-5 NB Ramps / Gravelly Lake Drive.

The I-5 northbound ramp intersection with Center Drive is directly affected by PM peak hour outbound traffic from JBLM. Traffic does not normally use this interchange during the AM peak period. This interchange was analyzed with the revised roadway configuration built in 2014.

MAIN GATE INTERCHANGE

The cloverleaf configuration of the Main Gate interchange does not have traditional intersections with traffic control devices, such as stop signs or traffic signals. To analyze the merge and diverge points on 41st Division Drive with the various I-5 ramps, output from the Meso Model was used to estimate average approach delays. A summary of these approach delays is shown in Table 4.3-4.

Based on a review of the estimated approach delays at the I-5 northbound ramps, the northbound approach along 41st Division Drive has an average delay of over five minutes per vehicle during the PM peak hour. The other approaches have delays of less than 30 seconds per vehicle. At the I-5 southbound ramps, the southbound approach along 41st Division Drive has an average delay of over three minutes per vehicle during the PM peak hour. The other approaches have delays of less than 30 seconds per vehicle. These long delays are caused by traffic congestion along the I-5 mainline, which backs up traffic on the on-ramps to their junction with 41st Division Drive.

Table 4.3-3 *Summary of 2013 Intersection Delays and Levels of Service at the Other Project Area Interchanges ****

	AM		PM	
Intersection*	**Avg Delay**	**LOS**	**Avg Delay**	**LOS**
I-5 NB Ramps/Center Drive (2-way Stop Control) **	NA	--	**40.8 sec.**	**E**
I-5 SB Ramps/Center Drive (2-way Stop Control)	13.9 sec.	B	12.7 sec.	B
Center Drive/Wilmington Drive (Signal Control)	13.0 sec.	B	14.7 sec.	B
I-5 NB Ramps/Steilacoom-DuPont Road (Signal Control)	32.3 sec.	C	49.9 sec.	D
I-5 SB Ramps/Steilacoom-DuPont Road (Signal Control)	18.8 sec.	B	27.3 sec.	C
Steilacoom-DuPont Road/Barksdale Avenue/ Wilmington Drive (Signal Control)	43.1 sec.	D	29.7 sec.	D
I-5 NB Ramps/Gravelly Lake Drive (Signal Control)	39.8 sec.	D	**70.3 sec.**	**E**
I-5 SB Ramps/Gravelly Lake Drive (Signal Control)	41.9 sec.	D	47.3 sec.	D
Gravelly Lake Drive/Pacific Highway (Signal Control)	25.5 sec.	C	29.0 sec.	C

*Notes * Signalized & non-signalized intersections analyzed using Synchro software. Please note that the Synchro analysis does not account for on-ramp back-ups from the ramp meter or freeway.*

*** Assumes new configuration of intersection built in 2014.*

**** LOS E and LOS F values shown in bold.*

Table 4.3-4 *2013 Delay Summary at Main Gate Interchange*

	NB I-5 Ramp / 41st Division Drive		SB I-5 Ramp / 41st Division Drive	
Approach	**Volume AM/PM**	**Delay (seconds per vehicle) AM/PM**	**Volume AM/PM**	**Delay (seconds per vehicle) AM/PM**
NB on 41st Division Drive	790/1,830	0.1/311	690/1,445	0.6/24.2
SB on 41st Division Drive	1,335/1,195	0.4/26.1	1,095/1,375	1.1/188
EB on I-5 NB Off-ramp	285/120	0.0/0.0	420/225	0.9/23.4
WB on I-5 NB Loop Off-ramp	200/60	0.1/12.2	240/180	0.2/0.0

Note: Delay based on Mesoscopic Model Output

What Other Travel Modes Use the Corridor?

While travel via single-occupant vehicles predominates in the I-5 corridor, other multimodal services and facilities are available. These include:

- **Transit.** There are currently three public transit providers operating within the study area: Intercity Transit, Pierce Transit, and Sound Transit. Service is largely focused on I-5 connecting Thurston and southern Pierce counties with Tacoma and other destinations to the north. Additionally, Pierce Transit provides limited service to destinations on JBLM and broader service in the city of Lakewood. An illustration of existing transit routes, transit centers and park-and-ride lots within the study area is presented in Figure III-25 in the *I-5 JBLM Vicinity IJR and Environmental Documentation Phase 1 - Corridor Plan Feasibility Study* (January 2014). During the 2013 weekday PM peak period (3 to 6 PM) nearly 1,100 transit riders traveled along I-5 within the study area.

  Transit service through the study area currently operates in general purpose travel lanes and is impacted by the same delays and congestion as all other vehicles which affects transit reliability. Service attractiveness is impacted by the lack of a competitive travel time advantage over single-occupant vehicles (SOVs).

- **Park-and-Ride Lots.** There are seven primary park-and-ride lots within or serving the study area between Tumwater on Bonniewood Road (shared use with Department of Health) and SR 512 in Lakewood. Many of these lots are heavily utilized.

- **Vanpools.** Vanpool service in the corridor is provided by Intercity Transit (IT) and Pierce Transit (PT), as well as other transit agencies and private employers. Vanpool activity is substantial during peak travel periods. During the 2013 weekday PM peak hour (4 to 5 PM) over 700 persons traveled in vanpools along I-5 within the study area.

  During a typical weekday PM peak hour in 2013, total transit and vanpool ridership along I-5 in the Project area came to over 1,200 persons. This level of ridership equates to nearly 1,000 cars that were not using I-5 during the busiest evening commuter hour.

- **Rail.** Sound Transit owns the existing rail line west of and parallel to I-5 in the study area. There are three rail operators who use this rail line: Burlington Northern Santa Fe rail (BNSF), Tacoma

Rail, and Sound Transit. The rail line is currently used exclusively for freight, with Tacoma Rail operating two to three trains per week and BNSF providing occasional service to JBLM. In 2012, Sound Transit increased rail operations north of the study area by extending commuter rail service to the Lakewood Station. Amtrak rail service is expected to begin passenger service operations on this line in 2017.

- **Bicycle and Pedestrian Facilities.** Within the corridor, non-motorized facilities are limited and there are substantial gaps in system continuity. Bicycles are allowed on the segment of I-5 south of the Gravelly Lake Drive interchange. Some of the local arterials and collectors crossing or paralleling I-5 include sidewalks and/or bicycle lanes, but there are no routes that provide a continuous alternative to I-5.

Further information on existing travel patterns and volumes is included in Chapter III of the *I-5 JBLM Vicinity IJR and Environmental Documentation Phase 1 - Corridor Plan Feasibility Study* (January 2014) or the *Transportation Operations and Safety Technical Memorandum* (September 2016).

What Are the Existing Safety Issues in the I-5 JBLM Study Area?

A five-year collision analysis was conducted along I-5 from milepost (MP) 117.42 (south of the Center Drive interchange) to MP 125.64 (north of the Gravelly Lake Drive interchange) using data from January 2010 through December 2014. This analysis of mainline, ramp and cross street collisions within the limited access area included a review of the existing collision rate, location, severity, type, and contributing factors.

TOTAL COLLISIONS

During this five-year period, there were 1,963 reported collisions along the I-5 corridor, an average of more than one collision per day. Of this total, approximately 84 percent occurred on the I-5 mainline, with 16 percent occurring at the six interchanges between Center Drive and Gravelly Lake Drive inclusive, and in the limited access segments of the cross streets, as shown in Figure 4.3-7.

Based on available data, average collision rates were calculated for I-5 including the mainline, ramps and ramp terminal intersections with cross streets that access the freeway. Collision rates are calculated as the ratio between the average annual number of crashes and 100 million vehicle miles of travel (MVMT) along the given roadway segment. The results of this analysis are presented in Table 4.3-5.

Average collision rates on I-5 through the JBLM area are well below the average Pierce County collision rate for all highways (177.5 collisions per 100 MVMT), as documented in WSDOT's *2013 Annual Collision Summary*.

Fatal and serious injury collision rates are also well below the county wide averages of 0.62 fatalities per 100 MVMT and 3.36 serious injuries per 100 MVMT.

WSDOT has conducted a safety assessment for all state highways in Washington State. Based on WSDOT's 2015 safety assessment and using 2009-2013 data, WSDOT identified four Collision Analysis Segments (CAS) located on I-5 within the project area. These I-5 locations are:

- Northbound off-ramp at Center Drive (MP 117.79) to 0.18 miles north of Center Drive bridge (MP 118.14).
- Southbound on-ramp from Steilacoom-DuPont Road (MP 118.64) to bridge over railroad to JBLM (MP 118.37).

- I-5 bridge over Pendleton Avenue (MP 119.38) to southbound on-ramp from Steilacoom-DuPont Road (MP 118.64).
- Bridge over Clover Creek near Bridgeport Way (MP 125.64) to southbound off-ramp at Thorne Lane (MP 123.94).

The recently completed projects on I-5 may improve these locations, but two years of data are needed to assess the effectiveness of the ramp meters and other improvements.

SEVERITY OF COLLISIONS

A summary of annual collisions by severity along I-5 in the study area is shown in Figure 4.3-8. These numbers include reported collisions along the I-5 mainline, ramps and all cross-streets from the Center Drive interchange to the Gravelly Lake Drive interchange within the limited access area. Collisions involving property damage only (no injuries) make up the majority (nearly 72 percent) of the collisions, with 84.3 percent of these collisions occurring along the I-5 mainline. Three fatal collisions occurred along I-5 during the five-year study period and 19 collisions involved serious injuries.

TYPES OF COLLISIONS

As shown in Figure 4.3-9, nearly 70 percent of collisions along the I-5 corridor between Center Drive and Gravelly Lake Drive were rear-end collisions and almost 20 percent were sideswipe collisions. About seven percent of the collisions involved hitting fixed objects, such as median barriers, guardrails, retaining walls, fences, bridges, and ditches. Rear-end and sideswipe collisions are common occurrences with congested stop-and-go conditions with heavy entering and exiting traffic such as those present on I-5 through the study area. Traffic on I-5 in this area is characterized by heavy entering and exiting traffic with high through volumes, which results in drivers frequently changing lanes.

Figure 4.3-7 *Number of I-5 Collisions, Center Drive to Gravelly Lake Drive – 2010 to 2014*

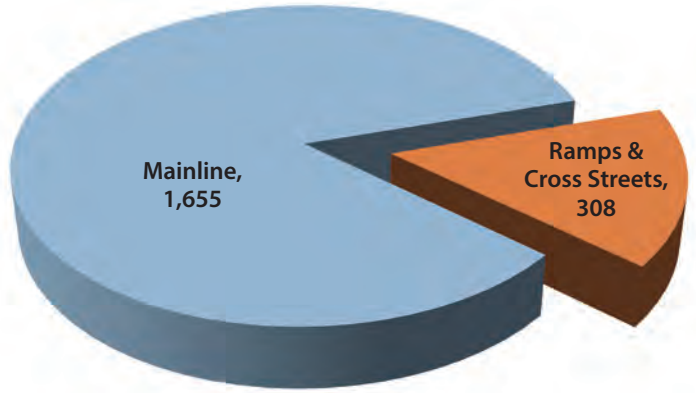


Table 4.3-5 *I-5 Collision Summary from Center Drive to Gravelly Lake Drive*

Severity of Collisions Mainline, Ramps and Cross Streets	2010 to 2014 Collisions	Average Annual Collisions	Collision Rate per 100 MVMT*
Fatal	3	0.6	0.17
Serious Injuries	19	3.8	1.06
Evident Injuries	105	21.0	5.83
Possible Injuries	430	86.0	24.16
Property Damage Only	1,401	280.2	77.83
All Crashes	1,963	392.6	109.04

**100 MVMT = 100 Million Vehicle Miles Traveled*

Figure 4.3-8 *Severity of I-5 Collisions, Center Drive to Gravelly Lake Drive – 2010 to 2014*

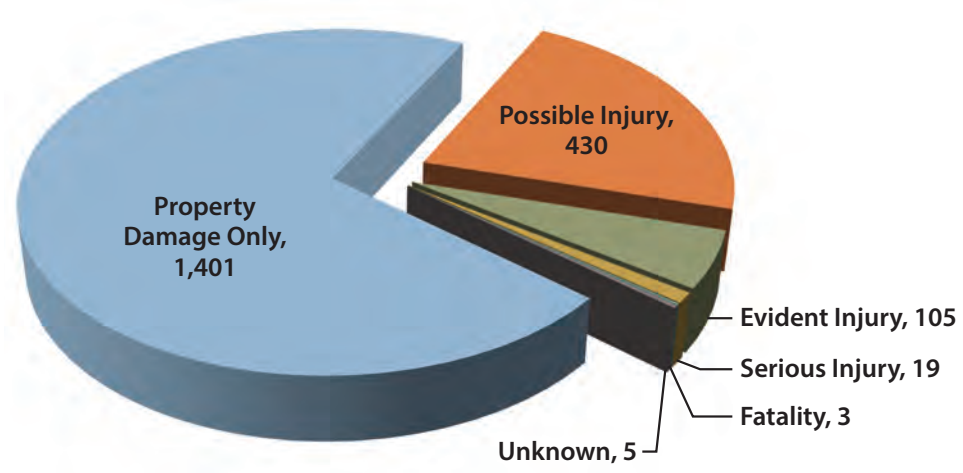
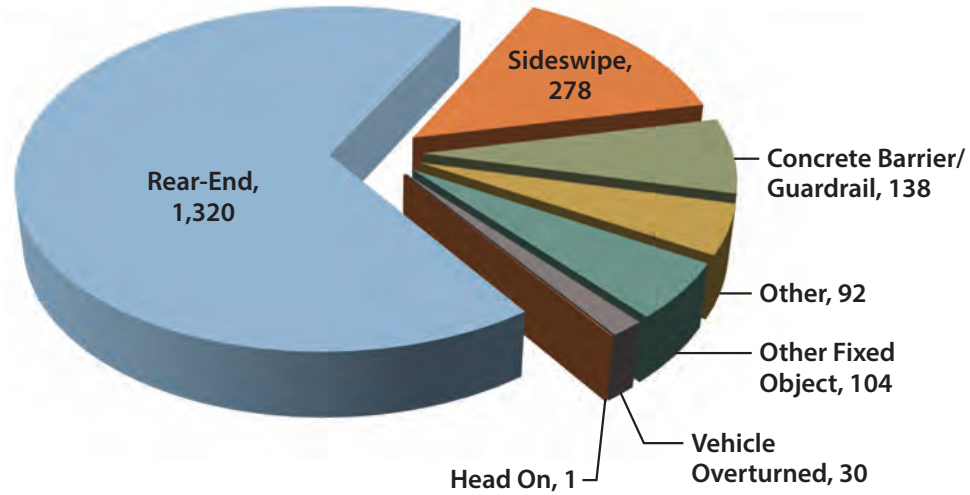


Figure 4.3-9 *I-5 Collisions by Type – Center Drive to Gravelly Lake Drive – 2010 to 2014*



Note: Under Section 409 of Title 23 of the United States Code, any collision data furnished is prohibited from use in any litigation against state, tribe or local government that involves the location(s) mentioned in the collision data.

