Appendix K

Technical Memorandum I-5 JBLM Vicinity Transportation Operations and Safety Summary

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Washington State
Department of Transportation

LOCHNER | SCJ ALLIANCE

I-5 JBLM Vicinity Congestion Relief Study

Technical Report

I-5 JBLM Vicinity Transportation Operations and Safety Summary

September 2016

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I-5 JBLM Vicinity Transportation Operations and Safety Summary

1.0 Background

Interstate 5 (I-5) is a national highway of strategic importance as it extends from the US/Mexican Border to the US/Canadian border. It is the primary highway for the movement of goods and people traveling north and south on the west coast of the United States. I-5 is one of the most significant freight corridors in Washington State and is essential to the economic vitality of the Puget Sound region. Within the study area, I-5 serves a function in national defense by providing access to Joint Base Lewis-McChord (JBLM) and the State's National Guard at Camp Murray.

Over the past several years, traffic has increased along the entire I-5 corridor. Within the study area in south Pierce County, traffic has also grown. Between 1986 and 2011 the average annual daily traffic (AADT) on I-5 at DuPont increased 72 percent (68,600 to over 118,000 vehicles per day.) During this time, JBLM has evolved into a strategic military base, Camp Murray has expanded, and the City of Lakewood was established, and the cities of Lakewood, DuPont and Steilacoom have all grown in both population and employment.

In 2012, the Washington State Legislature appropriated funding to prepare the studies and analyses necessary to identify the causes and potential solutions for chronic congestion on I-5 in the vicinity of JBLM. This work included the *I-5 Corridor Feasibility Study*, completed in January 2014 and the *Multimodal Alternatives Analysis Study*, completed in March 2015. These studies identified mainline and interchange capacity scenarios and examined local street and transit options to reduce congestion and improve mobility along I-5.

As part of the Connecting Washington Program, the Washington State Legislature in 2015 approved design, right of way and construction funds for the I-5 JBLM Corridor Improvements. Figure 1 indicates the vicinity map for the project.

2.0 Study Area for Traffic Analysis

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).

Figure 1: Project Vicinity Map

Figure 1.1-1
Project Vicinity Map

While the Project Corridor study area boundary includes the entire I-5 corridor through the JBLM vicinity, implementation of improvements would occur in phases. The northern portion of the corridor (referred to as he North Study Area), is generally situated between Steilacoom-DuPont Road (Exit 119) and Gravelly Lake Drive (Exit 124). A project-specific Build Alternative has been defined in this area. The Build Alternative includes modifications to the freeway mainline and interchanges between the vicinity of the Center Drive interchange (Exit 118) and the Gravelly Lake Drive interchange (Exit 124). They include two primary interchanges that would be reconstructed and four other study area interchanges that 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 2. NEPA environmental documentation and a corresponding Interchange Justification Report (IJR) for interstate access modifications have been prepared for this corridor segment. This report supports and provides added information for the Build Alternative analysis.

In the southern portion of the corridor, generally located between Mounts Road (Exit 116) and Steilacoom-DuPont Road (Exit 119), a specific build alternative has not been defined. This portion of the corridor is referred to as the South Study Area and has been evaluated at a corridor level. When a specific build alternative is defined more detailed analysis of traffic operations and safety will be conducted in the South Study Area.

Within the 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. These lanes are open to all traffic. Northbound and southbound auxiliary lanes are located between the Center Drive and Steilacoom-DuPont Road interchanges. A southbound auxiliary lane is also located between Center Drive and Mounts Road. In 2014, WSDOT added a southbound auxiliary lane between Thorne Lane and Berkeley Street as part of the TIGER III improvement project.

Through the study area, I-5 is physically constrained with secure military installations (JBLM and Camp Murray) on both sides and an active rail line paralleling immediately to the northwest. Alternative routes to move regional traffic are severely limited by the size of JBLM, and further

Figure 2: Proposed Build Alternative

limited by bodies of water, sensitive environmental areas, and locations of sites of archaeology or cultural significance. Because of security restrictions, access through the military installations is limited and alternative travel routes would require long detours.

Between mileposts 117.5 and 125.6 (essentially Center Drive to Gravelly Lake Drive), I-5 is situated on an easement whose ownership is retained by the Department of Defense (DoD). Changes to the existing easement to accommodate freeway improvements will require approval from DoD which can be a lengthy and complicated process.

3.0 Analysis of Existing Traffic Conditions

A summary of the existing I-5 traffic operations, including travel demand, travel speeds, congestion and travel times, is presented below. The analyses and procedures that were followed to evaluate existing and future operations used Synchro and Sidra software in accordance with the Highway Capacity Manual (HCM). The traffic analysis assumptions for this project are summarized in the *Methods & Assumptions Document for the I-5 Joint Base Lewis-McChord Vicinity Interchange Justification Report & Environmental Documentation*, contained in Appendix A.

3.1 Existing I-5 Traffic Analysis

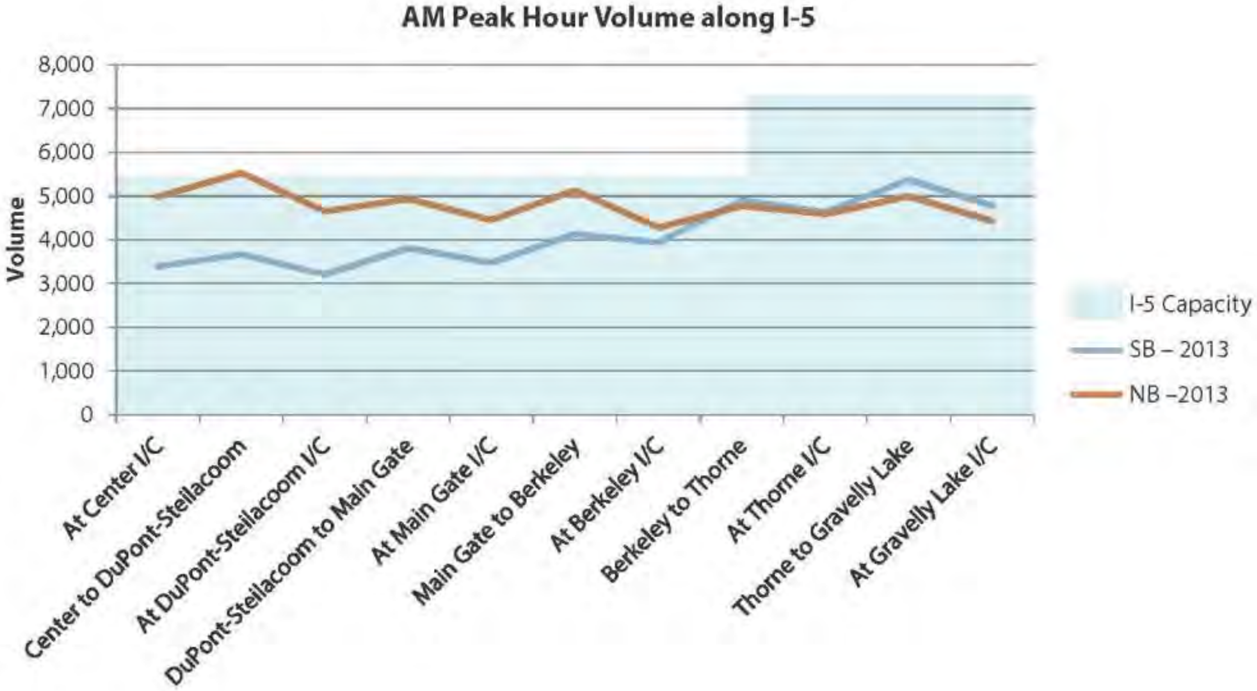
Based on existing traffic counts collected in 2013, AM and PM peak hour two-way traffic volumes along the I-5 corridor ranged from approximately 7,500 vehicles to 10,900 vehicles. Figure 3 shows the AM and PM peak hour vehicles along I-5 by direction. Using 1,800 vehicles per hour as a maximum practical capacity per lane, the three-lane section has a maximum capacity of 5,400 vehicles and the four-lane section has a capacity of 7,200 vehicles (as 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.

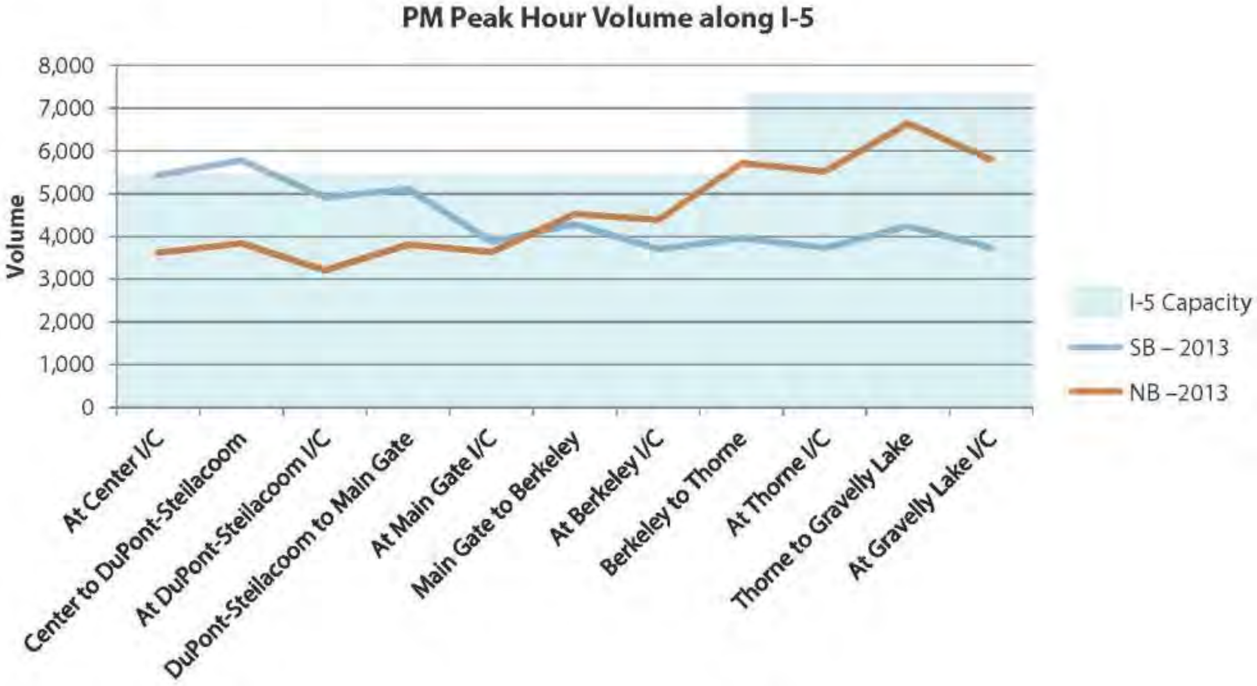
During the AM peak hour, the northbound lanes are at or near capacity from Center Drive to Thorne Lane. During the PM peak hour, the southbound lanes are at or near capacity south of the Main Gate Interchange and the northbound lanes are at or near capacity between Berkeley Street and Thorne Lane.

This level of traffic volume along the I-5 corridor together with the reduction in travel lanes at Thorne Lane creates lane turbulence and congestion that:

- Reduces the gap distance between vehicles
- Makes it more difficult for drivers to change lanes safely
- Causes drivers to slow down or even stop as other drivers try to change lanes with smaller gaps
- Results in higher number of rear-end and sideswipe collisions through this area of I-5

Figure 3: 2013 AM and PM Peak Hour Volumes on I-5 from Center Drive to Gravelly Lake Drive

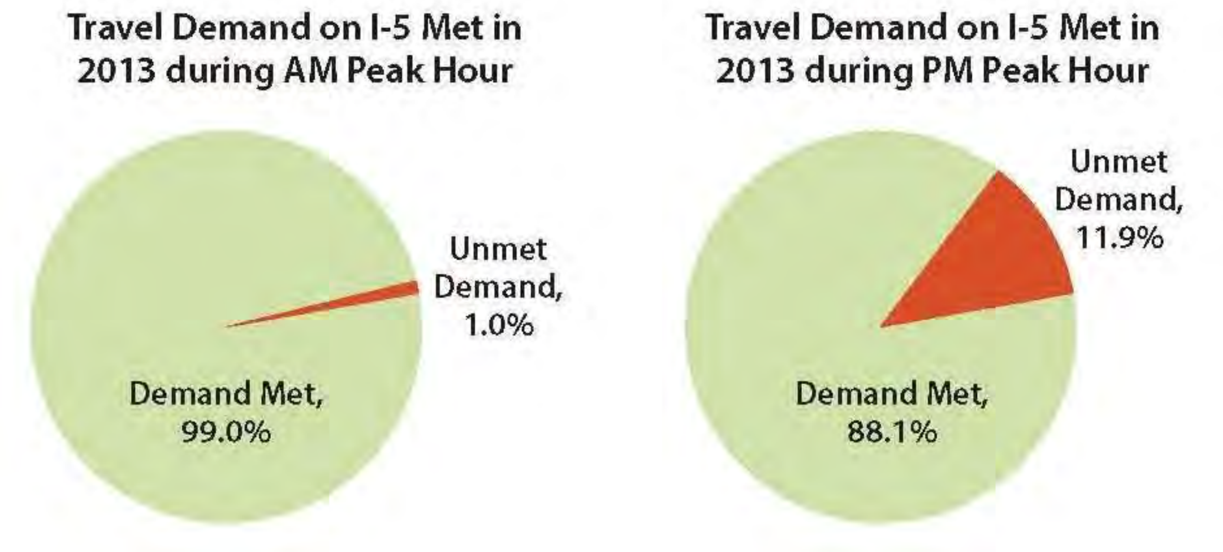




3.2 Travel Demand along I-5

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 and based on output from the study area Mesoscopic model, over 88 percent of PM peak hour 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.

Figure 4: Peak Hour Travel Demand Met on I-5 – Center Drive to Gravelly Lake Drive

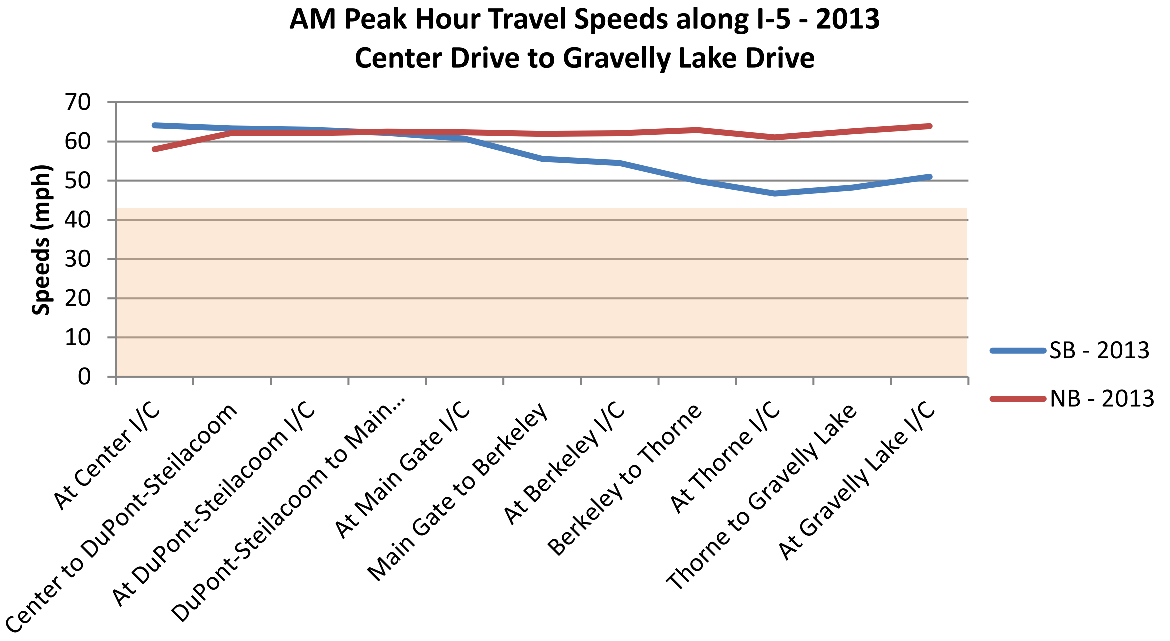


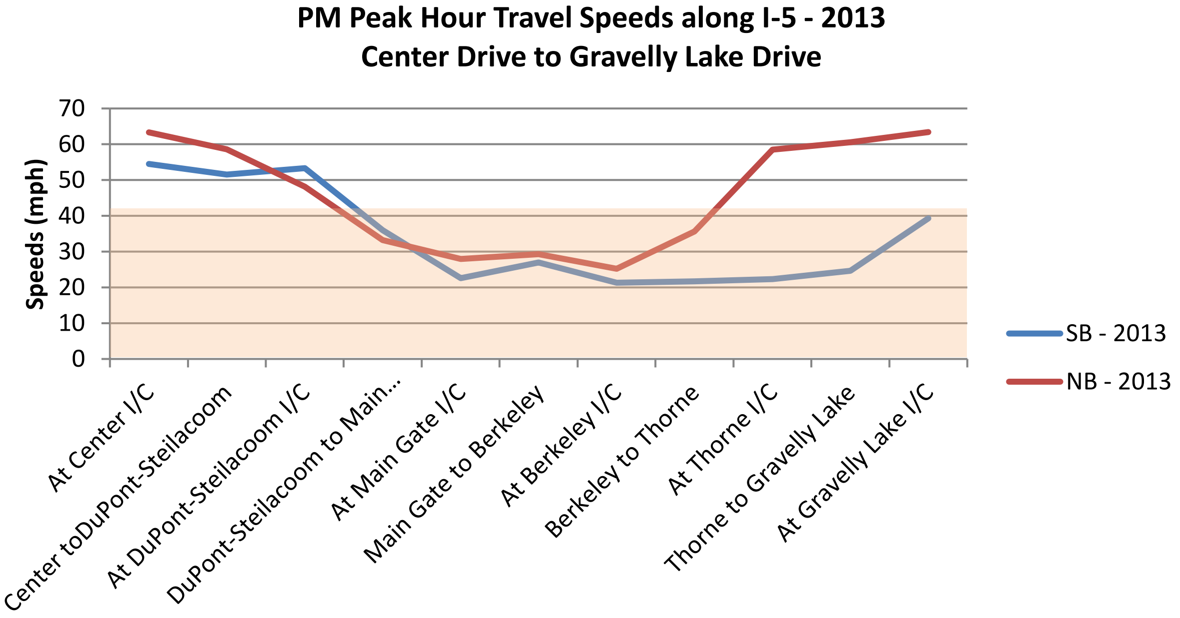
- Demand based on person miles of travel estimate from Mesoscopic travel model.

3.3 Average I-5 Travel Speeds and Congestion

Average travel speed along the I-5 corridor is a factor that WSDOT uses to illustrate congestion. In WSDOT's Highway System Plan 2007 - 2026, WSDOT uses 70 percent of posted speed (42 mph) to signify when congestion occurs at level of service (LOS) F (the shaded areas on Figure 5 are speeds below 70 percent of posted speeds). As can be observed from Figure 6, travel speeds in 2013 along I-5 in the AM peak hour are above 42 mph. However, during the PM peak hour in 2013, there are several segments of I-5 that fall below 42 mph.

Figure 5: 2013 AM and PM Peak Hour Average Travel Speed on I-5





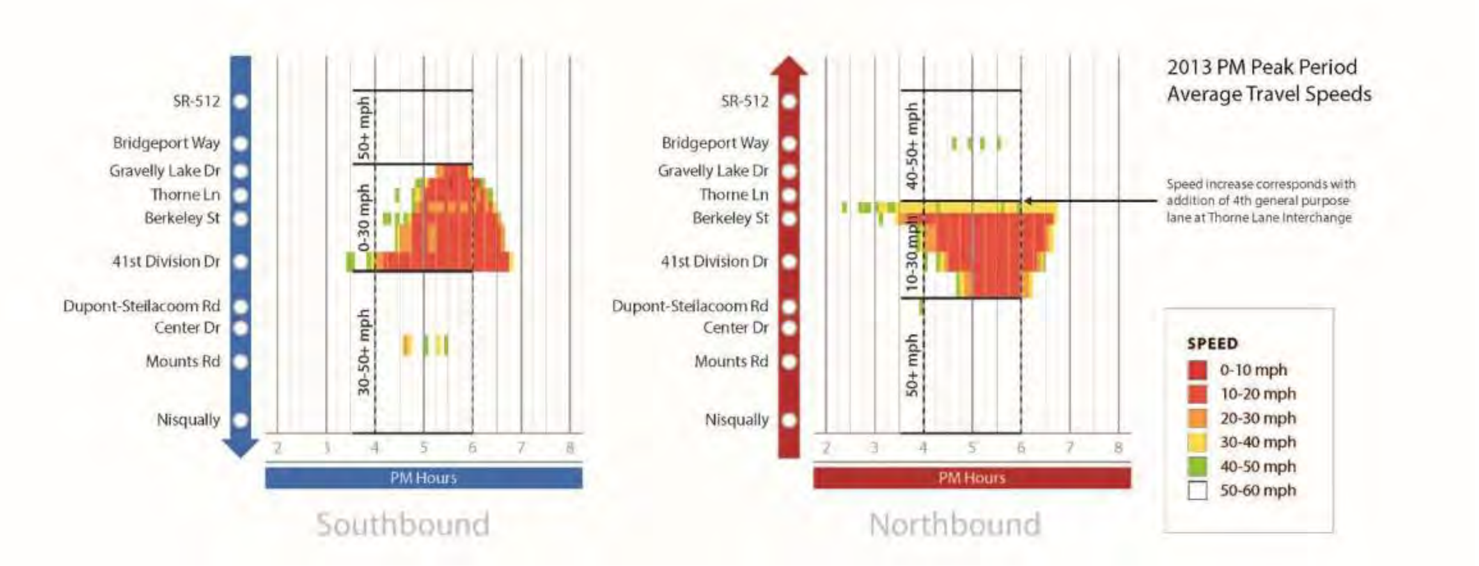
In the southbound direction average PM speeds are below 42 mph from Gravelly Lake Drive to Steilacoom-DuPont Road with the segment from Thorne Lane to Main Gate being near 20 mph. In the northbound direction, average PM speeds are below 42 mph between Steilacoom-DuPont Road and Thorne Lane. These low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

Figure 6: Average Travel Speeds on I-5 during the 2013 PM Peak Period

3.4 Hours of Congestion along I-5

To estimate how many hours of congestion might occur along I-5, an operational analysis was conducted using INRIX travel data and this project's Mesoscopic Model to estimate travel speeds along I-5 for a six-hour AM peak period and a six-hour PM peak period. Figure 7 illustrates the duration of slow speeds along I-5 at differing locations during the 2013 PM peak period on a typical weekday. The PM peak period that was evaluated ran from 2:00 PM to 8:00 PM. Congestion in both the northbound and southbound directions is shown. As indicated in the figure there are several areas where speeds fell below 42 mph, and for extended periods even below 20 mph. It also shows that these slow speeds extend well past the PM peak hour. In 2013, congestion during the PM peak period lasted for about three hours.

Figure 7: Average Travel Speeds on I-5 during the 2013 PM Peak Period – Nisqually to SR 512

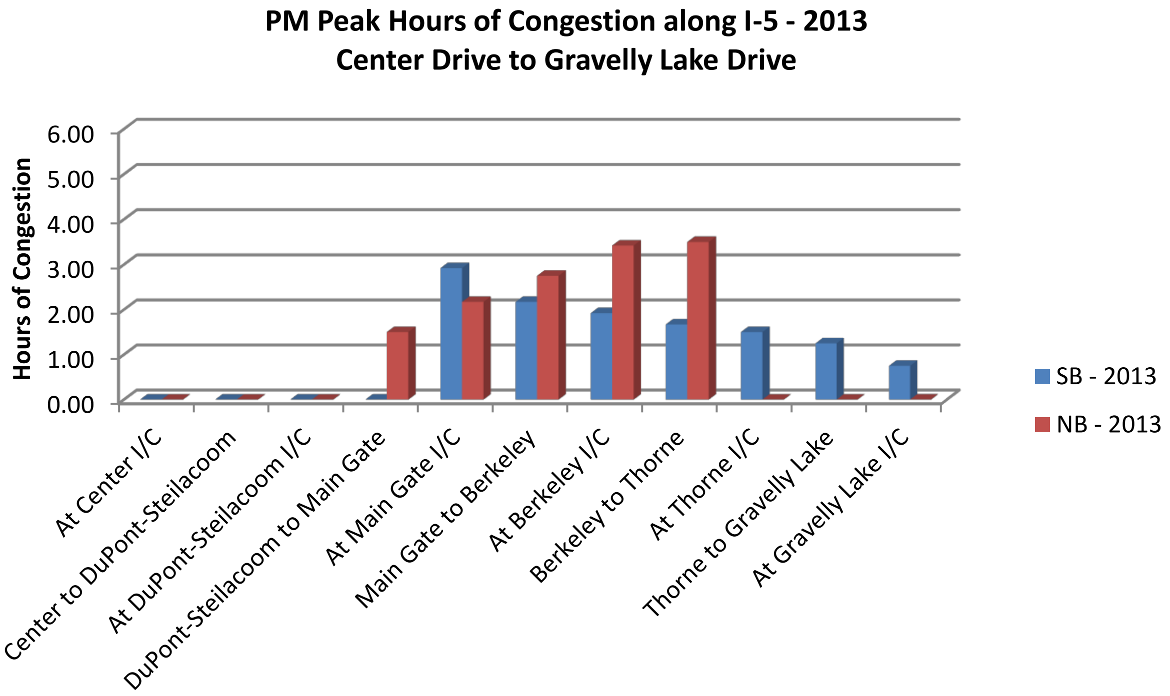


2013 PM Peak Period Average Travel Speeds

Speed increase corresponds with addition of 4th general purpose lane at Thorne Lane Interchange

Based on the INRIX and model data, estimates were made of the number of hours the travel speed operated below 70 percent of posted speed or 42 mph. Based on the analysis, less than one hour of congestion occurred during the AM peak period in 2013 (not illustrated). During the PM peak period, several hours of congestion occur along I-5. At experienced by drivers today, this congestion can last from two to 3.5 hours. The hours of congestion during the PM peak period are illustrated in Figure 8.

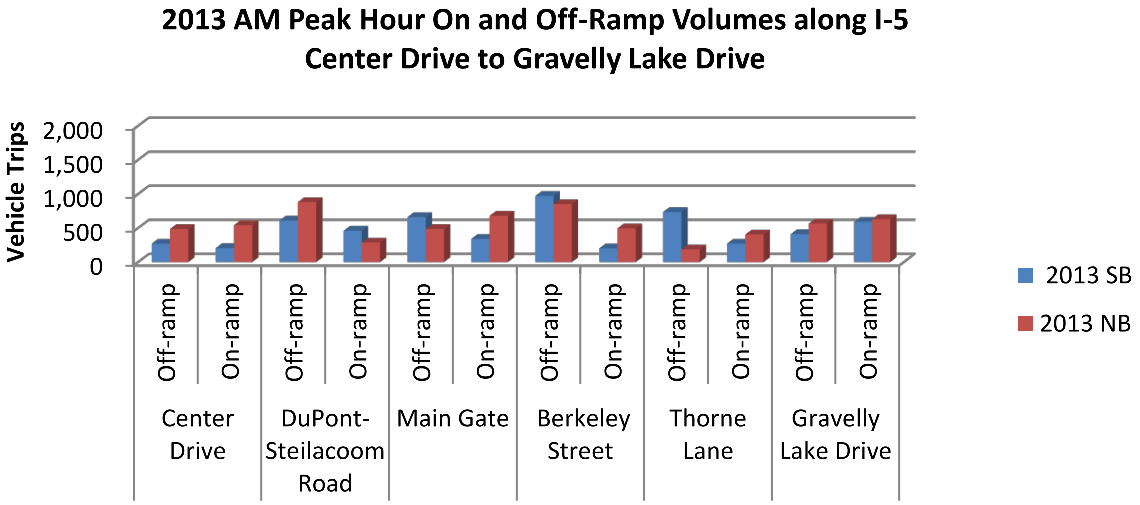
Figure 8: Hours of Congestion on I-5 during 2013 PM Peak Period – Center Drive to Gravelly Lake Drive

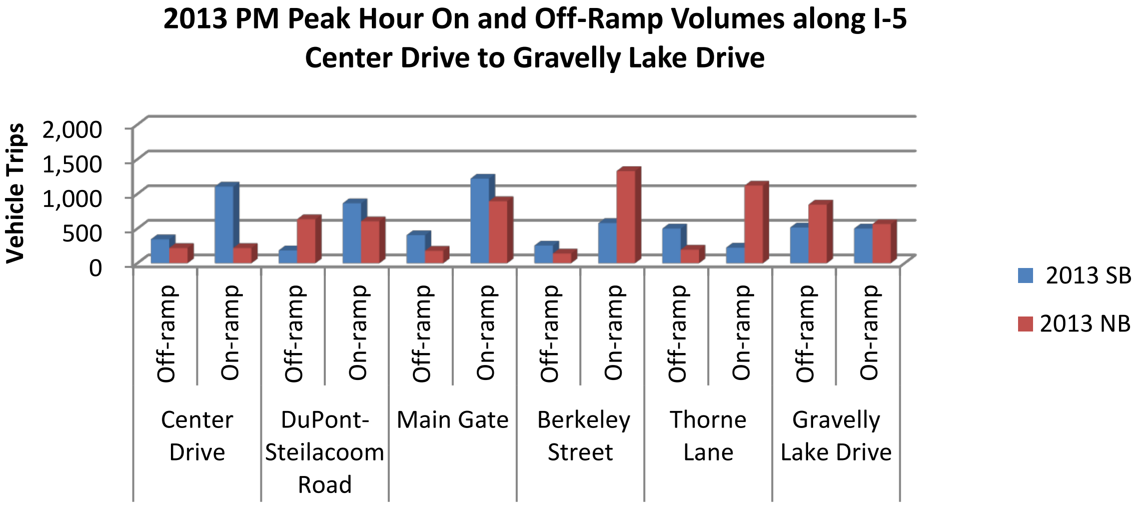


3.5 On- and Off-Ramp Volumes along I-5

One of the causes for congestion along I-5 through the JBLM area is the high volume of traffic switching lanes to enter and exit I-5. As shown in Figure 9, it can be observed that for the southbound direction during the AM peak hour, there are over 500 vehicles exiting at Thorne Lane, Berkeley Street, Main Gate and Steilacoom-DuPont Road interchanges. At the same time, there are over 500 drivers entering I-5 from Gravelly Lake Drive, over 300 from Main Gate and over 400 from Steilacoom-DuPont Road. All this traffic cannot be accommodated in the outside lane at the same time, so the exiting drivers must merge right from other lanes before their exit and entering drivers must merge left to clear the outside lane. These heavy merging movements are further complicated for southbound traffic entering north of Thorne Lane, as it must not only merge with the exiting traffic but also must then shift lanes to get past the Thorne Lane Interchange where the outside lane ends, reducing I-5 from four lanes to three lanes.

Figure 9: 2013 AM and PM Peak Hour On- and Off-Ramp Volume on I-5 - Center Drive to Gravelly Lake Drive





Similarly, during the PM peak hour in the northbound direction, there are over 500 vehicles merging onto I-5 at Steilacoom-DuPont Road, Main Gate, and Gravelly Lake Drive and over 1,000 vehicles merging onto I-5 at Berkeley Street and Thorne Lane. At the same time, there are over 500 vehicles exiting I-5 at Steilacoom-DuPont Road and Gravelly Lake Drive. All of this traffic cannot be in the outside lane at the same time, so drivers frequently change lanes as part of entering and exiting I-5.

These heavy lane change movements cause traffic to slow, increase congestion, result in an average of more than one traffic collision per day, and reduce the overall traffic throughput in the JBLM area.

To illustrate the impact of the on and off traffic merging and weaving, two locations are illustrated below. Figure 10 shows northbound weaving between Berkeley Street and Gravelly Lake Drive during a typical 2013 PM peak hour. Within this 1.5-mile distance, nearly 3,500 drivers are engaged in merging on or off the highway and weaving with existing through traffic which almost doubles the 1,800-vehicle capacity of the outside lane.

Figure 11 shows the high levels of weaving and merging that occur during the PM peak hour in the southbound direction between Steilacoom-DuPont Road and Mounts Road. Within this 1.5-mile segment of the freeway there are nearly 3,100 drivers, merging and weaving across travel lanes to enter or exit the freeway, well over the 1,800-vehicle capacity of the outside lane.

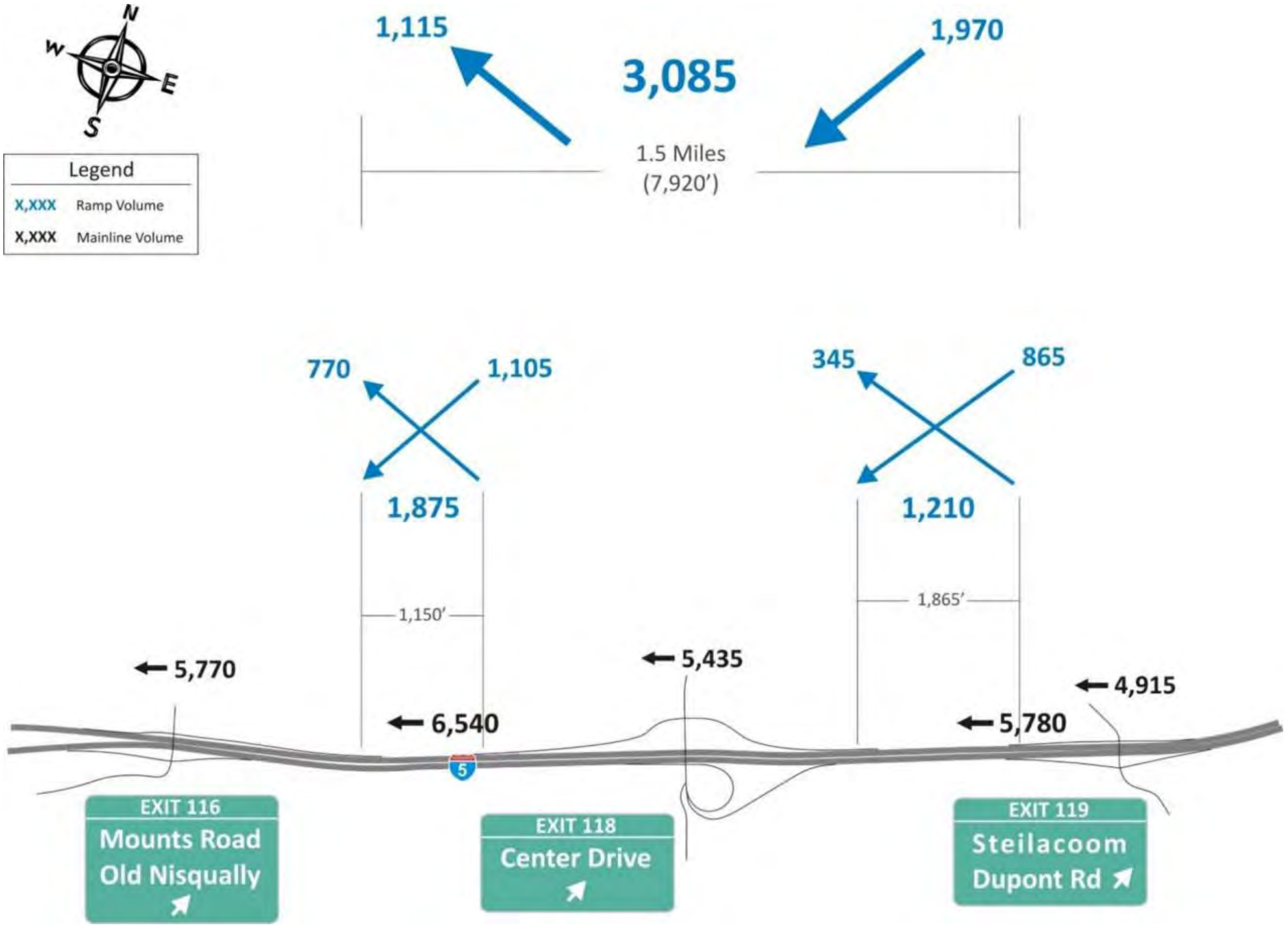
3.6 Short-Trip Traffic on I-5

Because of the high security military installations, I-5 is the main and essentially only traffic artery through the area for through trips, regional trips and short trips. As a result, there are several locations that have a significant volume of trips that begin and end within the project limits. Many of these short trips are military personnel living off-Base with their families in Lacey, DuPont, Steilacoom, Lakewood or other nearby communities, who generally use the gates closest to where they are stationed on the military base. Many of these short trips use I-5 as there are few to no alternatives for traveling between destinations within the study area.

Other short trips are to and from the Tillicum and Woodbrook neighborhoods. Because of the secure military base around these neighborhoods, these residents use I-5 to reach their destinations in Lakewood and other areas. Overall, these short trips contribute to the congestion and safety problems experienced in the corridor by increasing I-5 traffic volumes and contributing to the high level of weaving and merging activity.

Figure 10: 2013 PM Northbound On- and Off-Ramp Volumes on I-5 – Berkeley Street to Gravelly Lake Drive

Figure 11: 2013 PM Peak Hour Southbound On- and Off-Ramp Volumes on I-5 – Steilacoom-DuPont Road to Mounts Road



3.7 Factors affecting Existing Traffic Conditions along I-5

Several factors 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 2011, daily traffic volumes on I-5 in the study area increased by 73 percent, from just under 68,000 vehicles to over 118,000 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 through trips, regional trips and short trips. As a result, several locations have a heavy volume of trips that begin and end within the project limits, competing for freeway space with regional and through traffic. Further information about these trip patterns can be found in the I-5 JBLM Congestion Relief Study, Travel Patterns and Characteristics report dated August, 2014.

3.8 Intersection Analyses at the Reconfigured and Other Area Interchanges on I-5

The 2013 intersection analyses at the I-5 interchanges were conducted using Synchro software following the Highway Capacity Manual (HCM) procedures. A summary of the intersection turning movement volumes used for the analysis is contained in Appendix B. The results of these analyses are summarized Table 1. A detailed listing of the No Build Alternative analysis results is located in Appendix C.

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

- I-5 SB Ramps / Berkeley Street
- I-5 SB Ramps / Thorne Lane
- I-5 NB Ramps/ Thorne Lane

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

- I-5 NB Ramps / Thorne Lane
- I-5 NB Ramps / Center Drive
- I-5 NB Ramps / Gravelly Lake Drive

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 for an additional improvement at Berkeley Street, as part of the *Madigan Access Improvement Project*, which will open in 2017 to address the Berkeley Street Interchange deficiencies.

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 2.

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 1: Summary of Interchange Delay and Level of Service (LOS) at the Reconfigured Interchanges and Other Area Interchanges

Reconfigured Interchanges
Existing 2013

Intersections	AM	PM
I-5 NB Ramps/Berkeley Street **(Signal)**		
Average Delay (sec) / LOS	25.7/C	29.7/C
I-5 SB Ramps/Berkeley Street **(Signal)**		
Average Delay (sec) / LOS	**69.2/E**	54.0/D
Berkeley St/Union Avenue **(Signal)**		
Average Delay (sec) / LOS	10.6/B	12.1/B
I-5 NB Ramps/Thorne Lane **(Signal)**		
Average Delay (sec) / LOS	**56.9/E**	**71.2/E**
I-5 SB Ramps/Thorne Lane **(Signal)**		
Average Delay (sec) / LOS	**58.7/E**	49.1/D
Thorne Lane/Union Avenue **(4-way Stop)**		
Average Delay (sec) / LOS	9.6/A	11.1/B

NOTES:

**** - LOS values below "D" shown in bold font***

***** - Assumes new configuration of intersection built in 2015***

Other Area Interchanges
Existing 2013

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

Table 2: 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

3.9 Summary of Existing I-5 Traffic Conditions in the JBLM vicinity

A summary of the key findings from the traffic operation analyses of the 2013 I-5 conditions includes:

- Traffic volumes along several sections of I-5 in the JBLM area are near or exceed the practical capacity of the highway.
- Travel speeds along several sections of I-5 are below 70 percent of the posted speed (LOS F) with some sections operating between 20 mph to 30 mph.
- These lower travel speeds also reduce the capacity of the I-5 corridor.
- Congestion along the I-5 corridor through the JBLM area can last 2 to 3.5 hours during the PM peak period.
- High levels of exiting and entering traffic from multiple, close-proximity ramps cause drivers to shift lanes frequently, resulting in slow travel speeds.
- The lack of reasonable alternative routes results in short, local trips on I-5 for travel between JBLM and local communities, and between land-locked neighborhoods and other nearby destinations.
- Approximately 12 percent of the drivers wishing to use I-5 cannot use it during the PM peak hour and must travel at other times.
- Several of the ramp terminal intersections currently operate below LOS D.

4.0 Future Year Transportation System Assumptions

Over the next 25 years, traffic along the I-5 corridor through the JBLM area is expected to grow and congestion to increase as speeds along I-5 slow. To address this expected growth, WSDOT and local agencies have developed their transportation plans and have selected short-term improvement projects planned for implementation over the next six years. The 2020 and 2040 No-Build transportation system includes the existing transportation network plus these funded projects, outlined in the local agencies' Transportation Improvement Plans (TIPs) and WSDOT's State Transportation Improvement Plan (STIP), as well as funded JBLM improvements. These highway improvements, located in or near the study area, include:

- I-5 Congestion Management TIGER III: Southbound auxiliary lanes from Thorne Lane to Berkeley Street.
- I-5 Congestion Management TIGER III: Ramp metering, traffic cameras, and variable message signs (See Figure 12).
- Point Defiance Bypass Rail project improvements1.