4.3.3 What Would Be the Long-Term Impact of the Build Alternative in Comparison to the No Build Alternative?

The proposed Build Alternative, as previously described in Section 3.2, is designed to improve near-term (2020) traffic operations along the I-5 corridor in the vicinity of JBLM in comparison to the No Build Alternative. The effect of the proposed Build Alternative on the movement of people and goods is summarized in this subsection and compared to the No Build Alternative. An assessment of how the proposed Build Alternative would affect long-term (2040) traffic movements is also summarized.

The travel demand modeling area for this study extended from SR 510 in Lacey to SR 512 in Lakewood for mainline planning purposes. For the Build Alternative, project limits extend from the vicinity of Gravelly Lake Drive to the vicinity of Center Drive, while the South Study Area (see Chapter 5) extends south from the vicinity of Steilacoom-DuPont Road to Mounts Road. There is a short distance of overlap between the Build Alternative and the South Study Area.

*The proposed **Build Alternative** includes the following improvements:*

- *An added fourth lane from the Thorne Lane interchange to the Steilacoom-DuPont interchange.*
- *A new northbound auxiliary lane from Berkeley Street to Thorne Lane.*
- *New interchanges at Berkeley Street and Thorne Lane.*
- *A new southbound Gravelly-Thorne connector and a new northbound auxiliary lane between Thorne Lane and Gravelly Lake Drive.*
- *A new bicycle/pedestrian path from Steilacoom-DuPont Road to Berkeley Street and along the Gravelly-Thorne connector.*

HOW IS TRAFFIC IN THE I-5 JBLM STUDY AREA PREDICTED TO GROW BETWEEN 2013, 2020 AND 2040 WITH THE NO BUILD AND BUILD ALTERNATIVES?

Based on 2020 and 2040 land use assumptions, the travel demand/operational modeling tools were used to estimate Average Daily Traffic (ADT) and peak period volumes for 2020 and 2040 with the No Build and Build Alternatives. A summary of the estimated daily traffic growth on I-5 between the Center Drive interchange and the Gravelly Lake Drive interchange is shown in Table 4.3-6. Due to the congestion along I-5 and the reduced number of travel lanes south of Thorne Lane, the No Build Alternative attracts fewer vehicles to the corridor and results in lower growth than the Build Alternative that includes added highway capacity. Depending on location, existing traffic volumes are projected to increase by approximately 0.8 percent to 1.4 percent per year to the long-range planning horizon (2040).

Daily morning (AM) and evening (PM) peak hour traffic volume projections along I-5 in 2020 and 2040 are discussed in detail in the *I-5 JBLM Vicinity Congestion Relief Study, Transportation Operations and Safety Technical Memorandum* (July 2016). With the Build Alternative in 2020, the two-way traffic volume along I-5 between Center Drive and Gravelly Lake Drive are expected to range from approximately 8,900 to 11,250 vehicles in the AM peak hour (depending on location), and from 10,400 to 12,000 vehicles in the PM peak hour. In 2040, the two-way traffic volume along I-5 would range from approximately 9,000 to 12,100 vehicles in the AM peak hour, and from 8,500 to nearly 10,900 vehicles in the PM peak hour.

I-5 Corridor: *For analyses of the Build Alternative, the I-5 corridor in the vicinity of JBLM extends from the Gravelly Lake Drive interchange on the north to the vicinity of the Center Drive interchange on the south.*

Table 4.3-6 *ADT Traffic Growth Along I-5 in the JBLM Vicinity*

		2-Way Average Daily Traffic Volumes on I-5 in Vicinity of JBLM											
			Center Drive		Steilacoom-DuPont Road		41st Division Drive		Berkeley Street		Thorne Lane		Gravelly Lake Drive
Scenario													
2013	**Existing**	122,000		124,000		120,000		129,000		137,000		146,000		143,000
2020	No Build Alternative	135,900		132,600		130,000		138,000		149,700		159,100		154,900
2020	**Build** Alternative	135,700		137,300		141,800		154,400		168,900		167,300		158,800
2040	No Build Alternative	164,600		152,700		149,600		154,200		165,800		181,800		171,100
2040	**Build** Alternative	165,600		158,900		170,100		183,900		195,000		192,000		176,600

The lower number of PM peak hour vehicles on I-5 as compared to AM peak hour vehicles results from the lower travel speeds in the PM which reduces the number of vehicles than can actually use the I-5 corridor during this time period. The small projected growth in vehicles on I-5 between 2020 and 2040 in the AM peak hour, and the decrease in vehicles in the PM peak hour would also result from the reduction in average travel speeds caused by increased congestion. This would result in trips being diverted to other travel times.

ABILITY TO MEET TRAVEL DEMAND

The traffic volume forecasts discussed in the preceding paragraphs and highlighted in Table 4.3-6 represent expectations of the level of traffic that would use I-5 in the study area in 2020 and 2040, particularly during peak hours. This differs from the level of traffic that would ***like*** to use the corridor during these time periods. A key performance measure for understanding the impact of congestion on the I-5 corridor involves assessing the amount of travel demand that could be accommodated during the PM (highest) peak hour. This subsection discusses the ability of the No Build and Build Alternatives to meet demand for travel in the corridor in 2013, 2020 and 2040.

PM Peak Hour – As shown in Figure 4.3-10, the level of demand for travel on I-5 during the PM peak hour is substantively higher than what could actually be accommodated with either the No Build or Build Alternatives. As indicated by the data in this figure, the No Build Alternative would accommodate less travel demand on I-5 than the Build Alternative during the PM peak hour. In 2020, the Build Alternative would accommodate a slightly higher percentage of the demand than the 2013 existing system (89.2 percent vs. 88.1 percent), and almost 19 percent more (89.2 percent vs. 70.5 percent) than the 2020 No Build Alternative. By 2040, the Build Alternative would accommodate about 49 percent of the PM peak hour demand, while the No Build Alternative would accommodate about 30 percent of the demand. This finding is a useful indicator of the duration of congestion which would not only affect the PM peak hour, but would likely spread into the hours adjacent to the peak. The greater the percentage of travel demand that cannot be met in a single peak hour, the greater the total number of hours of peak period congestion that would be expected.

PM Peak Three Hours – While over 88 percent of existing demand during the single 2013 PM peak hour can be accommodated in the corridor, Figure 4.3-11 shows that nearly everyone who wanted to travel on I-5 in 2013 could make the journey at some point during the three hour PM peak period. Only one percent of all PM peak three hour demand could not be satisfied during this time period. Figure 4.3-11 also shows that as demand grows to 2020, over 90 percent of demand could be accommodated with the No Build Alternative, while nearly 98 percent could be accommodated by the Build Alternative. By 2040, less than 72 percent of demand could be accommodated by the No Build Alternative, while the Build Alternative is expected to accommodate 80 percent of demand during the three-hour PM peak period.

2020 Traffic Conditions

In analyzing the impact of the proposed Build Alternative, three factors were used to assess traffic operations on the I-5 corridor in the vicinity of JBLM. These factors are travel speed, hours of congestion, and travel time. Nearby intersection operations were analyzed using level of service (LOS) and delay.

2020 AVERAGE I-5 TRAVEL SPEEDS

During the AM peak hour in 2020, travel speeds would generally be above 42 mph for both the No Build and Build Alternatives. Exceptions would occur at the Project's northern and southern limits with the No Build Alternative. Southbound speeds are expected to

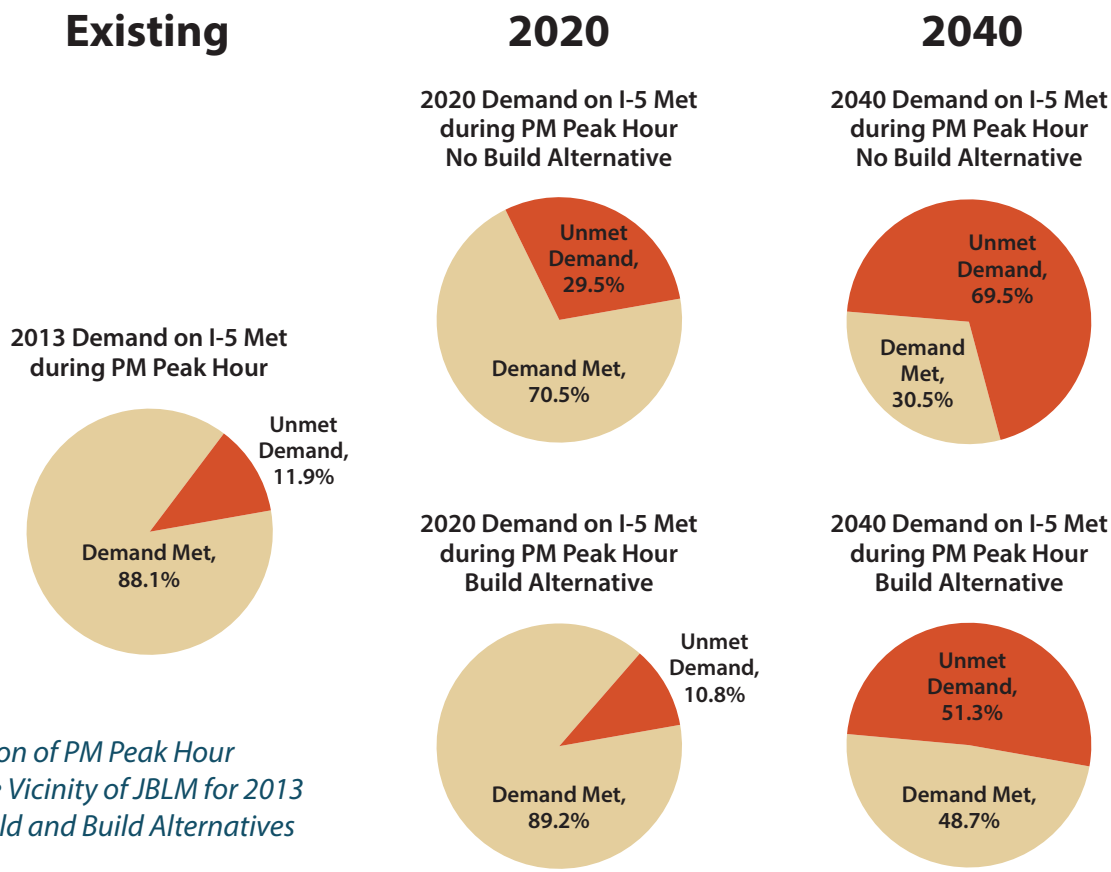


Figure 4.3-10 *Comparison of PM Peak Hour Demand Met on I-5 in the Vicinity of JBLM for 2013 Existing, and 2020 No Build and Build Alternatives*

be around 30 mph between Gravelly Lake Drive and Thorne Lane for the No Build condition, where the highway narrows from four lanes to three lanes. Northbound speeds would be above 42 mph for both alternatives between Center Drive and Gravelly Lake Drive.

As can be observed from Figure 4.3-12, 2020 No Build Alternative average northbound travel speeds along I-5 for all lanes in the PM peak hour are generally expected to be above 42 mph north of Thorne Lane, where the travel lanes increase from three lanes to four lanes. No Build Alternative southbound speeds would be above 42 mph between Steilacoom-DuPont Road and Center Drive.

With the Build Alternative, 2020 northbound average speeds for all modes would be above 42 mph from the Center Drive interchange to the Berkeley Street interchange. North of Berkeley Street, speeds would begin to fall below 42 mph, as more traffic is expected to enter I-5 from the Berkeley Street and Thorne Lane interchanges. This increased demand would begin to reach the practical capacity of the widened I-5.

In the southbound direction, 2020 Build Alternative speeds would be mostly above 42 mph from the Gravelly Lake Drive interchange to the Berkeley Street interchange. South of the Berkeley Street

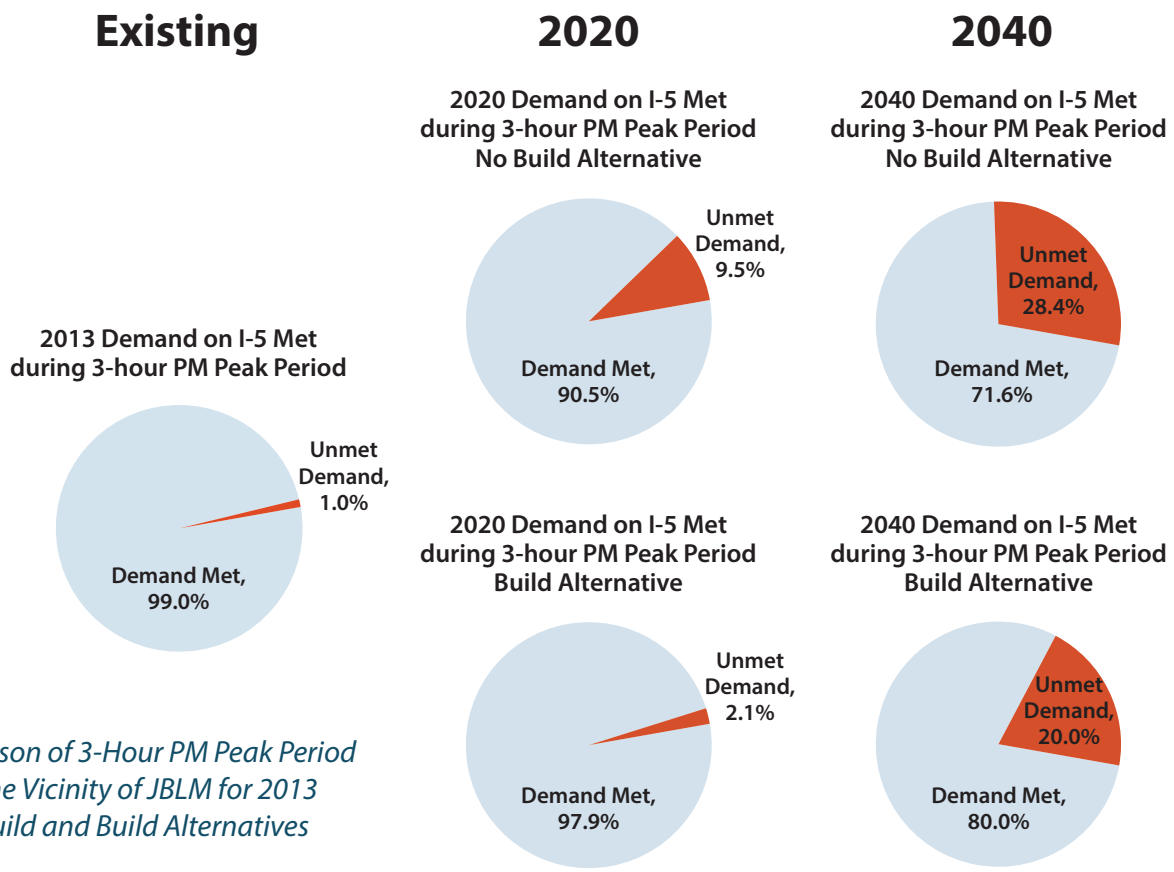


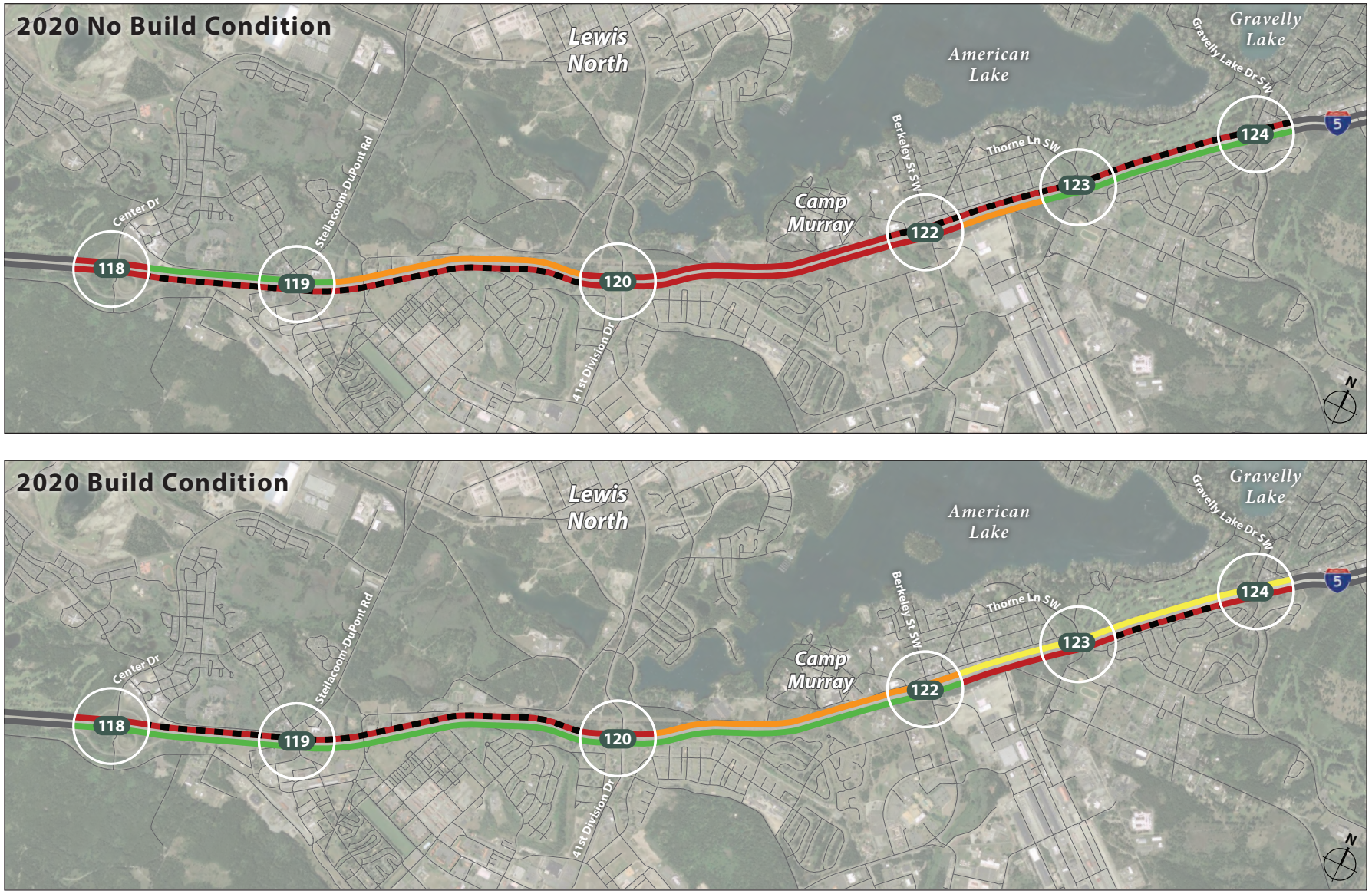
Figure 4.3-11 *Comparison of 3-Hour PM Peak Period Demand Met on I-5 in the Vicinity of JBLM for 2013 Existing, and 2020 No Build and Build Alternatives*

interchange, Build Alternative speeds would fall below 42 mph because of the reduction in travel lanes from four to three at the Center Drive interchange. This is the location where high on-ramp volumes from the Main Gate, Steilacoom-DuPont Road and Center Drive interchanges would merge onto I-5 with other traffic heading into Thurston County. This high level of vehicle merging activity is expected to cause traffic to slow in all lanes along I-5 and back traffic up to the Berkeley Street interchange.

Overall, northbound travel speeds with the Build Alternative would be higher than the No Build Alternative (42 mph vs 18 mph) and southbound Build Alternative speeds would be slightly better than the No Build Alternative (14 mph vs 12 mph).

2020 HOURS OF CONGESTION

Figure 4.3-13 depicts the expected Congestion Contour for 2020 with the No Build and Build Alternatives. This graphic shows how average traffic speeds in all lanes would change along the I-5 corridor during the six-hour PM peak analysis period. Outputs from the Meso Model were used to develop these diagrams. As can be observed, southbound speeds for the No Build Alternative would be below 40 mph north of 41st Division Drive. The greatest concentration of slow



MAINLINE I-5 SPEED

- > 51 mph
- 42 - 51 mph
- 36 - 41 mph
- 20 - 35 mph
- < 20 mph

INTERCHANGES

- 118 Center Drive interchange
- 119 Steilacoom-DuPont Road interchange
- 120 Main Gate interchange
- 122 Berkeley Street interchange
- 123 Thorne Lane interchange
- 124 Gravelly Lake Drive interchange

Figure 4.3-12
Comparison of 2020 PM Peak Hour Travel Speeds Along I-5 Between Center Drive and Gravelly Lake Drive – No Build Alternative and Build Alternative

speeds is expected to occur between 3:30 PM and 7:30 PM from the Main Gate interchange through the Gravelly Lake Drive interchange. Some additional slow travel speeds are also expected between Mounts Road and Center Drive, which would be caused by merging traffic from Center Drive and Steilacoom-DuPont Road. For the Build Alternative, low speeds would occur north of Mounts Road for about three hours because of the lane reduction at Center Drive, but the lower speeds would extend only to the Berkeley Street interchange.

In the northbound direction, with the No Build Alternative, slowing traffic would begin just north of Nisqually and extend to the Thorne Lane interchange between 3 PM and 7:30 PM. With the Build Alternative, the slower speeds are expected to occur further north on the highway segment between the vicinity of Thorne Lane and Bridgeport Way between 4 PM and 6 PM.

As can be observed from Figure 4.3-13, the overall extent of congestion along I-5 through the JBLM area is anticipated to be less for the Build Alternative with the added travel lanes than for the No Build Alternative.

2020 ESTIMATED PEAK HOUR TRAVEL TIMES

Comparisons of No Build Alternative and Build Alternative 2020 travel times along I-5 between Gravelly Lake Drive and Center Drive provide the most telling story of the improved performance and effects of the Build Alternative. Traveling on I-5 between Gravelly Lake Drive and Center Drive at the posted speed limit would normally take about 7.2 minutes to cover the 7.2 miles between the two interchanges. During the 2020 AM peak hour, traffic during this time would generally operate near the posted speed limit. Drivers traveling southbound or northbound on I-5 between these interchanges for the No Build and Build Alternatives would experience about the same travel times (about 6.8 and 8.1 minutes for the No Build Alternative, and about 6.7 and 7.3 minutes for the Build Alternative). Traffic during this time would generally operate near the posted speed limit.

As shown in Figure 4.3-14, during the 2020 PM peak hour, overall northbound travel times along I-5 from Center Drive to Gravelly Lake Drive for the Build Alternative would be about 13 minutes faster than the 2020 No Build Alternative (10.1 minutes vs. 23.5 minutes). At an interim point like the Berkeley Street interchange, northbound travel time savings would be approximately 16 minutes faster with the Build Alternative.

During the 2020 PM peak period, southbound travel along I-5 between Gravelly Lake Drive and Center Drive with the Build Alternative would be about four minutes faster than the No Build Alternative (31.5 minutes vs. 35.7 minutes). The most notable improvement would be near the Main Gate interchange. The Build Alternative is expected to show travel times which would be up to 24 minutes shorter than the No Build Alternative from the southbound off-ramp at Gravelly Lake Drive to the Main Gate interchange. South of the Main Gate interchange, where the Build Alternative speeds would be reduced because of the reduction in travel lanes at Center Drive and heavy merging traffic, average travel times are expected to increase.

2020 INTERSECTION ANALYSES AT THE KEY INTERCHANGES

Comparisons of 2013 along with 2020 traffic operations during the AM and PM peak hours at the Berkeley Street, Thorne Lane and Gravelly Lake Drive interchanges for the No Build and Build Alternatives are shown in Table 4.3-7. This information is also illustrated graphically in Figure 4.3-15.

The intersection analyses for the Berkeley Street, Thorne Lane and Gravelly Lake Drive intersections used Synchro software for signalized and non-signalized intersections and Sidra software for roundabouts.