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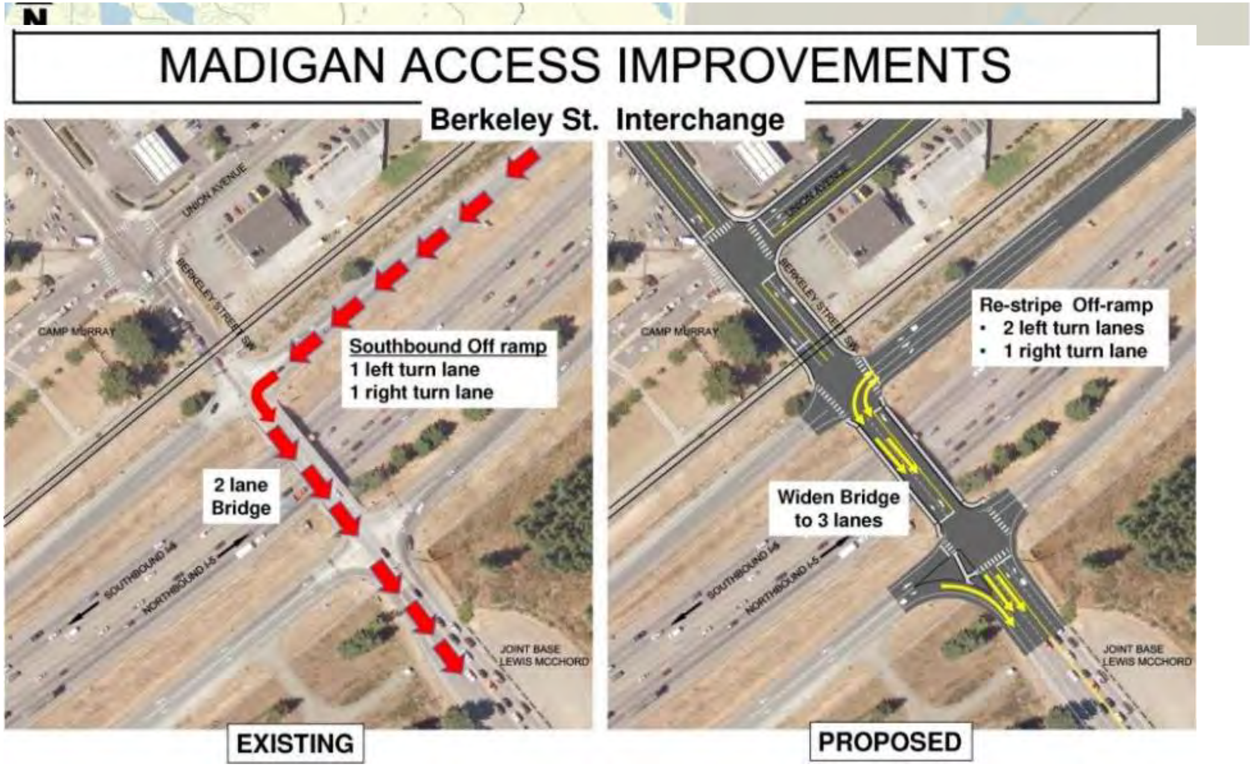
[1] *Point Defiance Bypass Project – Transportation Discipline Report, WSDOT, September, 2012*

- Madigan Gate Access Improvements (See Figure 13).
- Center Drive northbound ramp intersection improvements.
- Joint-Base Connector Phase 1 improvements, including the closure of the Rainer Gate.
- Integrity Gate and Mounts Gate opened with full access and closed the I-Street Gate.

Figure 13: Interim Improvements Using Federal Grant Funding

This City of Lakewood-led project improves access to Madigan Hospital by providing double left turn lanes from southbound I-5 and widening the overpass (Freedom Bridge).

Figure 12: Access Improvements to Madigan Gate



5.0 Traffic Forecasting Modeling Process and Assumptions

The travel forecasts for the *I-5 JBLM Vicinity Congestion Relief Study* were developed using a series of inter-related and complimentary modeling tools that included a Macroscopic (Macro) Model, Mesoscopic (Meso) Model and Transit Sketch Planning (Transit) Model. Each of the three modeling tools was developed specifically for the *I-5 JBLM Vicinity Congestion Relief Study* and were used to evaluate the No Build and Build Alternatives. More extensive information is available in that study, while the following is a general description of each model and how they were integrated for the project.

5.1 Macroscopic Model

The I-5 JBLM Macro Model was used to develop travel forecasts in the study area and to understand travel pattern changes that would result from various improvement alternatives. The Macro Model has a base year of 2013, and two forecast horizon years of 2020 (opening year) and 2040 (design year). The model area includes Pierce County south of the Puyallup River and northern Thurston County. The model includes trip assignments for both high-occupancy vehicle (HOV) and single-occupancy vehicle (SOV) mode splits for two time periods: AM peak period (6 AM to 9 AM), and PM peak period (3 PM to 6 PM). The Macro Model is consistent with local land use plans, and the Puget Sound Regional Council (PSRC) and Thurston Regional Planning Council (TRPC) regional models.

5.2 Transit Sketch Planning Model

The Transit Model was developed to provide a more comprehensive, multimodal assessment of how corridor level improvements can help achieve the congestion reduction goals of the project. The Transit Model captured the effects that commuter-oriented transportation demand management programs (subsidized transit passes, vanpools, shuttles, etc.), investments in high-occupancy vehicle facilities, and improvements to commuter transit service can have on congestion in the corridor. Using the Transit Model in the planning process also allowed the project team to better understand the commuter transit market in this corridor.

The Transit Model was designed to build on the existing Macro Model while also integrating with the Meso Model. The Transit Model used data from the established regional models, as well as data that had been identified through industry research as important for forecasting commuter transit ridership.

The Transit Model was integrated into the overall modeling process, interfacing directly with the Macro Model. A variety of data inputs from the Macro Model fed into the Transit Model including SOV and HOV travel times. Once transit ridership forecasts for each alternative were developed, the data were input back into the Macro Model to account for the changes in mode share.

Ridership forecasts were also used directly in performance assessments of the improvement alternatives.

5.3 Mesoscopic Model

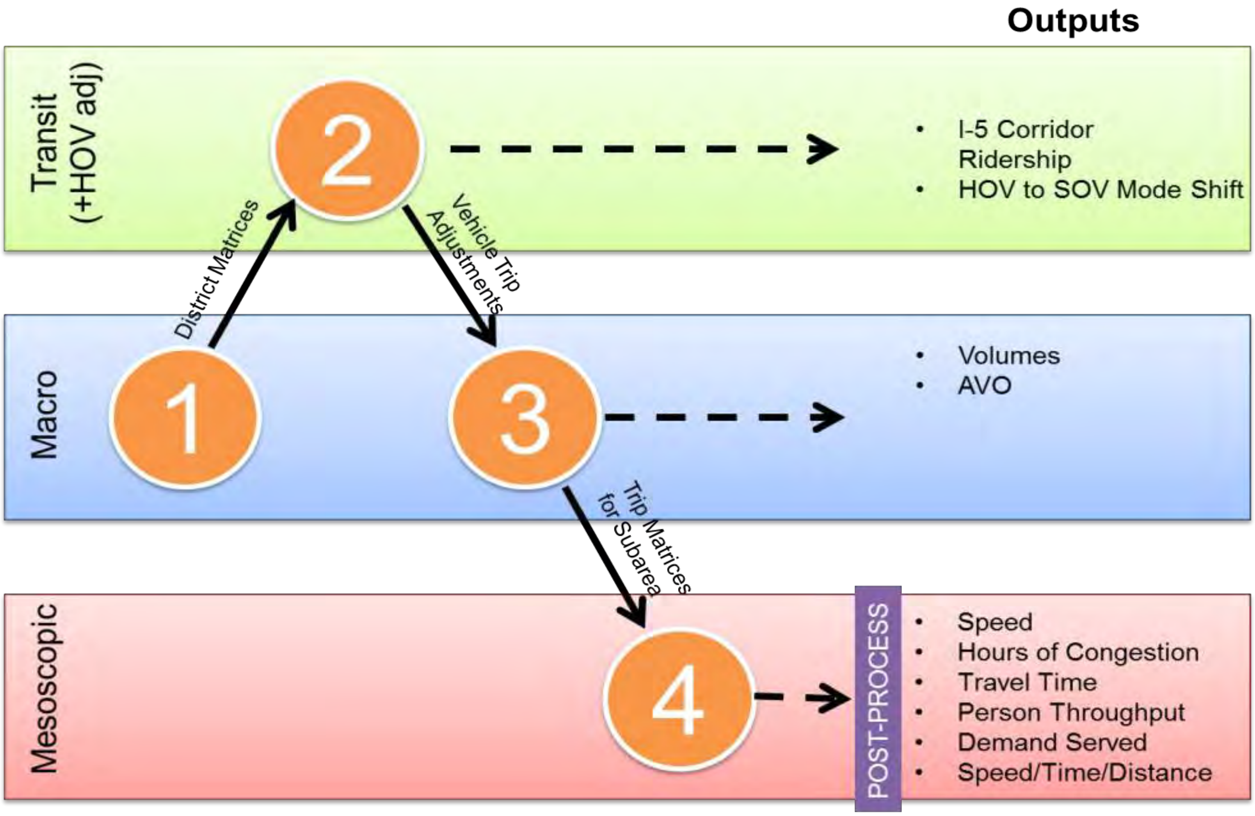
The I-5 JBLM Meso Model was developed to evaluate a series of detailed transportation performance measures that could be used to compare each of the improvement alternatives. The Meso Model was built using Dynameq software and is based upon the Macro Model, so it is also consistent with local and regional land use plans and regional transportation models. The general analysis area of the Meso Model is the I-5 corridor between SR 512 and SR 510, including the adjoining local on-JBLM and off-JBLM arterials. The Meso Model incorporates specific roadway and intersection operational details, such as signal timing, roadway channelization, ramp metering, and merging/weaving conflicts along the I-5 mainline. It also includes operational impacts from at-grade railroad crossings and military gate operations. These features enable the Meso Model to dynamically balance traffic volumes as the various alternative routes become congested.

The Meso Model has a base year of 2013 and two forecast horizon years of 2020 and 2040. The model includes trip assignments for both high-occupancy vehicle (HOV) and single-occupancy vehicle (SOV) modes for two time periods: AM peak period (5 AM to 11 AM) and PM peak period (2 PM to 8 PM). The 6-hour time periods provide the opportunity to evaluate impacts from increased congestion and peak spreading already occurring along the I-5 corridor.

5.4 Modeling Procedure

Outputs from the modeling effort were coordinated between the three different models. Figure 14 illustrates the general procedure for modeling each alternative. Step 1 included coding the Macro Model with the assumptions inherent in the improvement alternative, running the model, and outputting SOV and HOV travel time trip tables for use in the Transit Sketch Model. Step 2 included coding the Transit Sketch Model with the improvement alternative’s assumptions, running the model, and outputting transit ridership and vehicle trip adjustments (changes in amount of vehicle trips due to changes in transit ridership) for use back in the Macro Model. Step 3 included revising the Macro Model with the transit ridership adjustments, re-running the model, and outputting vehicle volume metrics and subarea trip tables for use in the Meso Model. The final step, Step 4, included detailed operational coding of the Meso Model, running the model, and then outputting various performance metrics, such as travel volumes, speeds, times and hours of congestion and mode shares.

Figure 14: Model Process Flowchart



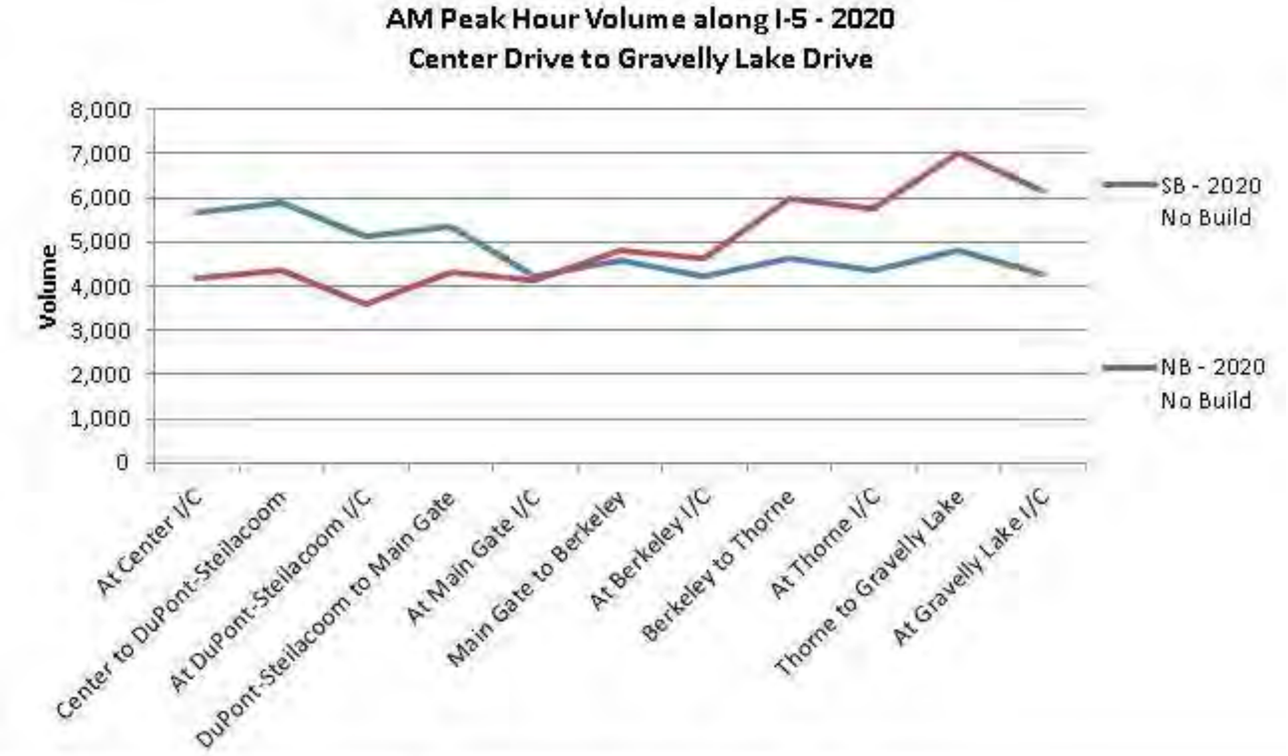
6.0 2020 and 2040 I-5 No Build Alternative Traffic Analysis

The following section summarizes the base traffic operations along I-5 for an opening year (2020) and a design year (2040) time frame. Synchro software is used to analyze signalized and non-signalized intersections; Sidra software is used to analyze roundabout operations; and SimTraffic and the Meso Model are used to simulate and analyze traffic operations along the I-5 mainline and at interchanges.

6.1 Future No Build Alternative I-5 Traffic Volumes

The forecasted No Build Alternative traffic volumes along I-5 for both the AM and PM peak hours, are shown in Figures 15 and 16, respectively. In 2020, the two-way traffic volume along I-5 between Center Drive and Gravelly Lake Drive ranges from approximately 8,200 to nearly 11,000 vehicle trips in the AM peak hour and from 7,400 to nearly 11,000 vehicle trips in the PM peak hour. In 2040, the two-way traffic volume along I-5 ranges from approximately 8,600 to 11,200 vehicle trips in the AM peak hour and from 7,200 to nearly 10,100 vehicle trips in the PM peak hour.

Figure 15: 2020 and 2040 AM Peak Hour Volumes on I-5 – No Build Alternative



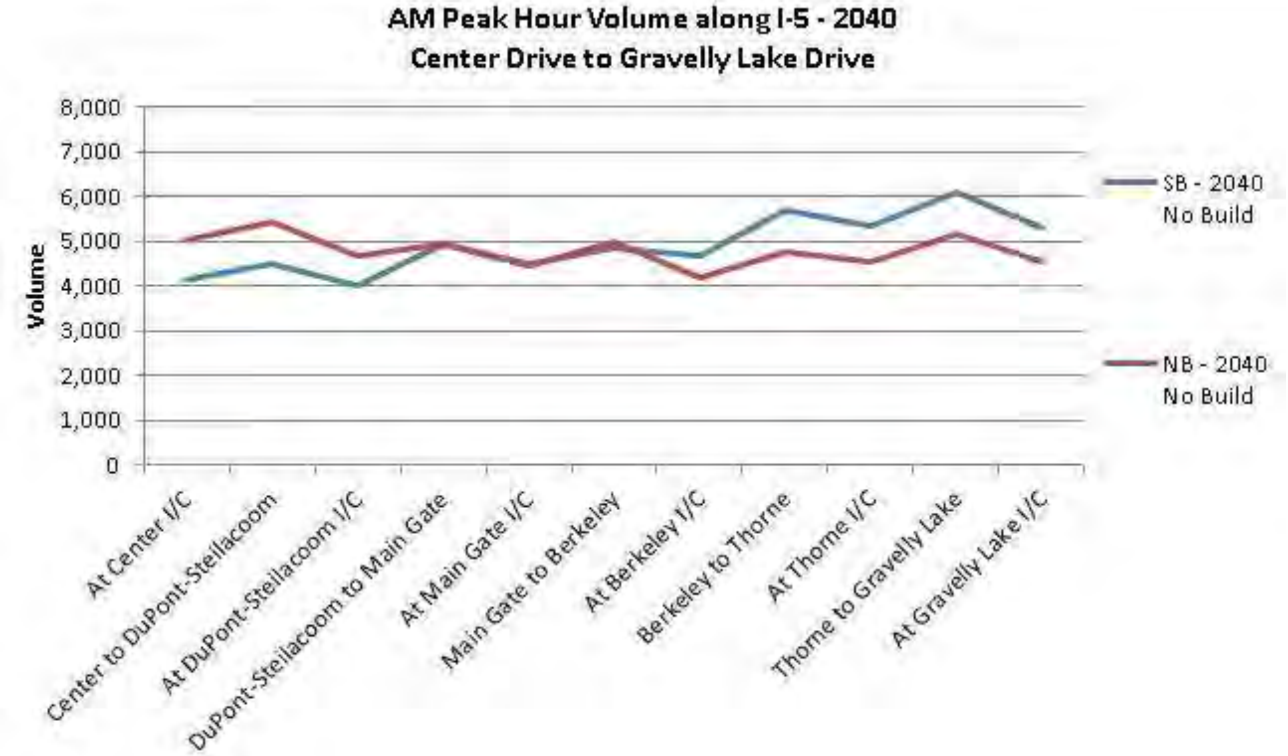
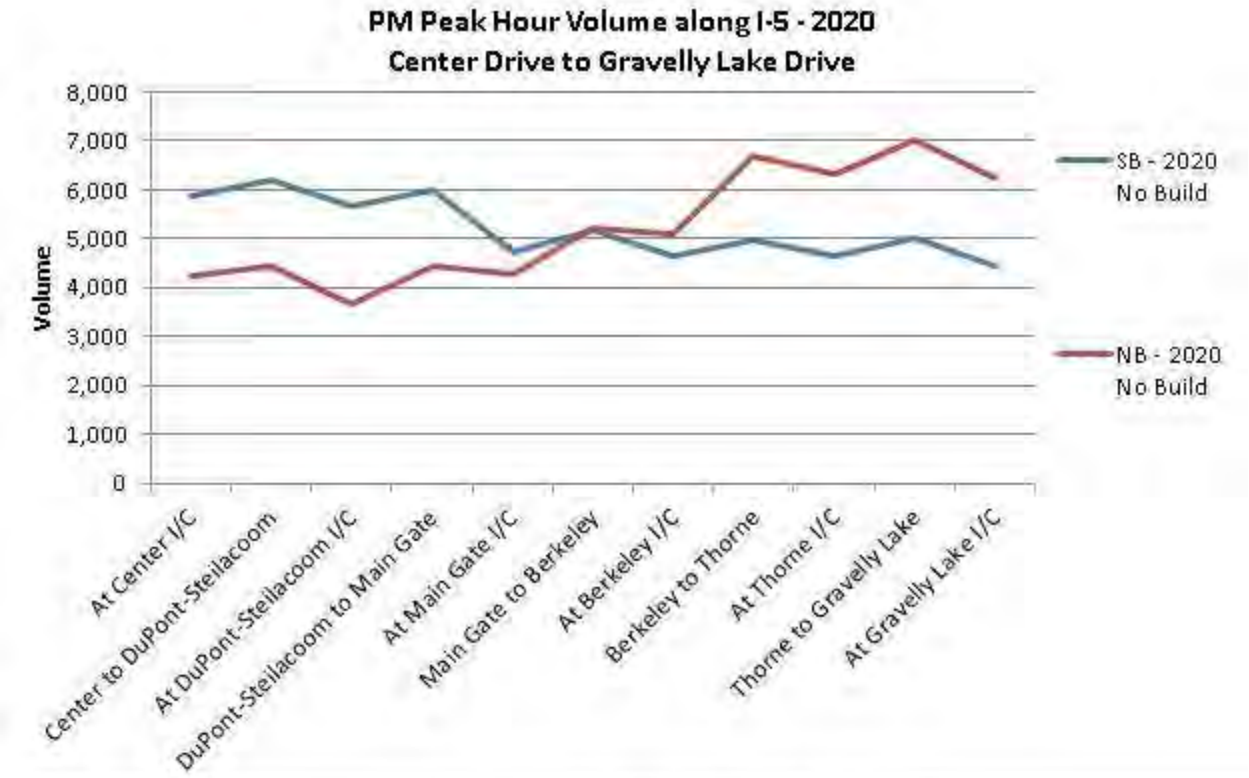
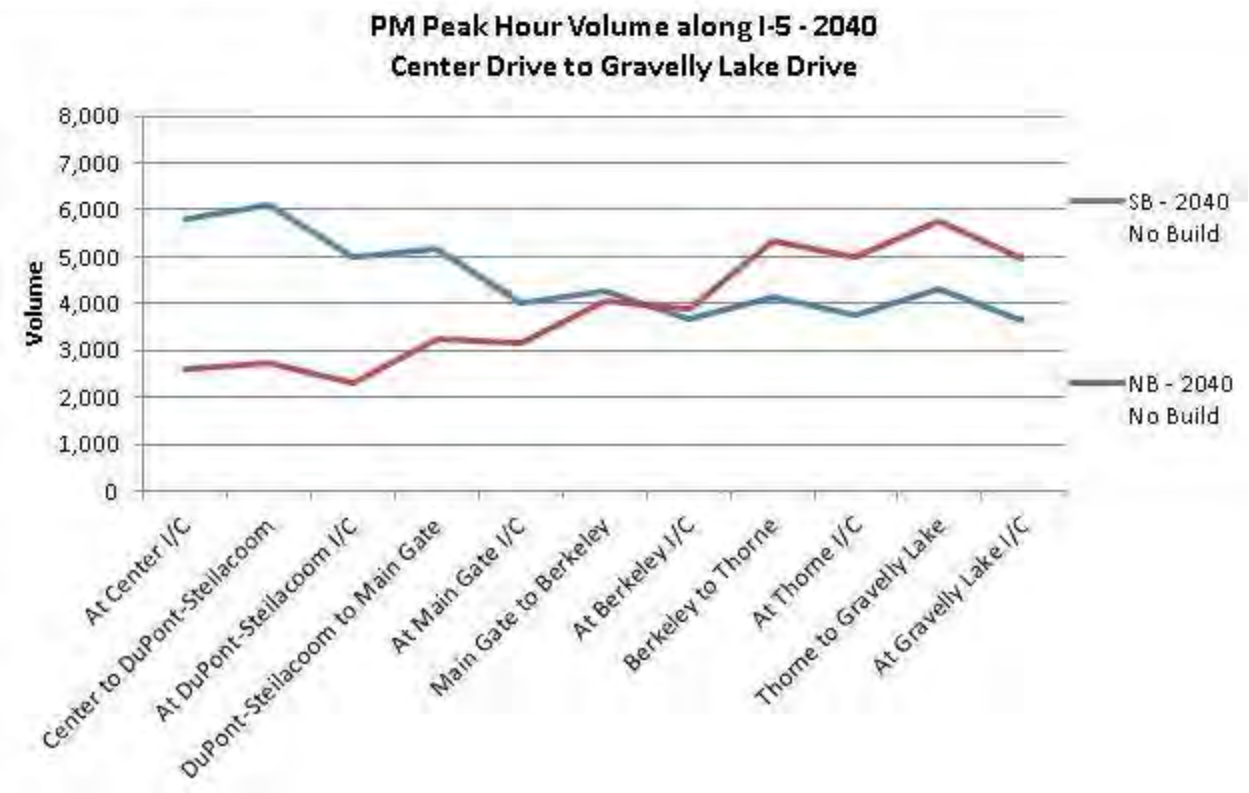


Figure 16: 2020 and 2040 PM Peak Hour Volumes on I-5 – No Build Alternative





The lower number of PM vehicle trips along I-5 as compared to the AM vehicle trips is because of the slower travel speeds in the PM which reduces the number of vehicles than can actually use the I-5 corridor during the PM peak hour. The small growth in vehicle trips along I-5 between 2020 and 2040 in the AM peak hour and the decrease in vehicle trips in the PM peak hour are also because of the reduction in average travel speeds, caused by the increased congestion, resulting in trips being diverted to other travel departure times.

6.2 Average Daily Traffic along the I-5 Mainline

Using the 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 from the Center Drive interchange and the Gravelly Lake Drive interchange is shown in Table 3. Due to the congestion along I-5 and the reduced number of travel lanes south of Thorne Lane, the No Build Alternative would attract fewer vehicles to the corridor and results in lower growth than the Build Alternative that includes added capacity. Depending on location, existing traffic volumes are projected to increase by approximately 0.8 percent to 1.4 percent per year over the long-range planning horizon (2040). A detailed summary of peak hour and ADT volumes in listed in Appendix D.

Table 3: Daily Traffic Growth on I-5 in the JBLM Vicinity

	2-Way Average Daily Traffic Volumes on I-5 in Vicinity of JBLM												
Scenario		**Center Drive**		**Steilacoom-DuPont Road**		**41st Division Drive**		**Berkeley Street**		**Thorne Lane**		**Gravelly Lake Drive**	
2013 Existing	122,000		124,000		120,000		129,000		137,000		146,000		143,000
2020 No Build	135,900		132,600		130,000		138,000		149,700		159,100		154,900
2020 Build Alt	135,700		137,300		141,800		154,400		168.900		167.300		158,800
2040 No Build	164,600		152,700		149,600		154,200		165,800		181,800		171,100
2040 Build Alt	165,600		158,900		170,100		183,900		195,0 00		192.000		176,600

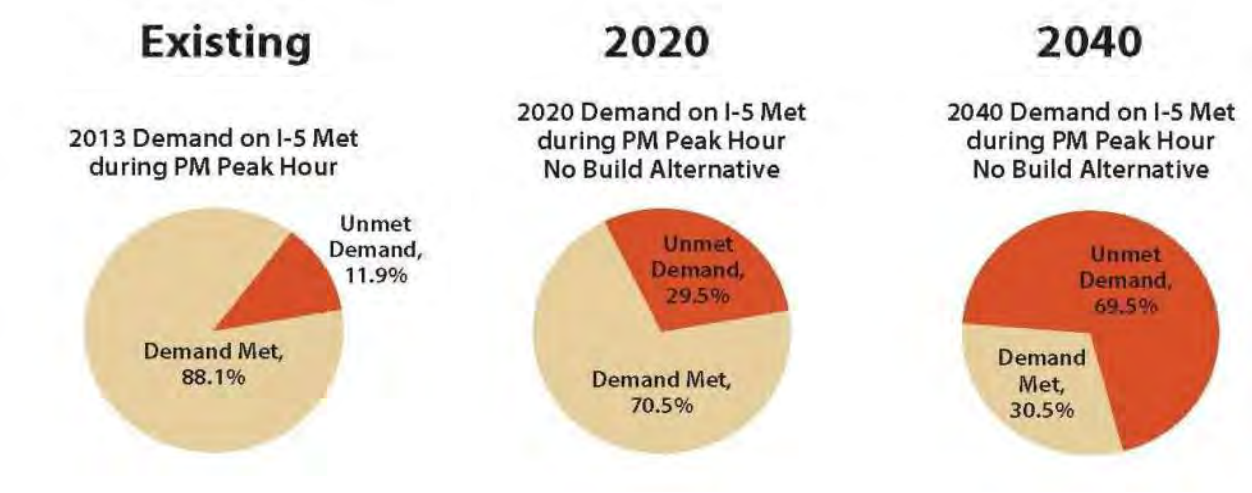
6.3 2020 and 2040 No Build Alternative Travel Demand along I-5

In 2013, 99 percent of the AM peak hour demand for travel on I-5 was accommodated and just over 88 percent of the PM peak hour was able to operate on I-5, based on person miles of travel from the Meso Model. By 2020, the ability of the No Build Alternative to meet AM peak hour demand is expected to about 94 percent, and by 2040 it would continue to drop to about 74 percent. During the PM peak hour, the travel demand that could be accommodated on I-5 with the No Build Alternative is forecast to drop to about 71 percent in in 2020, and to about 30 percent by 2040. Increased congestion along I-5 through the JBLM area prevents drivers who want to travel on I-5 from using it during peak travel times.

The traffic volume forecasts discussed in the preceding paragraphs and highlighted in Table 3 represent expectations of the level of traffic that would use I-5 in the study area in 2020 and 2040. 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 17, 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 2013 conditions during the PM peak hour. In 2020, the No Build Alternative would accommodate approximately 70 percent of demand, while in 2013 slightly more than 88 percent of demand was met. By 2040, the No Build Alternative would accommodate about 30 percent of the PM peak hour 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.

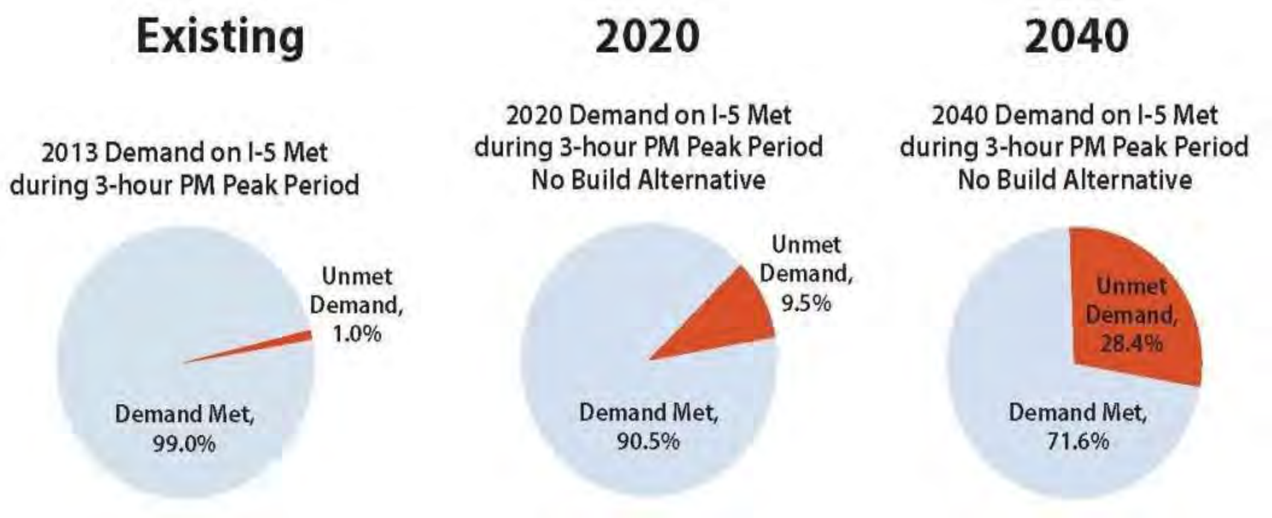
Figure 17: 2020 and 2040 Met and Unmet Travel Demand on I-5 during PM Peak Hour



*Demand based on person miles of travel estimate from Mesoscopic travel model.

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 16 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 18 also shows that as demand grows to 2020, over 90 percent of demand could be accommodated with the No Build Alternative. By 2040, less than 72 percent of demand could be accommodated by the No Build Alternative during the three-hour PM peak period.

Figure 18: 2020 and 2040 Met and Unmet Demand on I-5 during PM Peak 3-hours



*Demand based on person miles of travel estimate from Mesoscopic travel model.

6.4 Average 2020 and 2040 I-5 Travel Speeds

Predicted average travel speeds along the I-5 corridor in 2020 and 2040 for the AM peak hour are illustrated in Figure 19. As can be observed from the figure, 2020 and 2040 AM peak hour northbound travel speeds along I-5 would be around the posted speed of 60 mph north of Center Drive. In the southbound direction, travel speeds are expected to fall below 42 mph or LOS F north of Thorne Lane. These slow speeds would be attributed to the reduction in the number of travel lanes from four lanes to three lanes, requiring drivers to merge. This slows traffic and causes back-ups north of this choke point.

Figure 20 illustrates expected travel speeds during the 2020 and 2040 PM peak hours. As shown in this figure, 2020 and 2040 PM peak hour northbound travel speeds would be below 42 mph or LOS F, with some sections below 10 mph. The only exception is north of Thorne Lane where speeds are expected to return to near the posted speed limit, because the number of travel lanes increase from three to four lanes. Figure 21 presents projected PM peak hour travel speeds visually.

Figure 19: 2020 and 2040 AM Peak Hour Average Travel Speeds on I-5 – No Build Alternative

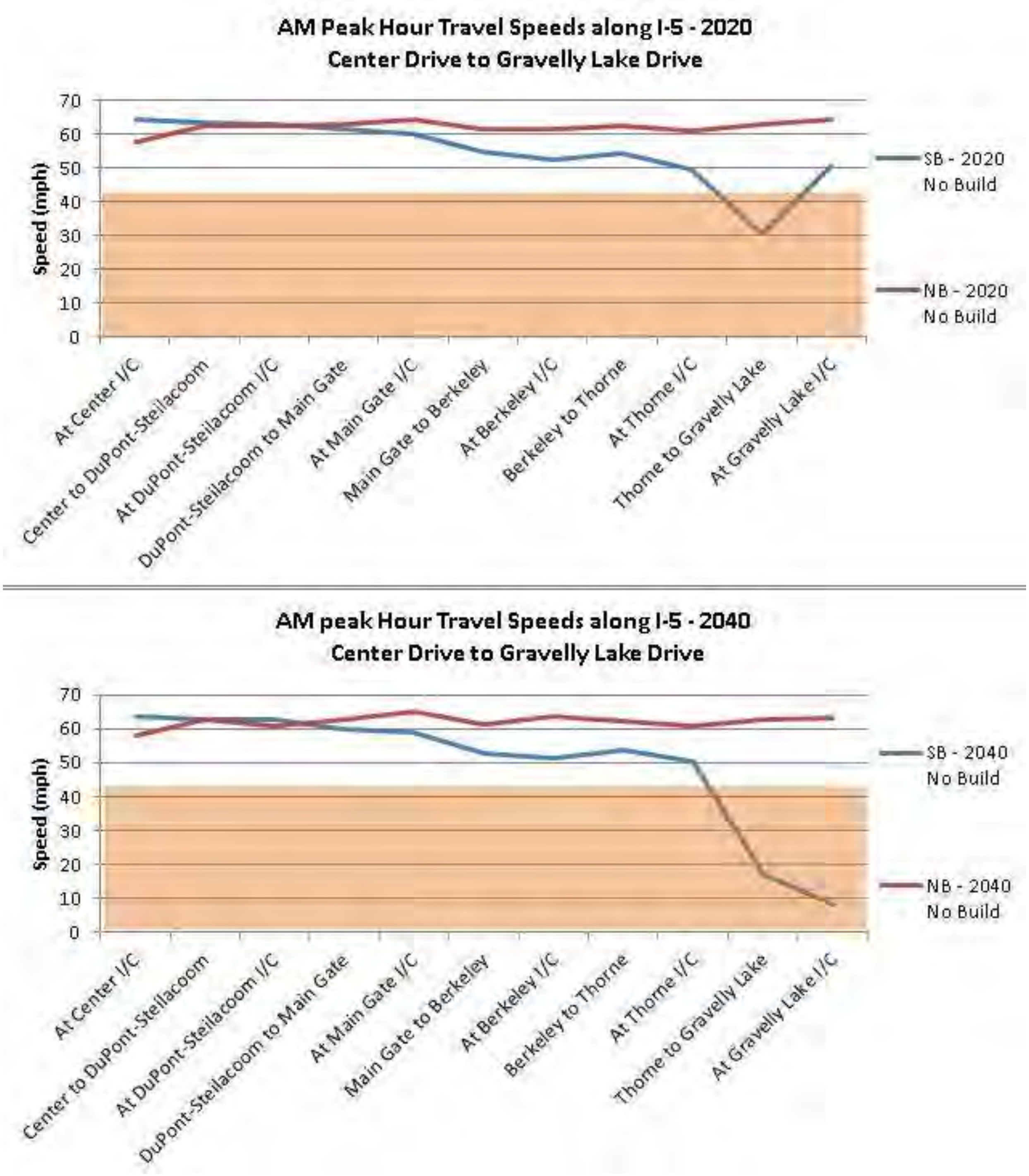


Figure 20: 2020 and 2040 PM Peak Hour Average Travel Speeds on I-5 – No Build Alternative

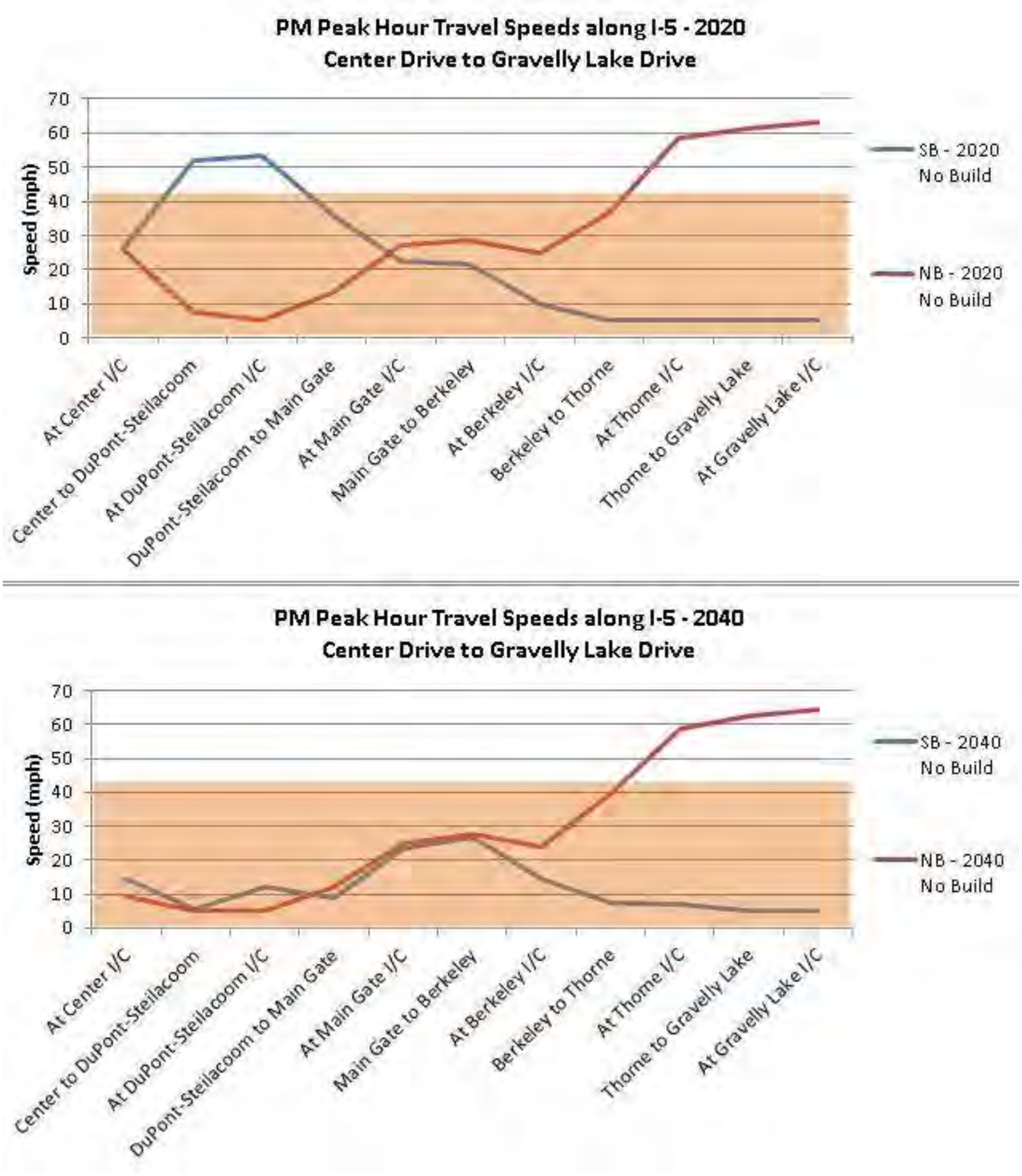
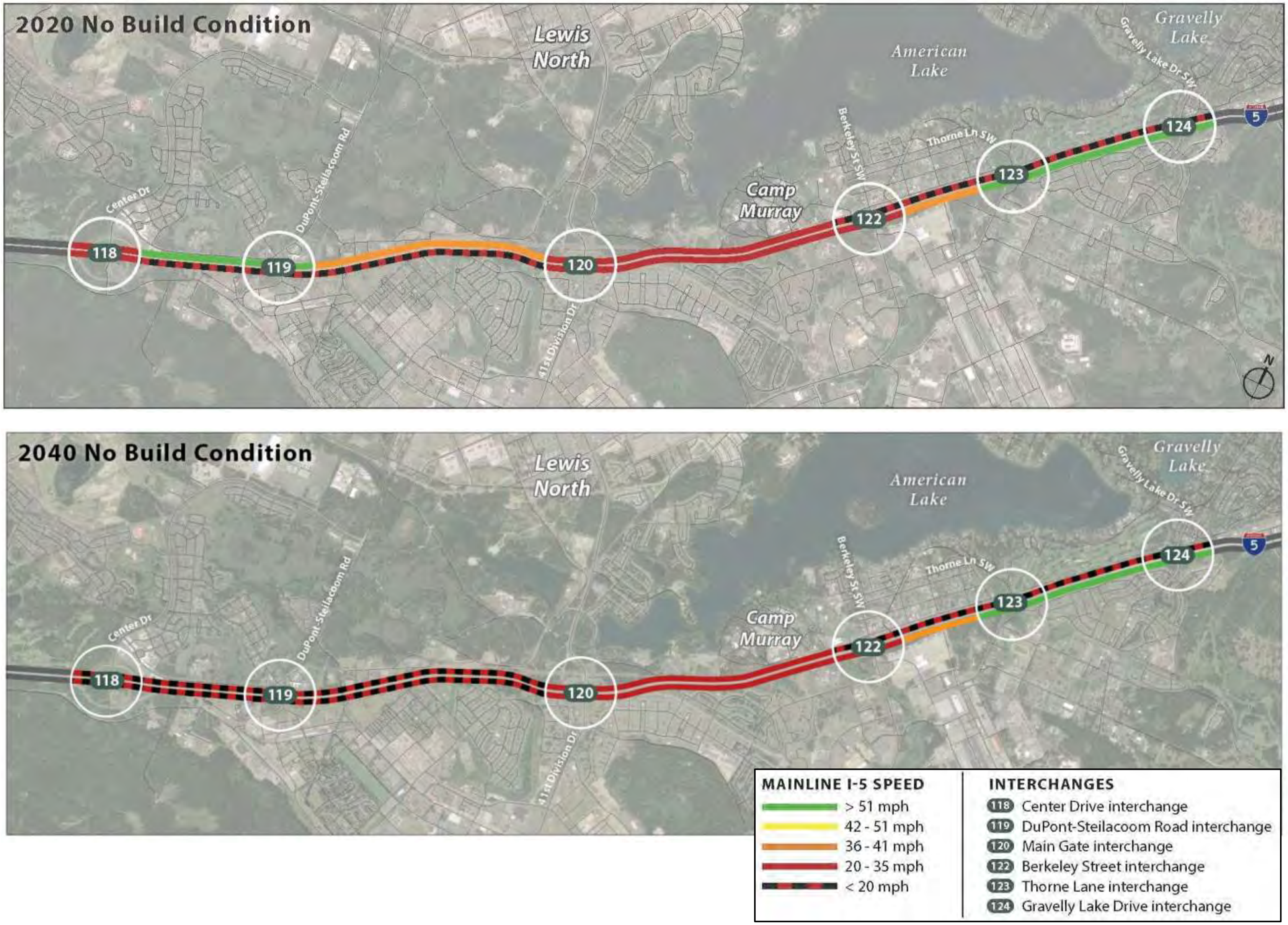


Figure 21: 2020 and 2040 PM Peak Hour Travel Speeds on I-5 between Center Drive and Gravelly Lake Drive – No Build Alternative



In the southbound direction during 2020, PM peak hour travel speeds would be generally below 42 mph or LOS F, except for a short section between Steilacoom-DuPont Road and Center Drive where traffic speeds are expected to increase to around 50 mph as traffic volumes stabilize. During 2040 southbound travel speeds on I-5 between Gravelly Lake Drive and Center Drive are expected to be less than 30 mph with some sections at 10 mph or below. These slow average PM speeds signify severe congestion with slow moving vehicles and periods of stop-and-go traffic.