Figure 4.3-13 *2020 PM Peak Period Congestion for the No Build and Build Alternatives*

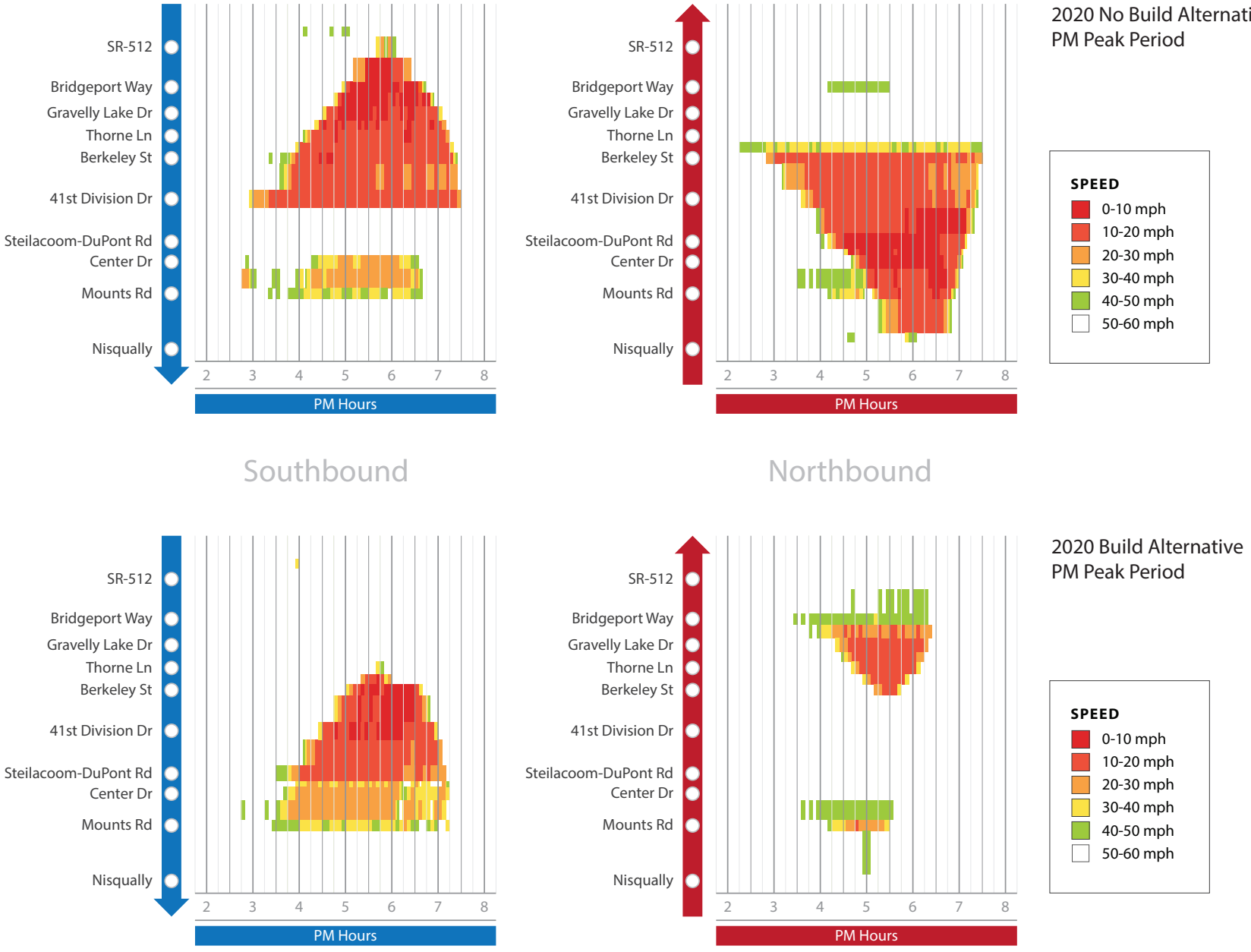
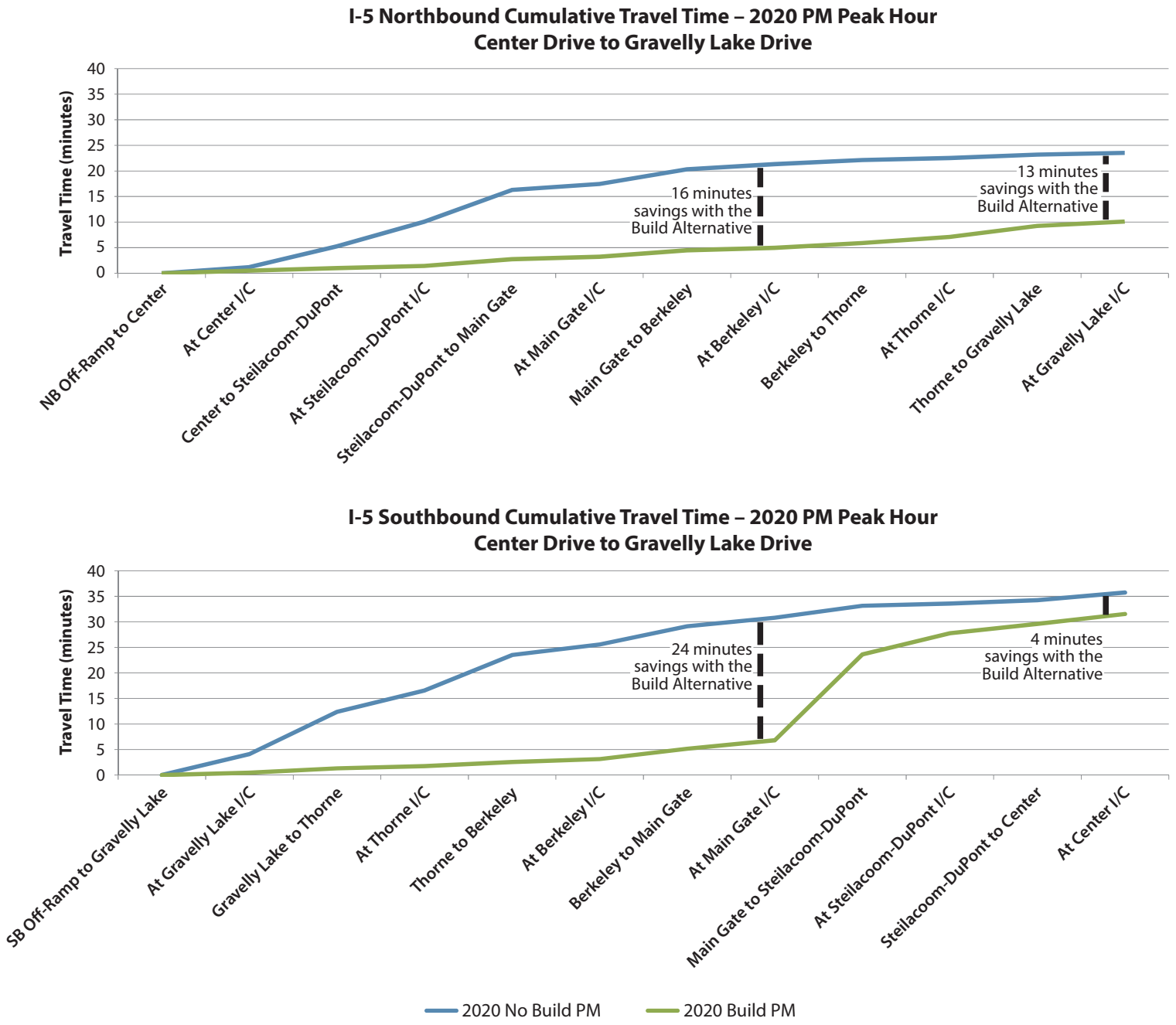


Figure 4.3-14 *2020 Cumulative PM Peak Hour Travel Times Along I-5 Between Center Drive and Gravelly Lake Drive – No Build and Build Alternatives*



Turning movement volumes at each intersection were developed through the use of the Meso Model.

Berkeley Street Interchange

In addition to providing grade-separation over the adjacent rail line, the proposed Build Alternative reconfiguration for the Berkeley Street interchange with teardrop roundabouts would improve traffic operations at this interchange. Overall, the levels of service at the Berkeley Street intersections are expected to be LOS B or better for the Build Alternative. For the No Build Alternative, the levels of service at the Berkeley Street intersections with the I-5 southbound ramp would be LOS D or better with the interim Madigan Access improvements.

Thorne Lane Interchange

At the Thorne Lane intersections with the I-5 ramps, the levels of service for the No Build Alternative would generally be at LOS D or better. The reconfigured Build Alternative interchange with teardrop roundabouts is expected to operate at LOS B or better.

Gravelly Lake Drive

During the 2020 AM and PM peak hours, the I-5 ramp intersections at Gravelly Lake Drive are expected to operate at LOS D or better for both the No Build and Build Alternatives. At the intersection of Gravelly Lake Drive and Pacific Highway, the PM peak hour LOS would be D for the No Build Alternative, but is expected to improve to LOS B with the Build Alternative.

2020 INTERSECTION ANALYSIS AT OTHER PROJECT AREA INTERCHANGES

The study also looked at other nearby interchanges that are influenced by the Build Alternative, including I-5 at the Center Drive, Steilacoom-DuPont Road and Main Gate interchanges, and selected adjacent intersections. Analysis was based on direct Meso Model output, which incorporates the potential effects of freeway congestion and on-ramp traffic back-ups onto city streets. Results are illustrated in Figure 4.3-16 and described in the paragraphs below. This information is also shown in Table 4.3-8 for the AM and PM peak hours. In general, the traffic operations at the adjacent intersections of the key interchanges would improve with the Build Alternative.

Intersection Level of Service (LOS) Criteria

LOS	Signalized Intersection Delay (sec)	Unsignalized Intersection Delay (sec)
A	≤10 sec	≤10 sec
B	10–20 sec	10–15 sec
C	20-35 sec	15-25 sec
D	35-55 sec	25-35 sec
E	55-80 sec	35-50 sec
F	≥80 sec	≥50 sec

Source: 2010 Highway Capacity Manual

Center Drive

Traffic operations analysis indicated that the AM and PM peak hour for the northbound I-5 ramp intersection at Center Drive is expected to perform at LOS A in 2020 with both the No Build and Build Alternatives. At the southbound I-5 ramp intersection with Center Drive, AM peak hour traffic is expected to operate at LOS B for the No Build Alternative, and at LOS A with the Build Alternative. However, during the PM peak hour, the southbound ramp intersection is expected to operate at LOS F with the No Build Alternative, and slightly improve to LOS E with the Build Alternative. This poor performance would be caused by heavy southbound traffic congestion on both I-5 and the southbound Center Drive on-ramp. Backups from the southbound ramp meter are expected to extend

Table 4.3-7 *2020 AM and PM Peak Hour Intersection Level of Service at Key Interchanges – No Build and Build Alternatives****

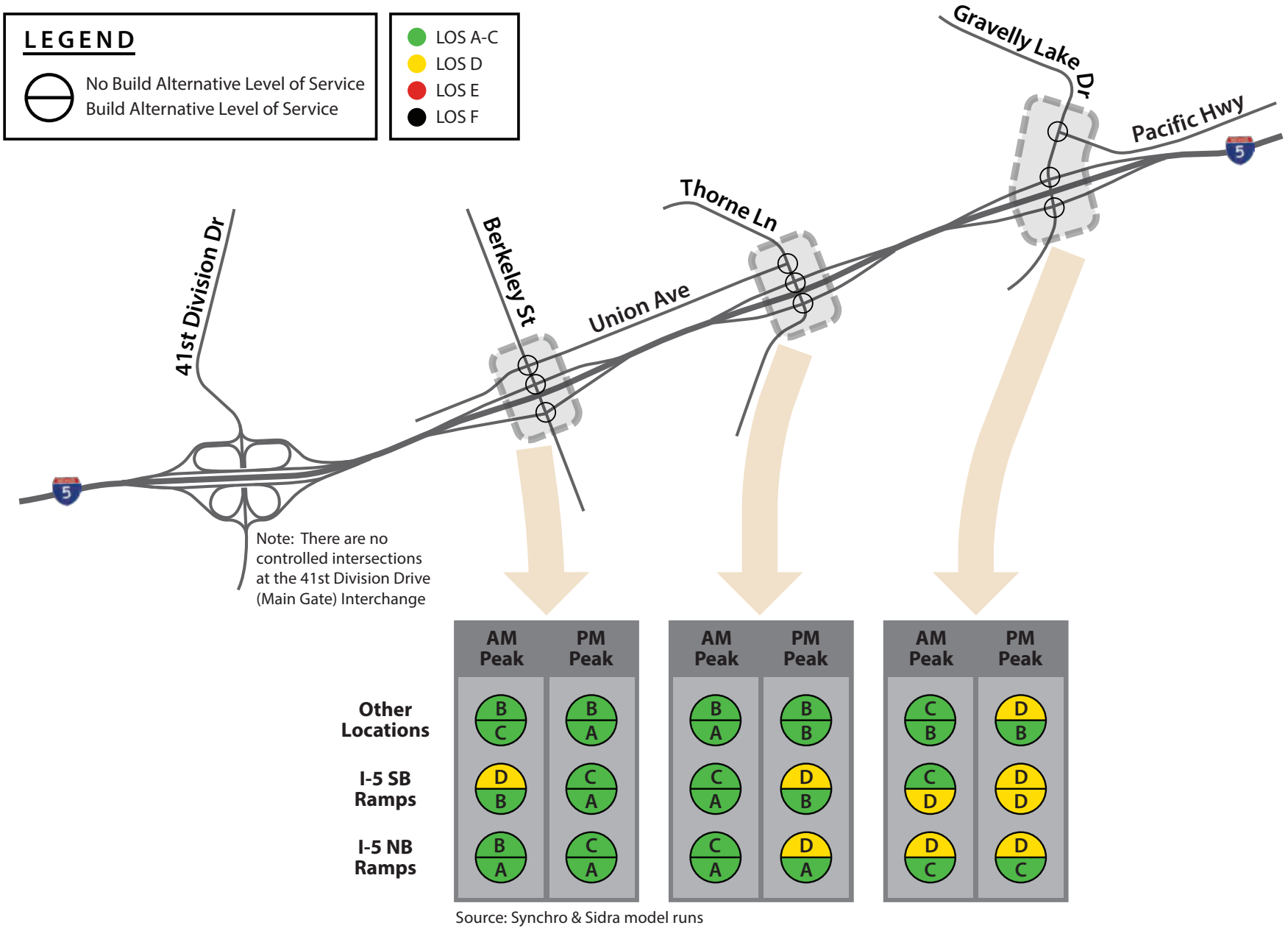
	Baseline 2013		2020 No Build		2020 Build	
Intersection*	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**
I-5 NB Ramps / Berkeley Street**						
Control Type	Signal		Signal**		Roundabout	
Average Delay (sec) / LOS	25.7/C	29.7/C	16.3/B	20.8/C	4.4/A	5.2/A
I-5 SB Ramps / Berkeley Street**						
Control Type	Signal		Signal**		Roundabout	
Average Delay (sec) / LOS	**69.2/E**	54.0/D	36.0/D	26.0/C	13.2/B	9.1/A
Berkeley Street / Union Avenue						
Control Type	All-way Stop		Signal		2-way Stop	
Average Delay (sec) / LOS	10.6/B	12.1/B	11.0/B	12.0/B	15.2/C	9.0/A
Berkeley Street / Washington Avenue						
Control Type	2-way Stop		2-way Stop		2-way Stop	
Average Delay (sec) / LOS	NA	NA	12.6/B	14.3/B	9.3/A	9.2/A
Berkeley Street / Jackson Avenue Extension						
Control Type	NA		NA		All-way Stop	
Average Delay (sec) / LOS	NA	NA	NA	NA	13.9/B	23.8/C
I-5 NB Ramps / Thorne Lane						
Control Type	Signal		Signal		Roundabout	
Average Delay (sec) / LOS	**56.9/E**	**71.2/E**	34.2/C	37.9/D	5.5/A	7.1/A
I-5 SB Ramps / Thorne Lane						
Control Type	Signal		Signal		Roundabout	
Average Delay (sec) / LOS	**58.7/E**	49.1/D	33.9/C	47.5/D	8.8/A	14.6/B
Thorne Lane/Union Avenue Loop (New Intersection)						
Control Type	NA		NA		Roundabout	
Average Delay (sec) / LOS	NA	NA	NA	NA	6.5/A	21.1/C
Thorne Lane / Union Avenue (with southbound Gravelly-Thorne connector for the Build Alternative)						
Control Type	2-way Stop		2-way Stop		2-way Stop	
Average Delay (sec) / LOS	9.6/A	11.1/B	10.4/B	11.6/B	9.6/A	11.2/B
I-5 NB Ramps/Gravelly Lake Drive (Signal)						
Average Delay (sec) / LOS	39.8/D	**70.3/E**	46.5/D	46.1/D	24.0/C	35.0/C
I-5 SB Ramps/Gravelly Lake Drive (Signal)						
Average Delay (sec) / LOS	41.9/D	47.3/D	31.3/C	37.2/D	38.4/D	37.9/D
Gravelly Lake Drive/Pacific Highway (Signal)						
Average Delay (sec) / LOS	25.5/C	29.0/C	32.0/C	37.1/D	12.6/B	17.9/B

*Notes * Signalized & non-signalized intersections analyzed using Synchro software and the Highway Capacity Manual. Please note that the Synchro analysis does not account for back-ups on on-ramp from the ramp meter or freeway.*

*** Assumes Madigan Access improvements at the Berkeley Street interchange are implemented by 2020 as part of No Build Alternative*

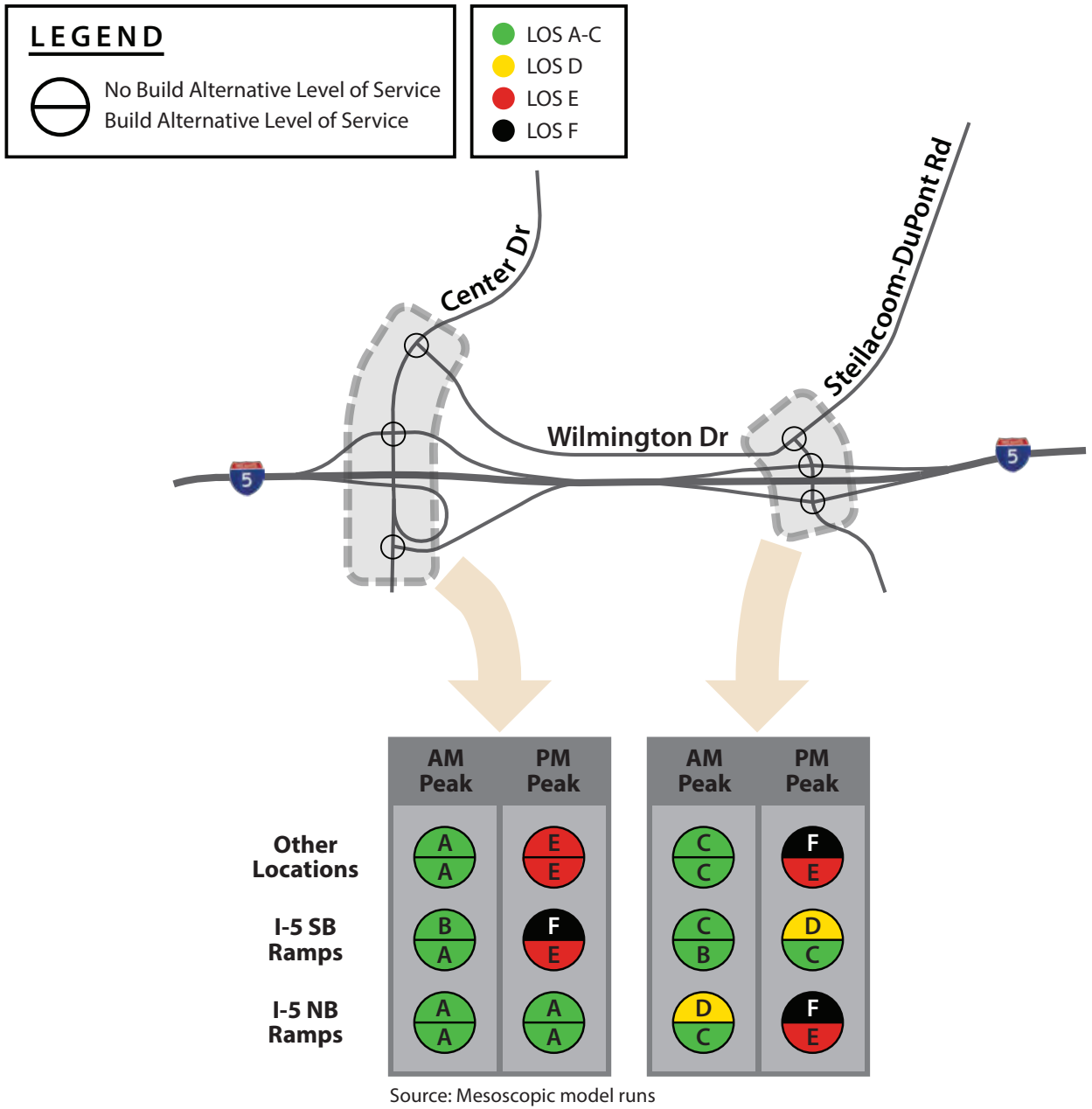
**** LOS E and LOS F values shown in bold.*

Figure 4.3-15 *2020 AM and PM Peak Hour Levels of Service for No Build and Build Alternatives*



Source: Synchro & Sidra model runs

Figure 4.3-16 *2020 AM and PM Peak Hour Levels of Service for No Build and Build Alternatives at Center Drive and Steilacoom-DuPont Road*



Source: Mesoscopic model runs

Table 4.3-8 *2020 AM and PM Peak Hour Intersection Level of Service at Other Area Interchanges – No Build and Build Alternative*

	2020 No Build		2020 Build	
Intersection*	**AM**	**PM**	**AM**	**PM**
I-5 NB Ramps/Center Drive** (2-way Stop) Average Delay (sec) / LOS	8/A	4/A	2/A	5/A
I-5 SB Ramps/Center Drive (2-way Stop) Average Delay (sec) / LOS	10/B	**66/F**	2/A	**61/E**
Center Drive/Wilmington Drive (Signal) Average Delay (sec) / LOS	9/A	**59/E**	9/A	**75/E**
I-5 NB Ramps/Steilacoom-DuPont Road (Signal) Average Delay (sec) / LOS	55/D	**113/F**	29/C	**66/E**
I-5 SB Ramps/Steilacoom-DuPont Road (Signal) Average Delay (sec) / LOS	29/C	40/D	13/B	21/C
Steilacoom-DuPont Road/Barksdale Avenue/ Wilmington Drive (Signal) Average Delay (sec) / LOS	21/C	**135/F**	21/C	**66/E**

*Notes: * Intersection operations analysis is based on direct output from the Meso Model which reflects impacts of traffic queuing through adjacent intersection.*
*** The I-5 NB Ramps / Center Drive intersection was redesigned in 2015. This new design is reflected in the 2020 and 2040 analysis.*
**** LOS E and LOS F values shown in bold.*

through the intersection with Center Drive, and then westerly along Center Drive and through the signalized intersections at Wilmington Drive and McNeil Street.

Figure 4.3-17 shows the expected 2020 PM peak hour traffic queues along Center Drive from the I-5 southbound ramp intersection with Center Drive and along Wilmington Drive west of Center Drive. With the Build Alternative, queues along Center Drive would increase by about 1,050 feet, and along Wilmington Drive by about 325 feet. The increases in traffic queues along Center Drive and Wilmington Drive with the Build Alternative would be partially due to traffic re-routing in the area caused by mainline congestion north of Center Drive, and the reduction of I-5 travel lanes at Center Drive from four lanes to three lanes.

Steilacoom-DuPont Road

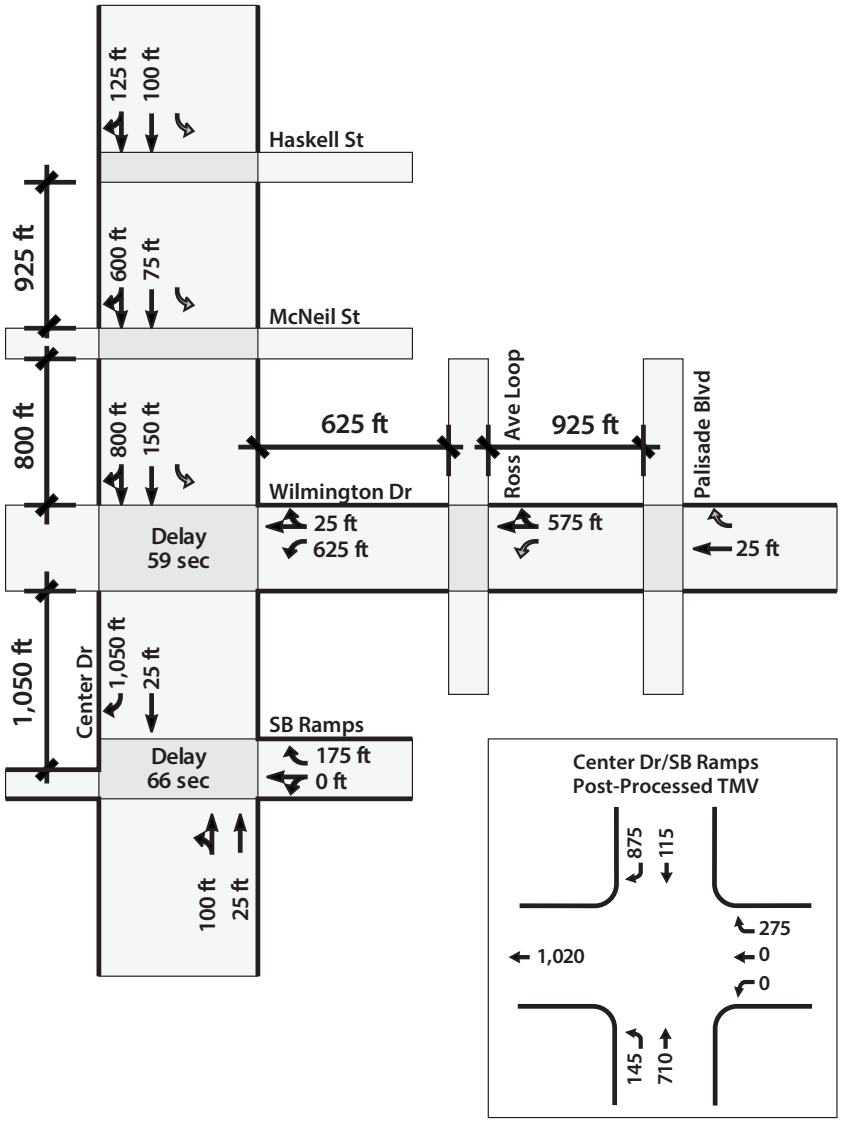
For the No Build Alternative, the level of service at the northbound Steilacoom-DuPont Road intersection with the I-5 ramps is expected to be LOS D during the AM peak hour, but dropping to LOS F during the PM peak hour. LOS C is expected at the southbound ramp intersection during the AM peak hour, dropping to LOS D during the PM peak hour. For the Steilacoom-DuPont Road intersection with Barksdale Avenue and Wilmington Drive, the level of service is