6.5 2020 and 2040 Hours of Congestion along I-5

Based on the Mesoscopic Model data, estimates were made of the number of hours the travel speed operated below 70 percent of posted speed or 42 mph in 2020 and 2040. Based on the analysis, less than one hour of congestion north of Thorne Lane is expected to occur southbound during the AM peak period in 2020. By 2040, the congestion north of Thorne Lane is expected to increase to 3.5 hours during the AM peak period.

During the PM peak period in 2020 and 2040, several hours of congestion occur along I-5 between Center Drive and Gravelly Lake Drive, as illustrated in Figure 22. These hours of congestion could last around four hours in 2020 and over five hours by 2040 in both the northbound and southbound directions.

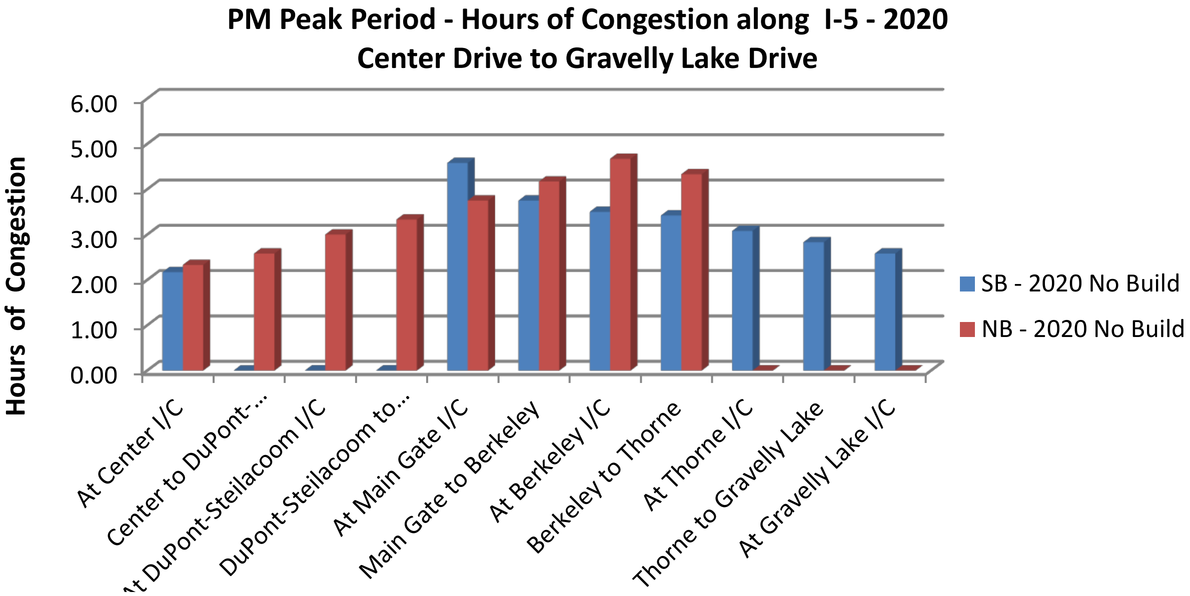
The travel speed diagrams, illustrated in Figure 23, show that these slow average speeds and hours of congestions during the PM peak period extend between 2:00 PM and 8:00 PM and beyond. These diagrams show that there are several areas that speeds fall below 42 mph. In 2020, the southbound congestion generally extends north of the Main Gate Interchange with some congestion associated with the heavy on-ramp traffic at Center Drive. The northbound congestion in 2020 is south of Thorne Lane where the number of travel lanes increase from three lanes to four lanes. By 2040, congestion extends past the 8:00 PM analysis period and would geographically extend both north and south of the study area.

6.6 2020 and 2040 On- and Off-Ramp No Build Alternative Volumes along I-5

On- and Off-ramp volumes along I-5 between Center Drive and Gravelly Lake Drive remain high in 2020 and 2040. A comparison of the 2020 and 2040 AM peak hour on- and off-ramp volumes is shown in Figure 24. Overall, ramp volumes generally decrease in 2040 over the 2020 volumes during the peak hour because of increased congestion along I-5.

Similarly, in 2040 AM peak hour, there are about 3,660 vehicles exiting I-5 and 2,070 vehicles entering I-5 at these seven interchanges southbound and about 3,450 vehicles exiting I-5 and 3,040 vehicles entering I-5 northbound. Again, the total of trips entering and exiting I-5 continues to be more than the capacity of a single lane, requiring drivers to shift lanes.

Figure 22: Hours of Congestion on I-5 during 2020 and 2040 PM Peak Periods from Center Drive to Gravelly Lake Drive – No Build Alternative



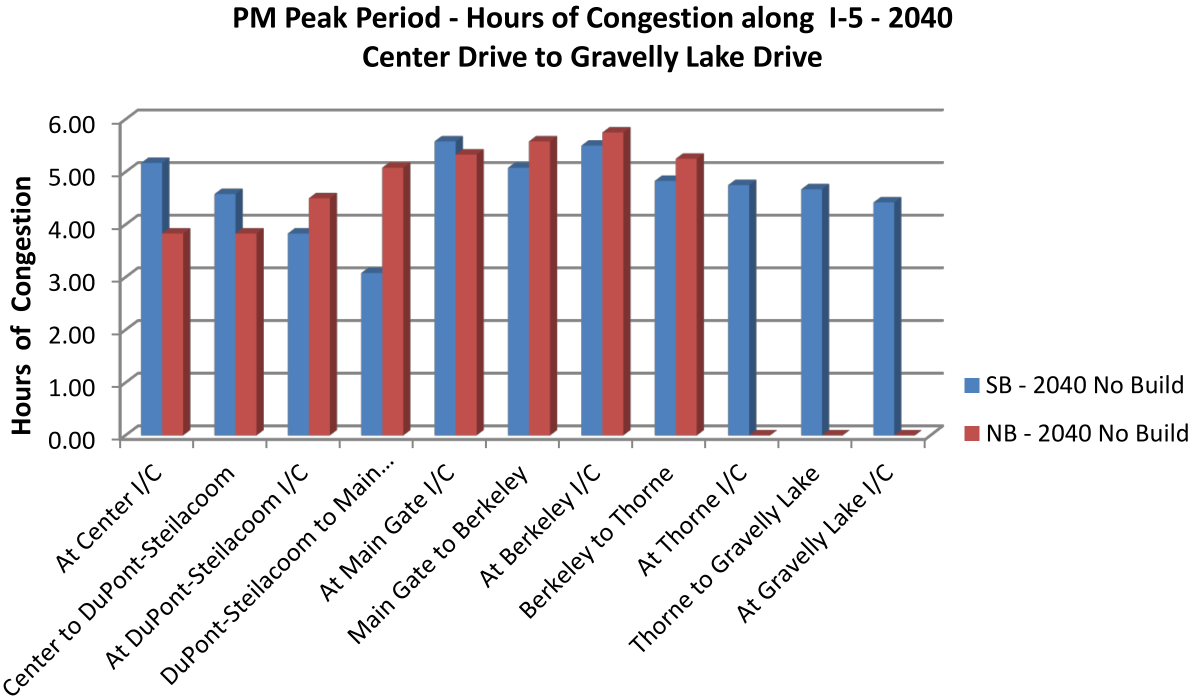
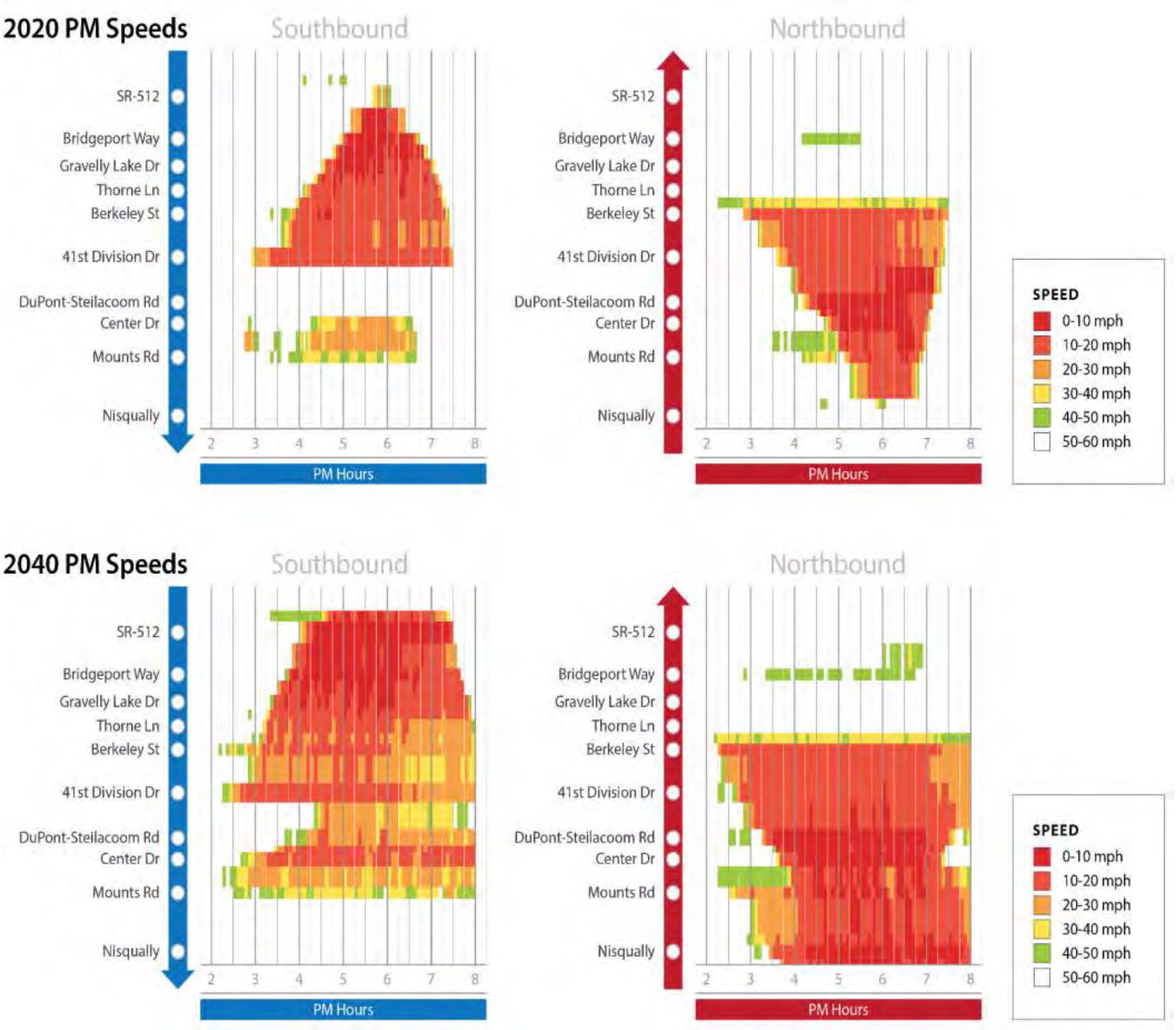
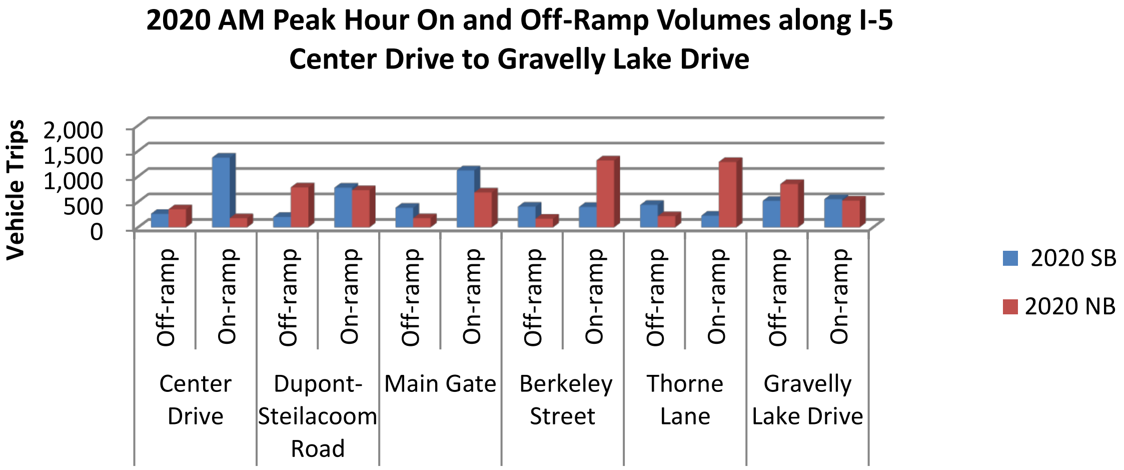


Figure 23: Travel Speeds on I-5 during the 2020 and 2040 PM Peak Period – No Build Alternative



A comparison of the PM peak hour on- and off-ramp volumes in 2020 and 2040 is shown in Figure 25. Overall at the six interchanges along I-5 in the study area in 2020, there are a total of about 2,300 vehicles exiting I-5 and 4,370 vehicles entering I-5 southbound, and about 2,640 vehicles exiting I-5 and 4,760 vehicles entering I-5 northbound.

Figure 24: 2020 and 2040 AM On- and Off-Ramp Volumes on I-5 from Center Drive to Gravelly Lake Drive – No Build Alternative



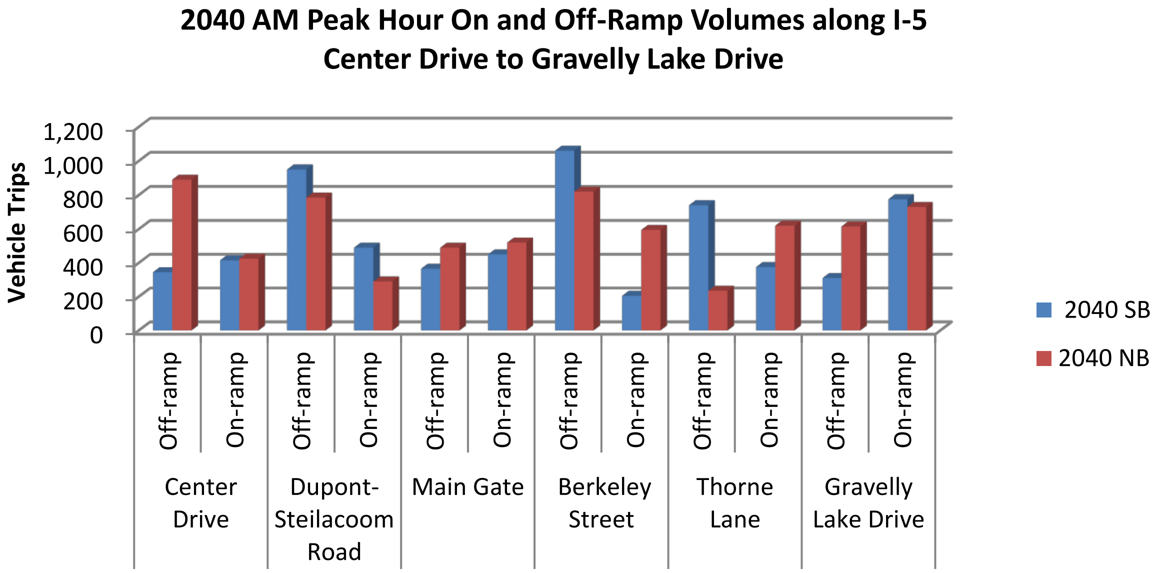
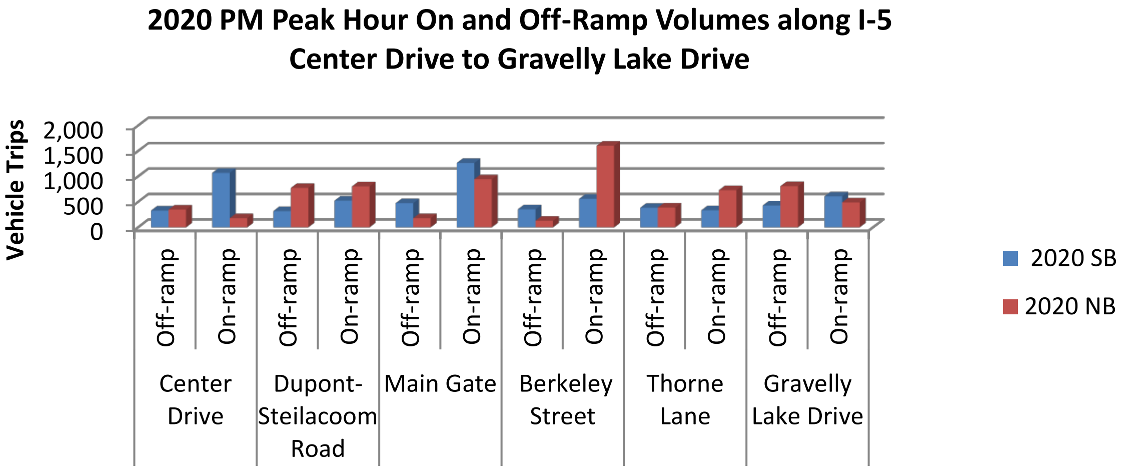
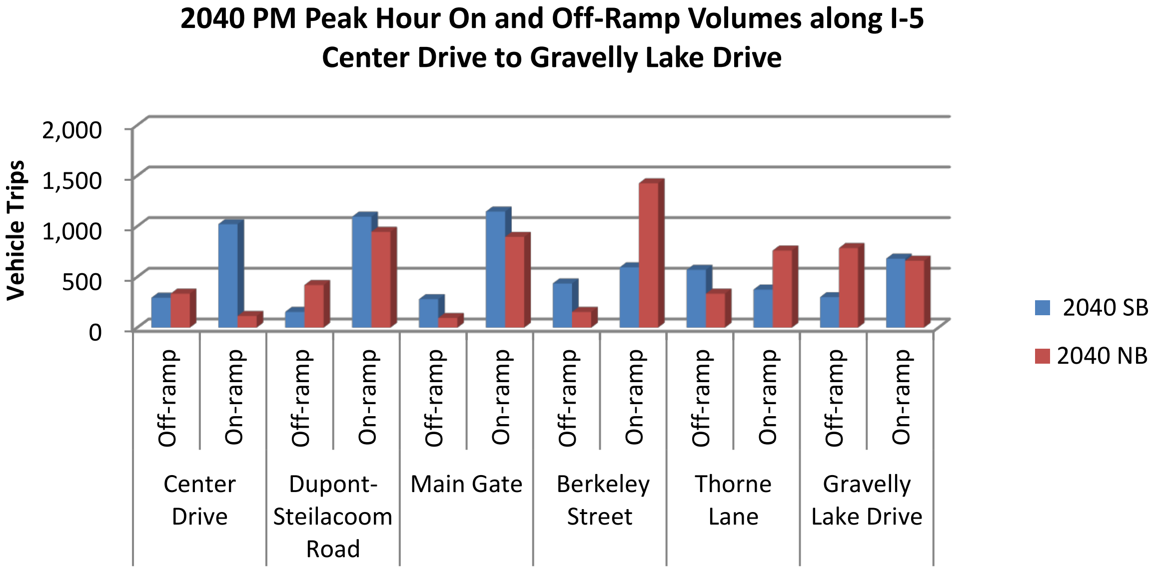


Figure 25: 2020 and 2040 PM On- and Off-Ramp Volumes on I-5 from Center Drive to Gravelly Lake Drive – No Build Alternative





Similarly, in 2040 during the PM peak hour, there are about 2,210 vehicles exiting I-5 and 4,500 vehicles entering I-5 at these six interchanges southbound and about 2,220 vehicles exiting I-5 and 4,740 vehicles entering I-5 at these six interchanges northbound

All of this traffic cannot be in the outside lane at the same time, so drivers frequently change lanes to enter and exit I-5. This heavy amount of lane change movement causes traffic to slow, increases congestion, and reduces the overall traffic throughput in the JBLM area.

6.7 Comparison of I-5 No Build Alternative Travel Times

A comparison of No Build Alternative travel times along I-5 between Center Drive and Gravelly Lake Drive was made using output from the Meso Model. As shown on Figure 26, drivers traveling southbound on I-5 during the AM peak period would generally operate near or at the posted speed limit in 2013 and 2020 and take about nine minutes. By 2040, southbound travel time would increase to about 12 minutes in the northbound direction in 2013, drivers operated about the posted speed and take around 8.1 minutes to travel between Center Drive and Gravelly Lake Drive. In both 2020 and 2040, the No Build Alternative northbound travel time would increase to about nine minutes during the AM peak hour.

During the PM peak period, 2013 southbound travel times along I-5 between Center Drive and Gravelly Lake Drive were estimated at about 15 minutes with no accidents, while in the northbound direction, it would take drivers about 12 minutes. By 2020, No Build Alternative southbound PM travel times are expected to increase to around 37 minutes, while it would take northbound drivers about 26 minutes to travel between Center Drive and Gravelly Lake Drive.

Figure 27 plots the travel time data in the northbound direction. In the northbound direction, 2040 No Build Alternative PM peak hour travel times are expected to increase to about 34 minutes between Center Drive and Gravelly Lake Drive. In the southbound direction, 2040 No Build Alternative PM peak hour travel times are expected to increase to about 48 minutes during the peak hour. The southbound 2040 PM Peak hour travel time between Thorne Lane and Main Gate is expected to be slightly better than the 2020 travel time because of a bottleneck at SR 512 which is limiting the amount of traffic that can travel southbound in 2040 and allows some drivers to temporarily speed up in this area. In 2020, the SR 512 bottleneck is less restrictive than in 2040 so more traffic can get through which reduces travel speeds between Thorne Lane and Main Gate.

Figure 26: Comparison of Southbound Cumulative Travel Times during AM and PM Peak Hours – No Build Alternative

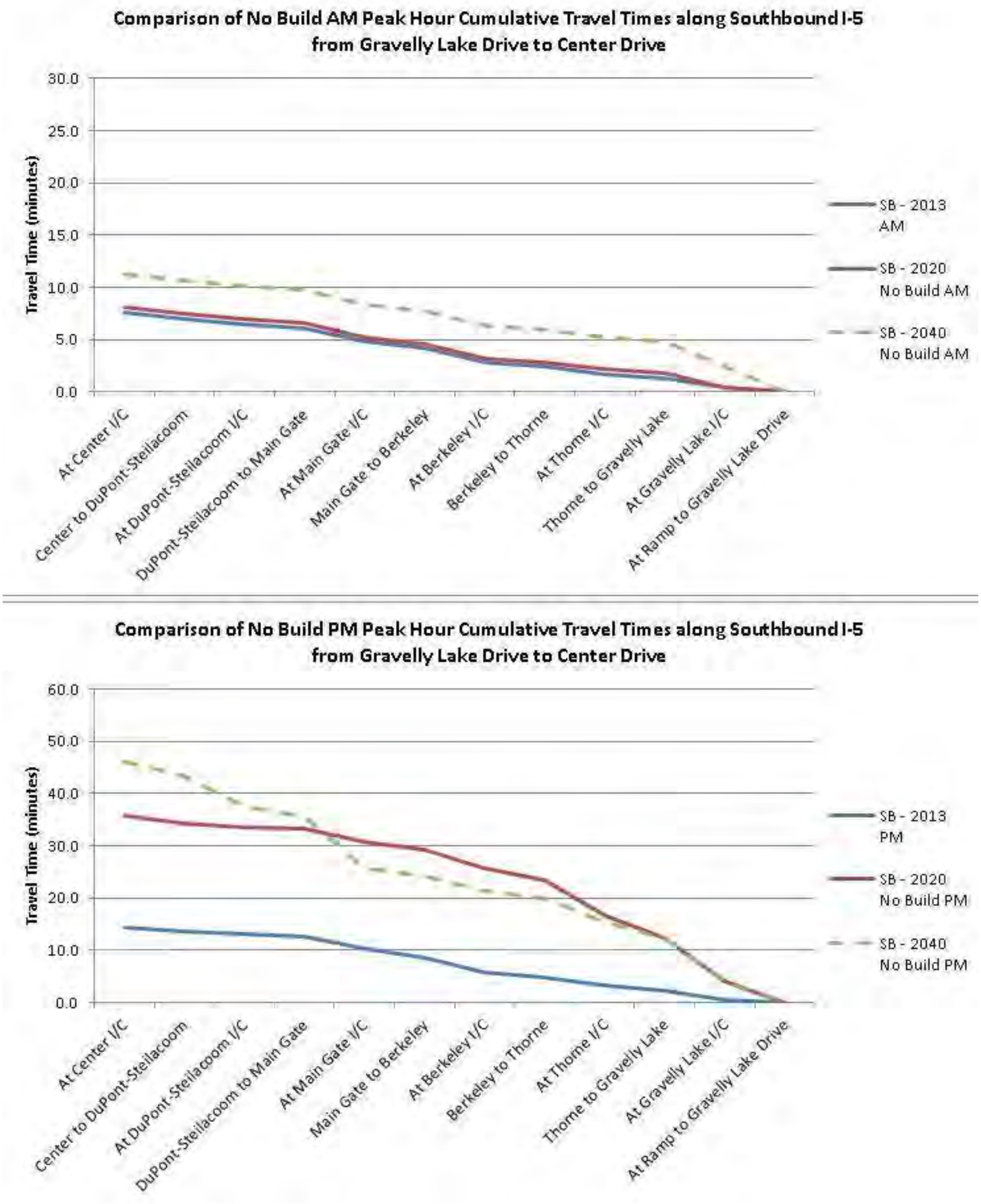
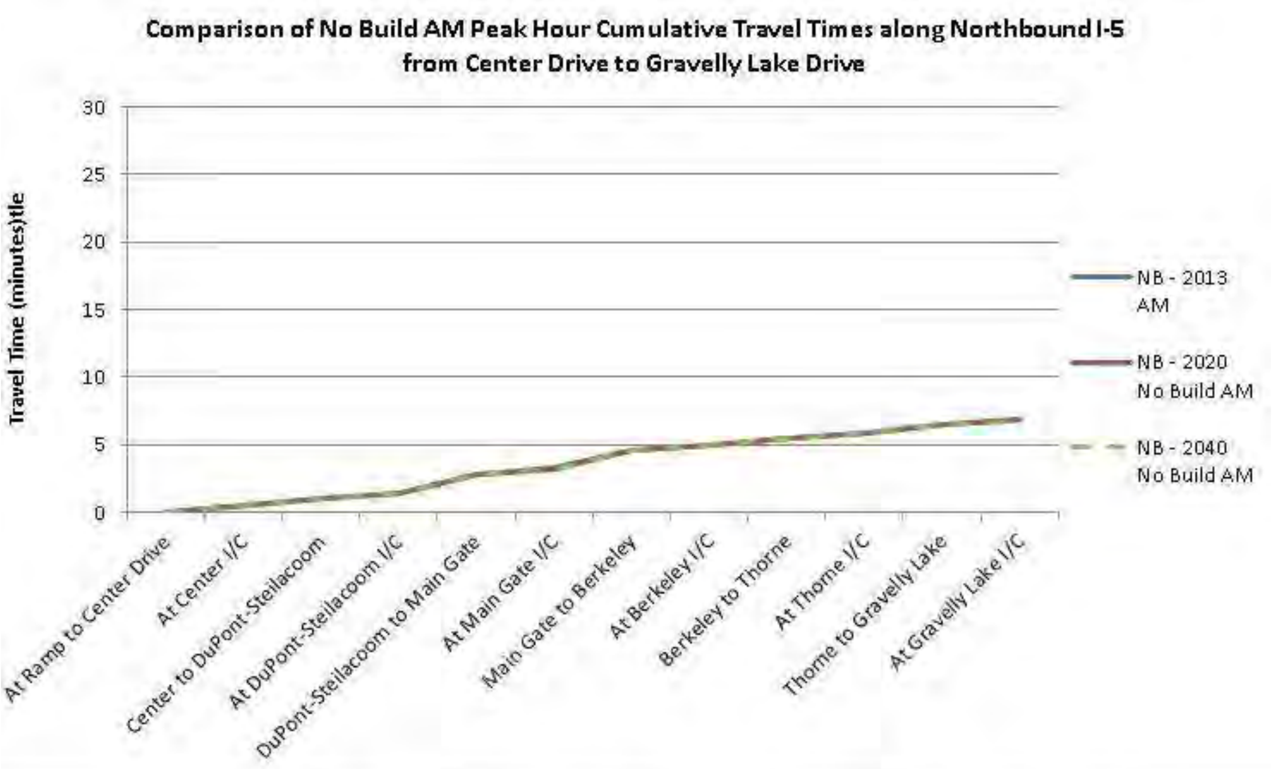
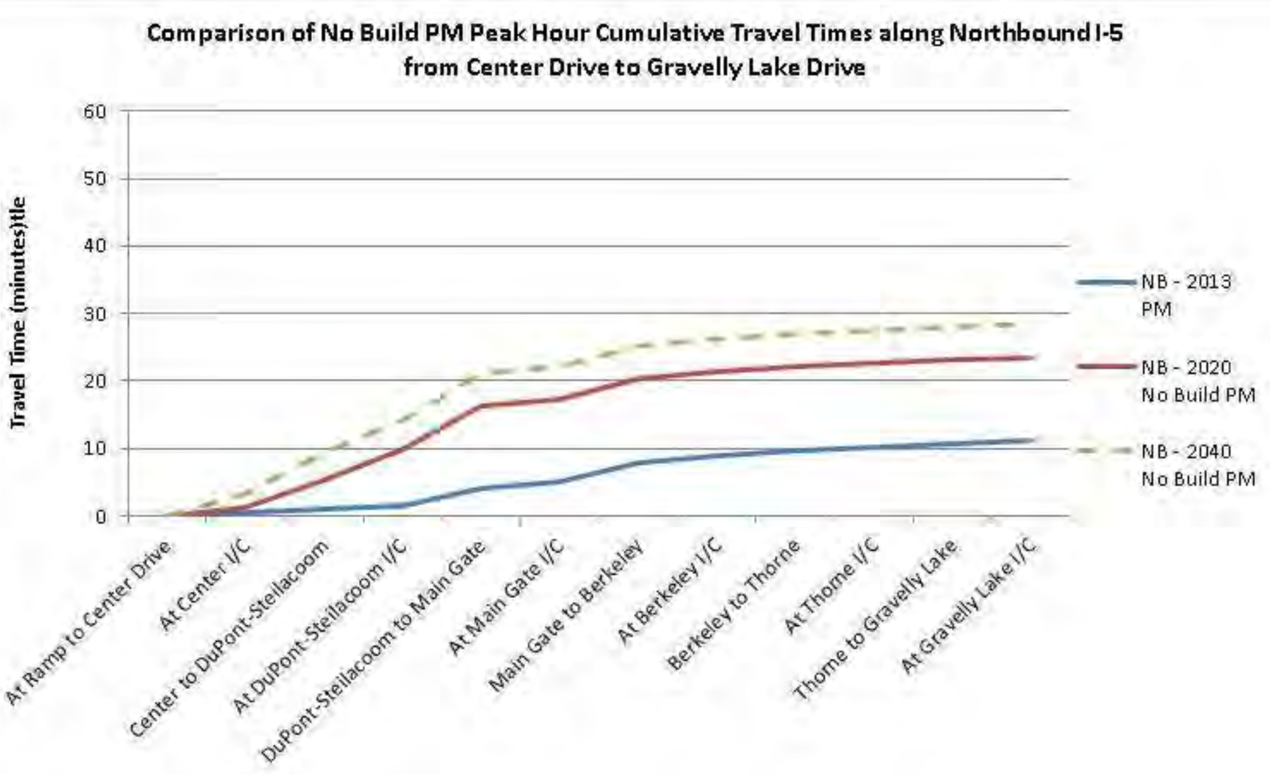


Figure 27: Comparison of Northbound Cumulative Travel Times during AM and PM Peak Hours – No Build Alternative





6.8 Summary of Future Year Intersection Analysis with the No Build Alternative at the Reconfigured and Adjacent Interchanges along I-5

The future year intersection analyses at the I-5 interchanges with the No Build Alternative assumed that the following intersection and mainline improvements were implemented:

- A southbound auxiliary lane was added between the Thorne Lane on-ramp to the Berkeley Street off-ramp
- Ramp meters were added to the on-ramps at all interchanges except the northbound Thorne Lane ramp
- The Madigan Access improvements at the Berkeley Street Interchange were implemented, including a second left-turn lane on the southbound off-ramp, a second lane on the Berkeley Street bridge easterly towards JBLM, and a third lane on Murray Road from the northbound off-ramps into JBLM.
- I-5 northbound ramp intersection with Center Drive was improved to better tie the exit from JBLM into the intersection.

The intersection analyses were conducted using Synchro software following the Highway Capacity Manual procedures. The results of these analyses for the two Build Alternative interchanges are summarized in Table 4. The analyses show that during the AM and PM peak hours, intersections at the Thorne Lane Interchange would operate at LOS D or better in both 2020 and 2040. The interim Madigan Access Improvements would allow the Berkeley Street Interchange to operate at LOS D or better in 2020 and 2040.

The results of the intersection analyses for the adjacent interchanges at Center Drive, Steilacoom-DuPont Road, and Gravelly Lake Drive are summarized in Table 5. The analyses show that the ramp intersections at Center Drive, Steilacoom-DuPont Road, and at Gravelly Lake Drive would operate at LOS D or better during the 2020 AM and PM peak hours. In 2040 the southbound ramp intersections at Center Drive and Steilacoom-DuPont Road would operate at LOS E during the AM peak hour. During the 2040 PM peak hour the intersections of the northbound and southbound ramps at Steilacoom-DuPont Road and at Gravelly Lake Drive are expected to be at or below LOS D.

In reviewing these results, it is important to remember the following data constraints:

- Congestion along I-5 limits the amount of traffic wanting to use I-5, as indicated in the previous section (only 30 percent of the demand that wants to use I-5 during the 2040 PM peak hour can actually use I-5). This reduces the amount of traffic at the various intersections.
- The Synchro analyses do not account for queue back-ups on the on-ramps from the ramp meters or queues from I-5 congestion into the intersection.

A list of the turning movements used for both the Synchro analyses and from the mesoscopic model is shown in Appendix B. A more detailed summary of the intersection analyses is contained in Appendix C.

Table 4: Summary of Interchange Delay and Level of Service (LOS) at the Reconfigured Interchanges – No Build Alternative

Intersection[2]	**2013 Existing**		**2020 No Build**[3]		**2040 No Build**[3]	
	AM	PM	AM	PM	AM	PM
I-5 NB Ramps / Berkeley Street[3]						
Control Type	Signal		Signal		Signal	
Average Delay (sec) / LOS	25.7/C	29.7/C	16.3/B	20.8/C	11.4/B	14.5/B
I-5 SB Ramps / Berkeley Street[3]						
Control Type	Signal		Signal		Signal	
Average Delay (sec) / LOS	**69.2/E**	54.0/D	36.0/D	26.0/C	32.4/C	23.8/C
Berkeley Street / Union Avenue						
Control Type	All-way Stop		Signal		Signal	
Average Delay (sec) / LOS	10.6/B	12.1/B	11.0/B	12.0/B	10.0/B	12.7/B
Berkeley Street / Washington Ave						
Control Type	2-way Stop		2-way Stop		2-way Stop	
Average Delay (sec) / LOS	NA	NA	12.6/B	14.3/B	14.2/B	12.2/B
I-5 NB Ramps / Thorne Lane						
Control Type	Signal		Signal		Signal	
Average Delay (sec) / LOS	**56.9/E**	**71.2/E**	34.2/C	37.9/D	37.3/D	36.6/D
I-5 SB Ramps / Thorne Lane						
Control Type	Signal		Signal		Signal	
Average Delay (sec) / LOS	**58.7/E**	49.1/D	33.9/C	47.5/D	49.5/D	44.4/D
Thorne Lane / Union Avenue						
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	11.2/B	12.8/B

Notes [1] LOS values less than “D” shown in bold font

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

[3] Assumes Madigan Access Improvements at the Berkeley Street Interchange are implemented by 2020

Table 5: Summary of Interchange Delay and Level of Service (LOS) at other Area Interchanges – No Build Alternative

Intersection[2]	2013 Existing		2020 No Build		2040 No Build	
	AM	PM	AM	PM	AM	PM
I-5 NB Ramps / Center Drive[3]						
Control Type	2-way Stop		2-way Stop		2-way Stop	
Average Delay (sec) / LOS	NA	**40.8/E**	12.3/B	12.7/B	12.0/B	11.9/B
I-5 SB Ramps / Center Drive						
Control Type	2-way Stop		2-way Stop		2-way Stop	
Average Delay (sec) / LOS	13.9/B	12.7/B	18.6/C	13.3/B	**35.1/E**	13.2/B
Center Drive / Wilmington Drive						
Control Type	Signal		Signal		Signal	
Average Delay (sec) / LOS	13.0/B	14.7/B	14.1/B	20.2/C	18.4/B	20.2/C
I-5 NB Ramps / Steilacoom-DuPont Road						
Control Type	Signal		Signal		Signal	
Average Delay (sec) / LOS	32.3/C	49.9/D	22.5/C	45.1/D	29.7/C	**57.9/E**
I-5 SB Ramps / Steilacoom-DuPont Road						
Control Type	Signal		Signal		Signal	
Average Delay (sec) / LOS	18.8/B	27.3/C	34.0/C	29.1/C	**68.7/E**	37.5/D
Steilacoom-DuPont Road / Barksdale Avenue / Wilmington Drive						
Control Type	Signal		Signal		Signal	
Average Delay (sec) / LOS	43.1/D	29.7/C	36.9/D	27.1/C	**58.2/E**	26.6/C
I-5 NB Ramps / Gravelly Lake Drive						
Control Type	Signal		Signal		Signal	
Average Delay (sec) / LOS	39.8/D	**70.3/E**	46.5/D	41.6/D	35.4/D	49.6/D
I-5 SB Ramps / Gravelly Lake Drive						
Control Type	Signal		Signal		Signal	
Average Delay (sec) / LOS	41.9/D	47.3/D	31.3/C	37.2/D	32.8/C	40.8/D
Gravelly Lake Drive / Pacific Highway						
Control Type	Signal		Signal		Signal	
Average Delay (sec) / LOS	25.5/C	29.0/C	32.0/C	37.1/D	34.6/C	34.7/C

Notes [1] LOS values less than "D" shown in bold font

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

[3] The I-5 NB Ramps / Center Drive intersection was redesigned in 2015. This new design is reflected in the 2020 and 2040 analysis.

7.0 Description of the Build Alternative

Based on the analysis conducted in the *Corridor Plan Feasibility Study*, the *Multimodal Alternatives Analysis*, and the preliminary corridor traffic analysis, the most promising alternative was selected for further environmental analysis as part of the NEPA assessment and the I-5 JBLM Vicinity Interchange Justification Report (IJR). The *Corridor Plan Feasibility Study*, the *Multimodal Alternatives Analysis*, and a description of the alternative packages considered are included in Appendix E. The Build Alternative includes the following elements, as illustrated in Figure 28:

- **Mainline widening** adds a fourth lane northbound on I-5 from the Steilacoom-DuPont Road interchange on-ramp to Thorne Lane interchange, and southbound from Thorne Lane to Center Drive. The new lanes would operate for General Purpose (GP) traffic. See Figure 28 for an illustration of the added travel lanes.
- **Auxiliary lanes** would be added northbound between the Berkeley Street and Thorne Lane interchanges and between the Thorne Lane and Gravelly Lake Drive interchanges. The existing southbound auxiliary lanes would be maintained between Thorne Lane and Berkeley Street and between Center Drive and Mounts Road. The existing northbound auxiliary lane between Center Drive and Steilacoom-DuPont Road would also be maintained. See Figure 29 for the location of existing and proposed auxiliary lanes.
- **Interchange reconfigurations** are included at Thorne Lane and at Berkeley Street:
    - The Thorne Lane Interchange would be relocated approximately 350 feet south of the existing Thorne Lane Bridge and reconfigured as a tight diamond interchange with roundabouts at the ramp intersections. It would be elevated to grade separate Thorne Lane over the adjacent rail line and Union Avenue. A new loop road would be added to connect Thorne Lane with Union Avenue. A preliminary rendering of the relocated Thorne Lane Interchange is illustrated in Figure 30.
    - The Berkeley Street Interchange would be relocated approximately 120 feet south of the existing Berkeley Street Bridge and reconfigured as a tight diamond interchange with roundabouts at the ramp intersections. It would be elevated to grade separate the extension of Jackson Avenue over the adjacent rail line and Militia Drive. The extended Jackson Avenue would loop around an existing business and descend to grade at the intersection of Berkeley Street and Washington Avenue. A preliminary rendering of the relocated Berkeley Street Interchange is also illustrated in Figure 30.
    - The relocated interchanges would be designed to accommodate I-5 mainline widening, improve traffic operations at the interchanges, provide pedestrian and bicycle facilities and accommodate planned community growth and support activities at JBLM and Camp Murray through improved access and circulation.

Figure 28: Proposed Build Alternative

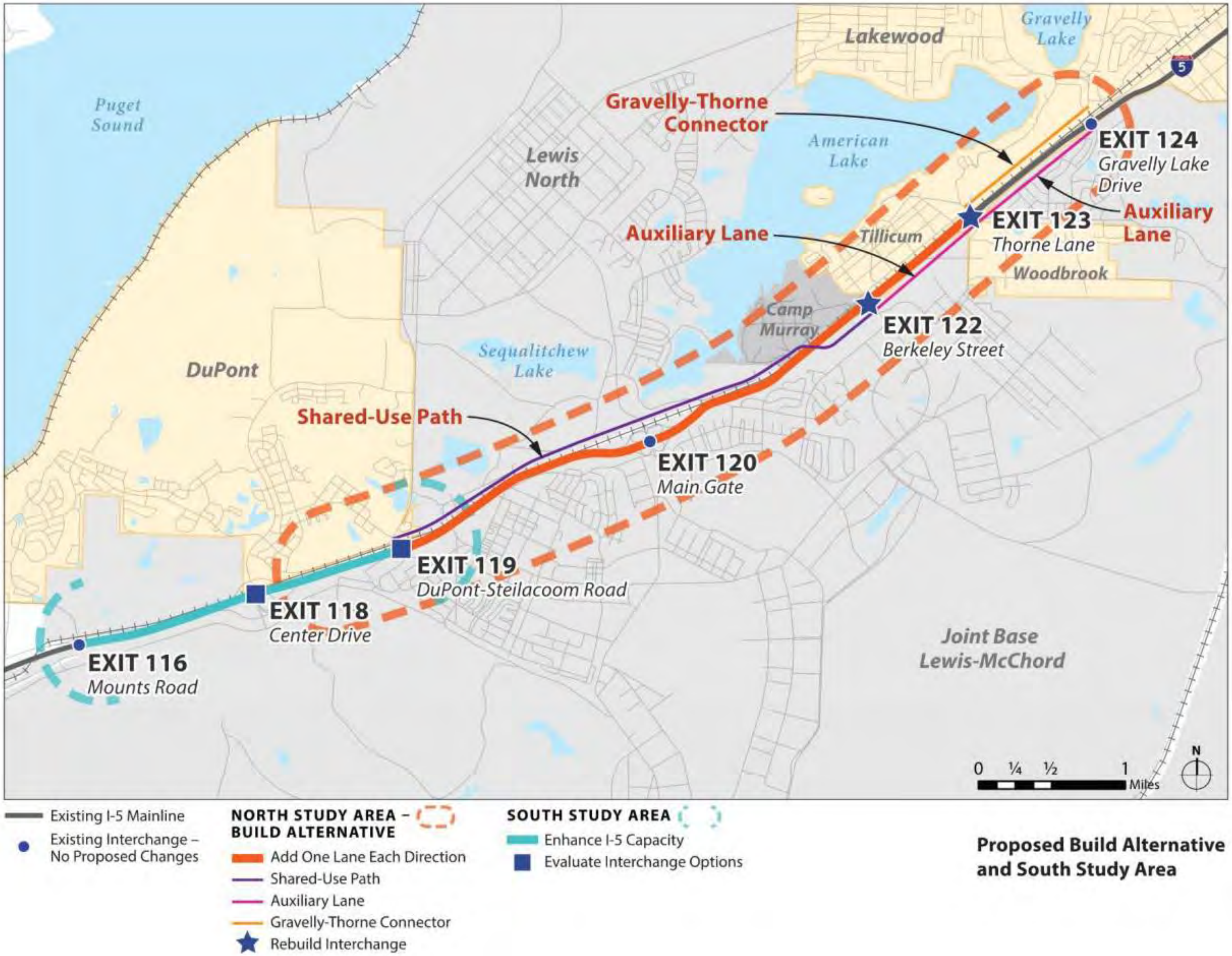


Figure 29: Existing and Proposed I-5 Build Alternative with Average Daily Traffic

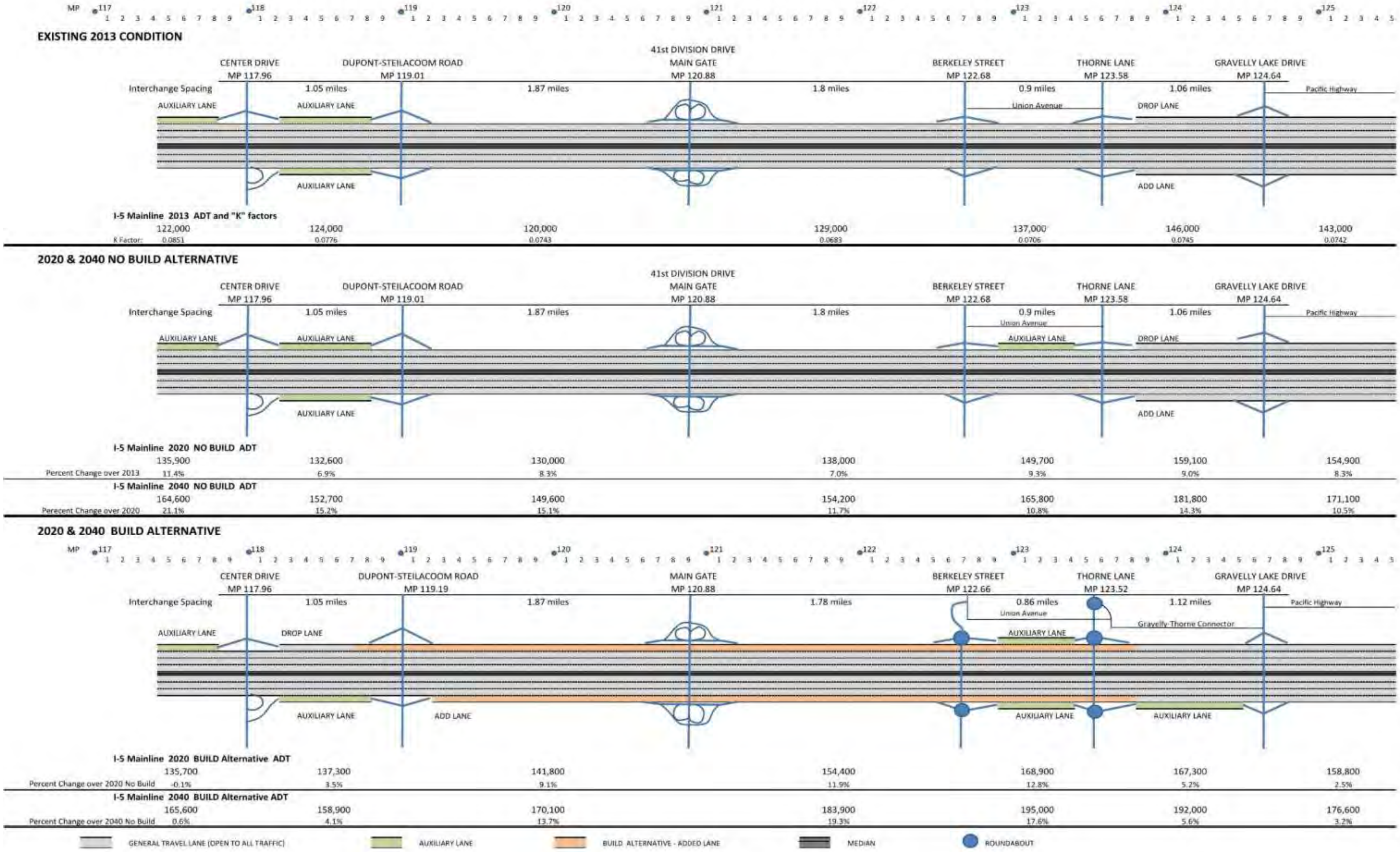


Figure 30: Proposed Thorne Lane and Berkeley Street Interchange Concepts

Rendering of the Proposed I-5/Thorne Lane Interchange

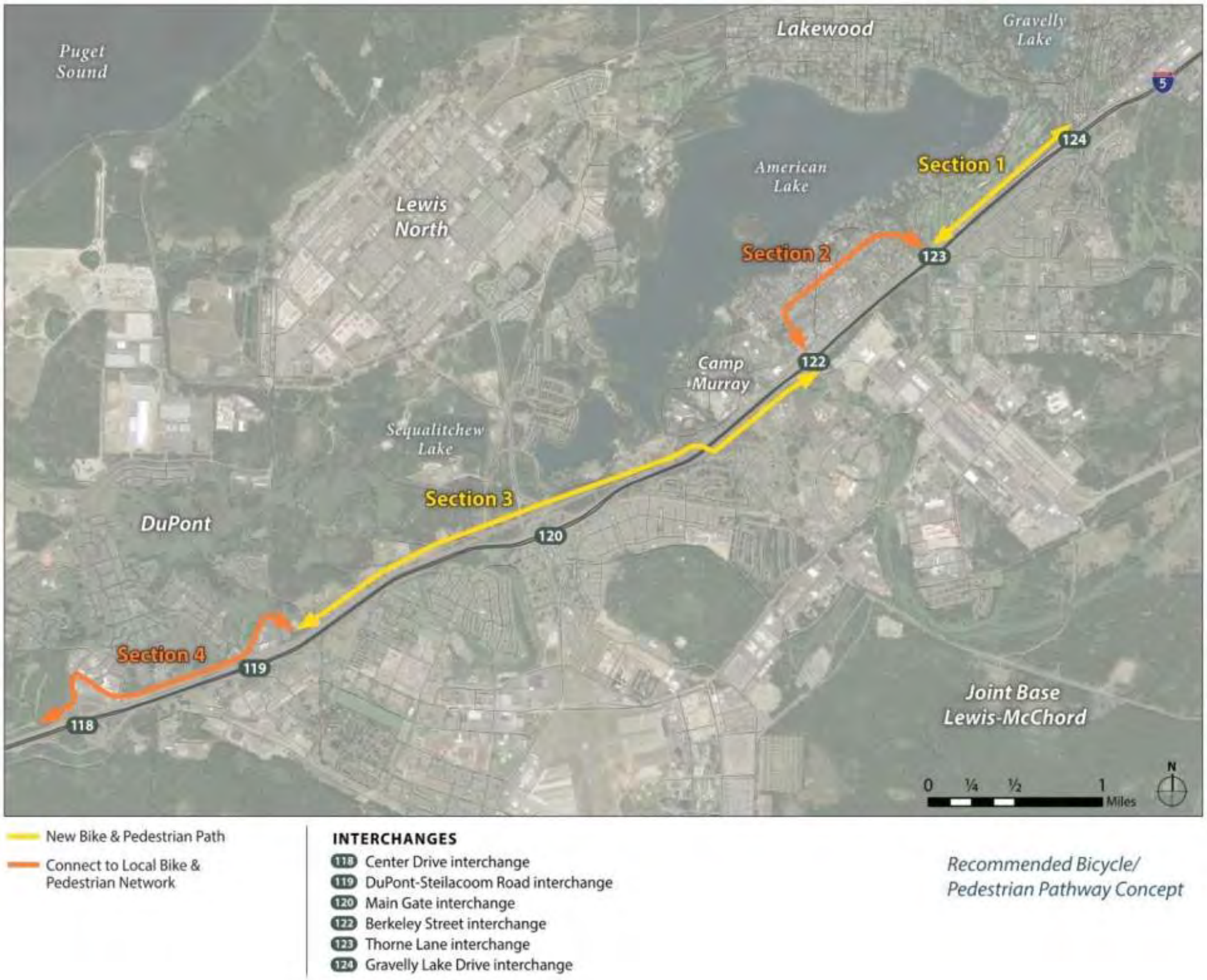
Rendering of the Proposed I-5/Berkeley Street Interchange

- **Gravelly -Thorne Connector** would be constructed to reduce short trips on I-5 between the Tillicum neighborhood and Lakewood. The new connector road would be a single southbound lane parallel and west of the adjacent rail line and extend between Gravelly Lake Drive and Thorne Lane. A preliminary layout for the Gravelly-Thorne Connector is illustrated in Figure 31. The connector would use approximately 25 feet of the railroad right of way and approximately five feet of the golf course right of way. Non-motorized linkages would also be included in its design.

Figure 31: Proposed Gravelley-Thorne Connector

- **Bicycle/pedestrian shared use path** would be added to provide enhanced non-motorized access along the corridor. A preliminary layout of the bicycle/pedestrian route is illustrated in Figure 32. New sections of the shared used paths are planned along the new Gravelly-Thorne Connector (segment one in the figure), as well as from the new Berkeley Street interchange along the east side of I-5 crossing to the west side just south of Camp Murray and extending to Steilacoom-DuPont Road (segment three). Between Thorne Lane and Berkeley Street (segment two), and between Center Drive and Steilacoom-DuPont Road (segment four), bicycles and pedestrians would use existing local streets and pedestrian facilities in the communities of Tillicum and DuPont.

Figure 32: Recommended Bicycle/Pedestrian Pathway Concept



8.0 2020 and 2040 I-5 Traffic Analysis for the Build Alternative

The following section summarizes the traffic operations along I-5 for the Build Alternative in the opening year (2020) and in the design year (2040). Synchro software was used to analyze signalized and non-signalized intersections; Sidra software was used to analyze roundabout operations; and SimTraffic and the Meso Model were used to simulate traffic operations.

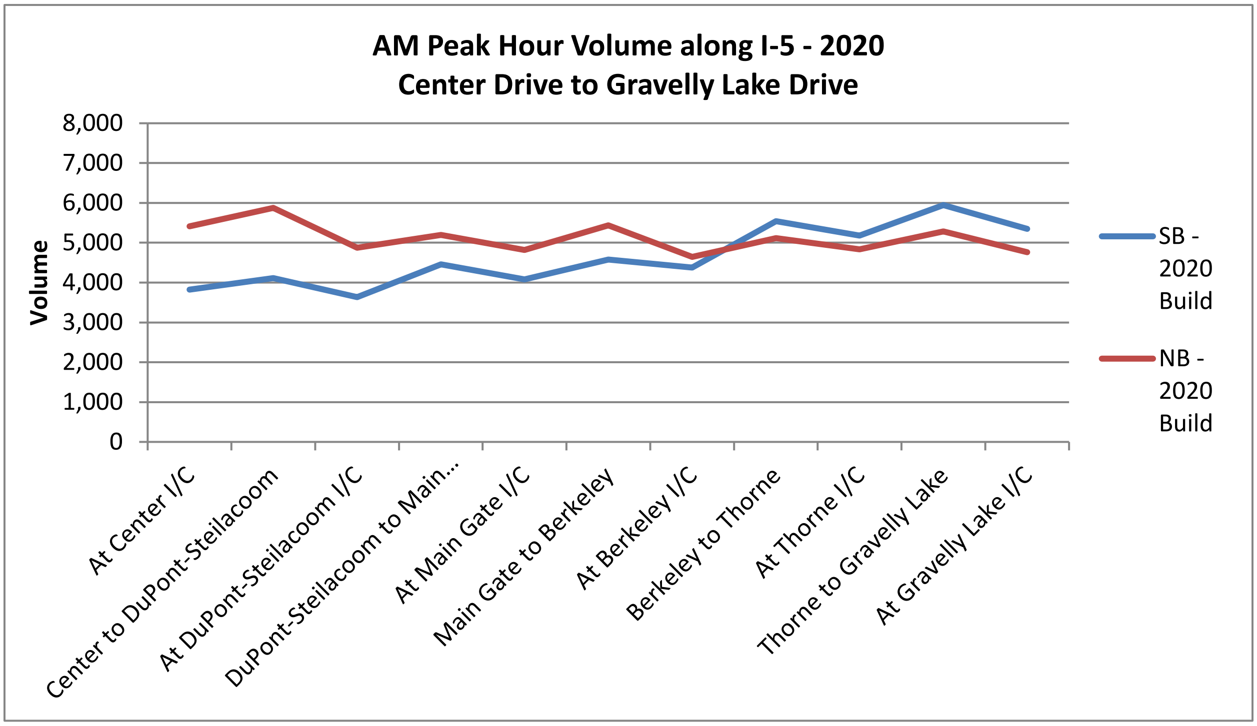
8.1 2020 and 2040 Build Alternative Average Peak Hour I-5 Traffic Volumes

The forecasted travel volumes along I-5 for the Build Alternative during the AM and PM peak hours are shown in Figures 33 and 34, respectively. In 2020, the two-way traffic volume along I-5 between Center Drive and Gravelly Lake Drive would range from approximately 9,200 to nearly 10,900 vehicles in the AM peak hour with an overall average volume of about 10,200 vehicles. During the 2020 PM peak hour, two-way traffic volumes would range from 8,200 to nearly 11,300 vehicles with an overall average of about 9,900 vehicles. These AM peak hour Build Alternative volumes would represent a 6.6 percent increase in vehicles over the 2020 No Build Alternative, and the PM peak hour Build Alternative volumes would be about 12.5 percent higher than 2020 No Build Alternative volumes.

In 2040, the two-way traffic volume along I-5 would range from approximately 10,100 to nearly 13,300 vehicles in the AM peak hour with an overall average two-way volume of 11,700 vehicles. In the 2040 PM peak hour, two-way traffic volumes on I-5 are expected to range from about 7,700 to 11,100 vehicles with an average of about 9,400 vehicles operating along I-5. These AM peak hour Build Alternative volumes would represent an 18.8 percent increase in vehicles over the 2040 No Build Alternative, while PM peak hour Build Alternative volumes would be about 8.8 percent higher than the No Build Alternative.

The lower PM vehicle trips along I-5 in 2040, as compared to the AM vehicle trips are expected to result because the increases congestion would cause lower travel speeds in the PM peak. This would reduce the number of vehicles than can actually use the I-5 corridor during the PM peak hour. The small growth in vehicles along I-5 between 2020 and 2040 in the AM peak hour, and the decrease in vehicle trips in the PM peak hour would result from the reduction in average travel speeds along I-5, caused by increased congestion, and by trips being diverted to other travel times to avoid congestion.

Figure 33: Average 2020 and 2040 AM Peak Hour Volumes on I-5 from Center Drive to Gravelly Lake Drive – Build Alternative



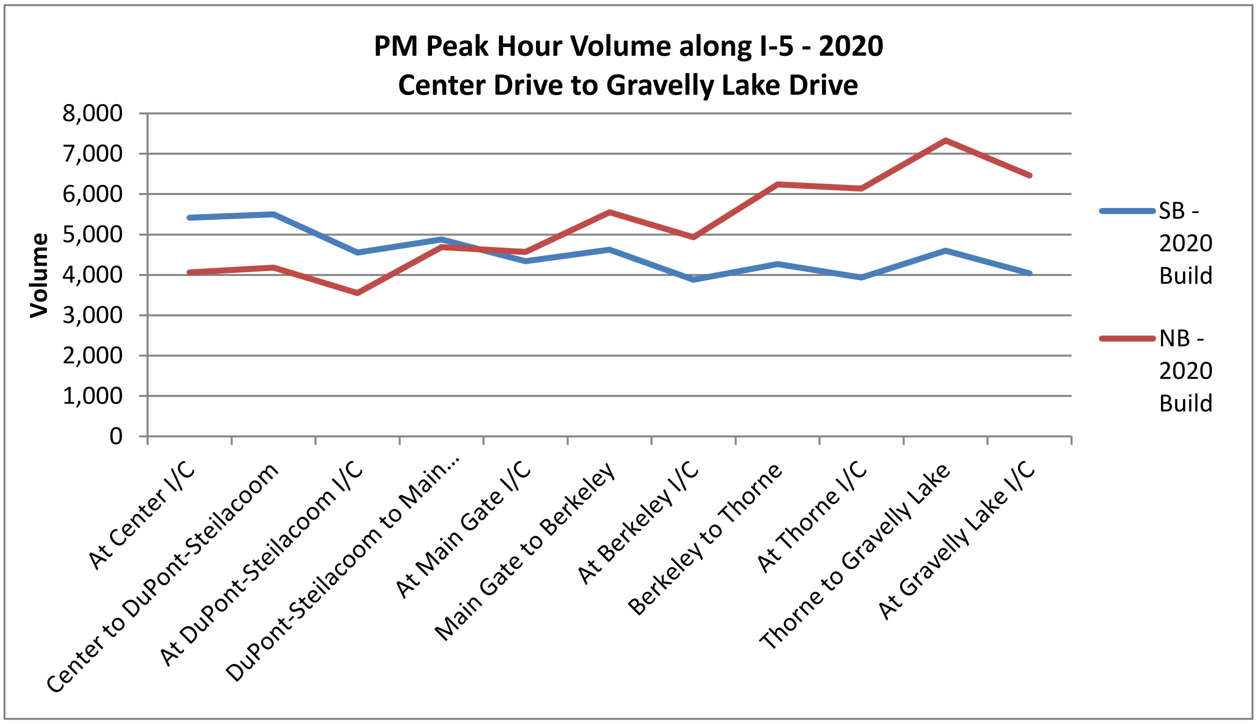
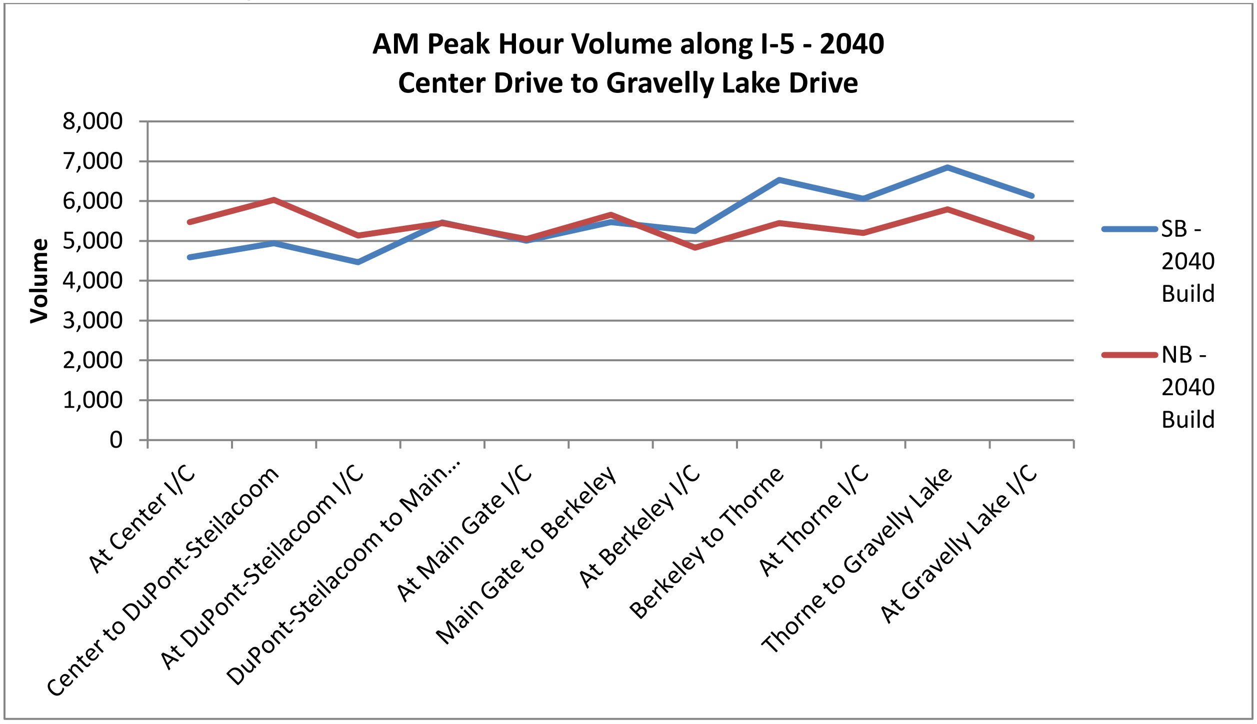
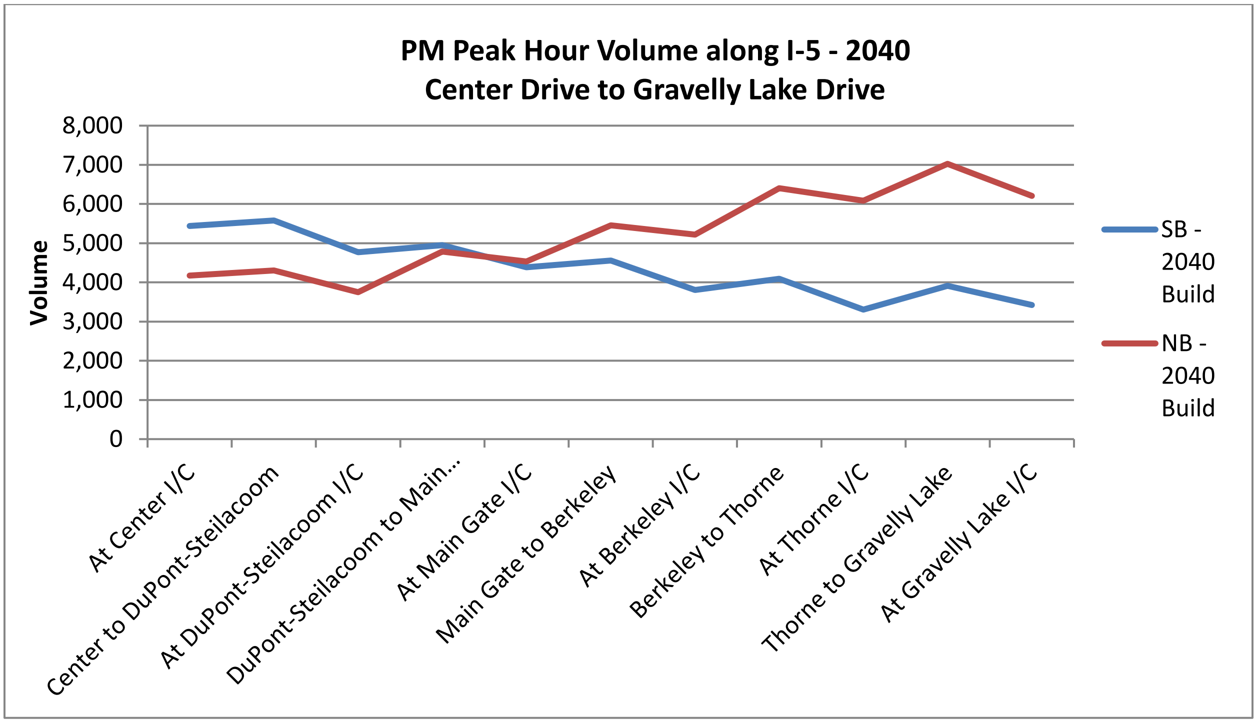


Figure 34: Average 2020 & 2040 PM Peak Hour Vehicles along I-5 from Center Drive Road to Gravelly Lake Drive – Build Alternative





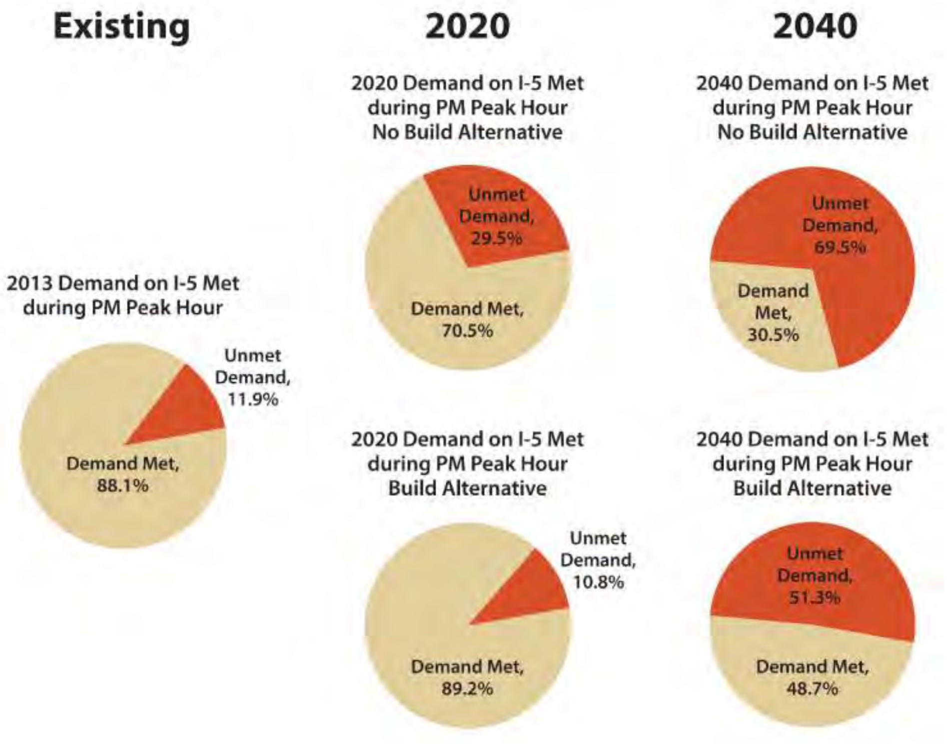
8.2 Travel Demand along I-5 – Build Alternative

PM Peak Hour – As shown in Figure 35, 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. Additionally, the No Build Alternative could accommodate less travel demand on I-5 than the Build Alternative.

In 2020, the Build Alternative could 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 could accommodate about 49 percent of the PM peak hour demand, while the No Build Alternative could accommodate only 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.

During the AM peak hour in 2020, it is expected that nearly 99 percent of the demand for travel on I-5 could be accommodated with the Build Alternative. This compares with the 2020 No

Figure 35: 2020 & 2040 Travel Demand along I-5 during AM and PM Peak Hours from Center Drive to Gravelly Lake Drive – Build Alternative

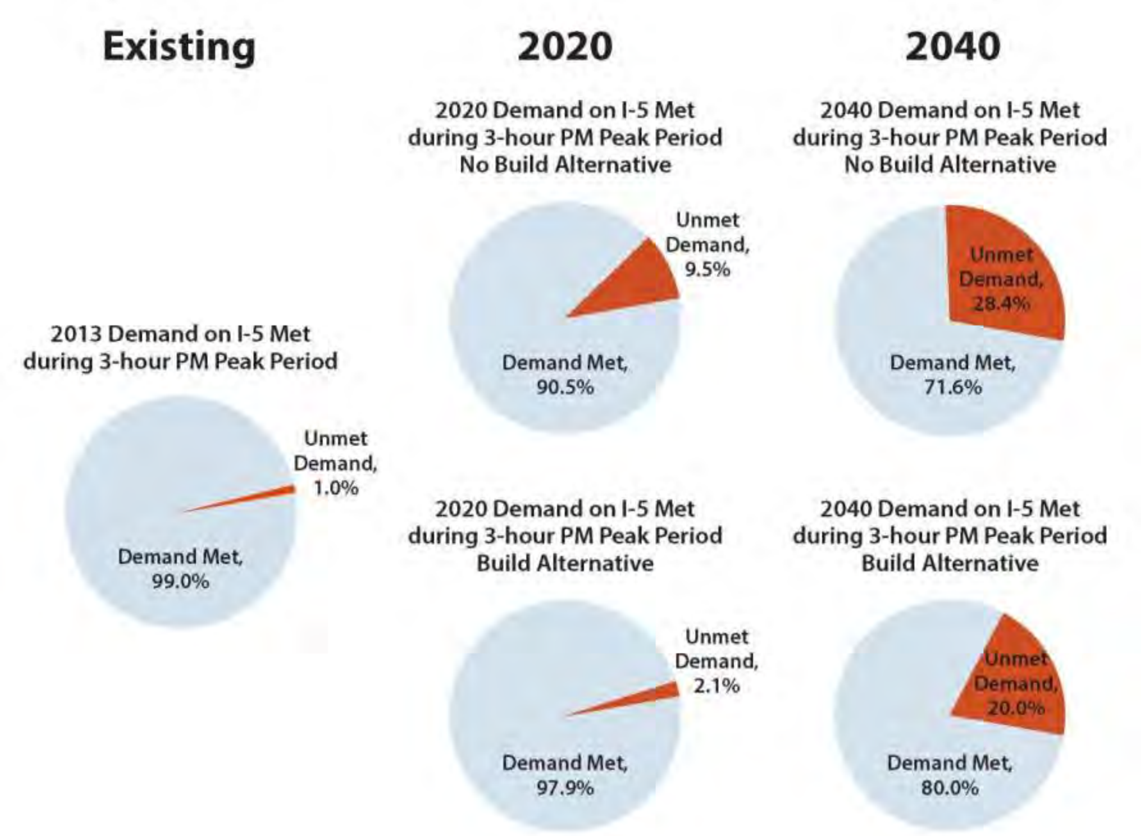


*Demand based on person miles of travel estimate from Mesoscopic

Build Alternative that could accommodate about seven percent less demand. In 2040, about 90 percent of AM peak hour travel demand on I-5 could be accommodated with the Build Alternative, as compared to the 2040 No Build Alternative which could accommodate about 29 percent less demand. Thus, while congestion would exist, the situation is expected to be substantially better than with the No Build Alternative.

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 36 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 36 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.

Figure 36: Comparison of 3-Hour PM Peak Period Demand Met on I-5 in the Vicinity of JBLM



*Demand based on person miles of travel estimate from Mesoscopic travel

8.3 Future Build Alternative Average Peak Hour I-5 Travel Speeds

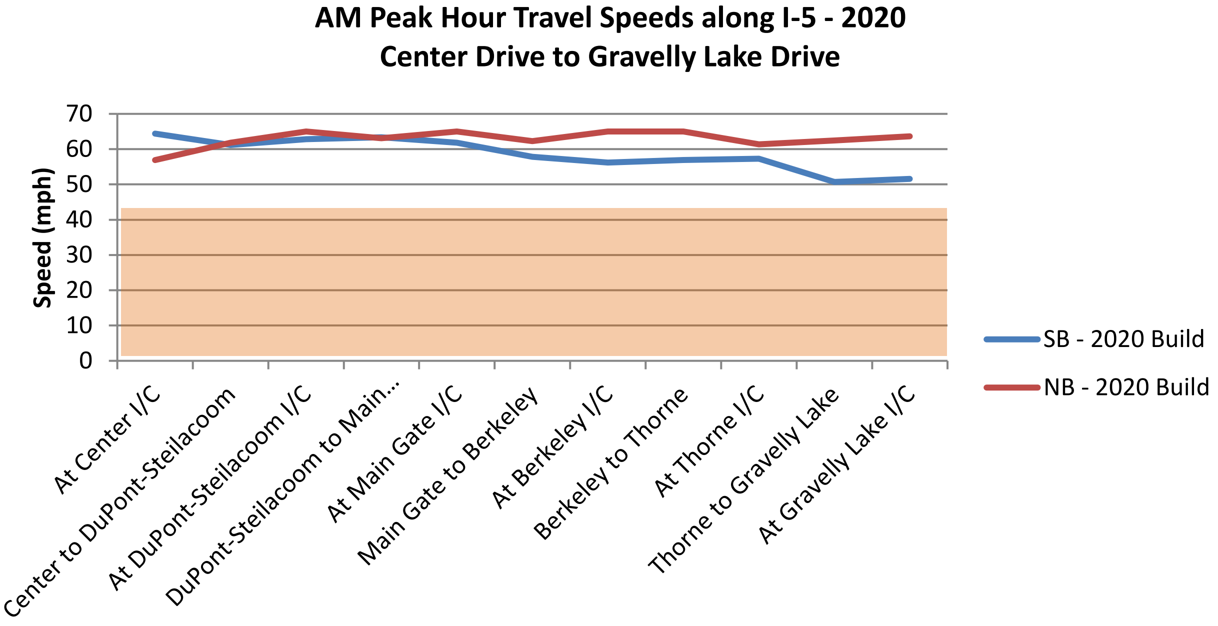
Expected average travel speeds along the I-5 corridor in 2020 and 2040 for the AM peak hour and the PM peak hour are illustrated in Figures 37 and 38, respectively. As can be observed from the figures, in both 2020 and 2040 travel speeds along I-5 in the AM peak hour with the proposed improvements range from 50 mph to 60 mph for most of the study area with southbound speeds falling below 50 mph north of Thorne Lane in 2040. These slower speeds are attributed to the increase in traffic volumes through this area. The southbound AM peak hour Build alternative speeds are estimated to increase by nearly ten percent in 2020 and over 40 percent in 2040 as compared to the No Build Alternative. In the northbound direction the AM peak hour speeds increase by about 12 percent in both 2020 and 2040 as compared to the No Build Alternative speeds.

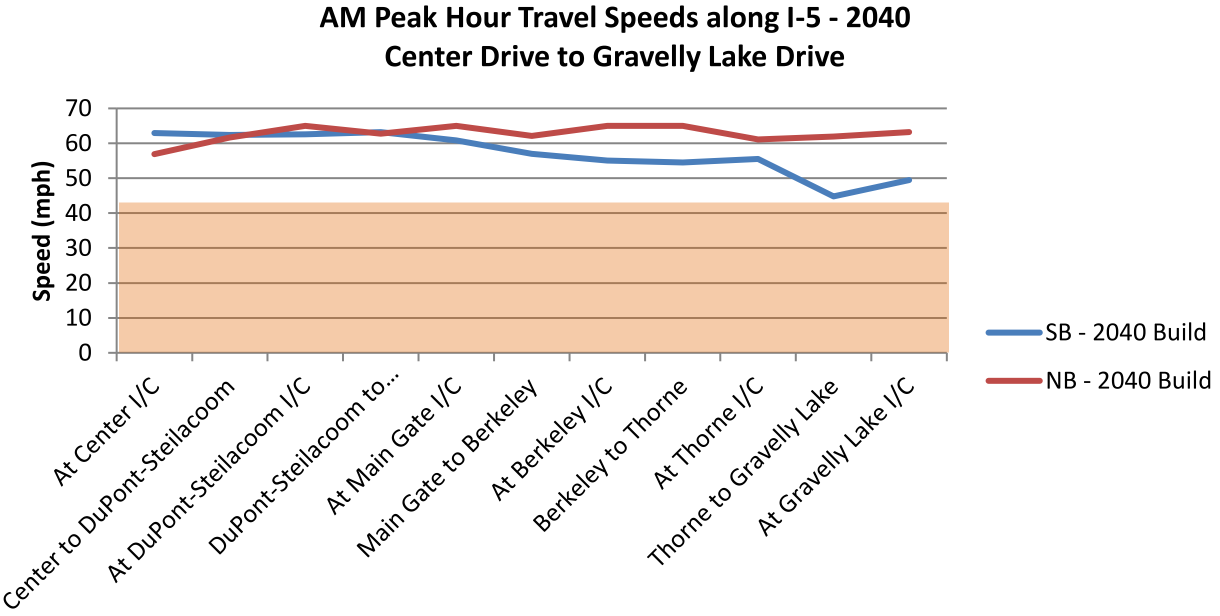
During the PM peak hour with the proposed improvements in 2020, northbound travel speeds along I-5 fall below 42 mph or LOS F (the shaded areas show speeds less than 42 mph) north of the Berkeley Street Interchange as traffic volumes approach the practical capacity of the highway and drivers are changing lanes to enter and exit I-5. In the southbound direction in 2020, travel speeds along I-5 fall below 42 mph south of the Main Gate Interchange with speeds dropping to less than 10 mph, indicating area of stop-and-go traffic.

These slow speeds are caused by several factors, including the reduction of the number of southbound through travel lanes from four lanes to three lanes at Center Drive, the increase in traffic volumes, and drivers frequently change lanes to enter and exit I-5. However, these northbound speeds with the Build Alternative show a speed increase of more than 125 percent (44.2 mph vs. 19.4 mph) as compared to the No Build Alternative in 2020. While the southbound Build Alternative average speeds are about the same as the No Build Alternative at 13 mph due primarily to the reduction in the number of through lanes.

During the PM peak hour with the proposed improvements in 2040, southbound PM peak hour travel speeds are generally less than 10 mph from Gravelly Lake Drive to Center Drive. These slow speeds reduce the number of vehicles that can travel through the corridor during the PM peak hour and prevent other cars from entering the corridor.