Figure 4.3-17 *Comparison of No Build and Build Alternatives 2020 PM Peak Hour 95 Percent Traffic Queues Along Center Drive and Wilmington Drive in DuPont*

2020 No Build

Extended 2,450 feet to the North along Center Drive from I-5 SB Ramps

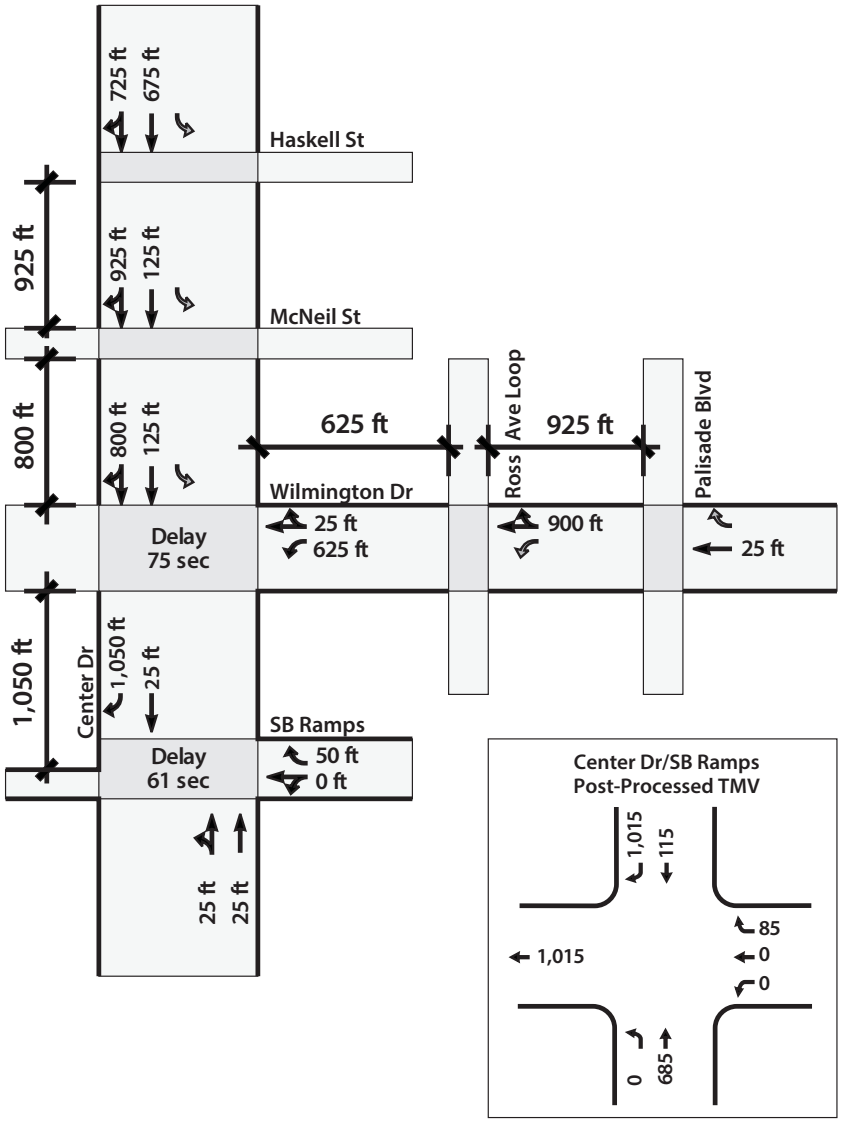
Extended 1,200 feet to the East along Wilmington Drive from Center Drive



2020 Build

Extended 3,500 feet to the North along Center Drive from I-5 SB Ramps

Extended 1,525 feet to the East along Wilmington Drive from Center Drive



expected to be LOS C during the AM peak hour, dropping to LOS F during the PM peak hour.

With the Build Alternative, the northbound ramp intersection is expected to operate at LOS C during the AM peak hour and LOS E during the PM peak hour. Operations would improve to LOS C or better at the southbound ramp intersection during both the AM and PM peak hours. At Barksdale Avenue and Wilmington Drive, the AM peak hour is expected to operate at LOS C, dropping to LOS E during the PM peak hour.

Main Gate/41st Division Drive Interchange

As the I-5 / Main Gate interchange ramp terminals have no signalized or stop-controlled intersections, a separate analysis was conducted for the cloverleaf design at this interchange, focusing on the ramp connections to 41st Division Drive. Analysis was conducted using output from the Meso Model, as shown in Table 4.3-9. The analysis shows that the northbound approach along 41st Division Drive would have long delays (nearly five minutes) at the northbound ramp connections for the No Build Alternative in the PM peak hour, while there would be minimal delay on the other approaches. At the southbound ramp connections, delays in the PM peak hour would be less than 30 seconds on all approaches.

Table 4.3-9 *2020 Delay Summary at Main Gate Interchange – No Build vs. Build Alternative*

	2020 No Build		2020 Build	
Approach	**Volume AM/PM**	**Delay (seconds per vehicle) AM/PM**	**Volume AM/PM**	**Delay (seconds per vehicle) AM/PM**
NB I-5 Ramp / 41st Division Drive				
NB on 41st Division Drive	710/1,835	4.7/294	735/1,395	4.0/36.4
SB on 41st Division Drive	1,220/1,075	0.3/1.6	1,220/995	0.4/13.8
EB on I-5 NB Off-ramp	305/50	0.0/0.0	300/80	0.0/0.0
WB on I-5 NB Loop Off-ramp	75/25	0.0/0.0	65/40	0.0/0.0
SB I-5 Ramp / 41st Division Drive				
NB on 41st Division Drive	525/1,425	0.3/0.9	530/915	0.4/24.6
SB on 41st Division Drive	1,015/1,435	2.5/28.2	1,060/990	2.1/3.2
EB on I-5 NB Loop Off-ramp	390/50	0.8/0.7	345/125	0.7/0.3
WB on I-5 NB Off-ramp	120/50	0.5/0.0	135/165	0.5/9.9

For the Build Alternative, traffic operations are expected to improve, with delays of less than 37 seconds in the PM peak hour for all approaches at the northbound ramp connections to 41st Division Drive. The southbound ramp connections would have slightly lower delays of approximately 25 seconds or less for all approaches along 41st Division Drive. Overall, the Main Gate interchange is expected to perform better and to experience lower average delays with the Build Alternative than with the No Build Alternative.

2040 Traffic Operations

The proposed Build Alternative was designed to address traffic issues in the near-term (five to 10 years) along I-5 through the JBLM area. The analysis presented in this subsection is focused on determining how the proposed Build Alternative would operate in the long-term (ten to twenty years). The analysis broadly concludes that northbound operations would be improved with the Build Alternative, while southbound operations would further deteriorate, largely resulting from the merging of heavy traffic volumes at several key locations. The Build Alternative would result in a lane reduction (from four lanes to three lanes) at Center Drive, requiring freeway traffic to merge. Also, heavy traffic from the Center Drive and Steilacoom-DuPont Road interchanges is expected to merge onto I-5 in the vicinity of the lane reduction.

A summary of 2040 mainline traffic operations, evaluated by comparing travel speed, hours of congestion, and travel time, as well as level of service and delay for area intersections for both the No Build and Build Alternatives, is presented below.

2040 Average I-5 Travel Speeds

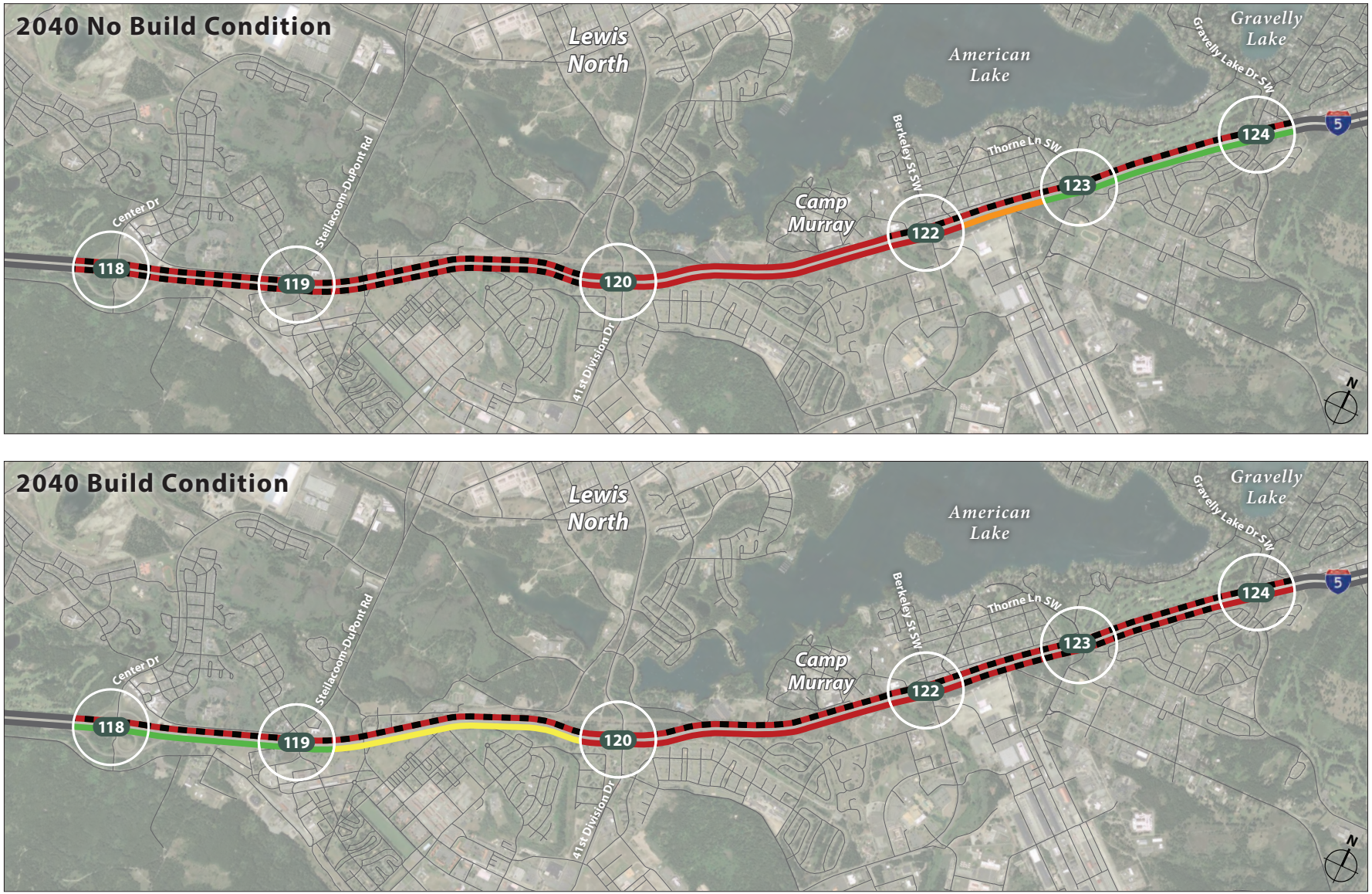
During the 2040 AM peak hour, travel speeds would generally be above 42 mph for both the No Build and Build Alternatives, except at north end of the study area. Along the segment of I-5 between Gravelly Lake Drive and Thorne Lane, southbound speeds with the No Build Alternative are expected to be around 10 to 20 mph, as I-5 narrows from four lanes to three lanes in this segment. Overall, AM peak hour average speeds through the project area for the No Build Alternative would be about 40 mph southbound and 62 mph for all northbound lanes, as compared to 57 mph southbound and 62 mph for all northbound for all lanes with the Build Alternative.

As can be observed from Figure 4.3-18, average travel speeds along I-5 in the 2040 PM peak hour would generally be below 42 mph in both directions for the No Build Alternative, except that northbound speeds north of Thorne Lane would be above 42 mph where the number of travel lanes increases from three to four. Speeds would be less than 20 mph south of the Main Gate interchange for the No Build Alternative. Overall, with the No Build Alternative, southbound speed would average about 9 mph and northbound speeds would average about 15 mph.

With the Build Alternative, 2040 northbound speeds are anticipated to be above 42 mph from the Center Drive interchange to the Main Gate interchange, and then fall below 42 mph as more traffic merges onto I-5 from area interchanges. Southbound traffic would operate at less than 20 mph through most of the corridor. Overall, average northbound PM peak hour speeds for all lanes would be about 26 mph and southbound speeds would be about 7 mph. The slow average southbound speeds with the Build Alternative would result from the metering effect of narrowing the roadway from four lanes to three at Center Drive combined with heavy merging traffic.