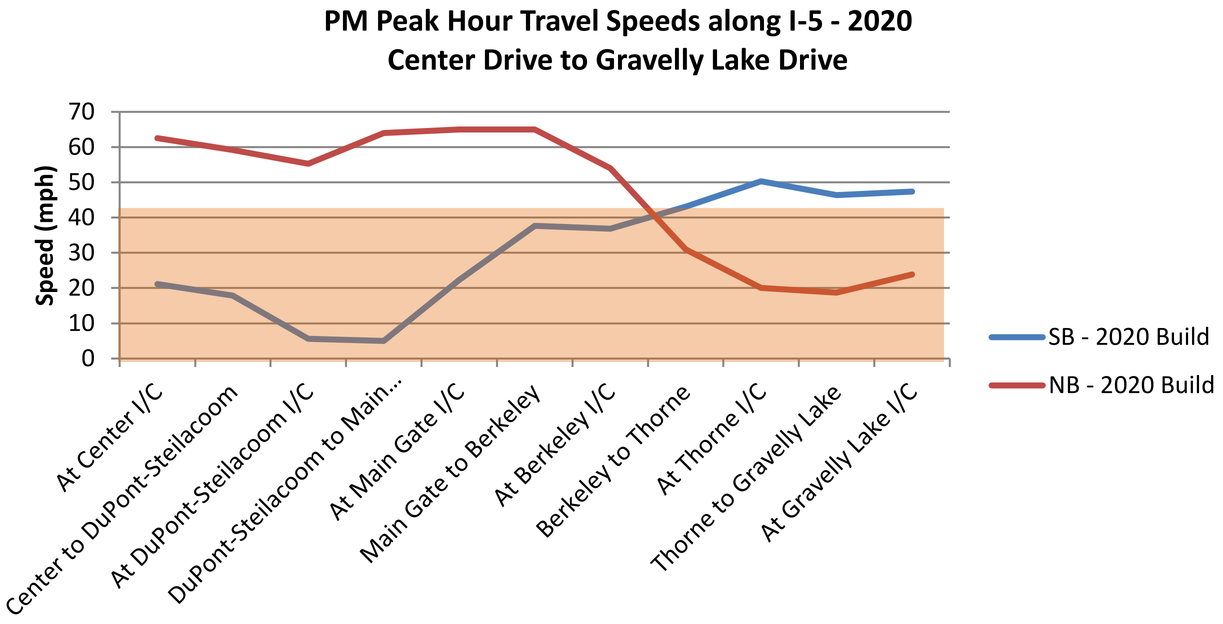
Figure 37: 2020 & 2040 AM Peak Hour Travel Speed along I-5 from Center Drive to Gravelly Lake Drive – Build Alternative

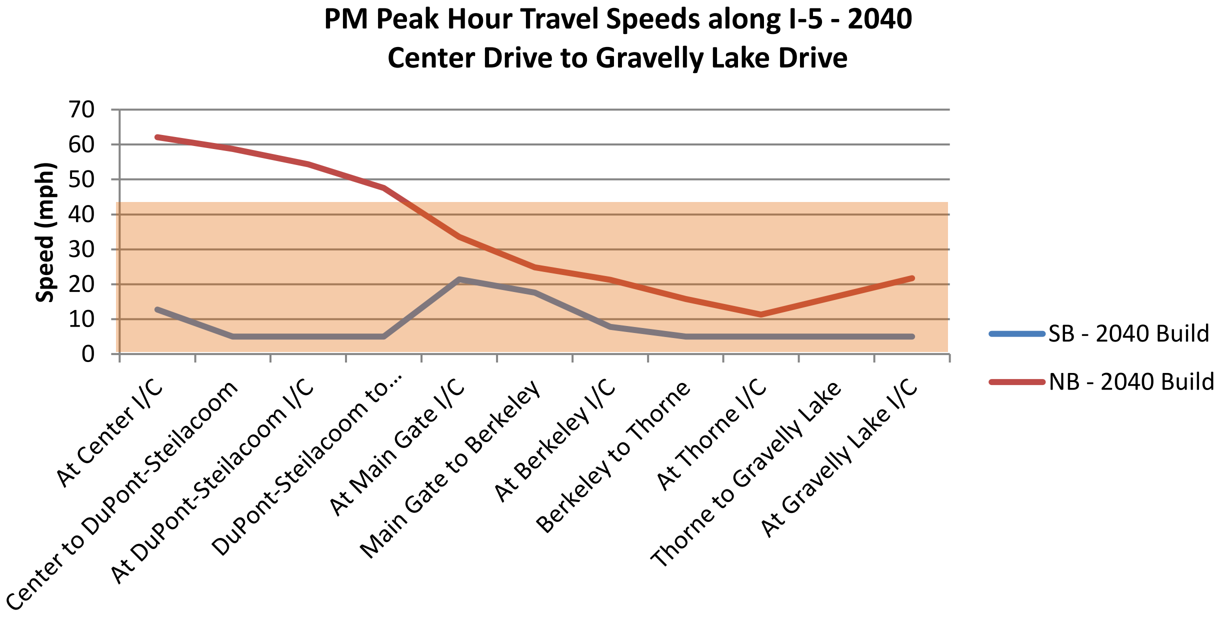




Based on the Meso Model data, estimates were made of the number of hours the travel speed operated below 70 percent of posted speed of 42 mph in 2020 and 2040. The analysis also showed that no hours of congestion are expected to occur during the AM peak period in 2020 and 2040, which correlates with the AM peak hour average travel speeds shown in Figure 36 above.

Figure 38: 2020 & 2040 PM Peak Hour Travel Speed along I-5 from Center Drive to Gravelly Lake Drive – Build Alternative





During 2040 northbound PM peak hour, travel speeds on I-5 between Center Drive and Steilacoom-DuPont Road are generally above 50 mph because of the added travel lane at Center Drive. North of Steilacoom-DuPont Road, as traffic volumes increase and drivers frequently change lane to enter and exit I-5, travel speed fall below 42 mph. These slow average PM speeds signify severe congestion with slow moving vehicles and periods of stop-and-go traffic. In 2040, the southbound Build Alternative average travel speeds are less the No

Build Alternative speeds (7 mph vs 10 mph); while the northbound Build Alternative average speeds increase by about 85 percent (27.3 mph for the Build alternative vs 14.8 mph for the No Build Alternative.) Southbound travel for the No Build Alternatives operates better south of Thorne Lane because the bottleneck occurs at the north end of the study area rather than at the south end, effectively metering the number of southbound vehicles using I-5 with the No Build Alternative. Figure 39 presents a summary map that illustrates and compares projected 2020 and 2040 travel speeds with the Build Alternative.

8.4 Peak Period I-5 Hours of Congestion – Build Alternative

During the PM peak period in 2020 and 2040, several hours of congestion are expected to occur along I-5 between Center Drive and Gravelly Lake Drive, as illustrated in Figure 40. During the 2020 PM peak period from two to four hours of congestion is expected northbound and southbound. During the 2040 PM peak period, congestion is expected to occur along the entire corridor in both directions that may last for nearly six hours.

These slow average speeds and hours of congestion expected during the PM peak period (2:00 PM and 8:00 PM) are also illustrated on the Congestion Contours shown in Figure 41. In 2020, southbound congestion would generally extend from north of the Main Gate Interchange to Center Drive. This congestion would be caused by the reduction in travel lanes from four lanes to three lanes at Center Drive and the high on-ramp volume at Center Drive. In the northbound direction in 2020, congestion would extend from around Berkeley Street to Bridgeport Way. In comparing these diagrams with the 2020 No Build Alternative diagrams, the duration and area of congestion is reduced.

By 2040, congestion is expected to extend past the 8:00 PM analysis period and would also extend north and south of the study area. In the southbound direction, congestion is expected to extend from Mounts Road past SR 512 for both the No Build and Build Alternatives. However, with the Build Alternative, there would generally be less congestion north of Berkeley Street. In the northbound direction during the 2040 PM peak period, congestion is expected to extend from north of Mounts Road with about one hour of congestion to nearly six hours of congestion at Bridgeport Way. South of Center Drive longer periods of congestion are expected.

Figure 39: 2020 and 2040 PM Peak Hour Travel Speeds on I-5 between Center Drive and Gravelly Lake Drive – Build Alternative

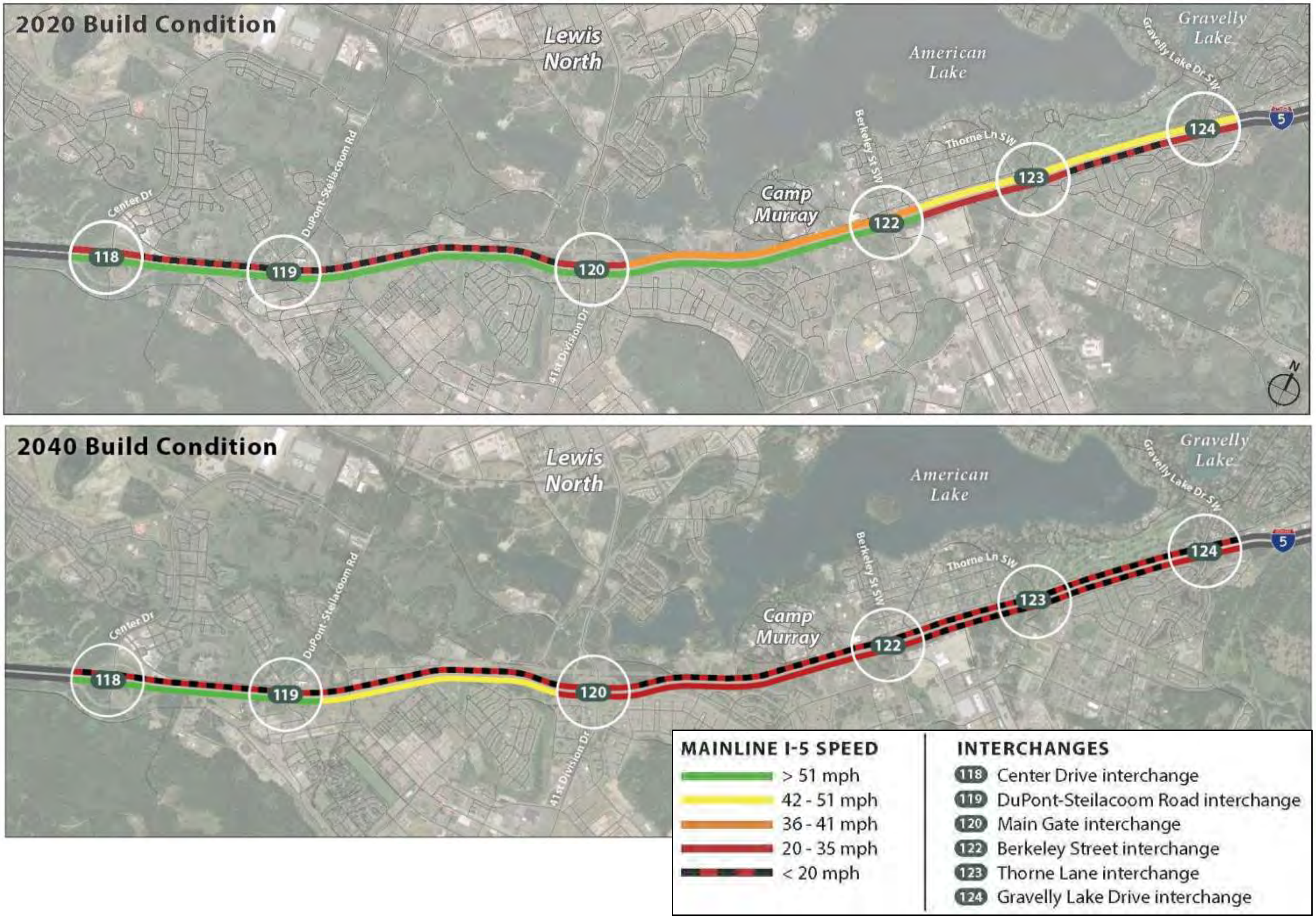
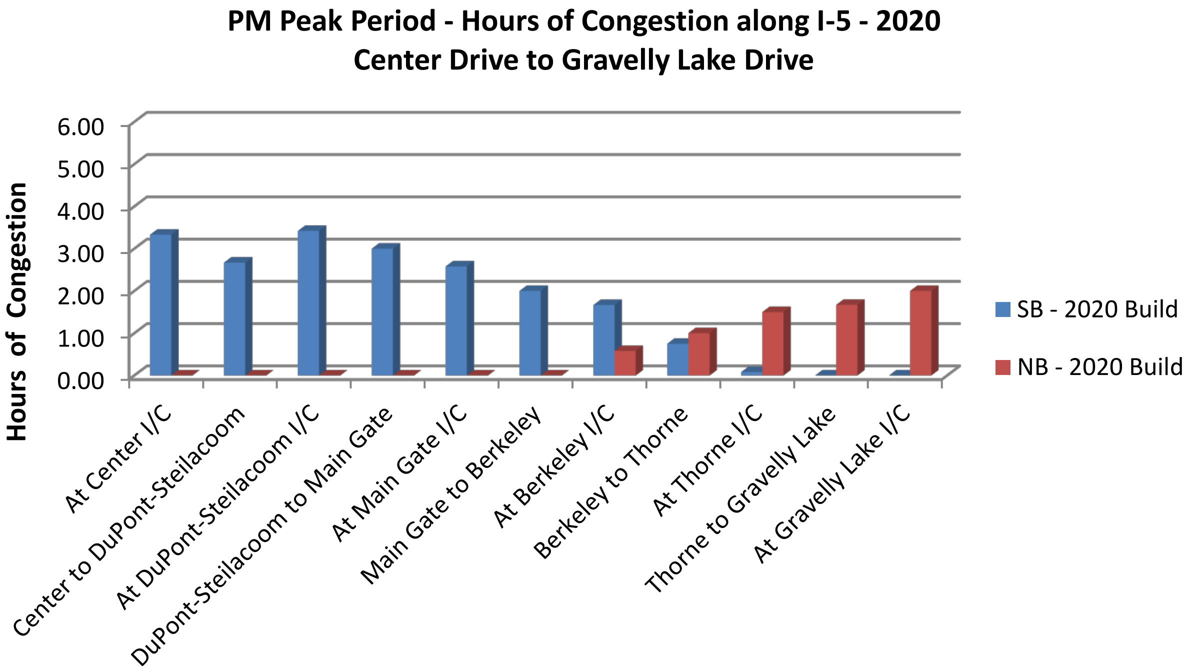


Figure 40: Hours of Congestion along I-5 during 2020 & 2040 PM Peak Period from Center Drive to Gravelly Lake Drive – Build Alternative



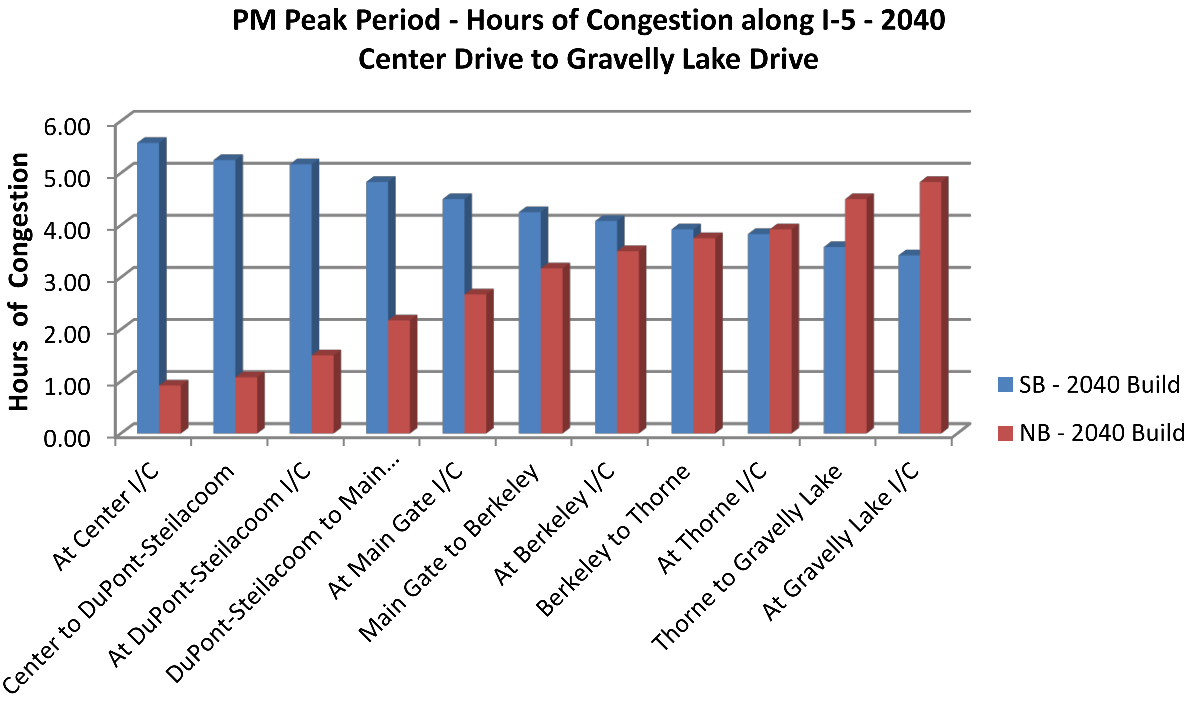
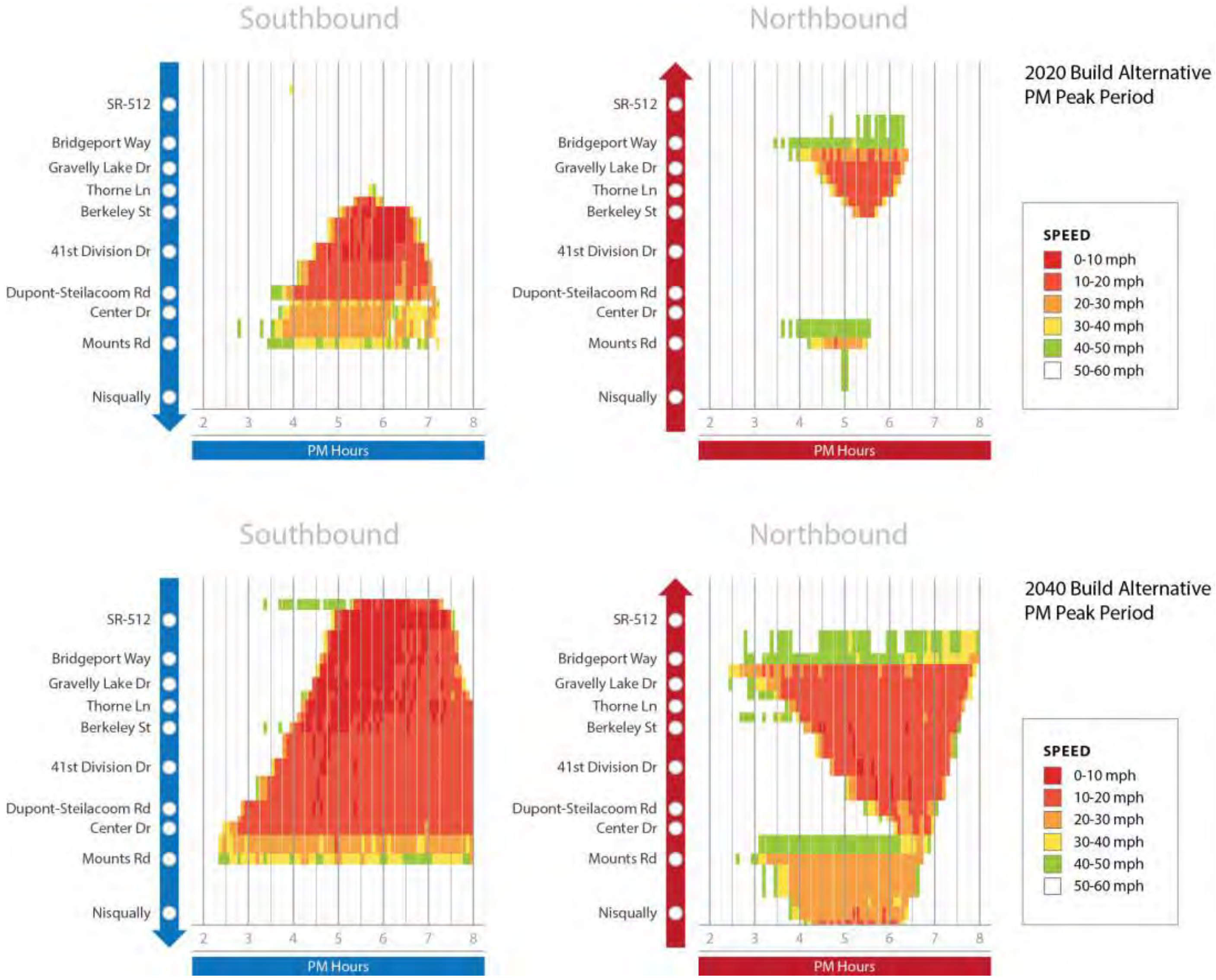


Figure 41: Travel Speeds along I-5 during the 2020 & 2040 PM Peak Period – Build Alternative

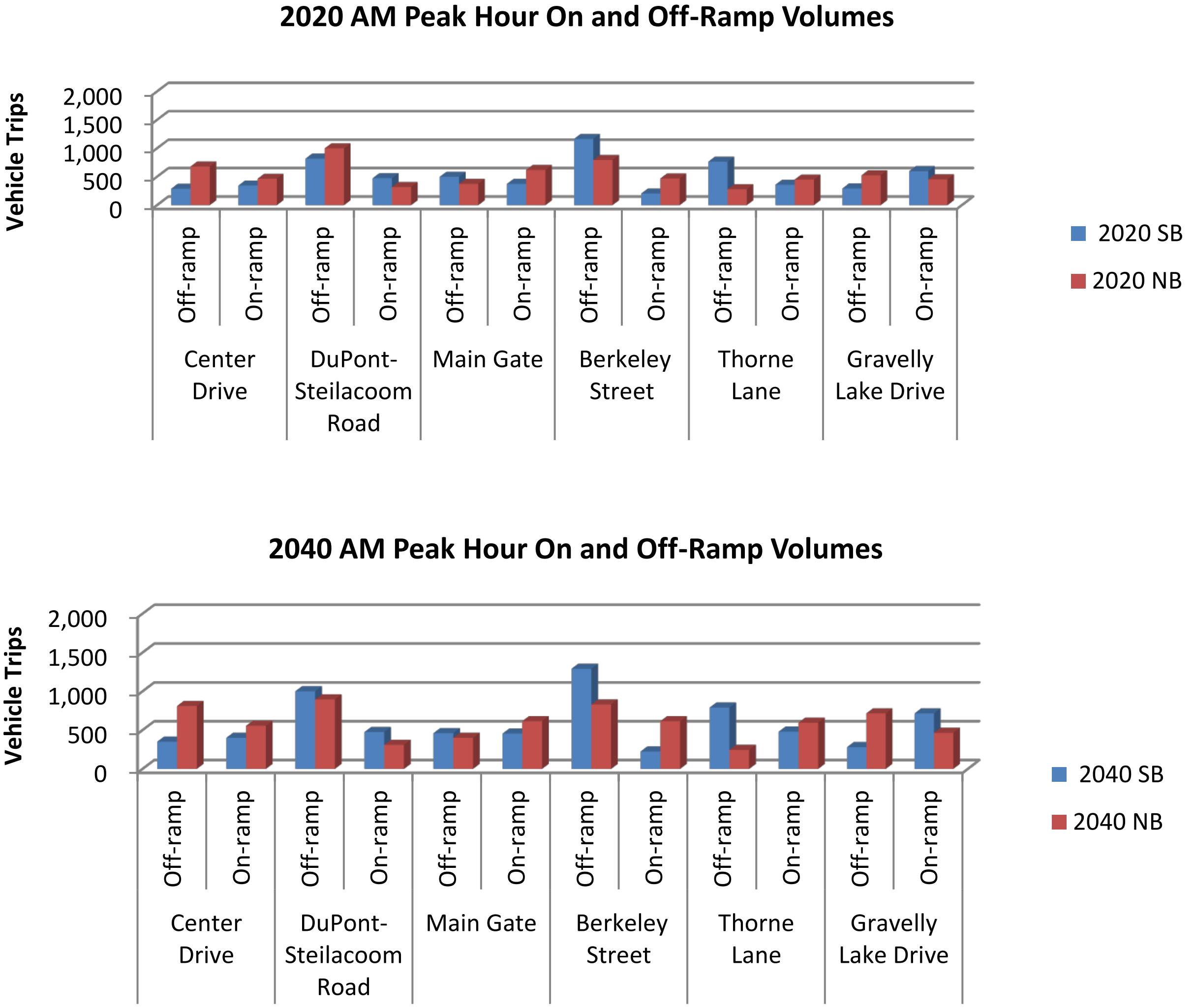


8.5 Peak Hour I-5 On and Off-Ramp Volumes – Build Alternative

On- and off-ramp volumes along I-5 between Center Drive and Gravelly Lake Drive would remain high in 2020 and 2040 peak hours for the Build Alternative. A comparison of the projected 2020 and 2040 AM peak hour on- and off-ramp volumes is shown in Figure 42. At these six interchanges there would be a total of about 3,840 vehicles exiting I-5 and 2,360 vehicles entering I-5 southbound in 2020, and about 3,660 vehicles exiting I-5 and 2,780 vehicles entering I-5 northbound in 2020 AM peak hour. The total of trips entering and exiting I-5 is more than the capacity of a single lane, and would require drivers to shift lanes.

Similarly, in 2040, there would be about 4,170 vehicles exiting I-5 and 2,750 vehicles entering I-5 at these six interchanges southbound, and about 3,900 vehicles exiting I-5 and 3,160 vehicles entering I-5 northbound. The total of trips entering and exiting I-5 would continue to be more than the capacity of a single lane, requiring drivers to shift lanes.

Figure 42: 2020 & 2040 AM On- and Off-Ramp Volume along I-5 from Center Drive to Gravelly Lake Drive – Build Alternative

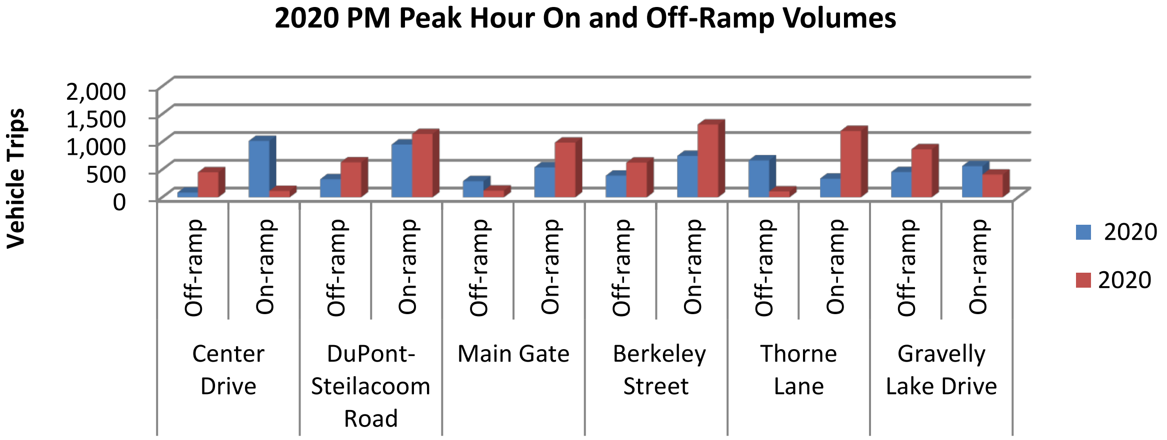


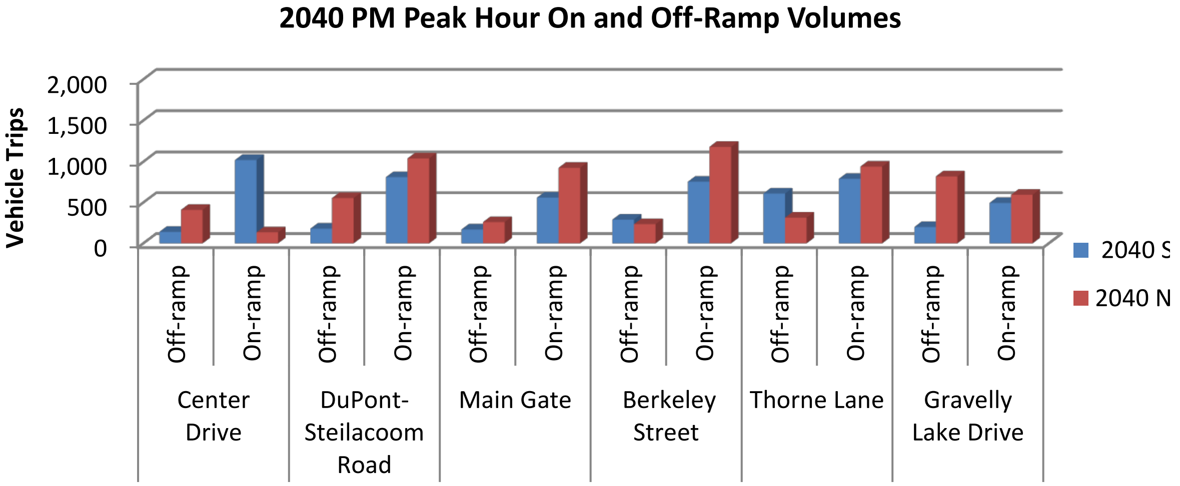
A comparison of the PM peak hour on- and off-ramp volumes in 2020 and 2040 is shown in Figure 43. Overall, at the interchanges along I-5 in the study area in 2020, there would be a total of about 2,210 vehicles exiting I-5 and 4,150 vehicles entering I-5 southbound, and about 2,800 vehicles exiting I-5 and 5,160 vehicles entering I-5 northbound.

Similarly, in 2040, there would be about 1,590 vehicles exiting I-5 and 4,430 vehicles entering I-5 at these interchanges southbound, and about 2,600 vehicles exiting I-5 and 4,820 vehicles entering I-5 at the study area interchanges northbound.

As with the existing conditions and the No Build Alternative, all of this traffic cannot be in the outside lane at the same time, so drivers must frequently change lanes to enter and exit I-5. This heavy amount of lane change movement would cause traffic to slow, increase congestion, and reduce the overall traffic throughput in the JBLM area.

Figure 43: 2020 & 2040 PM On- and Off-Ramp Volume along I-5 from Center Drive to Gravelly Lake Drive – Build Alternative



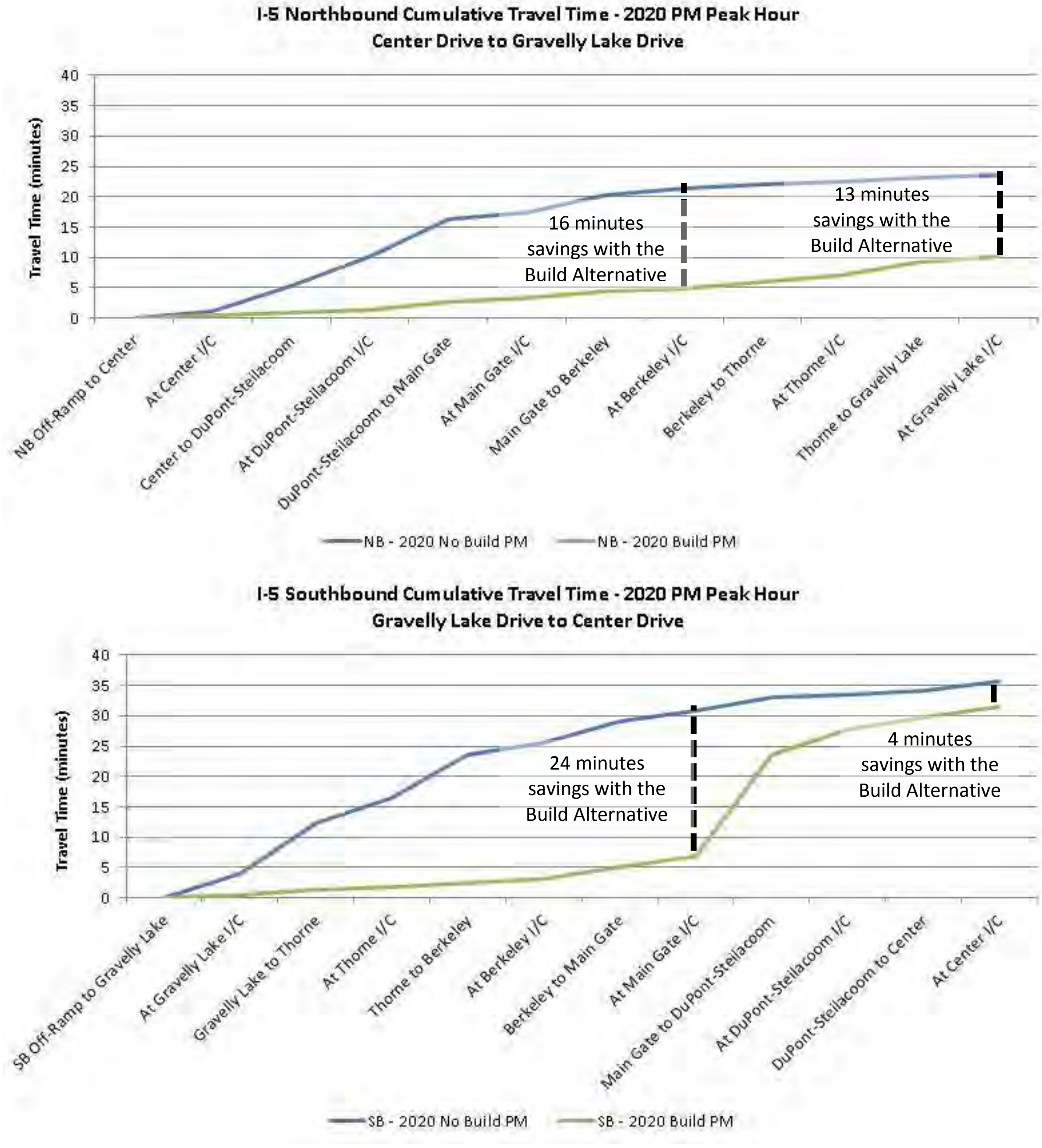


As compared to the 2020 and 2040 No Build Alternative on- and off-ramp volumes, these 2020 and 2040 Build Alternative ramp volumes would generally be within plus or minus 10 percent.

8.6 Comparison of I-5 Travel Times – No Build Alternative vs Build Alternative

A comparison of No Build Alternative travel times along I-5 between Center Drive and Gravelly Lake Drive was made using output from the Meso Model and is shown in Figure 44 for the AM and PM peak hours. Traveling along I-5 between Center Drive and Gravelly Lake Drive at the posted speed limit would normally take about 8.2 minutes to cover the 8.2 miles between the two interchanges.

Figure 44: 2020 Cumulative PM Peak Hour Travel Times along I-5 between Center Drive and Gravelly Lake Drive –2020 No Build Alternative and Build Alternative



Comparisons of No Build Alternative and Build Alternative travel times along I-5 between Center Drive and Gravelly Lake Drive were made using output from the Mesoscopic Model and are shown in Figures 45 and 46 for 2020 and 2040 AM and PM peak hours, respectively. Traveling along I-5 between Center Drive and Gravelly Lake Drive at the posted speed limit would require about 8.2 minutes to cover the 8.2 miles between the two interchanges.

As shown on Figure 45, I-5 northbound and southbound travel times during the AM 2020 peak hour between these interchanges would be about the same for the No Build and the Build Alternatives as 2013 conditions (i.e. around eight to nine minutes). Traffic during the time would generally operate near the posted speed limit.

During the 2020 PM peak period, overall southbound travel along I-5 between Center Drive and Gravelly Lake Drive with either the No Build or Build Alternatives would take about 37 to 39 minutes. However, along I-5 north of the Main Gate Interchange, the Build Alternative would show better travel times than the 2013 conditions, and up to 25 minutes shorter travel times than the No Build Alternative. South of the Main Gate Interchange, where Build Alternative speeds are reduced because of the reduction in travel lanes from four lanes to three lanes at Center Drive, travel time are expected to increase relative to the No Build Alternative.

During the 2020 PM peak period, northbound travel along I-5 from Center Drive to Gravelly Lake Drive for the Build Alternative would be slightly better than the 2013 conditions (11 minutes vs 12 minutes) and about 15 minutes shorter compared to the 2020 No Build Alternative (11 minutes vs 26 minutes).

Figure 46 shows the 2040 AM and PM cumulative peak hour travel times along I-5 between Center Drive and Gravelly Lake Drive. During the AM peak hour, travel times with the Build Alternative would be similar to the 2013 conditions with overall travel times between Center Drive and Gravelly Lake Drive between eight and nine minutes. The 2040 No Build Alternative travel times would be about 12 minutes southbound and nine minutes northbound.

During the 2040 PM peak hour, northbound travel times on I-5 with the Build Alternative are expected to be similar to 2013 conditions from Center Drive to Berkeley Street, and then slightly increase such that overall travel time is about 12 minutes in 2013 and would be 18 minutes in 2040. The increase in northbound travel time would be caused by maintaining four lanes through the corridor with the Build Alternative, which allows more volume and results in slower traffic speeds. In 2013, only three lanes are available south of Thorne Lane and the increase to four lane allows northbound traffic to operate at slightly higher speeds. In contrast, travel time with the No Build Alternative is expected to increase to about 34 minutes because of the higher demand with the same number of lanes as with 2013 conditions.

Figure 45: Comparison of No Build vs Build Alternatives for 2020 AM & PM Peak Hour Cumulative Travel Times through the Study Area

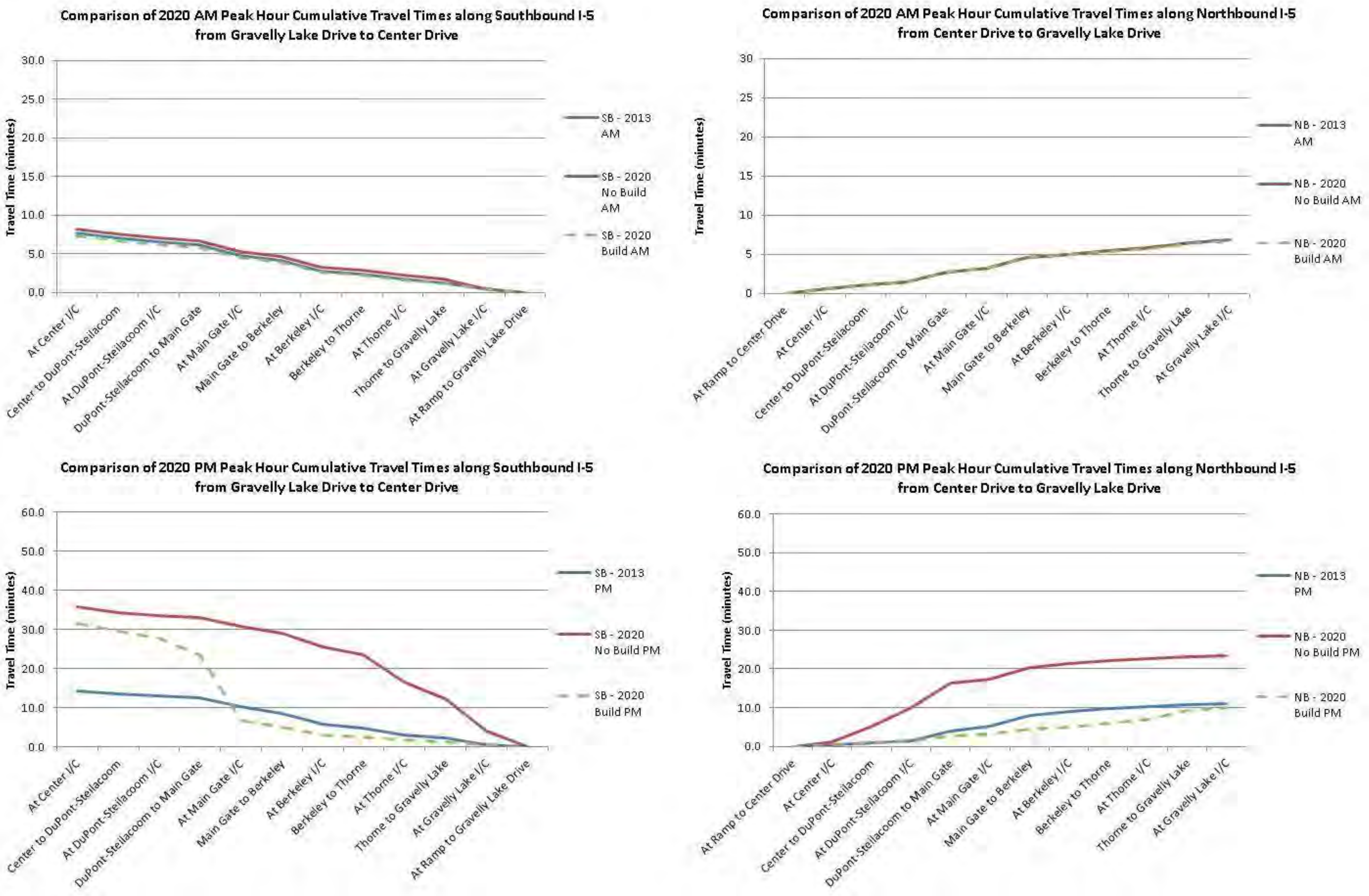
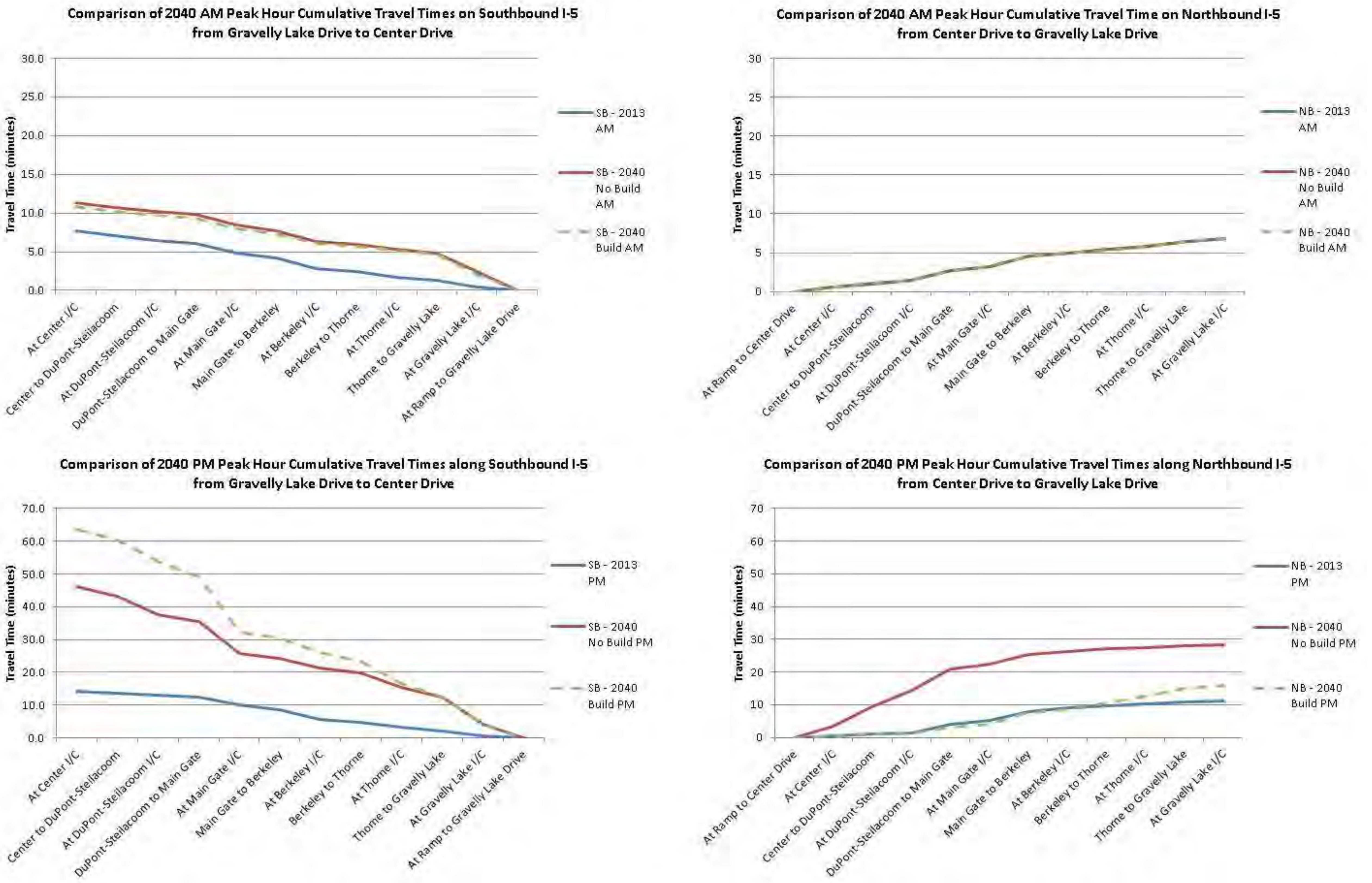


Figure 46: Comparison of No Build vs Build Alternatives for 2040 AM & PM Peak Hour Cumulative Travel Times through the Study Area



Conversely in the southbound direction, 2040 PM peak hour travel times with the Build Alternative are expected to be higher than the No Build Alternative (68 minutes vs 48 minutes). For the Build Alternative, the southbound four-lane to three-lane reduction is moved from Thorne Lane to Center Drive. For the 2040 No Build Alternative, congestion extends southward to around the Main Gate Interchange with some congestion at the Center Drive on-ramp. Because of the lower amount of traffic flowing through the corridor, No Build Alternative travel speeds are slightly higher along the corridor. With the Build Alternative, the reduction in travel lanes at Center Drive would allow more traffic on I-5 but travel speeds would be slower and back-ups would extend throughout the corridor which increases travel times.