2040 INTERSECTION ANALYSIS AT THE KEY INTERCHANGES

To see how the Build Alternative would operate in 2040 at and in the vicinity of the Berkeley Street, Thorne Lane and Gravelly Lake



MAINLINE I-5 SPEED

- > 51 mph
- 42 - 51 mph
- 36 - 41 mph
- 20 - 35 mph
- < 20 mph

INTERCHANGES

- 118 Center Drive interchange
- 119 Steilacoom-DuPont Road interchange
- 120 Main Gate interchange
- 122 Berkeley Street interchange
- 123 Thorne Lane interchange
- 124 Gravelly Lake Drive interchange

Figure 4.3-18 *Comparison of 2040 PM Peak Hour Travel Speeds Along I-5 Between Center Drive and Gravelly Lake Drive – No Build Alternative and Build Alternative*

Drive interchanges, a comparison of traffic operations for the 2020 and 2040 AM and PM peak hours was conducted. The results of this comparison are summarized in Table 4.3-10, and graphically illustrated in Figure 4.3-19 for the AM and PM peak hours.

At these interchanges, the Build Alternative would provide grade separations over the adjacent rail line to eliminate delays caused by the added Amtrak passenger rail service that is scheduled to begin in 2017. The proposed interchange improvements are also designed to enhance 2040 intersection operations, as the new freeway interchange ramp termini would be built as roundabouts. Traffic at these roundabout intersections is expected to operate at LOS B or better in both 2020 and 2040. Overall, the levels of service at the affected intersections are expected to be LOS D or better in 2040 for the Build Alternative.

2040 INTERSECTION ANALYSIS AT OTHER PROJECT AREA INTERCHANGES

Traffic performance at the adjacent interchanges of Center Drive, Steilacoom-DuPont Road, and Main Gate is expected to decline and operate poorly by 2040. Projects identified in the future (in the South Study Area) may improve traffic operations at several locations, and will be further evaluated when detailed studies are completed to determine an action strategy for the south end of the corridor.

What Are the Expected Future Safety Issues in the I-5 JBLM Study Area?

A future year collision analysis was conducted using the Enhanced Interchange Safety Analysis Tool (ISATe) developed for the National Cooperative Highway Research Program. This model estimates future year collisions based on projected traffic volumes and the geometric design of the proposed interstate and interchanges for the No Build and Build Alternatives. For the No Build Alternative, with future year traffic demand and increased congestion without any major capacity improvements, the number of collisions along I-5 is expected to increase between 2013 and 2020 and beyond to 2040. For the Build Alternative with improved interchanges and added capacity, collisions along I-5 and at the interchanges in 2020 and 2040 are expected to be higher than with the No Build Alternative because of higher expected traffic levels along the I-5 corridor, as shown in Table 4.3-11. However, the overall collision rate per million vehicles is slightly lower for the Build Alternative than for the No Build Alternative.

How Would the Build Alternative Affect Connections with Local Roads and Intersections?

The redesign and relocation of the interchanges at Thorne Lane and Berkeley Street would affect local travel patterns and change how drivers access I-5 from the local street system. Traffic on local roads would also be affected by the amount of congestion on I-5. As congestion increases on I-5, either northbound or southbound, more traffic is expected to shift to local roads. In addition, some drivers may use alternate interchanges to reach their final destination, depending on the level of congestion on I-5. Traffic changes caused by the reconfiguration of the Thorne Lane and Berkeley Street interchanges, the addition of I-5 travel and auxiliary lanes, and the Gravelly-Thorne connector are discussed below.

THORNE LANE

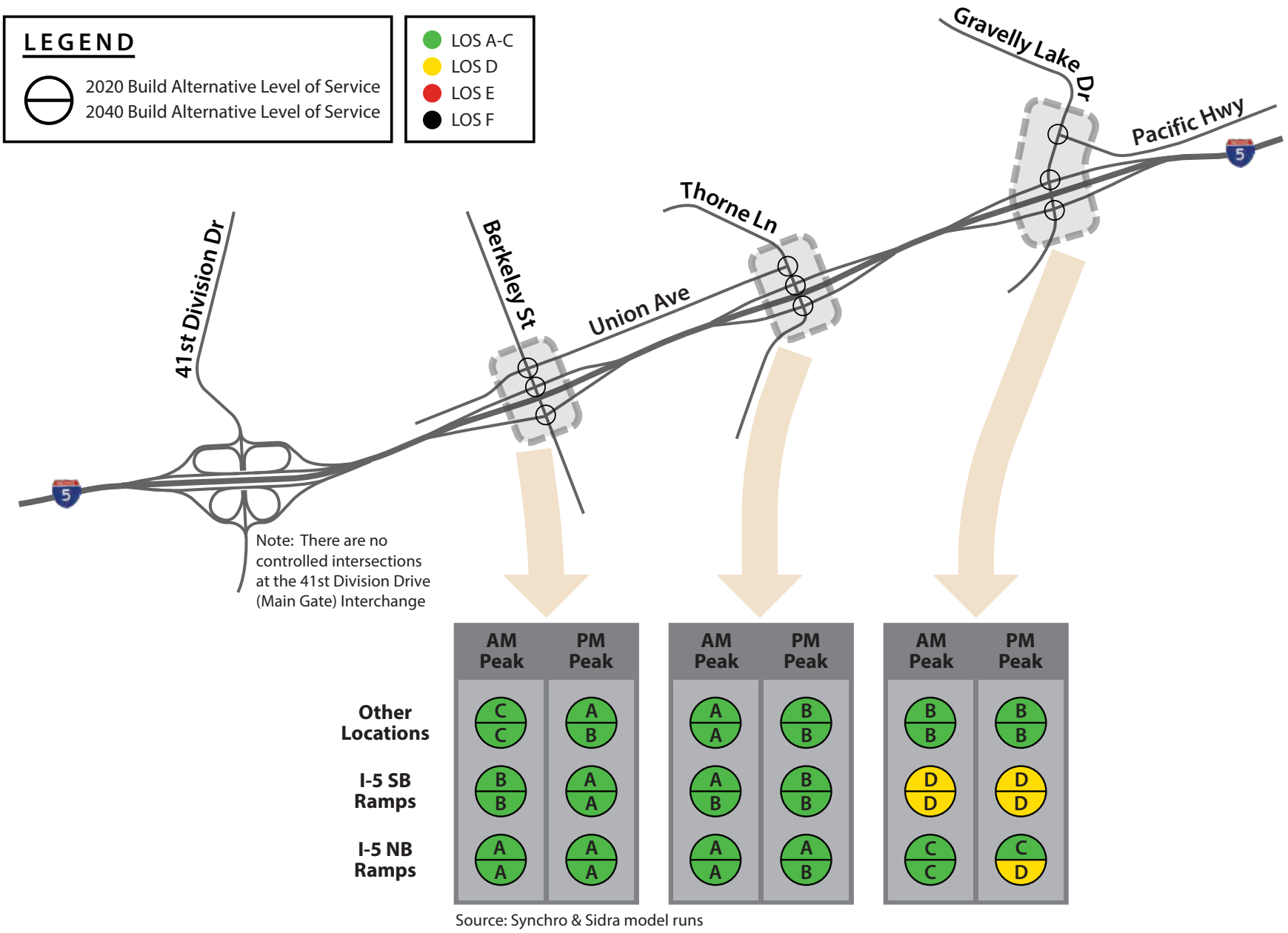
At Thorne Lane, the existing bridge over I-5 is proposed to be removed and replaced with a new bridge about 350 feet to the south that would grade-separate Thorne Lane over I-5, the adjacent rail line and Union Avenue, as previously shown in Figure 3.4-3. The new bridge would change part of the Thorne Lane and Murray Road alignment to connect to the existing street system. In addition, a new loop connector road would be added to tie Union Avenue to Thorne Lane. The proposed southbound Gravelly-Thorne connector

Table 4.3-10 *Comparison of 2020 and 2040 AM and PM Peak Hour Intersection Level of Service at the Key Interchanges with Build Alternative*

	2020 Build		2040 Build	
Intersection*	**AM**	**PM**	**AM**	**PM**
I-5 NB Ramps / Berkeley Street				
Control Type	Roundabout		Roundabout	
Average Delay (sec) / LOS	4.4/A	5.2/A	4.5/A	4.6/A
I-5 SB Ramps / Berkeley Street				
Control Type	Roundabout		Roundabout	
Average Delay (sec) / LOS	13.2/B	9.1/A	16.7/B	8.7/A
Berkeley Street / Union Avenue				
Control Type	2-way Stop		2-way Stop	
Average Delay (sec) / LOS	15.2/C	9.0/A	15.5/C	13.2/B
Berkeley Street / Washington Avenue				
Control Type	2-way Stop		2-way Stop	
Average Delay (sec) / LOS	9.3/A	9.2/A	9.6/A	9.2/A
Berkeley Street / Jackson Avenue Extension				
Control Type	All-way Stop		All-way Stop	
Average Delay (sec) / LOS	13.9/B	23.8/C	12.3/B	10.9/B
I-5 NB Ramps / Thorne Lane				
Control Type	Roundabout		Roundabout	
Average Delay (sec) / LOS	5.5/A	7.1/A	7.0/A	11.9/B
I-5 SB Ramps / Thorne Lane				
Control Type	Roundabout		Roundabout	
Average Delay (sec) / LOS	8.8/A	14.6/B	12.6/B	17.7/B
Thorne Lane/Union Avenue Loop (New Intersection)				
Control Type	Roundabout		Roundabout	
Average Delay (sec) / LOS	6.5/A	21.1/C	6.9/A	9.1/A
Thorne Lane / Union Avenue (with Gravelly-Thorne connector for the Build Alternative)				
Control Type	2-way Stop		2-way Stop	
Average Delay (sec) / LOS	9.6/A	11.2/B	9.6/A	12.0/B
I-5 NB Ramps/Gravelly Lake Drive (Signal)				
Average Delay (sec) / LOS	24.0/C	35.0/C	26.1/C	51.6/D
I-5 SB Ramps/Gravelly Lake Drive (Signal)				
Average Delay (sec) / LOS	38.4/D	37.9/D	47.0/D	40.2/D
Gravelly Lake Drive/Pacific Highway (Signal)				
Average Delay (sec) / LOS	12.6/B	17.9/B	15.8/B	12.3/B

Notes ** Signalized & non-signalized intersections analyzed using Synchro software and the Highway Capacity Manual. Please note that the Synchro analysis does not account for back-ups on on-ramp from the ramp meter or freeway.*

Figure 4.3-19 *Comparison of 2020 and 2040 AM and PM Peak Hour Levels of Service for the Build Alternative*



Source: Synchro & Sidra model runs

Table 4.3-11 *Comparison of 2020 and 2040 Predicted Collisions Along I-5 Between Center Drive and Gravelly Lake Drive Interchanges*

	Mainline		Ramps		Ramp Intersections			
Alternative	Collisions	Collisions Per MVM	Collisions	Collisions Per MVM	Collisions	Collisions Per MVM	Total Collisions	Total Collisions Per MVM
2020 No Build	354	0.87	27	1.13	40	0.42	421	1.08
2020 Build	377	0.91	30	1.18	42	0.42	449	1.06
2020 No Build	443	0.96	25	1.05	45	0.43	513	1.14
2020 Build	491	0.97	36	1.42	42	0.41	569	1.11

Notes:
MVM = Million vehicle miles
MEV = Million entering vehicles
Based on average traffic volumes at the permanent count location south of the Main Gate Interchange

and the new northbound auxiliary lane between the Thorne Lane and Gravelly Lake Drive interchanges would also affect traffic movements to and from the Tillicum and Woodbrook neighborhoods. The new interchange is proposed to have roundabouts at the I-5 ramp intersections instead of traffic signals.

These interchange revisions, together with the new southbound only Gravelly-Thorne connector roadway and northbound auxiliary lane between Thorne Lane and Gravelly Lake Drive, would likely affect local travel patterns in the vicinity of the Thorne Lane interchange. Because of the Gravelly-Thorne connector, some trips would be diverted from I-5 and would use the new roadway connected to Union Avenue near Thorne Lane. This diversion is an intended benefit of the proposed Build Alternative.

Changes in two-way traffic volumes on local roads near the Thorne Lane interchange are shown in Table 4.3-12 for the No Build and Build Alternatives. A comparison with 2013 volumes is also included in the table. With the No Build Alternative, two-way traffic along Union Avenue near Thorne Lane in 2020 is expected to be approximately 355 vehicles during the AM peak hour, and around 525 vehicles during the PM peak hour. In 2040, there are expected to be approximately 390 vehicles during the AM peak hour, and around 385 vehicles during the PM peak hour. Projected AM peak hour volumes at this location with the No Build Alternative are expected to be less than in 2013, and similar or greater in the PM peak hour. With the Build Alternative, AM peak hour two-way volume on Union Avenue is expected to be less than 265 vehicles in 2020 and 2040, and the PM peak hour volume is expected to be about 290 vehicles in 2020, and reduced to about 210 vehicles by 2040. In general, volumes on Union Avenue are expected to be lower with the Build Alternative as a result of the added capacity on I-5 and the improved interchanges.