8.7 Summary of Future Year Intersection Analysis at I-5 Reconfigured and Adjacent Interchanges for the Build Alternative

The Build Alternative intersection analyses were conducted using Synchro software for signalized and non-signalized intersections and Sidra software for roundabouts for a 2020 opening year and a 2040 design year. Results of the analyses for the two focus interchanges are summarized in Table 6. The analyses show that during the AM and PM peak hours with the revised interchange configurations with roundabouts for the Build Alternative, intersections at the Berkeley Street Interchange and Thorne Lane Interchange all operate at LOS C or better and operate better than the No Build Alternative. A comparison between 2020 AM and PM peak hour LOS results for the No Build and Build Alternatives is presented graphically in Figures 47 and 48.

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

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. 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 C or better for the Build Alternative, and the teardrop roundabouts would operate at LOS B or better. For the No Build Alternative, the levels of service at the Berkeley Street intersections with the I-5 ramp would be LOS D or better with the interim Madigan Access improvements.

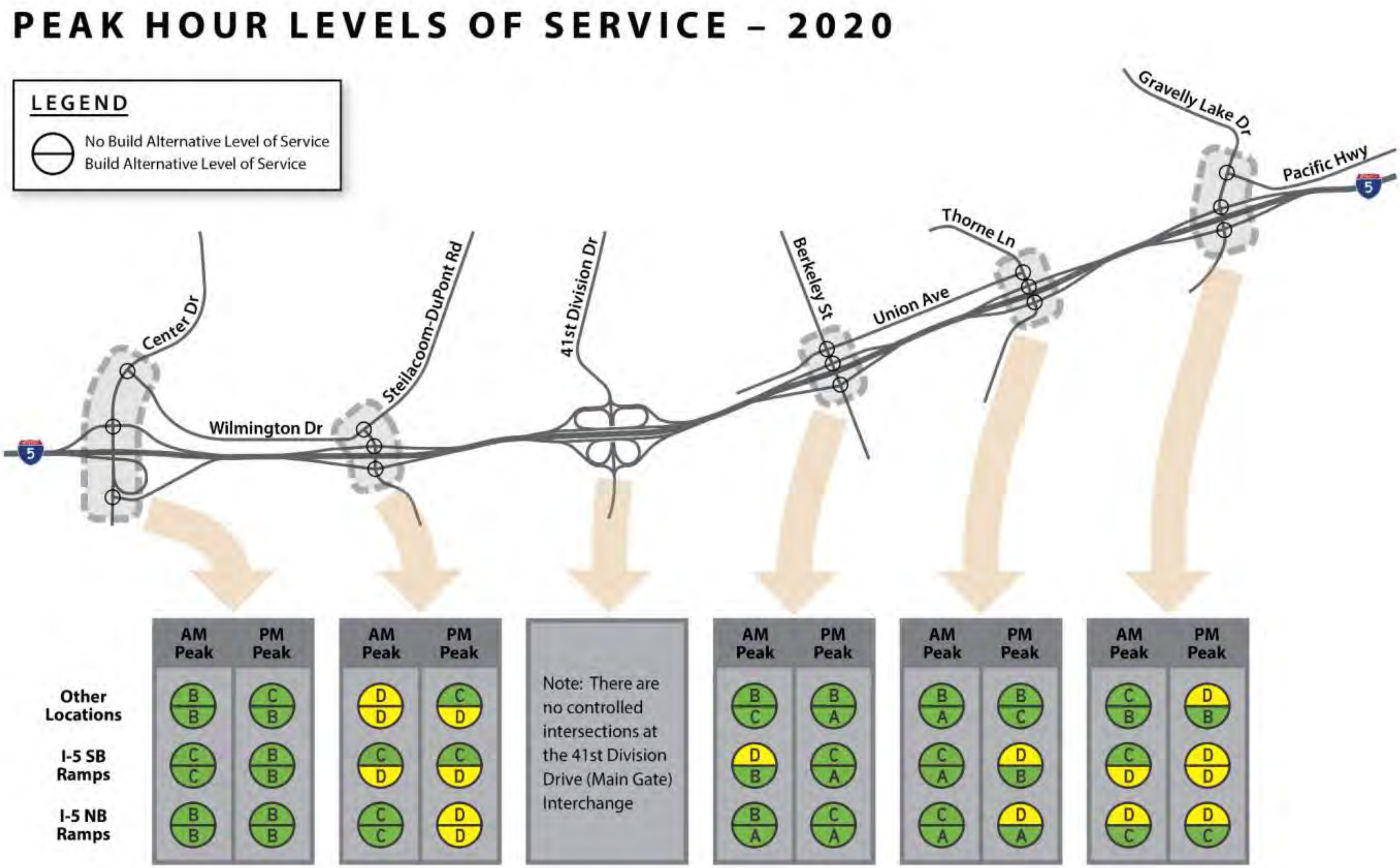
Table 6: Summary of Interchange Delay and Level of Service (LOS) at the Reconfigured Interchanges—No Build vs. Build Alternative

Intersection*	2020 No Build		2020 Build		2040 No Build		2040 Build	
	AM	PM	AM	PM	AM	PM	AM	PM
I-5 NB Ramps / Berkeley Street								
Control Type	Signal**		Roundabout		Signal**		Roundabout	
Average Delay (sec) / LOS	16.3/B	20.8/C	4.4/A	5.2/A	11.4/B	14.5/B	4.5/A	4.6/A
I-5 SB Ramps / Berkeley Street								
Control Type	Signal**		Roundabout		Signal**		Roundabout	
Average Delay (sec) / LOS	36.0/D	26.0/C	13.2/B	9.1/A	32.4/C	23.8/C	16.7/B	8.7/A
Berkeley Street / Union Avenue**								
Control Type	Signal		2-Way Stop		Signal		2-Way Stop	
Average Delay (sec) / LOS	11.0/B	12.0/B	15.2/C	9.0/A	10.0/B	12.7/B	15.5/C	13.2/B
Berkeley Street / Washington Avenue								
Control Type	2-Way Stop		2-Way Stop		2-Way Stop		2-Way Stop	
Average Delay (sec) / LOS	12.6/B	14.3/B	9.3/A	9.2/A	14.2/B	12.2/B	9.6/A	9.2/B
Berkeley Street / Jackson Avenue Extension								
Control Type	NA		All-way Stop		NA		All-way Stop	
Average Delay (sec) / LOS	NA	NA	13.9/B	23.8/C	NA	NA	12.3/B	10.9/B
I-5 NB Ramps / Thorne Lane								
Control Type	Signal		Roundabout		Signal		Roundabout	
Average Delay (sec) / LOS	34.2/C	37.9/D	5.5/A	7.1/A	37.3/D	36.6/D	7.0/A	11.9/B
I-5 SB Ramps / Thorne Lane								
Control Type	Signal		Roundabout		Signal		Roundabout	
Average Delay (sec) / LOS	33.9/C	47.5/D	8.8/A	14.6/B	49.5/D	44.4/D	12.6/B	17.7/B
Thorne Lane/Union Avenue Loop (New Intersection)								
Control Type	NA		Roundabout		NA		Roundabout	
Average Delay (sec) / LOS	NA	NA	6.5/A	21.1/C	NA	NA	6.9/A	9.1/A
Thorne Lane / Union Avenue (with Gravelly-Thorne Connector for Build Alternative)								
Control Type	2-way Stop		2-way Stop		2-way Stop		2-way Stop	
Average Delay (sec) / LOS	10.4/B	11.6/B	9.6/A	11.2/B	11.2/B	12.8/B	9.6/A	12.0/B

Notes* Signalized & non-signalized intersections analyzed using Synchro software and Highway Capacity Manual procedures. 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 with the No Build Alternative by 2020.

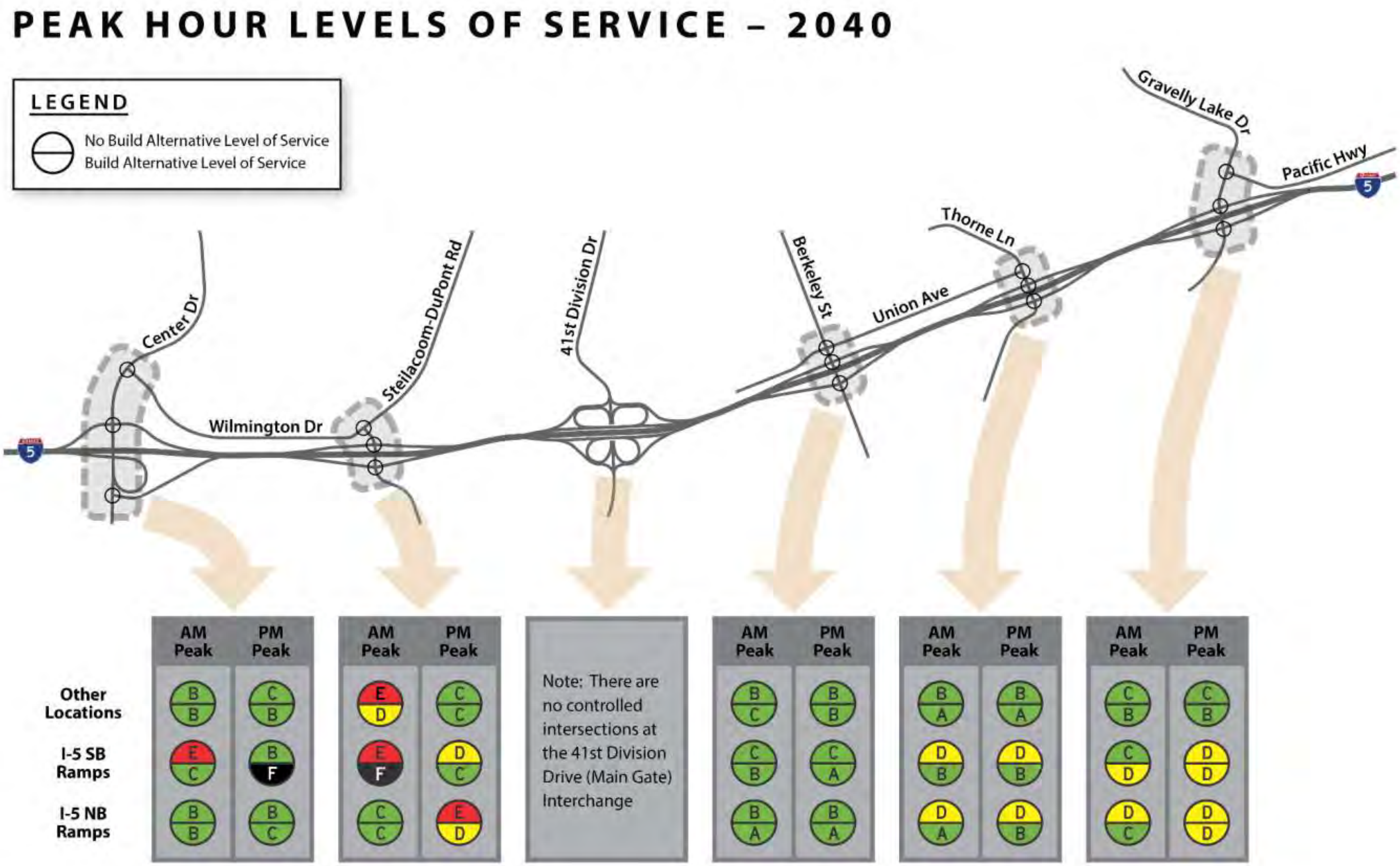
Thorne Lane Interchange – The proposed Build Alternative reconfiguration with teardrop roundabouts at the I-5 ramps and grade separation over the adjacent rail line would improve traffic operations at this interchange. At the Thorne Lane intersections with the I-5 ramps, the levels of service for the No Build Alternative would generally be at LOS D or better. The reconfigured Build Alternative interchange is expected to operate at LOS B or better through 2040. Results of the intersection analyses for the adjacent interchanges at Center Drive, Steilacoom-DuPont Road and Gravelly Lake Drive are summarized in Table 7.

Figure 47: 2020 AM and PM Peak Hour Levels of Service for the No Build and Build Alternatives



	AM Peak	PM Peak	AM Peak	PM Peak		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Other Locations	B B	C B	D D	C D	Note: There are no controlled intersections at the 41st Division Drive (Main Gate) Interchange	B C	B A	B A	B C	C B	D B
I-5 SB Ramps	C C	B B	C D	C D		D B	C A	C A	D B	C D	D D
I-5 NB Ramps	B B	B B	C C	D D		B A	C A	C A	D A	D C	D C

Figure 48: 2040 AM and PM Peak Hour Levels of Service for the No Build and Build Alternatives



	AM Peak	PM Peak	AM Peak	PM Peak		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Other Locations	B B	C B	E D	C C	Note: There are no controlled intersections at the 41st Division Drive (Main Gate) Interchange	B C	B B	B A	B A	C B	C B
I-5 SB Ramps	E C	B F	E F	D C		C B	C A	D B	D B	C D	D D
I-5 NB Ramps	B B	B C	C C	E D		B A	B A	D A	D B	D C	D D

Table 7: Summary of Interchange Delay and Level of Service (LOS) at Other Area Interchanges—No Build vs. Build Alternatives

Intersection*	2020 No Build		2020 Build		2040 No Build		2040 Build	
	AM	PM	AM	PM	AM	PM	AM	PM
I-5 NB Ramps / Center Drive**								
Control Type	2-way Stop		2-way Stop		2-way Stop		2-way Stop	
Average Delay (sec) / LOS	12.3/B	12.7/B	12.2/B	10.9/B	12.0/B	11.9/B	13.3/B	15.0/C
I-5 SB Ramps / Center Drive								
Control Type	2-way Stop		2-way Stop		2-way Stop		2-way Stop	
Average Delay (sec) / LOS	18.6/C	13.3/B	15.3/C	11.4/B	**35.0/E**	13.2/B	21.0/C	**63.1/F**
Center Drive / Wilmington Drive								
Control Type	Signal		Signal		Signal		Signal	
Average Delay (sec) / LOS	14.1/B	20.2/C	13.0/B	18.6/B	18.4/B	20.2/C	13.7/B	18.7/B
I-5 NB Ramps / Steilacoom-DuPont Road								
Control Type	Signal		Signal		Signal		Signal	
Average Delay (sec) / LOS	22.5/C	45.1/D	22.3/C	43.8/D	29.7/C	**57.9/E**	28.6/C	49.3/D
I-5 SB Ramps / Steilacoom-DuPont Road								
Control Type	Signal		Signal		Signal		Signal	
Average Delay (sec) / LOS	34.0/C	29.1/C	37.2/D	41.2/D	**68.7/E**	37.5/D	**82.2/F**	30.9/C
Steilacoom-DuPont Road / Barksdale Avenue / Wilmington Drive								
Control Type	Signal		Signal		Signal		Signal	
Average Delay (sec) / LOS	36.9/D	27.1/C	46.9/D	37.4/D	**58.2/E**	26.6/C	50.3/D	28.5/C
I-5 NB Ramps / Gravelly Lake Drive								
Control Type	Signal		Signal		Signal		Signal	
Average Delay (sec) / LOS	46.5/D	46.1/D	24.0/C	35.0/C	35.4/D	49.6/D	26.1/C	50.2/D
I-5 SB Ramps / Gravelly Lake Drive								
Control Type	Signal		Signal		Signal		Signal	
Average Delay (sec) / LOS	31.3/C	37.2/D	38.4/D	37.9/D	32.8/C	40.8/D	47.0/D	39.3/D
Gravelly Lake Drive / Pacific Highway								
Control Type	Signal		Signal		Signal		Signal	
Average Delay (sec) / LOS	32.0/C	37.1/D	12.6/B	17.9/B	34.6/C	34.7/C	15.8/B	12.8/B

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

** The I-5 NB Ramps / Center Drive intersection was redesigned in 2015. This new design is reflected in the 2020 and 2040 analysis.

Center Drive – For the northbound and southbound ramp intersections at Center Drive for the Build Alternative, the Synchro analyses show that these intersections would operate at LOS C or better in 2020 and 2040 during the AM and PM peak hours, except that the I-5 southbound ramp intersection for the Build Alternative is expected to operate at LOS E in the PM Peak hour. However, the Synchro analysis does not account for back-ups from the ramp meter on the southbound on-ramp.

For both the No Build and Build Alternatives, traffic at the Center Drive southbound on-ramp is expected to back-up from the ramp meter through the I-5 southbound ramp intersection with Center Drive and then westbound along Center Drive and through the signalized intersections at Wilmington Drive and McNeil Street. Figure 49 shows the 2020 PM peak hour queue back-ups 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 mainline congestion north of Center Drive, and the reduction of I-5 travel lanes at Center Drive from four lanes to three lanes.

To provide a quantitative assessment of expected future traffic operations at this location that does account for the effects of traffic queuing, further analysis was conducted using the Meso Model (Dynameq). Results are presented in Table 8.

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 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.

Gravelly Lake Drive – During the 2020 AM and PM peak hours, the 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 or better for the No Build Alternative, but is expected to improve to LOS B with the Build Alternative.

A more detailed summary of the intersection analyses for the Build Alternative, including turning movements for both the Synchro analyses and from the Mesoscopic Model, is contained in Appendix F.

Figure 49: Comparison of No Build vs. Build Alternatives 2020 PM Peak Hour of 95 % Traffic Queues along Center Drive and Wilmington Drive in DuPont

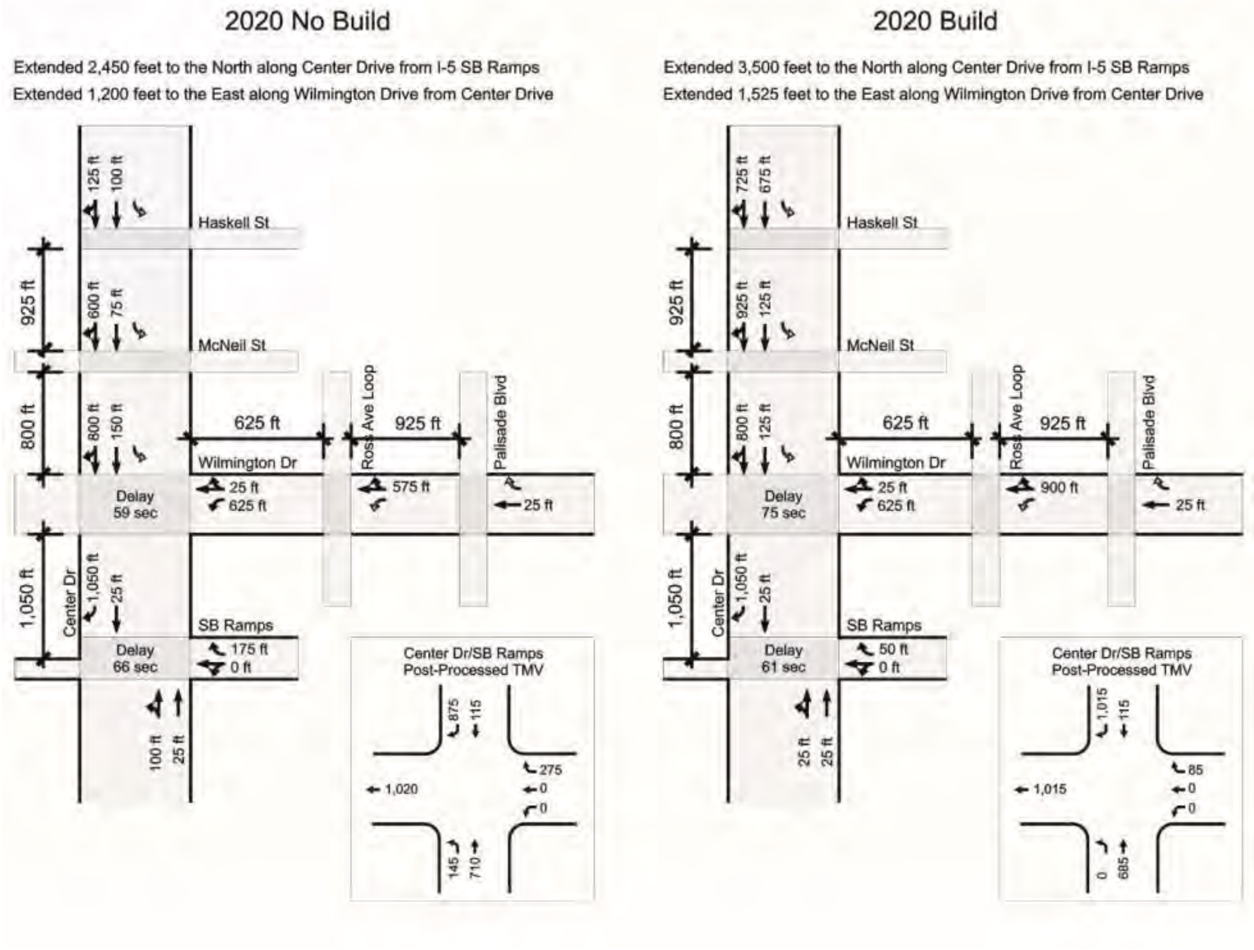


Table 8: 2020 AM and PM Peak Hour Intersection Level of Service at Center Drive Interchange using Meso Model – No Build and Build Alternatives

	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**

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.

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 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 would be less than 30 seconds on all approaches.

For the Build Alternative, traffic operations are expected to improve with delays of less than 37 seconds 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 than with the No Build Alternative.

Table 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

8.8 Summary of 2020 and 2040 I-5 Traffic Conditions in the JBLM vicinity

A summary of the key findings from the I-5 traffic operation analysis of the No Build Alternative and the Build Alternative in 2020 and 2040 include:

- Traffic demand along I-5 in the JBLM area remains high but the Build Alternative accommodates a higher percent of trip demand during the PM peak hours than the No

Build Alternative (92.6 percent vs 71.4 percent in 2020 and 49.0 percent vs 30.4 percent in 2040).

- 2020 PM northbound I-5 travel speeds average 44 mph with the Build Alternative and 19 mph with the No Build Alternative.
- 2020 PM southbound I-5 travel speeds average about 13 mph for both the Build and No Build Alternatives.
- 2040 PM northbound I-5 travel speeds average 27 mph with the Build Alternative and 15 mph with the No Build Alternative.
- 2040 PM southbound I-5 travel speeds average about 7 mph for the Build Alternative and about 10 mph for the No Build Alternative. The slightly lower Build Alternative average speed is caused by moving the reduction in travel lanes from Thorne Lane for the No Build Alternative to Center Drive for the Build Alternative. This change causes slower southbound traffic through most of the study area, whereas the No Build Alternative causes more back-up outside the study area.
- The No Build Alternative has congestion lasting for up to 4.5 hours through most of the study area, whereas the Build Alternative has congestion lasting between two and four hours during the six-hour PM peak analysis period.
- High levels of exiting and entering traffic from several ramps cause drivers to shift lanes frequently, resulting in slow travel speeds for both the No Build Alternative and the Build Alternative.
- Average AM travel times in 2020 along the I-5 corridor between Center Drive and Gravelly Lake Drive are lower in both directions with the Build Alternative as compared to the No Build Alternative.
- Average PM travel times in 2040 along the I-5 corridor between Center Drive and Gravelly Lake Drive are lower in the northbound direction with the Build Alternative as compared to the No Build Alternative. However, in the PM southbound direction average travel times are higher for the Build Alternative, because of the higher demand, moving the lane reduction to Center Drive, and the high merging traffic from Center Drive.
- With the interchange improvements at Steilacoom-DuPont Road, Berkeley Street and Thorne Lane, intersection operations are at LOS C or better in both 2020 and 2040 for the Build Alternative; whereas several ramp intersections are at LOS E or F with the No Build Alternative.

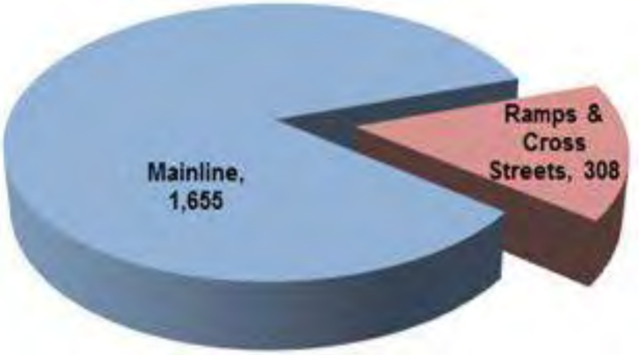
9.0 I-5 Collision Analysis

> ***"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."***

A five-year collision analysis was conducted along the I-5 mainline from milepost (MP) 117.42 (south of the Center Drive Interchange) to MP 124.79 (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.

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. Approximately 84 percent occurred on the I-5 mainline with 16 percent occurring at the six interchanges between Center Drive and Gravelly Lake Drive and in the limited-access segments of the cross streets, as indicated by Figure 50.

Figure 50: Number of I-5 Collisions - Number of I-5 Collisions Center Drive to Gravelly Lake Drive -- 2010 to 2014



9.1 Collision Rates

A summary of the annual collision rates by severity of collisions along the I-5 mainline is shown in Table 10. Table 10 shows the total collisions along the mainline, ramps and all cross-streets within the limited access area.

Table 10: Collision Summary on I-5 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

The average collision rates on I-5 through the JBLM area, based on available data, are below the Pierce County collision rate for all highways (177.5 collisions per 100 MVMT), as documented in WSDOT's *2013 Annual Collision Summary*. Fatalities and serious injury rates are also below the county wide averages of 0.62 fatalities per 100 MVMT and 3.36 serious injuries per 100 MVMT.

WSDOT has also conducted a safety assessment for all state highways in Washington State. Based on WSDOT's 2015 safety assessment, using 2009-2013 data, WSDOT identified four Collision Analysis Segments (CAS) located on I-5 within the study area, as shown in Table 11. One is in the vicinity of Center Drive, two are near Steilacoom-DuPont Road and one is from Thorne Lane to Bridgeport Way. The recently completed Tiger III improvements can improve these locations, but two years of data are needed to assess the effectiveness of the ramp meters and other improvements.

Table 11: Location of IU-5 Mainline, Ramp and Cross Street Collision Summary

Highway	From Location	To Location
I-5	NB off-ramp to Center Drive Gore MP 117.79	0.18 miles north of Center Drive bridge MP 118.14
I-5	Bridge over Railroad to JBLM MP 118.37	At SB on-ramp from Steilacoom-DuPont Road MP 118.64
I-5	At SB on-ramp from Steilacoom-DuPont Road MP 118.64	Bridge over Pendleton Avenue MP 119.38
I-5	SB Off-ramp to Thorne Lane MP 123.94	Bridge over Clover Creek near Bridgeport Way MP 125.64

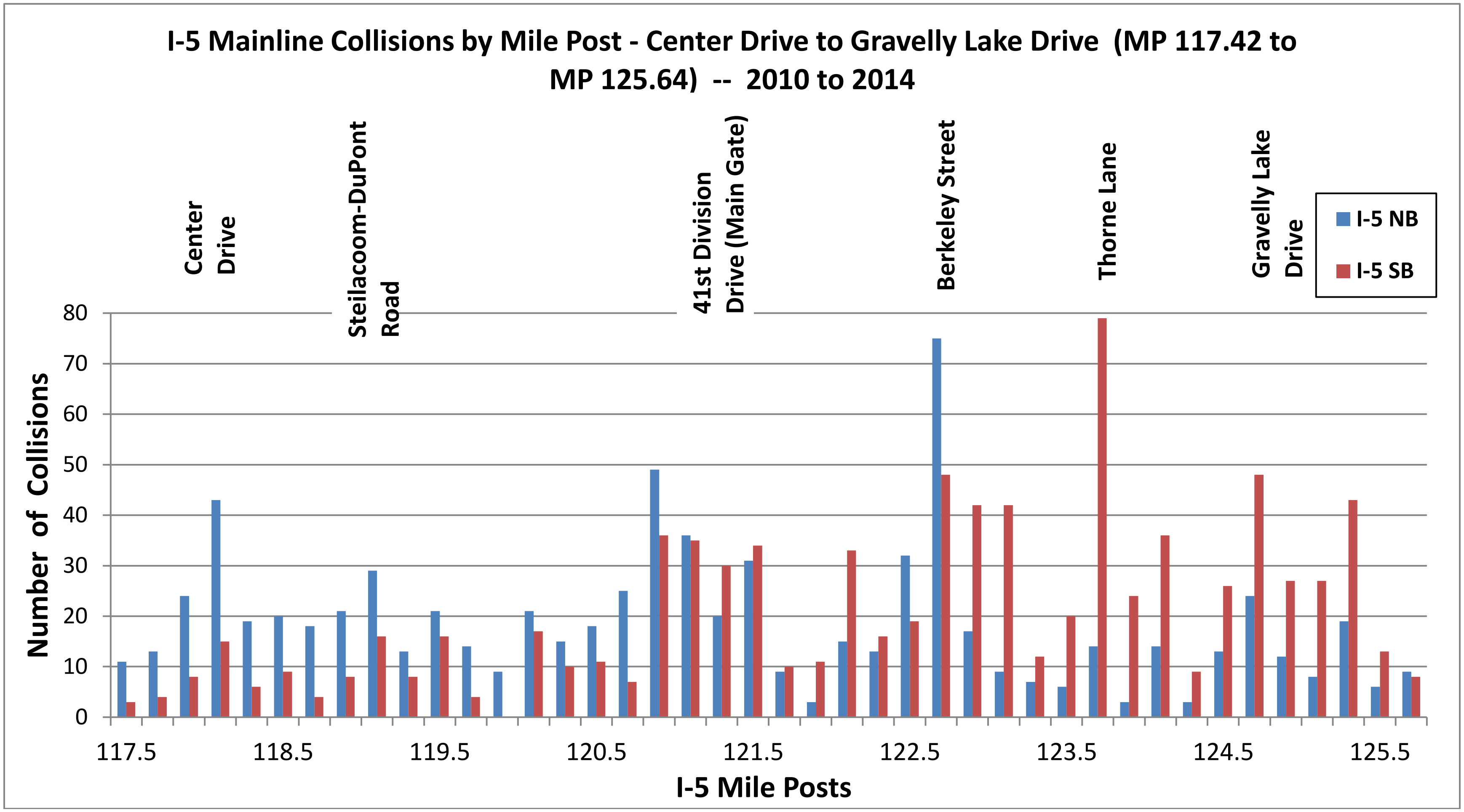
9.2 I-5 Mainline Collision

The locations of collisions along the I-5 mainline and the time of day they occur over the five-year period from 2010 through 2014 are discussed below.

Location of I-5 Collisions: With 84 percent (1,635 collisions of five years) of the collisions between Center Drive and Gravelly Lake Drive occur along the I-5 mainline, an analysis was conducted to determine the location of collisions. Figure 51 shows the location and number of collisions along the I-5 corridor by milepost in both directions over the five-year period from January 2010 through December 2014. With the close proximity of interchanges and heavy merging and existing volumes, many of the collisions occur near the interchange on- and off-ramps, or as drivers merge across traffic to change lanes. At the Thorne Lane Interchange, southbound collisions are high because of the outside lane becoming an exit only lane and through traffic in this lane must change lanes to continue south.

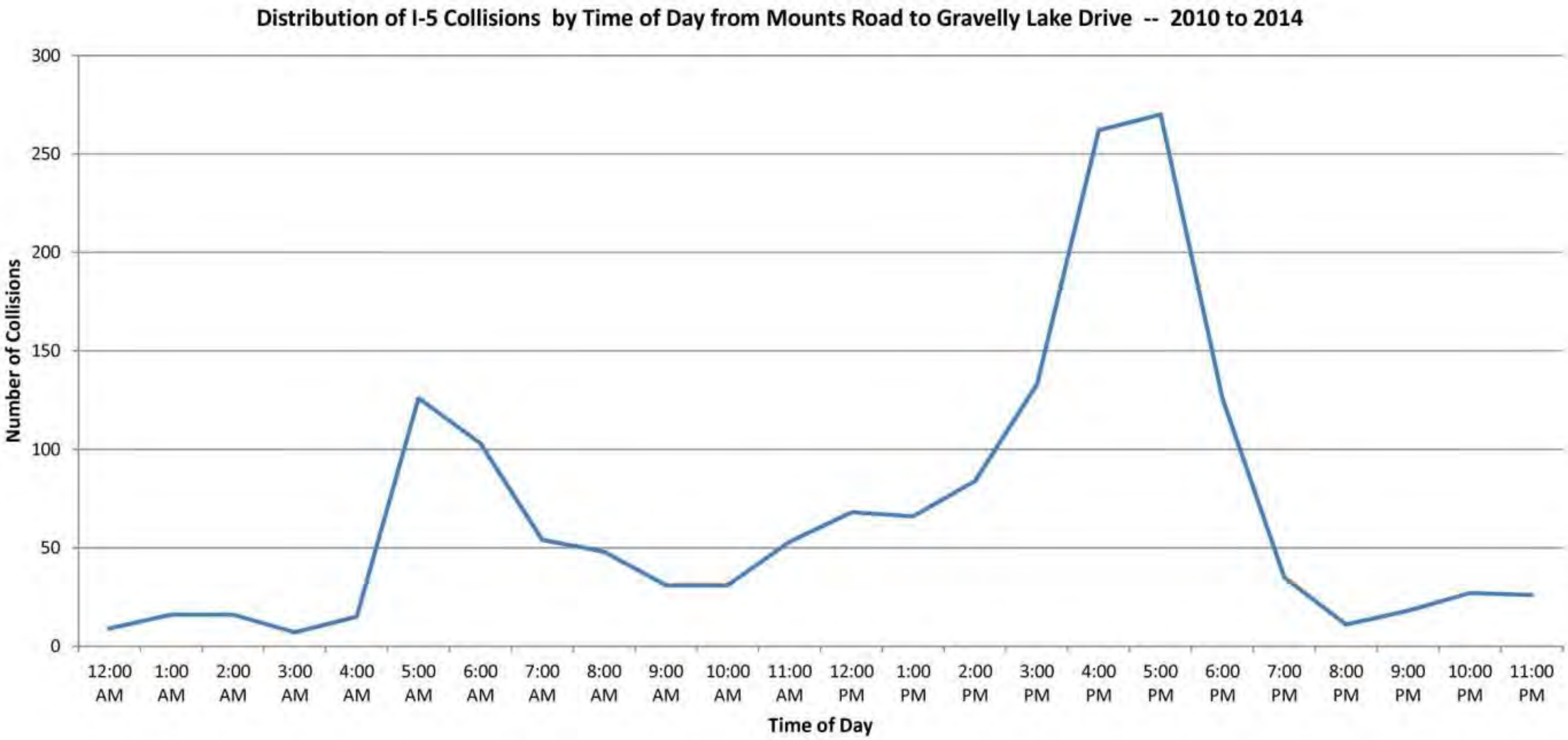
Collisions by Time of Day: Figure 52 shows the distribution of mainline collision by time of day over the five year (2010 to 2014) period along I-5 between Center Drive and Gravelly Lake Drive. Approximately 14 percent of the collision along I-5 occur between 5:00 AM and 7:00 AM, and over 48 percent of the collisions occur between 3:00 PM and 7:00 PM. These times of collision generally correspond AM and PM peak travel times with the most congestion

Figure 51: I-5 Mainline Collisions by Milepost



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."

Figure 52: Distribution of I-5 Collisions by Time of Day between Center Drive and Gravelly Lake Drive



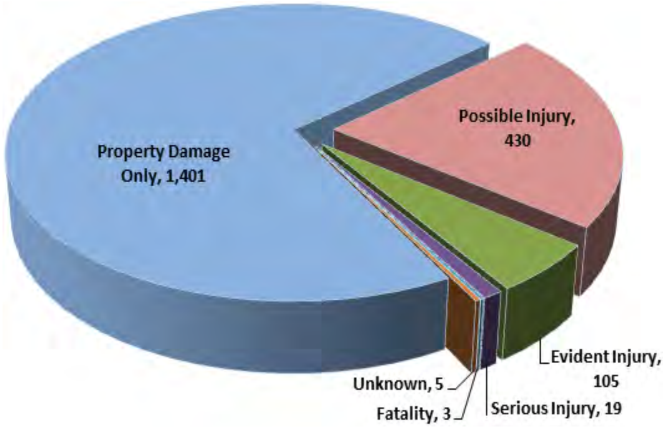
Note: Under Section 409 of Title 23 of the United States Code, any collision data furnished is prohibited from use in any litigation against state, tribe or local government that involves the location(s) mentioned in the collision data."

9.3 Severity, Type and Contributing Circumstance for I-5 Collisions

An analysis of all I-5 collisions, including mainline, ramp and cross street collisions, between Center Drive and Gravelly Lake Drive was conducted to determine the severity, types, and contributing circumstances of the collisions.

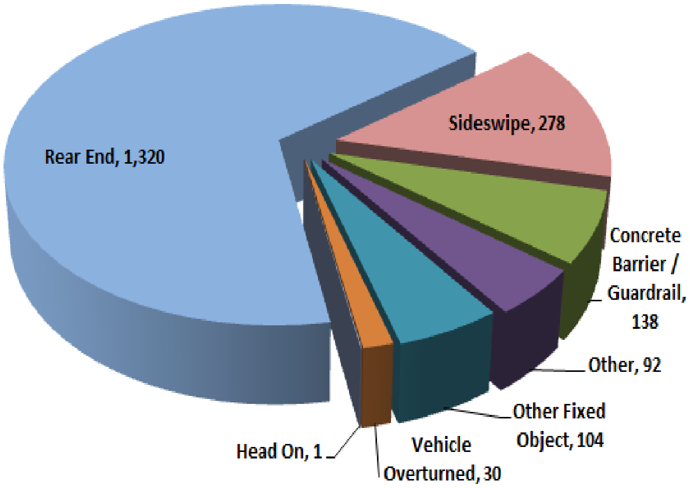
Severity of I-5 Collisions: The severity of the I-5 collisions is summarized in Figure 53. Collisions involving property damage only (no injuries) make up the majority (nearly 72 percent) of the collisions with almost 83 percent of these collisions occurring along the I-5 corridor between Center Drive and Gravelly Lake Drive. Three fatalities occurred along I-5 during the five-year study period and 19 collisions involved serious injuries.

Figure 53: Severity of I-5 Collisions – Center Drive to Gravelly Lake Drive – 2010 to 2014



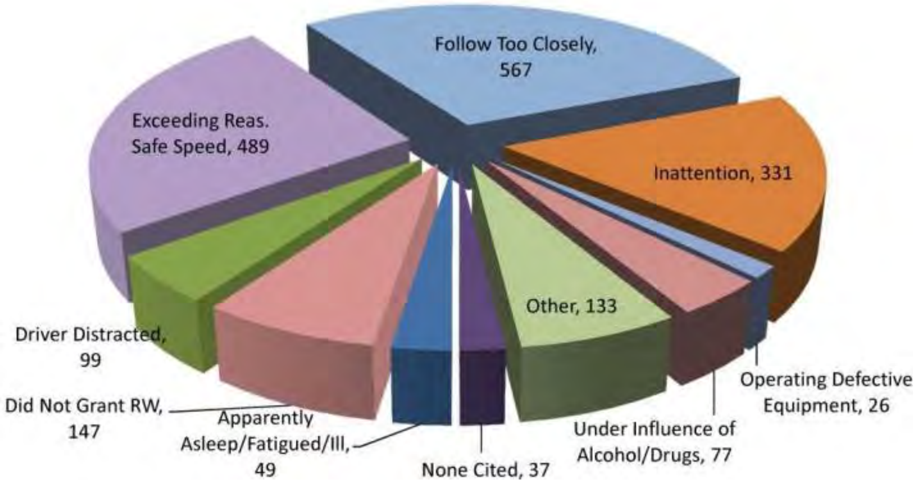
Types of I-5 Collisions: As shown in Figure 54, nearly 70 percent of collisions along the I-5 corridor between Center Drive and Gravelly Lake Drive were rear-end collisions and almost 20 percent were sideswipe collisions. About seven percent of the collisions involve hitting fixed objects, such as median barriers, guardrails, retaining walls, fences, bridges, and ditches. The rear-end and sideswipe collisions are common occurrences in congested stop-and-go conditions, like I-5 through the study area with heavy entering and exiting traffic and drivers frequently changing lanes.

Figure 54: I-5 Collisions by Type – Center Drive to Gravelly Lake Drive – 2010 to 2014



Contributing Circumstances for I-5 Collisions: Based on existing collision data, there are several circumstances that contribute to the collisions along the I-5 corridor between Center Drive and Gravelly Lake Drive, as shown on Figure 55. Exceeding reasonable speeds, following too closely, and driver inattention are three factors that contribute to 71 percent of the collisions that have occurred along this section of I-5. Drivers who were distracted or did not grant others the right of way to merge or change lanes contributed another 12 percent of the collisions along the I-5.