Table 4.3-12 *2020 and 2040 AM and PM Peak Hour Two-Way Volume on Local Streets Near the Thorne Lane Interchange – No Build Alternative and Build Alternative*

	Baseline		No Build Alternative				Build Alternative			
Location	**2013 AM**	**2013 PM**	**2020 AM**	**2020 PM**	**2040 AM**	**2040 PM**	**2020 AM**	**2020 PM**	**2040 AM**	**2040 PM**
Union Avenue south of Thorne Lane	645	350	355	525	390	385	265	290	180	210
Thorne Lane west of Union Avenue or Union Avenue Loop connector	30	375	375	570	440	455	575	1,180	715	910
Thorne Lane over I-5	1,000	940	1,020	1,105	1,165	1,095	1,125	1,645	1,405	1,540

On Thorne Lane west of Union Avenue, 2020 Build Alternative traffic is expected to increase by about 545 vehicles in the AM peak hour, and by about 195 vehicles in the PM peak hour, as compared to 2013 and by 200 vehicles in the AM peak hour and by 610 vehicles in the PM peak hour compared to the No Build Alternative. In 2040, traffic is expected to increase by about 275 vehicles in the AM peak hour, and by about 455 vehicles in the PM peak hour. On the Thorne Lane bridge over I-5, 2020 and 2040 traffic volumes with the No Build Alternative would be relatively consistent with existing 2013 conditions. 2020 Build Alternative traffic is expected to increase by about 100 vehicles in the AM peak hour, and by about 540 vehicles in the PM peak hour, in comparison to the No Build Alternative. In 2040, traffic is expected to increase by about 240 vehicles in the AM peak hour, and by about 445 vehicles in the PM peak hour. Based on the predicted level of traffic, the current and newly constructed roadways serving the Thorne Lane interchange would have adequate carrying capacity and are not expected to be impacted by the changes in vehicle traffic.

BERKELEY STREET

At Berkeley Street, the existing bridge over I-5 is proposed to be removed and replaced with a new bridge centered about 120 feet south of the existing bridge centerline. The new interchange would have roundabouts at the I-5 ramp intersections. The new bridge would extend Jackson Avenue over I-5, the adjacent rail line and Militia Drive. The Jackson Avenue extension would tie into Berkeley Street just west of Washington Avenue, as previously shown in Figure 3.4-4. The segment of Berkeley Street east of Union Avenue, including the at-grade railroad crossing near I-5, would be removed. A new residential street would be added and connected to Grant Avenue to provide access for properties along a southern portion of Washington Avenue.

Changes in two-way traffic volumes on local roads near the Berkeley Street interchange are shown in Table 4.3-13 for the No Build and Build Alternatives. Two-way traffic along Berkeley Street west of Washington Avenue in 2020 and 2040 is expected to be less than 525 vehicles during the AM and PM peak hours for the No Build and Build Alternatives.

Table 4.3-13 *2020 and 2040 AM and PM Peak Hour Two-Way Volume on Local Streets Near the Berkeley Street Interchange – No Build Alternative and Build Alternative*

	No Build Alternative				Build Alternative			
	2020		2040		2020		2040	
Location	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**
Berkeley Street west of Washington Avenue	415	510	525	450	415	365	445	380
Berkeley Street between Union Avenue and Washington Avenue	460	545	575	515	375	300	385	250
Berkeley Street Bridge over I-5	1,475	1,190	1,370	1,280	1,590	1,570	1,675	1,255
Washington Avenue north of Berkeley Street	55	75	70	85	50	75	70	140
Union Avenue north of Berkeley Street	380	365	395	500	365	295	375	300

For the portion of Berkeley Street between Union Avenue and Washington Avenue, traffic is generally expected to be reduced with the Build Alternative, as traffic to and from Camp Murray would use the new interchange and the new extension to Jackson Avenue, and would connect to Berkeley Street north of Washington Avenue. However, because of increased congestion along southbound I-5 during the 2040 PM peak hour, some I-5 southbound drivers would likely exit at Thorne Lane, and use Union Avenue and Berkeley Street to reach their destinations. Traffic along Washington Avenue is expected to be about the same under the No Build Alternative in both 2020 and 2040, and to be less than 140 vehicles.

Traffic volumes crossing I-5 on the new bridge are generally expected to increase with the capacity added by the Build Alternative. An exception would be during the PM peak hour in 2040, when a decrease of about 100 vehicles is expected. Based on the operations analyses of the intersections along these local roads with the Build Alternative, traffic is expected to operate at LOS C or better during both the AM and PM peak hours in 2020 and 2040.

The change in travel patterns would be isolated to a small area of the Tillicum neighborhood, and the subsequent change would not impact or create any adverse conditions on the local roadways. The revised intersection at Berkeley Street/Washington Avenue can be designed to discourage cut-through traffic on Washington Avenue. Possible mitigation could include right-in/right-out operations at the intersection and traffic calming features on Washington Avenue north of Berkeley Street. The final intersection layout would be designed to discourage both commuter and commercial traffic from using Washington Avenue as a cut-through route to reach destinations beyond the nearby neighborhoods.

GRAVELLY LAKE DRIVE TO THORNE LANE CONNECTOR

A new southbound connector road, referred to as the Gravelly-Thorne connector, is proposed to be constructed to provide a non-freeway connection between Lakewood and the neighborhoods of Tillicum and Woodbrook. Traffic along this new southbound connector road is expected to range from about 25 vehicles (in 2020 AM peak hour) to 75 vehicles (in 2020 PM peak hour). In 2040, traffic along this new southbound connector road is expected to be about 40 vehicles in the AM peak hour and 240 vehicles in the PM peak hour. Drivers are expected to use this new connector, instead of I-5 or other roads within the secure military installations, to travel from Lakewood to the Tillicum and Woodbrook neighborhoods, Camp Murray, and JBLM. These diversions would be an intended benefit of the proposed Build Alternative. In addition, a new northbound auxiliary lane between the Thorne Lane and Gravelly Lake Drive interchanges would be added, as previously illustrated in Figure 3.4-5. This connection offers additional I-5 capacity to accommodate northbound traffic movement between these two interchanges to complement the southbound capacity added by the Gravelly-Thorne connector.

How Would the Build Alternative Affect Transit and Transportation Demand Management (TDM) Activities?

During a typical weekday PM peak hour in 2013, transit and vanpool ridership along I-5 in the project area was over 1,200 persons. This level of ridership equates to nearly 1,000 cars that were not using I-5 during the busiest evening commuter hour. While changes to the existing level of transit service are not included as part of the proposed Build Alternative, the added general purpose lanes along the I-5 mainline would benefit the operations, speed and reliability of transit and various TDM activities such as vanpooling and ridesharing.

A summary of the existing transit and rideshare usage through the JBLM area can be found in the *I-5 JBLM Vicinity IJR and Environmental Documentation: Phase 1 – Corridor Plan Feasibility Study*, completed in January 2014.

With added travel lanes in the Build Alternative from the Thorne Lane to Steilacoom-DuPont Road interchanges, transit travel times would be improved along with all travel modes in comparison to the No Build Alternative. Speeds would be more stable along I-5 and interchange operations would be improved. With the proposed Build Alternative, transit, carpools, and vanpools, as well as general traffic are expected to have shorter PM peak period travel times in 2020, as compared to the No Build Alternative. Travel time savings would be in the order of four minutes for southbound travelers through the JBLM area. Northbound travelers could expect about 13 minutes in travel time savings for trips between Center Drive and Gravelly Lake Drive. These shorter travel times allow for better transit reliability and schedule adherence along I-5 through the JBLM area, and would also encourage additional vanpool and carpool activities.

In 2040, northbound travel times along I-5 through the project area would improve with the addition of the near-term facilities included with the proposed Build Alternative, while southbound travel time would increase. As a result, transit service, as well as all traffic, would be affected equally.

How Would the Project Affect Bicycle and Pedestrian Traffic?

The proposed Build Alternative includes a separate shared-use path for bicyclists and pedestrians along I-5 from Steilacoom-DuPont Road to Berkeley Street. In addition, bicycle and pedestrian facilities

are included along the Gravelly-Thorne connector. Bicyclists and pedestrians would be able to travel between DuPont and Lakewood by using local streets from Center Drive to Steilacoom-DuPont Road. They could travel on the new shared-use path to the Tillicum neighborhood, on local streets through Tillicum, and along the Gravelly-Thorne connector to Lakewood, as previously shown on Figure 3.4-6.

The redesigned interchanges at Berkeley Street and Thorne Lane are proposed to have pedestrian and bicycle lanes, with sidewalks or shared-use areas to improve non-motorized access over I-5 and the adjacent rail line, connecting portions of Lakewood with JBLM. The improved connections would allow persons stationed or working at JBLM, but living in adjacent communities, the opportunity to walk or bicycle to their duty station or work activities.

4.3.4 What Would Be the Short-Term or Construction Impacts of the Build Alternative?

Would There Be Closures on I-5 and/or Its Existing Interchanges?

The redesigned interchanges at Berkeley Street and Thorne Lane would be shifted south of the existing interchanges, which would result in fewer impacts to traffic operations during construction than would reconstruction at existing locations. However, some long-term temporary closures (three to six months) may be needed to rebuild the southbound on- and off-ramps at both interchanges. The current intention is to close the southbound ramps at one interchange at a time, while continuing to provide access to local neighborhoods, Camp Murray, and JBLM via the adjacent interchange. The southbound ramp long-term temporary closures could have the following effects:

- Drivers are expected to use adjacent interchanges such as Berkeley Street when Thorne Lane is closed or Thorne Lane when Berkeley Street is closed.
- Some drivers may use local streets during these closures.
- Some drivers may change the timing of their trips to avoid peak travel times.

A preliminary analysis was conducted to identify potential impacts associated with the long-term temporary closure of the southbound ramps at the Thorne Lane and Berkeley Street interchanges. Analysis showed that, while some traffic on local streets would be changed, the resulting volumes are well within the capacity that these roadways are designed to accommodate.

Temporary northbound on- and off-ramps would be provided around the interchange construction sites to maintain access to neighborhoods and the military installations. However, nighttime and/or weekend closures may be needed while the new ramps are being connected to the existing street system and to I-5.

Construction plans would be developed to keep three lanes open in both the northbound and southbound direction on I-5 between Thorne Lane and Center Drive during daytime and peak travel hours. I-5 will be narrowed and shifted through the corridor construction zone. In addition, nighttime lane closures would be needed to widen I-5, and to build walls and bridge abutments.

Would There Be Local Street Closures During Construction?

With the Berkeley Street and Thorne Lane interchanges being constructed away from the existing structures, temporary closures of local streets are not expected. However, some short-term lane closures or detours would likely be needed to connect the proposed interchange improvements with the existing street system.

Would There Be Changes to Existing Transit Service and Bus Routing?

Pierce Transit route #206 serves the Tillicum and Woodbrook communities, as well as Madigan Army Medical Center on JBLM. This route would need to pass through the construction work zones for the Thorne Lane and Berkeley Street interchanges, as well as the I-5 mainline between Gravelly Lake Drive and Berkeley Street. During the temporary closures of southbound ramps at the Thorne Lane and Berkeley Street interchanges, the path of Route 206 would need to be modified. Impacts are expected to relate primarily to travel delays and/or schedule changes resulting from the use of alternative I-5 interchangers to avoid construction closures. As part of the Project's Traffic Management Plan, the project team will coordinate with local agencies to define alternative bus routing and/or any necessary bus stop relocation , as well as associated impacts and improvements needed to accommodate pedestrians and bicyclists. Additionally, all transit service provided by Intercity Transit, Pierce Transit and Sound Transit along the I-5 mainline would need to pass through the construction work zone and may be affected by construction-related activity.

School bus service is currently provided by the Clover Park School District to the Tillicum Elementary School and Woodbrook Middle School. This service would be impacted by construction activity at both the I-5/Thorne Lane and I-5/Berkeley Street interchanges.

What Route Would Be Used to Haul Construction Materials?

With secure military installations on both sides of the project area, I-5 would be the primary route used to access the construction sites. SR 512 and SR 510 may also be used to haul construction materials to and from the construction area, depending on the location of material sources, off-site manufacturing areas, and staging areas used by the selected contractor.

4.3.5 How Would Construction Traffic Impacts Be Addressed?

Prior to award of the first construction contract to build the improvements included in the Build Alternative, a Traffic Management Plan (TMP) will be developed. The TMP would define strategies to manage traffic through the Project's construction work zones during each construction phase. Transit agencies, local governments, school districts, JBLM, Camp Murray and others as appropriate would be invited to participate in development of the TMP. The TMP would be monitored and amended over time as necessary.

Mitigation measures that could be implemented to manage construction traffic include:

- Providing advanced communications to all affected parties about closures including times and dates.
- Signing for detour routes to optimize routing and minimize impacts to residential streets and neighborhoods.
- Adjusted signal timings at adjacent interchanges to account for the added construction-detour traffic.

4.3.6 Would There Be Any Unavoidable Adverse Transportation Impacts from the Build Alternative?

In the southbound direction along I-5, the proposed Build Alternative would transition the added travel lane back to the existing three lane cross-section near the Center Drive interchange. This transition of travel lanes requires drivers to merge into fewer lanes, which would increase congestion in the area between the Center Drive and Main Gate interchanges, as compared to the No Build Alternative. For both the No Build and Build Alternatives, traffic operations at the Center Drive and Steilacoom-DuPont Road interchanges would not be improved and would continue to operate at a low level of service. In addition, traffic in the DuPont area may experience longer delays with long queues at area intersections. WSDOT is currently studying options to improve the Center Drive and Steilacoom-DuPont Road interchanges.