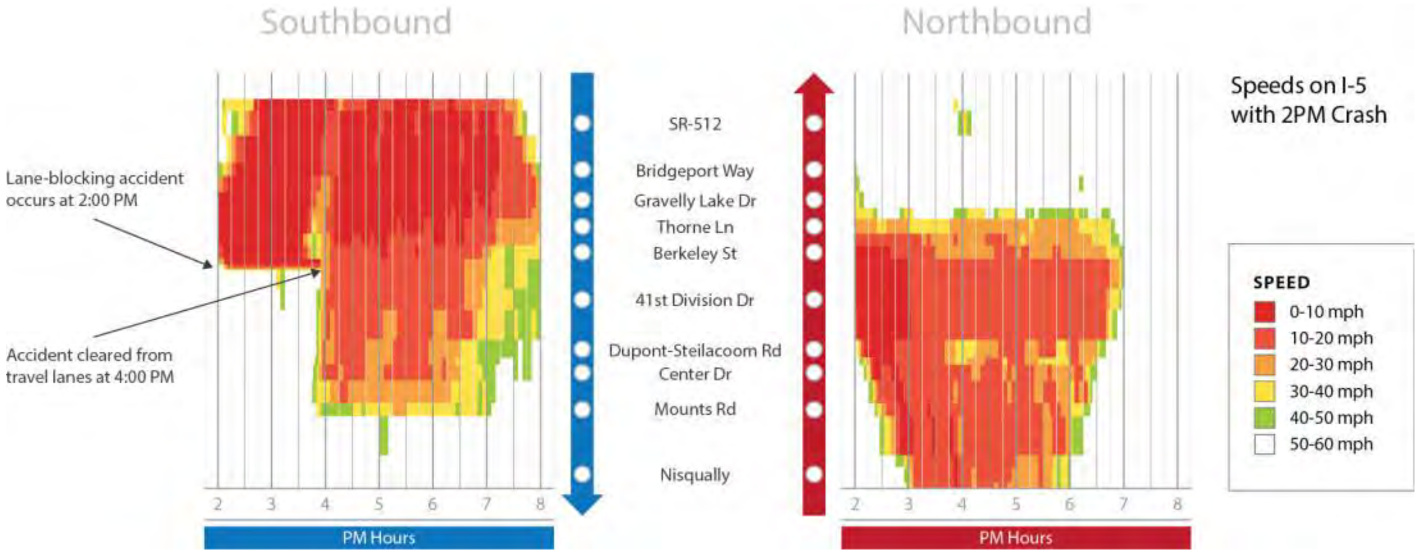
Figure 55: Contributing Circumstances for I-5 Collisions – Center Drive to Gravelly Lake Drive – 2010 to 2014



9.4 Effect of Collision on the Traffic Flow and Speeds along I-5

Figure 56 illustrates the effect of a collision on traffic congestion along I-5 through the study area. Data were obtained for a specific incident that occurred at approximately 2 PM on February 28, 2013 in the southbound directions of I-5. Traffic did not clear and begin to move until 4 PM. Northbound traffic remained slow until 7 PM and southbound traffic did not resume normal speeds until after 8 PM.

Figure 56: Speeds on I-5 between Exits 114 and 127 with a 2 PM Crash



9.5 Effect of Proposed Build Alternative on I-5 Collisions

The Build Alternative is expected to improve operations in the opening year of operation, add capacity, reduce congestion, and reduce mainline collisions. In addition, the reconfigured interchanges with roundabouts and longer ramps at Berkeley Street and Thorne Lane are expected to reduce collisions at the ramp terminals by reducing the number of conflict points as compared to signalized intersections. Also, the ramps are designed with longer queue areas that would reduce queue backing up onto the I-5 mainline, resulting in less traffic flow interruptions along I-5 and reduced collisions. By the 2040 design year, congestion would once again become a dominant pattern and other improvements would be needed to reduce collisions.

To quantitatively assess the expected effect of the Build Alternative on safety 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. A summary of the ISATe model results is located in Appendix G.

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 the No Build Alternative because of higher expected traffic levels along the I-5 corridor, as shown in Table 12. However, the overall collision rate per million vehicles is slightly lower for the Build Alternative than for the No Build Alternative.

Table 12: Comparison of 2020 and 2040 Predicted Collisions on I-5 – Center Drive Interchange to Gravelly Lake Drive Interchange

Alternative	Mainline Collisions		Ramp Collisions		Ramp Intersection Collisions		Total Collisions	Total Collisions per MVM
	Number	Per MVM	Number	Per MVM	Number	Per MEV		
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
2040 No Build	443	0.96	25	1.05	45	0.43	513	1.14
2040 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

10.0 Effects of the Build Alternative on Local Streets 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 30. 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 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 13 for the No Build and Build Alternatives. With the No Build Alternative, two-way traffic along Union Avenue near Thorne Lane in 2020 and 2040 is expected to be approximately 355 vehicles during the AM peak hour, and around 525 vehicles during the PM peak hour. With the Build Alternative, AM peak hour two-way volume on Union Avenue is expected to be less than 205 vehicles in 2020 and 2040, and the PM peak hour volume would be about 290 vehicles in 2020, but reduced to about 185 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 13: 2020 and 2040 AM and PM Peak Hour Two-way Volumes on Local Streets near the Thorne Lane Interchange – No Build Alternative vs. Build Alternative

	No Build Alternative				Build Alternative			
Location	**2020 AM**	**2020 PM**	**2040 AM**	**2040 PM**	**2020 AM**	**2020 PM**	**2040 AM**	**2040 PM**
Union Avenue south of Thorne Lane	355	525	390	385	205	290	180	185
Thorne Lane west of Union Avenue or Union Avenue Loop Connector	375	570	440	455	590	1,180	705	885
Thorne Lane over I-5	1,020	1,115	1,165	1,095	1,125	1,645	1,405	1,540

On Thorne Lane west of Union Avenue, compared to the No Build Alternative traffic is expected to increase with the Build Alternative during the AM peak hour by about 215 vehicles in 2020 and by about 265 vehicles in 2040. It is expected to increase during the PM peak hour by about 610 vehicles in 2020 and by about 430 vehicles in 2040. On the bridge over I-5, 2020 Build Alternative traffic would increase by about 100 (in the AM peak hour) to 530 (in the PM peak hour) vehicle trips in comparison to the No Build Alternative, but by only between 240 (in the AM peak hour) to 445 (in the PM peak hour) vehicles in 2040. 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 slight 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 centerline 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 30. 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 14 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.

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.

Table 14: 2020 and 2040 PM Peak Hour Two-way Volumes on Local Streets near the Berkeley Street Interchange – No Build Alternative vs. 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

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 mitigations can include right-in/right-out operations at the intersection and traffic calming features on Washington Avenue north of Berkeley. 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-Thorne 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 31.   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.

11.0 Transit Service and TDM Activities within the I-5 Study Area

Transit and vanpool service are important factors that affect traffic operations along I-5. The following is a summary of the existing transit service along the I-5 corridor though the JBLM area and the benefits to traffic operations.

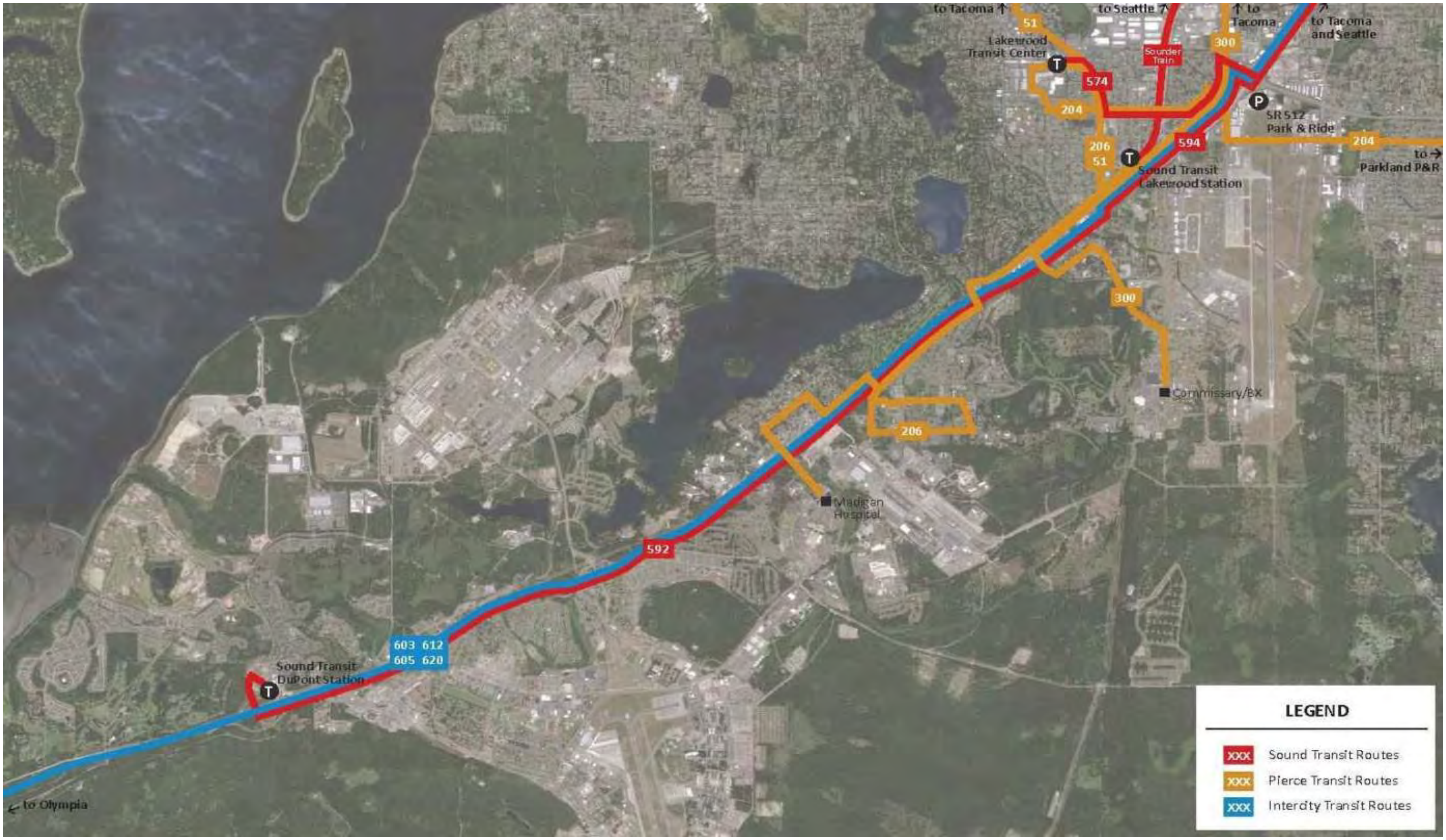
11.1 Existing Transit Service along I-5

Currently, there are three public transit providers operating within the study area: Intercity Transit, Pierce Transit, and Sound Transit. An illustration of existing transit routes, transit centers and park-and-ride lots within the study area is presented in Figure 57.

Intercity Transit: Based in Thurston County, Intercity Transit (IT) operates five routes through the study area, and sub-contracts service for a sixth route. All routes provide access to JBLM through a transfer at the Lakewood Transit Station to Pierce Transit buses, but none operate directly on the base due to strict security regulations prohibiting general public riders from entering the facility. IT service through the study area includes:

- Route 603 is a weekday route providing bi-directional service between downtown Olympia/Capitol Campus, Lacey (Martin Way park and ride), Lakewood (Lakewood Station/SR 512 park and ride), and Tacoma (Tacoma Dome and downtown).
- Route 605 is a weekday route providing bi-directional service between downtown Olympia/Capitol Campus, Lacey (Martin Way park and ride), Lakewood (Lakewood Station/SR 512 park and ride), and Tacoma (Tacoma Dome and downtown).
- Route 609 is a weekday route providing bi-directional service between Tumwater (state agency campus), Olympia Capitol Campus, Lacey (Hawkes Prairie park and ride), and Lakewood (Lakewood Station/SR 512 park and ride).

Figure 57: Existing Transit Service and Park and Ride Lots



- Route 612 is a weekday route providing bi-directional service between Tacoma (Tacoma Dome and downtown), Lakewood (SR 512 Park and Ride and Lakewood Station), Lacey (Lacey Transit Center), and Olympia (Capitol Campus and downtown).
- Route 620 serves the study area on weekends providing bi-directional service between Olympia (downtown and Capitol Campus), Lacey (Lacey Transit Center and Martin park and ride), Lakewood (Lakewood Station and SR 512 park and ride lot), and Tacoma Mall.

IT contracts with Sound Transit to provide Route 592 weekday service between Olympia and Seattle which is described below under Sound Transit.

IT also offers a commuter vanpool program that serves a wide variety of destinations throughout Thurston, Pierce, Kitsap, Grays Harbor, King, and Lewis counties. Thirty-seven of the more than 230 IT vans currently on the road operate to and from JBLM (including Ft. Lewis, Madigan and McChord) and Camp Murray.

Additional vanpool groups use I-5 with destinations in the cities of Lakewood and DuPont. IT has been in regional discussions with JBLM to consider methods that would serve the general public's need for transit to the bases while satisfying the military's need for base security.

Pierce Transit: Pierce Transit is responsible for local bus service in Pierce County and operates four routes that provide access to or close to JBLM.

- Route 51 connects the Lakewood Station in the vicinity of the Bridgeport Way interchange with the Lakewood Transit Center and destinations in central and north Tacoma.
- Route 204 operates via South 112th Street and serves the SR 512 park and ride lot. Service is also available to McChord North Gate at the intersection of South 112th and Tacoma Way/Union Avenue.
- Route 206 operates between the Lakewood Transit Center and Madigan Hospital.
- Route 300 serves JBLM McChord Field operating between the Tacoma Mall Transit Center and McChord Commissary with stops at the SR 512 park and ride lot.

Similar to IT, Pierce Transit also offers regional vanpool services along the I-5 corridor. Currently 31 vans serve JBLM.

Sound Transit: The Central Puget Sound transit provider, Sound Transit (ST), operates three express bus routes along the I-5 corridor within the study area. All service is provided during peak periods in the morning and evening. ST does not provide local bus service to JBLM. The closest stops are located at the Lakewood Sounder Station and park and ride lot and in DuPont. The Sound Transit routes are:

- Route 574 operates between the Lakewood Transit Center and SeaTac Airport.
- Route 592 (Olympia Express) operates between the Olympia Transit Center and downtown Seattle including the Hawks Prairie park and ride lot, DuPont, Lakewood and the SR 512 park and ride. Since October 2013, service has been contracted by IT and operated by ST.
- Route 594 operates between the Lakewood Sounder Station and Seattle.

ST also operates Sounder Rail Service that connects Seattle and Tacoma with the Lakewood Sounder Station. Sounder service is operated in the former BNSF right of way adjacent to and west of I-5 that is now owed by ST. As part of the *Point Defiance Bypass Project*, WSDOT will eventually improve the tracks along this corridor for Amtrak Cascades and Coast Starlight services which is expected to relocate from the current Point Defiance route in 2017. ST's Long-Range Plan includes the potential for commuter rail service to operate to DuPont (and possibly beyond), as well as to JBLM. Such service would likely require adding a second track within the right of way, grade-separating certain crossings, and locating new station(s) by the gate(s) to/from JBLM. Options for expanding I-5 and reconfiguring the interchanges should anticipate these rail operations and facilities, and not preclude or adversely impact them.

11.2 Park and Ride Lots

There are seven primary park and ride lots within or serving the corridor study area. A summary of the park and ride inventory data, including number of parking stalls and utilization is shown in Table 15.

Table 15: Park and Ride Lot Inventory

Facility/Lot	City	Location	Number of Parking Spaces	Average Daily Utilization
SR 512	Lakewood	I-5 & SR 512	493	93%
Lakewood Sounder Station	Lakewood	Pacific Highway & 47th Avenue SW	600	50%
DuPont	DuPont	Wilmington Drive & Palisade Blvd	126	63%
Martin Way	Lacey	I-5 & Martin Way	318	65%
Hawks Prairie	Lacey	I-5 & Hogum Bay Road	332	27%
Centennial Station	Thurston Co.	6600 Yelm Hwy SE	110	2%
Tumwater	Tumwater	Israel/Bonniewood Rd SE	30	15%

Source: Intercity Transit, Pierce Transit and Sound Transit, 2013.

10.3 Commute Trip Reduction

In 1991, the Washington State Legislature adopted the Commute Trip Reduction (CTR) Law as a tool to help address the growing traffic congestion problem in the state. The CTR encourages the use of non-single occupant vehicle travel modes for works trip using employer-based programs. In 2006, legislators passed the CTR Efficiency Act, that requires local governments in urban areas with traffic congestion to develop programs to reduce drive-alone trips and vehicle miles traveled per capita.

By 2009, the CTR Program had removed 30,000 vehicles from the states roadways each morning, reducing congestion, air pollution and energy consumption. Traffic delays have been cut by eight percent in the Central Puget Sound region, and rush hour commuters saved about $59 each during that year in fuel and time. CTR participants also conserved about 3 million gallons of gasoline in the 2009-2010 biennium and drove 154 million fewer miles in comparison with 2007. (Data from WSDOT's CTR website, December 23, 2013.)

CTR targets workplaces with 100 or more full-time employees in the most congested areas of the state. Employers develop and manage their own programs based on locally-adopted goals for reducing vehicle trips and miles traveled. Statewide there are more than 1,050 worksites and 530,000 commuters participating in the CTR program. Employers regularly report on their programs and jurisdictions report on progress toward meeting drive-alone and Vehicle Miles Travelled (VMT) reduction targets.

As noted previously, within the I-5 JBLM study area there are several active CTR programs that affect travel along I-5. These programs are provided by IT and Pierce Transit, which offer carpool, vanpool and other TDM services. In addition to the vanpool service provided by IT and Pierce Transit, Seattle Metro and JBLM also provide vanpool services that reduce traffic flow along the I-5 corridor.

As the largest employer in Pierce County, JBLM has developed an active CTR program:

- Approximately 125 employees use bus subsidies
- Approximately 375 employees use vanpools from either Pierce Transit or Intercity Transit

(Based on data from *Joint Base Lewis-McChord Growth Coordination Plan*, The Transpo Group, 2010)

The Department of the Army has a program called the "Mass Transportation Benefit Program" (MTBP) that provides reimbursement for using mass transit (either vanpool or carpool). The MTBP is available to all personnel on base (civilian and military) and is a non-taxable program that subsidizes the use of transit up to $245 per month.

11.4 Transit Performance

As previously shown in Figure 57, there are twelve existing transit routes that serve the study area, either directly or by accommodating through trips that may otherwise have been made in a single occupant vehicle. Even more significant in terms of reducing demand on I-5 is the level of vanpool activity presently occurring within the study area. The following is an analysis of transit ridership and vanpool activity as it affects I-5 in the study area. The focus of this analysis is the PM peak period, which typically has the highest level of congestion of any time period within the corridor.

Transit Ridership on I-5 in the Study Area: Table 16 presents a summary of existing PM peak period (3-6 PM) transit ridership on I-5 in the study area as of November 2013. Currently bus transit service in the area is provided primarily by three agencies: Intercity Transit (serving Olympia and Thurston County), Pierce Transit (serving Tacoma and Pierce County), and Sound Transit (serving the Central Puget Sound region). An additional three trips during this time period are provided by the Bremerton-Kitsap Airporter which directly services JBLM, connecting it with the Sea-Tac Airport.

As indicated in the table, IT is currently providing seventeen bus trips through the study area during the 3:00 PM to 6:00 PM peak period, ten in the northbound direction and seven in the southbound direction. The ten northbound routes carry a total average weekday ridership of 214 persons during the PM peak period. The seven southbound routes carry a total average weekday ridership during the PM peak period of 101 persons. This equates to a total weekday PM peak period average of 315 persons.

Pierce Transit has twenty-two buses serving the study area during the PM peak period, eleven in the northbound direction and eleven southbound. Average total weekday ridership during this time period is 226 persons northbound and 299 southbound for a total of 525 persons.

ST has eight trips serving the study area during this same time period, all of which head southbound. Average weekday PM peak period ridership is 232 persons.

Table 16: Weekday PM Peak Period (3-6 PM) Transit Ridership in the Study Area

		Number of Buses		Ridership	
Agency	**Route**	**NB**	**SB**	**NB**	**SB**
Intercity Transit	Route 603	5		159	
	Route 605		3		79
	Route 609	4	4	27	22
	Route 612	1		28	
Pierce Transit	Route 206	5	5	100	160
	Route 300	6	6	126	139
Sound Transit	Route 592		8		232
Totals		21	26	440	632

Source: Intercity and Pierce Transit, 2013.

The total number of buses providing service on I-5 in the study areas during a typical weekday PM peak period is twenty-one northbound and twenty-six southbound. Total persons using transit in the I-5 corridor during this same time period is 440 northbound and 632 southbound for a total weekday PM peak period ridership of 1,072 persons.

Vanpool Ridership on I-5 in Study Area: Table 17 shows weekday PM peak hour ridership in existing vanpools during the summer of 2013. Only official vanpools sponsored by one of the transit operators providing service in the study area are included in this table. Additional vanpool service is provided by other transit agencies and private employers. Currently, IT sponsors 71 vanpools that serve the study area during the PM peak hour. Twenty-two of these vanpools are traveling in the northbound direction from Thurston County to destinations in Pierce and King Counties. These vanpools carry an average of 205 persons on I-5 during the PM peak hour. Forty-nine of these vanpools are traveling southbound from a variety of destinations to Thurston County. These IT vanpools carry an average of 367 persons on I-5 during the PM peak hour.

Pierce Transit sponsors 16 northbound and 3 southbound vanpools that use I-5 through the study area during the weekday PM peak hour. Vanpool ridership on I-5 during this time period is 128 northbound and 24 southbound for a total of 153 persons.

Table 17: Weekday PM Peak Hour (4-5 PM) Vanpool Ridership in Study Area

			Number of Vanpools		Ridership	
Agency	**Begin Trip**	**End Trip**	**NB**	**SB**	**NB**	**SB**
Intercity Transit	King County	Thurston County		6		41
	Thurston County	King County	8		88	
	Kitsap County	Thurston County		2		19
	Camp Murray	Thurston County		3		19
	DuPont	Thurston County		12		76
	Gig Harbor	Thurston County		1		18
	JBLM/Ft. Lewis	Thurston County		10		70
	JBLM/Madigan	Thurston County		9		79
	Tacoma	Thurston County		6		45
	Thurston County	Pierce County	14		117	
Pierce Transit (1)	Pierce County	JBLM	16	3	129	24
Totals			38	52	334	391

(1) Only partial ridership data is available, ridership total based on estimated average vanpool ridership.

Impacts of I-5 Congestion on Transit: Existing transit service along I-5 in the study area primarily serves either regional through trips, trips to/from ST's Lakewood Station, or trips to/from the Lakewood Transit Center. With over 62,000 employees, JBLM is the second largest employer in Washington State and is the largest potential transit destination in the study area. However, the secure nature of JBLM limits the effectiveness of regular fixed route transit because buses carrying non-military personnel cannot enter the secure facility or require non-military riders to deboard at the security gate. Currently only two routes serve the base, one to Madigan Hospital and the other to the McChord Commissary.

Unlike fixed route bus service, vanpools and carpools that carry only base personnel do have access to and from JBLM. There are vanpools sponsored by the major transit providers in the area that are currently connecting JBLM with destinations throughout the region. In 2013, vanpools and bus service carried approximately 1,200 people along I-5 during the PM peak hour.

Both transit service and vanpools are impacted by freeway congestion, with existing PM peak travel times exceeding off-peak travel time by 75 percent. With no HOV facilities within the study area to facilitate the advantages of alternative mode choices, buses and vanpools are caught in the same traffic as single-occupant vehicles.

With the proposed Build Alternative, all traffic, including transit, carpools, and vanpools, would have shorter travel time in 2020 as compared to the 2020 No Build Alternative. Travel time savings of 10 to 20 minutes for southbound travelers and 10 to 30 minutes for northbound travelers for trips between SR 510 and SR 512 along I-5. This allows for better transit reliability through the JBLM area along I-5.

Transit and Vanpooling Benefits to Traffic Operations along I-5: Existing transit and vanpool ridership on I-5 in the study area has a substantial impact on reducing vehicular congestion in the corridor during peak weekday travel periods. As illustrated in Table 18, if existing riders where to switch to individual vehicles, a total of approximately 1,000 vehicles would be added to existing I-5 PM peak hour traffic (approximately 440 northbound and 560 southbound).

Table 18: Benefits of Transit and Vanpooling – Weekdays during 4 to 5 PM Peak Hour

		Ridership		Number of Cars Taken off I-5	
Agency	**Mode**	**NB**	**SB**	**NB**	**SB**
Intercity Transit	Bus	89	83	73	68
	Vanpool	205	367	168	301
Pierce Transit	Bus	100	96	82	79
	Vanpool	129	24	106	20
Sound Transit	Bus	11	107	9	88
Totals		534	677	438	555

By way of comparison, 560 vehicles represent about 31 percent of the existing maximum per lane capacity in the congested heart of the corridor. Thus, it is reasonable to conclude that the availability of transit and vanpooling options significantly benefits existing highway traffic operations. By making transit more reliable, the proposed Build Alternative can encourage more drivers to switch from single occupancy vehicles to transit buses and vanpools to commute to and from their workplace.

11.5 Effect of the Build Alternative on Transit and Transportation Demand Management (TDM) Activities

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.

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.

12.0 Build Alternative Benefits to Bicycle and Pedestrian Travel in the Study Area

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 32.

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.

13.0 Construction Traffic Effects of the Build Alternative

13.1 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:

- Some 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.

13.2 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 improvements with the existing street system.

13.3 Effects of Construction on Existing Transit Service and Bus Routing

Pierce Transit route #206 serves the Tillicum and Woodbrook communities as well as Madigan Hospital on JBLM. This route will 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 will need to be modified. Additionally, all transit service provided by Intercity Transit, Pierce Transit and Sound Transit along the I-5 mainline will 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.

13.4 Construction Traffic Haul Routes

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.

13.5 Construction Traffic Mitigation

Prior to award of the first construction contract to build the improvements included in the Build Alternative, a Transportation Management Plan (TMP) will be developed. The TMP will 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 will be invited to participate in development of the TMP. The TMP will be monitored and amended over time as necessary.

Some suggested mitigation measures that could be implemented to manage construction traffic could include:

- Allowing the contractor to close only one ramp at a time.
- 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.

Appendix A

Methods & Assumptions Document

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Washington State
Department of Transportation

I-5 Joint Base Lewis-McChord Vicinity Interchange Justification Report & Environmental Documentation

Methods & Assumptions Document

Prepared for: Washington State Department of Transportation

Prepared by: H.W. Lochner, Inc. & Shea Carr Jewell, Inc.

In association with:

The Transpo Group, Inc.
Shannon & Wilson, Inc.

April 2013

LOCHNER

SHEA - CARR - JEWELL
ENGINEERING AND PLANNING SERVICES

Table of Contents

Figures

Methods and Assumptions

1. Stakeholder Acceptance

"The undersigned parties, including all members of the team from WSDOT, FHWA and the Local Agencies, concur with the Interchange Justification Report Methods and Assumptions for the I-5 Joint Base Lewis-McChord Vicinity Interchange Justification Report (I-5 JBLM Vicinity IJR) as presented in this document." The signature pages for each jurisdiction are attached at the back of this document.

STAKEHOLDER ACCEPTANCE

Joint Base Lewis-McChord

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Signature

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Title

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Date

Camp Murray

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Signature

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Title

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Date

City of Lakewood

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City of DuPont

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Town of Steilacoom

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Pierce County

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Signature

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Title

____
Date

SEE ATTACHED AGENCY
SIGNATURE PAGES

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(1) Participation on the Stakeholders Committee and/or signing of this document does not constitute approval of the I-5 JBLM Vicinity IJR.

(2) All members of the Stakeholder Committee will accept this document as a guide and reference as the study progresses through the various stages of project development. If there are any agreed upon changes to the assumptions in this document a revision will be created, endorsed and signed by all the stakeholders.

SEE ATTACHED AGENCY SIGNATURE PAGES

Thurston Regional Planning Council

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Signature

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Title

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Date

Puget Sound Regional Council

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Signature

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Title

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Date

WSDOT – Olympic Region

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Signature

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WSDOT – Olympic Region Traffic Office

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WSDOT – HQ Traffic Office

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Signature

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WSDOT – HQ Development Division

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Signature

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Title

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WSDOT – HQ Access and Hearings

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Signature

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FHWA

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Signature

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Title

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Date

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2. Introduction and Project Description

Interstate 5 (I-5) is a national highway of strategic importance as it travels from the US/Mexican Border to the US/Canadian border. It is the primary highway for the movement of goods and people traveling north and south on the west coast of the United States. In Washington, I-5 links key population centers Vancouver, Olympia, Tacoma, Seattle, Everett and Bellingham.

Over the past several years, traffic has increased along the entire I-5 corridor from Mexico to Canada. Within our study area in south Pierce County, traffic has also grown, as Joint Base Lewis-McChord (JBLM) has evolved into a strategic military base, Camp Murray has expanded, and the communities of Lakewood, DuPont and Steilacoom have grown. These area changes have added to the increased through-traffic along the I-5 corridor from Olympia to Seattle. Because of the presence of secured military bases on both sides of I-5, there are no routes to use without extended detours to bypass the military bases. Congestion along I-5 through the JBLM vicinity has become a daily occurrence with ramp traffic backing onto the I-5 mainline causing delays and safety issues.

The I-5 JBLM Vicinity IJR Project will include:

- Development of an I-5 Interstate Corridor Plan from the I-5/Center Drive Interchange to the I-5/Gravelly Lake Road Interchange;
- Development of a corridor-wide Interchange Justification Report for revisions to the I-5/Steilacoom-DuPont Road Interchange, I-5/Main Gate Interchange, I-5/Berkeley Street Interchange, and I-5/Thorne Lane Interchange;
- Prioritization of interstate improvements; and
- Preparation of the Environmental Documentation and associated preliminary engineering for highest priority improvements.

Purpose of the Project

The purpose of this project is to define improvements to relieve traffic congestion on the I-5 corridor in the JBLM vicinity with a focus on M.P. 119 to 124 including the interchanges with Steilacoom-DuPont Road, Main Gate, Berkeley Street, and Thorne Lane. A corridor Interchange Justification Report will be prepared addressing these four interchanges at a minimum. The IJR document will be developed in cooperation with the Federal Highway Administration (FHWA), WSDOT, JBLM, Camp Murray, Puget Sound Regional Council (PSRC), Thurston Regional Planning Council (TRPC), Pierce County, Intercity Transit, Pierce Transit, the Town of Steilacoom, and the cities of Lakewood, DuPont, and Lacey.

This project will then develop the necessary environmental documentation and preliminary engineering for the highest priority element(s) of the preferred solutions, as guided by the stakeholders.

The results of the Interchange Justification Report (IJR) and environmental documentation will enable the project stakeholders to assess options and opportunities to improve the transportation system within the study area, and solicit funds to implement the preferred solution in a logical manner. Specifically, the project will address:

- Relieving congestion on I-5 within the study area;
- Improving local and mainline system efficiency;
- Enhancing mobility;
- Improving safety and operations;
- Increasing transit and TDM opportunities.

Project Leads and Proponents

- Washington State Department of Transportation
- Federal Highway Administration
- Joint Base Lewis-McCord
- Camp Murray
- City of Lakewood
- City of DuPont
- Town of Steilacoom
- City of Lacey
- Pierce County
- Puget Sound Regional Council
- Thurston Regional Planning Council
- Intercity Transit
- Pierce Transit

Environmental Document Type

Depending on the selected project(s) and the degree of impacts, we are envisioning a Documented Environmental Classification Summary (DECS) or an Environmental Assessment (EA).

Level of Documentation

The proposed improvement options likely will include substantial revisions to the existing interchanges. As required by WSDOT's Design Manual Chapter 550 and FHWA, eight specific points will be addressed in the IJR. These policy points are:

(1) Policy Point 1: Need for the Access Point Revision - What are the current and projected needs? Why are the existing access points and the existing or improved local system unable to meet the proposal needs? Is the anticipated demand short or long trip?

   - Using the Base Conditions operation analyses for 2013, 2020 and 2040 discuss the intersection and interstate deficiencies in access to the Interstate at the Thorne Lane, Berkeley Street, Main Gate and DuPont-Steilacoom Road interchanges.
   - Using the collision analysis, discuss the existing safety issues along I-5 and at the Thorne Lane, Berkeley Street, Main Gate and DuPont-Steilacoom Road interchanges and what it may look like in the future if changes do not occur.

(2) Policy Point 2: Reasonable Alternatives - Describe the reasonable alternatives that have been evaluated.

   - Discuss all alternatives developed as part of this IJR and explain how these alternatives met or did not meet the purpose of the improvement.
   - Discuss why the selected alternative(s) were carried forward for further development.

(3) Policy Point 3: Operational and Collision Analyses - How will the proposal affect safety and traffic operations at year of opening and design year?

- Discuss the results of the intersection and interstate operational analyses for the opening year (2020) and design year (2040) for the recommended Build Alternatives for this IJR.
- Compare the results of the Build Alternatives with the Base Condition results, including the Thorne Lane, Berkeley Street, Main Gate and Steilacoom interchanges.
- Determine the effect of the Build Alternatives on the I-5 mainline operations and adjacent interchanges at Gravelly Lake Road, and Center Drive Interchanges. If the impacts extend further north and south, also analyze the impacts to Mounts Road Interchange, Bridgeport Way Interchange and the SR 512 Interchange.
- Discuss the collision analysis results for the Build Condition as compared to the Base Condition for the opening and design years.
- Discuss impacts to safety and operation of I-5.

(4) Policy Point 4: Access Connections and Design - Will the proposal provide fully directional interchanges connected to public streets or roads, spaced appropriately, and designed to full design level geometric control criteria?

- Discuss the geometric designs of the proposed improvements and show that all movements are included in the design.
- Prepare conceptual horizontal and vertical alignments showing the existing I-5 mainline, proposed ramps and existing cross roads for the selected alternative.
- Discuss design criteria, including ROW and access impacts.

(5) Policy Point 5: Land Use and Transportation Plans - Is the proposed access point revision compatible with all land use and transportation plans for the area?

- Summarize how current land use assumptions are included in the travel demand model.
- Discuss the improvement consistency with local, regional, and statewide transportation plans.

(6) Policy Point 6: Future Interchanges - Is the proposed access point revision compatible with a comprehensive network plan? Is the proposal compatible with other known new access points and known revisions to existing points?

- Discuss the improvement consistency with other planned interstate improvements included in the State-wide Highway System Plan and refer to a future interstate master plan, including impacts of the Cross-Base highway.

(7) Policy Point 7: Coordination - Are all coordinating projects and actions programmed and funded?

  - Discuss plans of the local jurisdictions to provide other local improvements to support the interstate modifications and that they will commit to work with WSDOT to pursue funds for the interchange modifications.
  - Discuss any previous commitments between agencies or private entities; i.e. financial, environmental, etc.

(8) Policy Point 8: Environmental Processes - What is the status of the proposal's environmental processes? This section should be something more than just a status report of the environmental process; it should be a brief summary of the environmental process.

  - Discuss the environmental findings, such as endangered species, priority habitats, wetlands and streams in the area and what environmental permits may be needed to implement the improvements.
  - Discuss any known social issues that could affect this proposal.
  - Discuss any known or potential hazardous contamination in the area.
  - Discuss (if necessary) if the location is within a non-attainment area for air quality.
  - Discuss that the environmental process must have WSDOT approval prior to the final IJR approval.

3. Analysis Years/Periods

Operational analysis will include AM, Midday and PM peak hours for the following years:

- Existing Base Year - 2013
- Assumed Opening Year - 2020
- Horizon/Design Year – 2040

A sensitivity analysis will also be conducted to assess approximately ten percent higher through traffic volumes along I-5 to account for increased Friday afternoon or Sunday evening situations.

4. Project Study Area

The project study area for this *I-5 JBLM Vicinity IJR* will extend from the I-5/Center Drive Interchange on the south to the I-5/Gravelly Lake Road Interchange on the north as illustrated on Figure 1. This area will include the following intersections for analyses:

- Center Drive Interchange (Exit #118)
  - Northbound Ramps
  - (JBLM outbound gate)
  - Southbound Ramps
  - Wilmington Drive/Center Drive
- DuPont-Steilacoom Road Interchange (Exit #119)
  - Northbound Ramps
  - Southbound Ramps
  - Wilmington Dr./Barksdale Ave.

- Main Gate Interchange (Exit # 120)
    - Northbound Ramps
    - Southbound Ramps
    - JBLM Gates
- Berkeley Street Interchange (Exit #122)
    - Northbound Ramps
    - Southbound Ramps
    - Union Avenue/Berkeley Street
- Thorne Lane Interchange (Exit #123)
    - Northbound Ramps
    - Southbound Ramps
    - Union Avenue/Thorne Lane
- Gravelly Lake Drive Interchange (Exit #124)
    - Northbound Ramps
    - Southbound Ramps
    - Pacific Highway S/Gravelly Lake Dr.

If the traffic analyses and the volumes changes show that there are impacts to adjacent interchanges further north or south, then they will be included in the project impact analysis, including:

- Mounts Road Interchange (Exit #116)
    - Northbound Ramps
    - Southbound Ramps
- SR 512 Interchange (Exit #127)
    - Southbound Off-ramp
- Bridgeport Way Interchange (Exit #125)
    - Northbound Ramps
    - Southbound Ramps
    - Pacific Highway S/Bridgeport Way

The study area for the travel demand model will include most of Pierce County and the north portion of Thurston County.

5. Traffic Operations Analysis

For interstate highway operations, the *2010 Highway Capacity Manual* (HCM) using the associated *Highway Capacity* software (HCS) (version 6.4) will be used to analyze mainline, merge/diverge connections and weaves situations. Average vehicle speed and density will be used as performance measures for the HCS analysis. For the three analysis years, AM, Midday and PM peak hour analyses will be performed.

For ramp terminal/surface street operations, intersections will be analyzed as follows:

- Synchro 8.0 software will be used to analyze the operations of signalized intersections.
- Synchro 8.0 software or HCS will be used to analyze unsignalized intersections.
- SIDRA 5.1 software package using standard model with HCS on will be used to analyze roundabout controlled intersections.
- SimTraffic software will be used to check Synchro results for ramp queuing.

For the preferred alternative, a simulation model capable of analyzing freeway and geometry between intersections and interchanges, including weaving sections and multiple vehicle classes will be used. VISSIM was selected for the simulation of the preferred alternative because it meets these needs while also providing animation graphics. The following VISSIM simulations will be prepared:

- Existing Year 2013 PM Peak Period (for model calibration)

- Design Year 2040 PM Peak Period for the Base Conditions
- Design Year 2040 PM Peak Period for the preferred alternative
- Design Year 2013 AM Peak Period (for model calibration)
- Design Year 2040 AM Peak Period for the Base Conditions
- Design Year 2040 AM Peak Period for the preferred alternative

For this report, the operational analysis area will include the I-5 corridor between Mounts Road and SR 512 interchanges and all ramp terminals.

6. Travel Forecast

The existing I-5/JBLM/Lakewood model developed for the *I-5 Alternatives Analysis Study* and consistent with the PSRC regional model will be utilized to develop forecasts for 2020 (year of opening) and 2040 (design year). In addition, the recent results and modeling efforts completed for the Lacey Area IJR will be used to help reconcile the differences between the PSRC and TRPC travel demand forecasts. This will include a more refined post-processing effort and rationale in balancing the vehicle demand and trips entering and exiting the Pierce/Thurston County line.

The 2020 model will include all local and regionally funded improvements and the 2040 model will include projects adopted in the region's Metropolitan Transportation Plan. Travel forecasts for the AM, mid-day, and PM peak periods and hours will be prepared.

Model Overview

The I-5/JBLM/Lakewood model was selected as the preferred model because it was specifically developed to support evaluation of I-5 mainline and interchange concepts in the JBLM vicinity. The available models in the area such as the PSRC, Pierce County, and TRPC models were not sufficiently refined in and around JBLM, Camp Murray, DuPont, and Lakewood to allow for the level of detail needed for an accurate assessment of I-5 and the area's transportation system. The I-5/JBLM/Lakewood model is a refined version of Pierce County's regional EMME model, but has been converted to the VISUM software platform. Transportation Analysis Zones (TAZs) have been subdivided to better model traffic patterns in the area and between major subareas of JBLM. Travel characteristics specific to the area have been introduced along with specific trip purposes and distribution for JBLM related travel to better model each of the interchanges and installation points of entry.

The model study area includes most of Pierce County, and some major highways and arterials in northeastern Thurston County. The base year model will be calibrated for AM, mid-day, and PM peak periods based on traffic counts collected during those times. Model parameters (screen lines, trip distribution, time-of day, etc.) will be validated based on FHWA guidelines. Consistency with PSRC and TRPC assumptions will be part of the model validation process. Given the recent work that has been competed for the Lacey Area IJR, the model calibration and post-processing will be sensitive to the travel forecast imbalance between the Pierce and Thurston county boundaries. The IJR team will work closely with TRPC and PSRC to solidify the model results to ensure a more accurate representation of future travel characteristics are developed for this study. Testing of future scenarios will be conducted to review model sensitivity to changes in travel demand or the model network.

Freeway Traffic Forecasts

Forecasts will be developed for SOV and HOV classes of vehicles. Truck volumes will be estimated based upon available truck counts and existing truck percentages. HOV 2+ and HOV 3+ trip tables will be prepared based on PSRC model assumptions for each of the model time periods. In regards to transit, the VISUM model will not provide direct model data for transit vehicles, but it will be flexible to transit-related assumptions. The person-trip mode-split factors come from the PSRC model, and future year mode splits will reflect PSRC anticipated changes to transit in the future. For the I-5 JBLM specific zones, adjustments can be made to the mode split or time-of-day factors based on various transit scenario assumptions. The effect on traffic volumes will be scaled accordingly.

Interchange & Intersection Traffic Forecasts

Future interchange and intersection traffic volumes will be developed using travel forecasts from the model. The model travel forecasts for each time period will be post-processed and translated into vehicle volumes for use in the operations analysis. The interchange and intersection volumes will be balanced using the freeway ramp volumes as control totals.

7. Highway Network Assumptions

The following baseline conditions are assumed:

- 2013 Base Conditions
    - Existing Highway Network
- 2020 Base Conditions
    - Funded Tiger III Improvements
    - Funded TIP improvements from Local Jurisdictions
    - Funded STIP improvements
    - Funded JBLM Improvements
    - Funded rail improvements
    - Funded inter-regional transit and vanpool service
- 2040 Base Conditions
    - Same as 2020 Base Conditions.
    - Cross-Base Highway is not included as part of the base conditions.
- Modified 2040 Base with Unfunded Local Improvements
    - Local Improvements from the Long Range Regional Transportation Plan will be reviewed by the technical support group and selected improvements will be included.
    - Cross-Base Highway improvement will be analyzed for conditions with and without the corridor.

8. Build Highway Network Assumptions

- Build Alternatives 2020
    - Use same local highway network as developed for the 2020 Base Conditions.
    - Modify I-5 mainlines and ramps as approved by Stakeholders
- Build Alternatives 2040
    - Use same local highway network as developed for the Modified 2040 Base Conditions with and without the Cross-Base Highway.
    - Modify I-5 mainlines and ramps as approved by Stakeholders

9. Safety Issues

This IJR will use the current Collision Analysis Location/Collision Analysis Corridor (CAL/CAC) criteria and the Intersection Analysis Location (IAL) criteria for state highways within the project area. In addition, the collision rates along local streets will be estimated using available local collision data. Types of accidents and contributing factors to collisions will also be summarized by location. The most recent five years of available collision data will be used for this analysis. This corridor-specific information as well as statewide system collision statistics will be used in a predictive collision analysis effort to estimate any change in the level of safety for the interstate and connecting roadways.

Procedures developed in the Highway Safety Manual will be investigated for potential use in predicting future safety assessments of the preferred Build Alternative.

10. Deviations/Justifications

At this point in the process, there are no deviations identified. Deviations may be indentified through the various study results, and will be documented as they arise.

11. Selection of Measures of Effectiveness (MOE)

The metrics to be used to demonstrate how the proposal will accomplish the stated objectives will be aligned with the provisions outlined in the *Moving Washington* initiative. These metrics may include but not be limited to the following:

1. Traffic Operations along I-5 (Travel time and density)
2. Traffic Operations at ramp terminals (Average intersection delay and 95% queue lengths)
3. Impacts critical environmental habitat (Area impacted).
4. Safety Analysis Results (Accident Potential/Risk Reduction).
5. Travel time savings for freight movement
6. Reduction in SOV trips (identify goal) through increased TDM and transit ridership
7. Effect of “Managed Lanes” compared to general purpose (peak period SOV)
8. Design Standards/Deviations
9. Right of Way/Access Impacts

The list of criteria will be finalized as the evaluation methodology is developed with approval of the Stakeholders.

12. Resolution of Late Comments

From time to time, ideas or suggestions arise late in the evaluation or documentation process. Some of these late emerging ideas may have merit and added benefits to the project, but be difficult to incorporate in the on-going process. It is understood that new ideas may bring value to the final outcomes and therefore should not be automatically dismissed because of the sequence of events and timing of the information. Specific protocols will be in place to allow new ideas and information to be "vetted" and reviewed for consideration, as follows:

> If new ideas and information are brought forward, they will be first discussed between WSDOT's Project Manager and the Consultant's Project Manager who will determine its merits. If they decide that the new idea has merit it will be referred to WSDOT/FHWA Core Team to decide how the new idea should be addressed in the IJR and environmental process. If the WSDOT and Consultant Project Managers decide that the idea has little merit, it will be added under policy point 2, if appropriate, and addressed as an idea considered.
>
> For ideas that have already been considered and dismissed, but there is new interest in re-consideration, the WSDOT's Project Manager and the Consultant's Project Manager will determine if reintroducing the idea has merits. If they decide that the new idea has merit the idea will be referred to WSDOT/FHWA Core Team to decide how the revised idea should be addressed in the IJR and environmental process.
>
> If a new idea and/or prior information is brought forward during a stakeholder meeting, the content of this information will not be fully discussed if it impacts the scheduled agenda. The Consultant's Project Manager will note the comments and content of the information and will assure that review of the new information will follow the approved protocols for consideration.

A log of all late ideas and suggestions will be maintained by the Consultant's Project Manager who will briefly summarize the idea or concept and show its status.

13. Conclusion

This study will review and analyze options for improving access to the Interstate system without degrading the mainline freeway or off-ramp operations and safety. While degradation of the Interstate system is not an acceptable outcome, there may be localized areas where degradation may occur due to system tradeoffs. Engineering judgment will be applied to arrive at the best overall set of improvements practical within the study area. This will be accomplished by thoroughly evaluating specific MOEs that are in alignment with the stated goals and the *Moving Washington* initiative.

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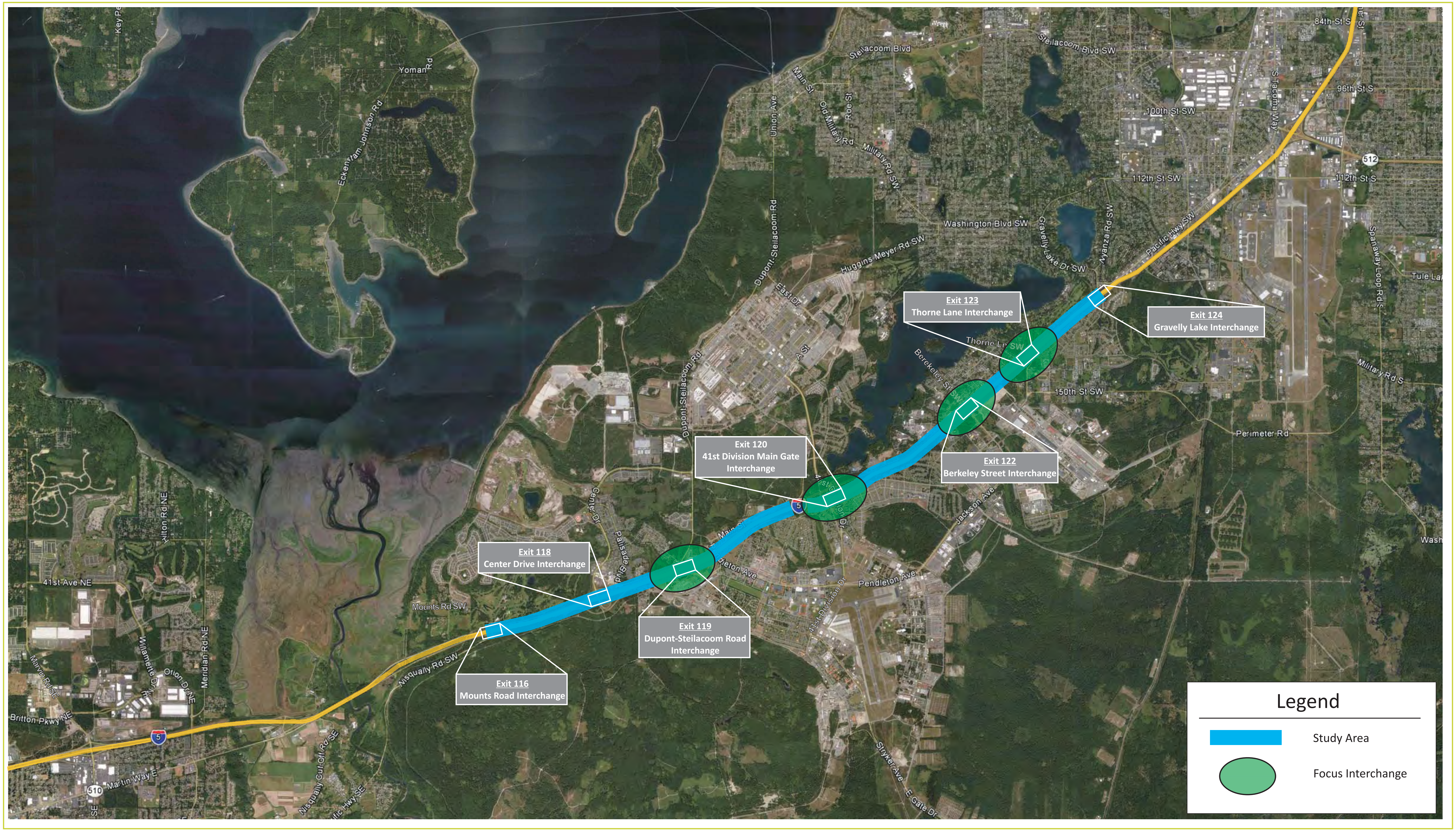

LOCHNER ‖ SHEA • CARR • JEWELL

Methods & Assumptions Document
Project Study Area

I-5 JBLM Vicinity
Interchange Justification Report &
Environmental Documentation

Stakeholder Acceptance

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Joint Base Lewis-McChord

Signature

Thomas Knight, Chief of Staff, Joint Base HQs, JBLM
Title

14 MAY 2013
Date

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Camp Murray

Signature

Planning and Programming Chief
Title

9 May 2013
Date

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City of DuPont

Signature

Mayor of DuPont

Title

July 16, 2013

Date

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Town of Steilacoom

Ron Lucas

Signature

MAYOR, TOWN OF STEILACOOM

Title

5/09/2013

Date

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Pierce County

Pat McCarthy

Signature

Executive

Title

5-13-13

Date

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Thurston Regional Planning Council

Signature

Executive Director

Title

July 11, 2013

Date

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Puget Sound Regional Council

Signature

Director of Integrated Planning
Title

July 11, 2013
Date

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WSDOT – Olympic Region

Signature

REGION ADMINISTRATOR
Title

MAY 13, 2013
Date

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Stakeholder Acceptance

"The undersigned party, in partnership with all members of the team from WSDOT, FHWA and the Local Agencies, concur with the Methods & Assumptions Document for the I-5 Joint Base Lewis-McChord Vicinity Interchange Justification Report (I-5 JBLM Vicinity IJR) as presented in this document."

WSDOT – Olympic Region Traffic

Signature

Region Traffic Engineer
Title

May 14, 2013
Date

(1) Participation on the Stakeholders Committee and/or signing of this document does not constitute approval of the I-5 JBLM Vicinity IJR.

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WSDOT – HQ Access and Hearings

Barb DeSt Croix
Signature

Development Services & Access Mgr
Title

June 28, 2013
Date

(1) Participation on the Stakeholders Committee and/or signing of this document does not constitute approval of the I-5 JBLM Vicinity IJR.

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Federal Highway Administration

Daniel M. Mathis

Signature

Division Administrator

Title

July 16, 2013

Date

(1) Participation on the Stakeholders Committee and/or signing of this document does not constitute approval of the I-5 JBLM Vicinity IJR.

(2) All members of the Stakeholder Committee will accept this document as a guide and reference as the study progresses through the various stages of project development. If there are any agreed upon changes to the parameters set forth in this document a revision will be created, endorsed and signed by all the stakeholders.

Appendix B

Summary of Intersection Turning Movement Volumes

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AM PEAK HOUR TURNING MOVEMENT SUMMARY

Post-processed Data
from Mesoscopic Model

Post-Processed EXISTING 2013 Model Volumes Peak Hour	Post-Processed NO BUILD P1 2020 Volumes Peak Hour	Post-Processed BUILD RB_sbGLC_noHOV_2020 Volumes Peak Hour	Post-Processed NO BUILD P1 2040 Volumes Peak Hour	Post-Processed BUILD RB_sbGLC_noHOV_2040 Volume Peak Hour

Intersection 3

North-South Street
East-West Street

Count Date: 3/5/2013

Count Source: TC2

	EB	WB	NB	SB	Total
%HV	0%	1%	2%	1%	
PHF					0.85

Peak Hour Used:

From 715 To 815

3 Center Dr
2013 Wilmington Dr

		655		495		
		10	590	55		
115	5				30	140
	15		1,630		15	
80	60				95	275
		90	460	205		
		745		755		

3 Center Dr
2020 Wilmington Dr

		680		660		
		10	610	60		
125	5				35	175
	15		1,925		15	
85	65				125	340
		100	620	265		
		800		985		

3 Center Dr
2020 Wilmington Dr

		670		625		
		10	605	55		
130	5				35	185
	20		1,920		15	
95	70				135	355
		105	585	280		
		810		970		

Center Dr
Wilmington Dr

		685		750		
		10	585	90		
	5				35	220
	20		2,250		15	
	75				170	540
		105	710	430		
		830		1,245		

3 Center Dr
2040 Wilmington Dr

		800		750		
		15	715	70		
150	5				35	215
	20		2,295		15	
100	75				165	440
		120	710	350		
		955		1,180		

Intersection 4

North-South Street
East-West Street

Count Date: 3/5/2013

Count Source: TC2

	EB	WB	NB	SB	Total
%HV		1%	1%	1%	
PHF					0.86

Peak Hour Used:

From 715 To 815

4 Center Dr
2013 SB I-5 Ramps

		745		755		
		205	540			
205					270	270
			1,500		0	
0					0	0
		0	485			
		540		485		

4 Center Dr
2020 SB I-5 Ramps

		800		985		
		340	460	0		
350	0				295	295
	0		1,795		0	
0	0				0	0
		10	690	0		
		460		700		

4 Center Dr
2020 SB I-5 Ramps

		810		970		
		335	475	0		
335	0				295	295
	0		1,780		0	
0	0				0	0
		0	675	0		
		475		675		

Center Dr
SB I-5 Ramps

		830		1,245		
		405	425	0		
	0				345	345
	0		2,085		0	
	0				0	0
		10	900	0		
		425		910		

4 Center Dr
2040 SB I-5 Ramps

		955		1,180		
		400	555	0		
400	0				350	350
	0		2,135		0	
0	0				0	0
		0	830	0		
		555		830		

Intersection 5

North-South Street
East-West Street

Count Date: 3/5/2013

Count Source: TC2

	EB	WB	NB	SB	Total
%HV			1%	1%	
PHF					0.86

Peak Hour Used:

From 715 To 815

5 Center Dr
2013 NB I-5 Ramps

		540		485		
			540			
0	0					0
			1,025			
0						0
			485			
		540		485		

5 Center Dr
2020 NB I-5 Ramps

		460		700		
		0	0	460		
0	0				685	685
	0		1,160		0	
0	0				0	460
		0	15	0		
		0		15		

5 Center Dr
2020 NB I-5 Ramps

		475		675		
		0	0	475		
0	0				660	660
	0		1,150		0	
0	0				0	475
		0	15	0		
		0		15		

Center Dr
NB I-5 Ramps

		425		910		
		0	0	425		
	0				890	890
	0		1,335		0	
	0				0	425
		0	20	0		
		0		20		

5 Center Dr
2040 NB I-5 Ramps

		555		830		
		0	0	555		
0	0				810	810
	0		1,385		0	
0	0				0	555
		0	20	0		
		0		20		

Intersection 6

North-South Street
East-West Street

Count Date: 2/14/2013

Count Source: TC2

	EB	WB	NB	SB	Total
%HV	8%	15%	4%	7%	
PHF					0.89

Peak Hour Used:

From 715 To 815

6 Steilacoom-DuPont Rd
2013 Wilmington Dr

		105		90		
		20	65	20		
320	10				15	620
	40		1,710		60	
125	75				545	615
		240	65	555		
		685		860		

6 Barksdale Ave
2020 Wilmington Dr

		105		90		
		20	65	20		
320	10				15	665
	60		2,130		60	
150	80				590	985
		240	65	905		
		735		1,210		

6 Barksdale Ave
2020 Wilmington Dr

		110		100		
		20	70	20		
330	10				15	670
	75		2,160		65	
170	85				590	985
		245	75	890		
		745		1,210		

Barksdale Ave
Wilmington Dr

		125		110		
		25	75	25		
	15				20	660
	165		2,490		60	
	115				580	1,260
		265	75	1,070		
		770		1,410		

6 Barksdale Ave
2040 Wilmington Dr

		125		105		
		25	75	25		
340	10				15	670
	90		2,460		70	
215	115				585	1,240
		245	80	1,125		
		775		1,450		

AM PEAK HOUR TURNING MOVEMENT SUMMARY

Post-processed Data
from Mesoscopic Model

Post-Processed EXISTING 2013 Model Volumes Peak Hour	Post-Processed NO BUILD P1 2020 Volumes Peak Hour	Post-Processed BUILD RB_sbGLC_noHOV_2020 Volumes Peak Hour	Post-Processed NO BUILD P1 2040 Volumes Peak Hour	Post-Processed BUILD RB_sbGLC_noHOV_2040 Volume Peak Hour

North-South Street
East-West Street

Count Date: 2/14/2013

Count Source: TC2

	EB	WB	NB	SB	Total
%HV		3%	2%	9%	
PHF					0.90

Peak Hour Used:

From 715 To 815

7 Steilacoom-DuPont Rd
2013 SB I-5 Ramps

		685		860		
		270	415			
460					445	610
			1,900		0	
0					165	0
		190	415			
		580		605		

9 Steilacoom-DuPont Rd
2020 SB I-5 Ramps

		735		1,210		
		285	450	0		
465	0				655	830
	0		2,300		0	
0	0				175	0
		180	555	0		
		625		735		

7 Steilacoom-DuPont Rd
2020 SB I-5 Ramps

		745		1,210		
		270	475	0		
460	0				660	845
	0		2,330		0	
0	0				185	0
		190	550	0		
		660		740		

Steilacoom-DuPont Rd
SB I-5 Ramps

		770		1,410		
		315	455	0		
	0				785	950
	0		2,520		0	
	0				165	0
		175	625	0		
		620		800		

7 Steilacoom-DuPont Rd
2020 SB I-5 Ramps

		775		1,450		
		290	485	0		
475	0				840	1,000
	0		2,570		0	
0	0				160	0
		185	610	0		
		645		795		

North-South Street
East-West Street

Count Date: 2/14/2013

Count Source: TC2

	EB	WB	NB	SB	Total
%HV	1%		1%	7%	
PHF					0.83

Peak Hour Used:

From 715 To 815

8 Steilacoom-DuPont Rd
2013 NB I-5 Ramps

		580		605		
			375	205		
0	320					0
	5		1,820			
880	555					285
			285	75		
		930		360		

10 Steilacoom-DuPont Rd
2020 NB I-5 Ramps

		625		735		
		0	410	215		
0	370				0	0
	5		2,055		0	
990	615				0	295
		0	365	75		
		1,025		440		

8 Steilacoom-DuPont Rd
2020 NB I-5 Ramps

		660		740		
		0	405	255		
0	380				0	0
	5		2,125		0	
1,025	640				0	340
		0	360	80		
		1,045		440		

Steilacoom-DuPont Rd
NB I-5 Ramps

		620		800		
		0	415	205		
	400				0	0
	5		1,885		0	
	380				0	290
		0	400	80		
		795		480		

8 Steilacoom-DuPont Rd
2020 NB I-5 Ramps

		645		795		
		0	410	235		
0	395				0	0
	5		2,010		0	
895	495				0	310
		0	400	70		
		905		470		

North-South Street
East-West Street

Count Date: 2/13/2013

Count Source: TC2 (tube)

	EB	WB	NB	SB	Total
%HV					
PHF					0.89

Peak Hour Used:

From 715 To 815

9 41ST DIVISION DR S
2013 I-5 SB Off Ramp

		1,095		770		
		180	915			
180					240	240
			2,445			
420	420					160
			530	160		
		1,335		690		

11 41ST DIVISION DR S
2020 I-5 SB Off Ramp

		1,015		440		
		185	830	0		
185	0				120	120
	0		2,050		0	
390	390				0	205
		0	320	205		
		1,220		525		

9 41ST DIVISION DR S
2020 I-5 SB Off Ramp

		1,060		450		
		185	875	0		
185	0				135	135
	0		2,070		0	
345	345				0	215
		0	315	215		
		1,220		530		

41ST DIVISION DR S
I-5 SB Off Ramp

		985		480		
		205	780	0		
	0				75	75
	0		2,000		0	
	290				0	245
		0	405	245		
		1,070		650		

9 41ST DIVISION DR S
2020 I-5 SB Off Ramp

		1,075		475		
		220	855	0		
220	0				75	75
	0		2,090		0	
330	330				0	210
		0	400	210		
		1,185		610		

North-South Street
East-West Street

Count Date: 2/13/2013

Count Source: TC2 (tube)

	EB	WB	NB	SB	Total
%HV					
PHF					0.91

Peak Hour Used:

From 715 To 815

10 41ST DIVISION DR S
2013 I-5 NB Off Ramp

		1,335		690		
		380	955			
380					200	200
			2,610			
285	285					300
			490	300		
		1,240		790		

12 41ST DIVISION DR S
2020 I-5 NB Off Ramp

		1,220		525		
		300	920	0		
300	0				75	75
	0		2,310		0	
305	305				0	260
		0	450	260		
		1,225		710		

10 41ST DIVISION DR S
2020 I-5 NB Off Ramp

		1,220		530		
		370	850	0		
370	0				65	65
	0		2,320		0	
300	300				0	270
		0	465	270		
		1,150		735		

41ST DIVISION DR S
I-5 NB Off Ramp

		1,070		650		
		215	855	0		
	0				135	135
	0		2,380		0	
	355				0	305
		0	515	305		
		1,210		820		

10 41ST DIVISION DR S
2020 I-5 NB Off Ramp

		1,095		460		
		220	875	0		
220	0				100	100
	0		2,150		0	
360	360				0	235
		0	360	235		
		1,235		595		

AM PEAK HOUR TURNING MOVEMENT SUMMARY

Post-processed Data
from Mesoscopic Model

Post-Processed
EXISTING
2013 Model Volumes
Peak Hour

Post-Processed
NO BUILD
P1 2020 Volumes
Peak Hour

Post-Processed
BUILD
RB_sbGLC_noHOV_2020 Volumes
Peak Hour

Post-Processed
NO BUILD
P1 2040 Volumes
Peak Hour

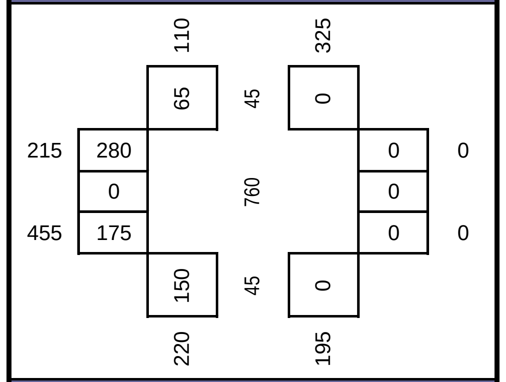
Post-Processed
BUILD
RB_sbGLC_noHOV_2040 Volume
Peak Hour

North-South Street
East-West Street

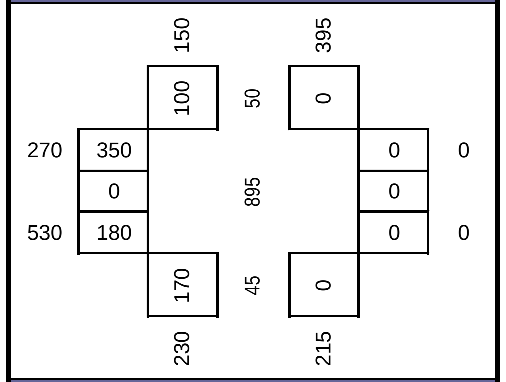
NEW INTERSECTION

BUILD ALTERNATIVE

11 Berkeley Ave
2020 Berkeley Interchange Ramp



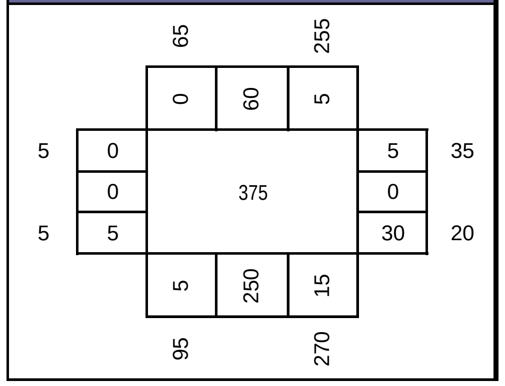
11 Berkeley Ave
2040 Berkeley Interchange Ramp



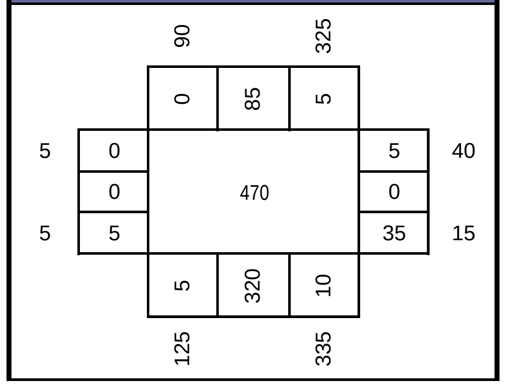
North-South Street
East-West Street

TRUCK DATA NOT AVAILABLE

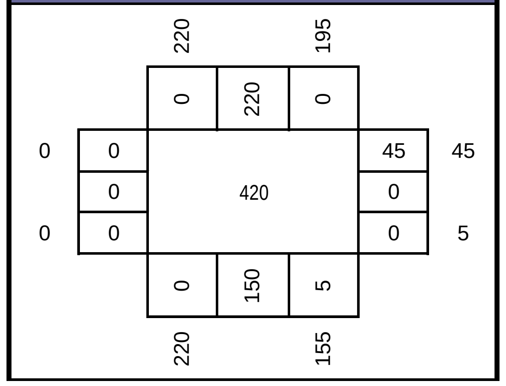
11 Berkeley St
2020 Washington Ave



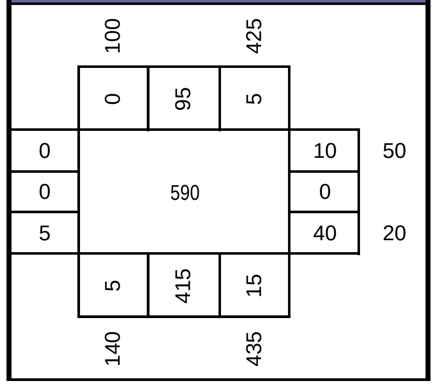
13 Berkeley St
2020 Washington Ave



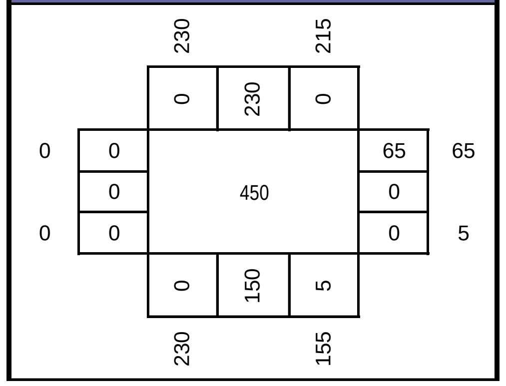
13 Berkeley St
2020 Washington Ave



Berkeley St
Washington Ave



12 Berkeley Ave
2020 Washington Ave



North-South Street
East-West Street

Count Date: 2/14/2013

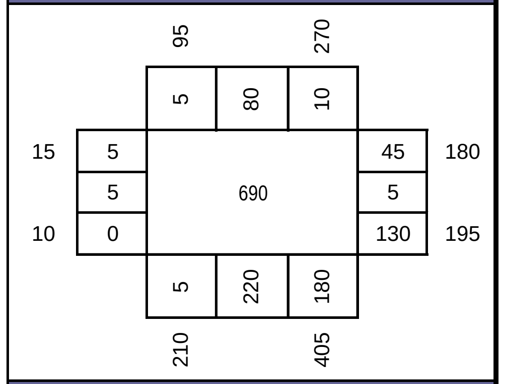
Count Source: TC2

	EB	WB	NB	SB	Total
%HV	2%	1%	1%	6%	
PHF					0.82

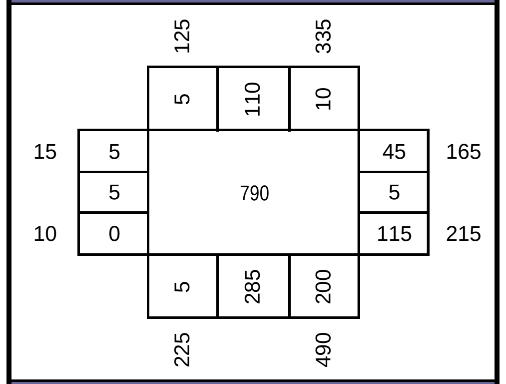
Peak Hour Used:

From 715 To 815

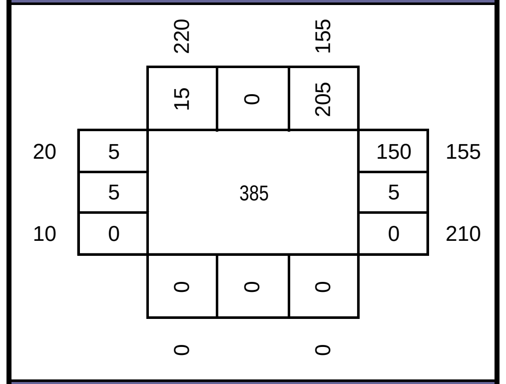
11 Berkeley St
2013 Union Ave



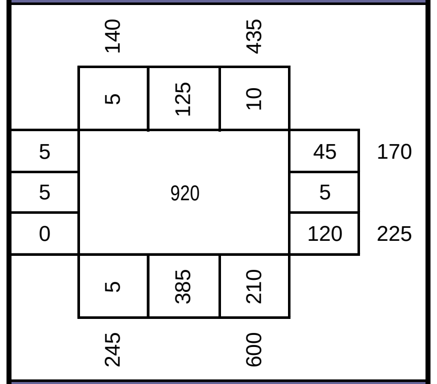
14 Berkeley St
2020 Union Ave



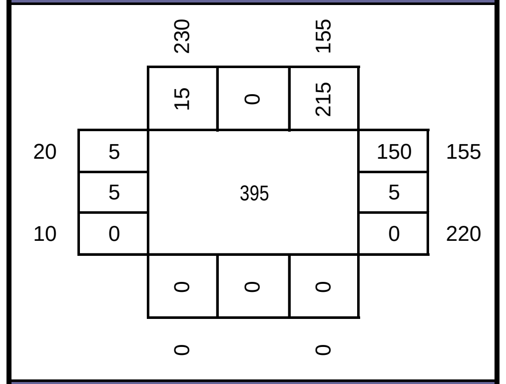
14 Berkeley St
2020 Union Ave



Berkeley St
Union Ave



13 Berkeley Ave
2020 Union Ave



North-South Street
East-West Street

Count Date: 2/14/2013

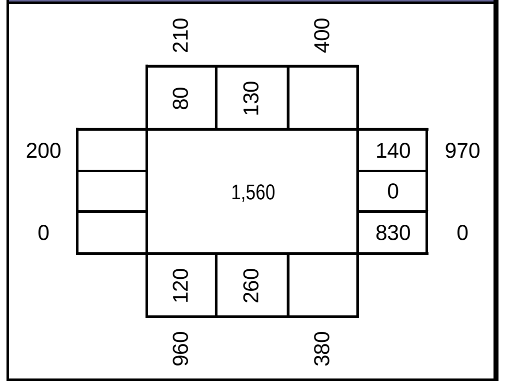
Count Source: TC2

	EB	WB	NB	SB	Total
%HV		1%	1%	3%	
PHF					0.86

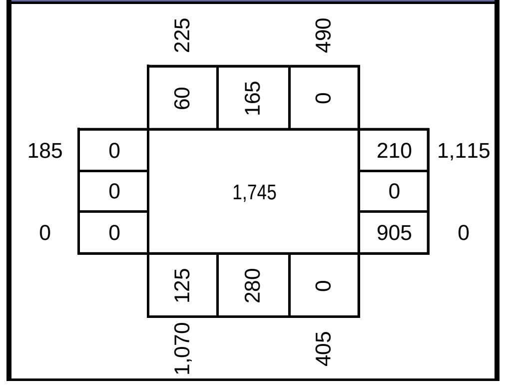
Peak Hour Used:

From 715 To 815

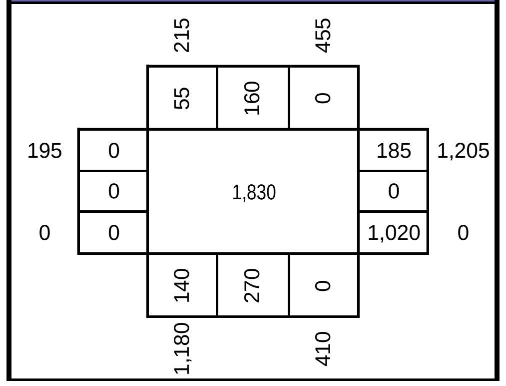
12 Berkeley St
2013 SB I-5 Ramps



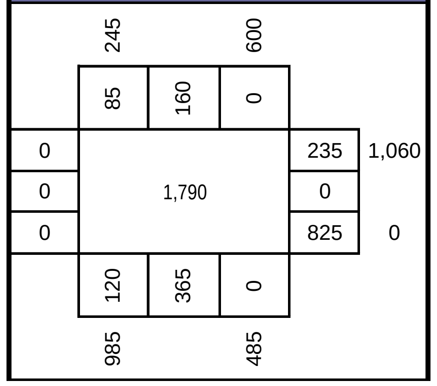
15 Berkeley St
2020 SB I-5 Ramps



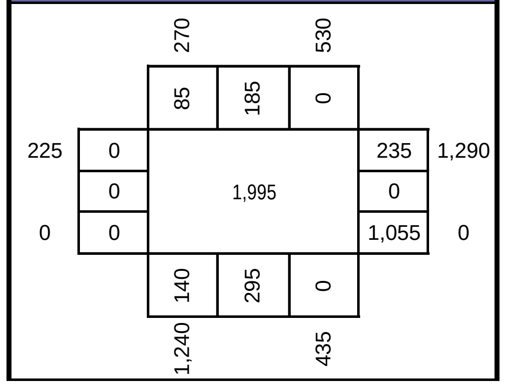
14 Berkeley Ave
2020 SB I-5 Ramps



Berkeley St
SB I-5 Ramps



14 Berkeley Ave
2020 SB I-5 Ramps



AM PEAK HOUR TURNING MOVEMENT SUMMARY

Post-processed Data
from Mesoscopic Model

Post-Processed
EXISTING
2013 Model Volumes
Peak Hour

Post-Processed
NO BUILD
P1 2020 Volumes
Peak Hour

Post-Processed
BUILD
RB_sbGLC_noHOV_2020 Volumes
Peak Hour

Post-Processed
NO BUILD
P1 2040 Volumes
Peak Hour

Post-Processed
BUILD
RB_sbGLC_noHOV_2040 Volume
Peak Hour

North-South Street
East-West Street

Count Date: 2/14/2013

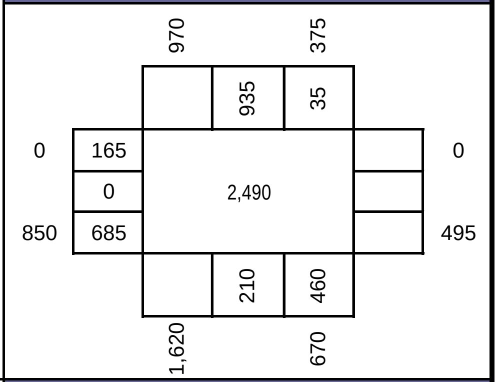
Count Source: TC2

	EB	WB	NB	SB	Total
%HV	1%		3%	2%	
PHF					0.93

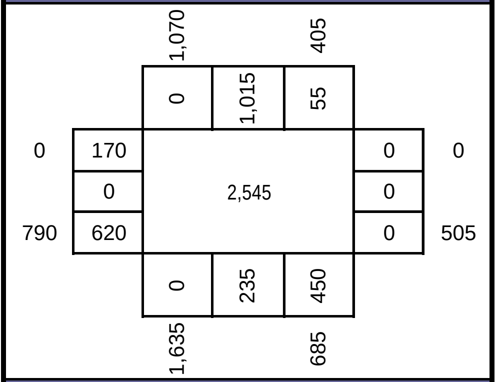
Peak Hour Used:

From 715 To 815

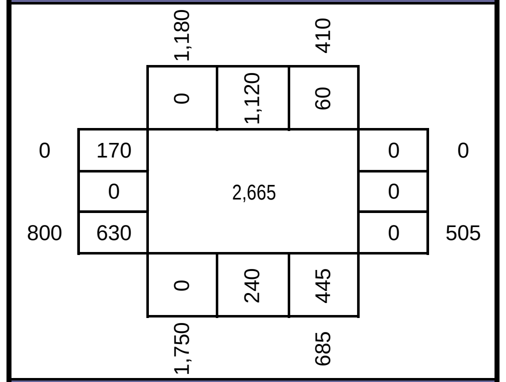
13 **Berkeley St**
2013 **NB I-5 Ramps**



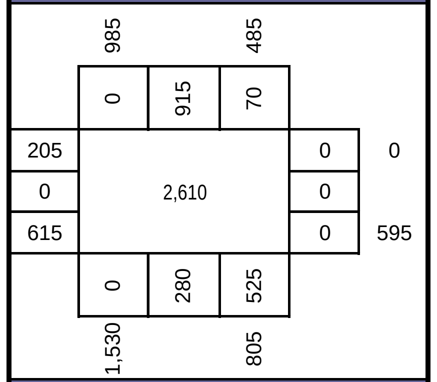
16 **Berkeley St**
2020 **NB I-5 Ramps**



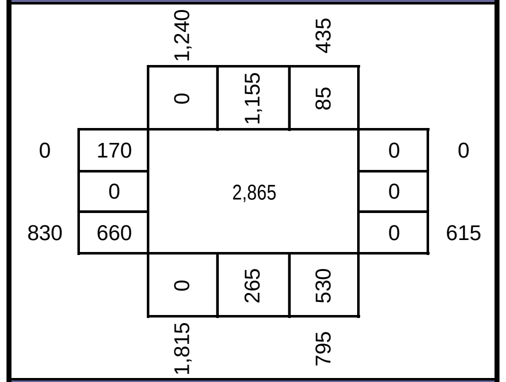
15 **Berkeley Ave**
2020 **NB I-5 Ramps**



Berkeley St
NB I-5 Ramps



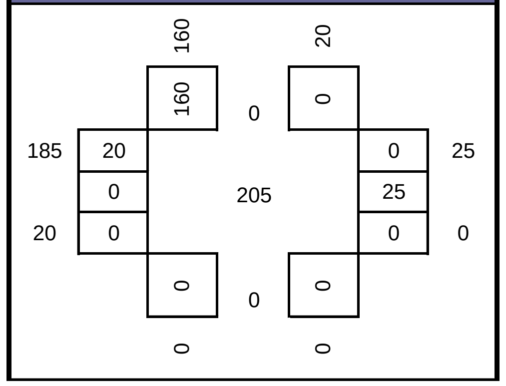
15 **Berkeley Ave**
2020 **NB I-5 Ramps**



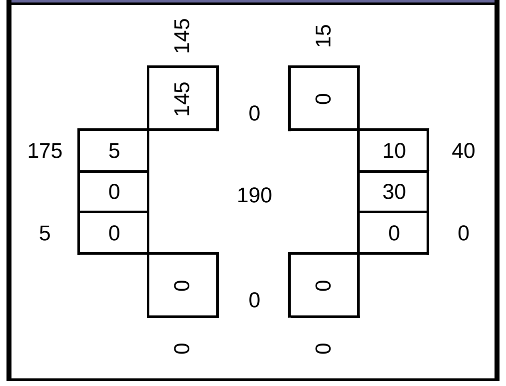
North-South Street
East-West Street

NEW INTERSECTION
BUILD ALTERNATIVE

16 **Gravelly-Thorne Connector Ln**
2020 **Union Ave**



16 **Gravelly-Thorne Connector Ln**
2020 **Union Ave**



North-South Street
East-West Street

Count Date: 3/5/2013

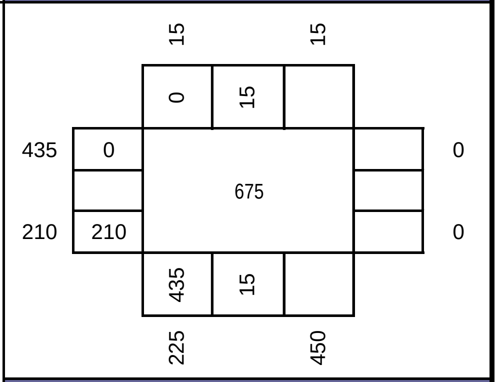
Count Source: TC2

	EB	WB	NB	SB	Total
%HV	7%		3%	0%	
PHF					0.80

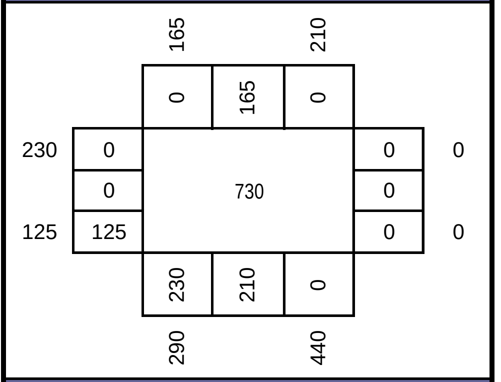
Peak Hour Used:

From 715 To 815

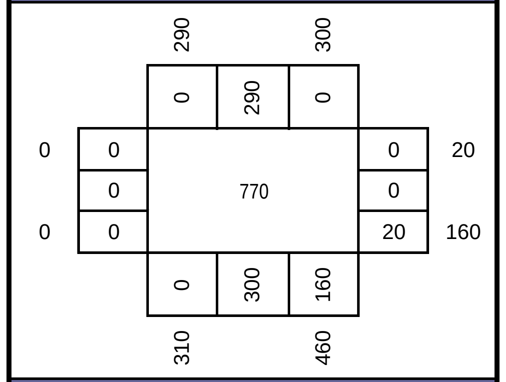
14 **Thorne Ln**
2014 **Union Ave**



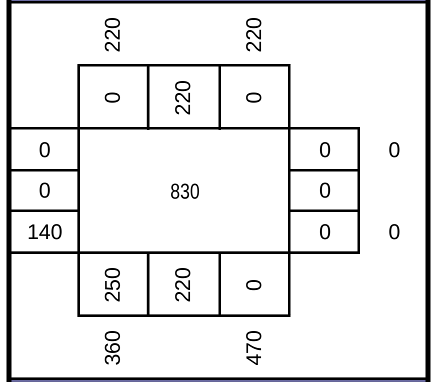
18 **Thorne Ln**
2020 **Union Ave**



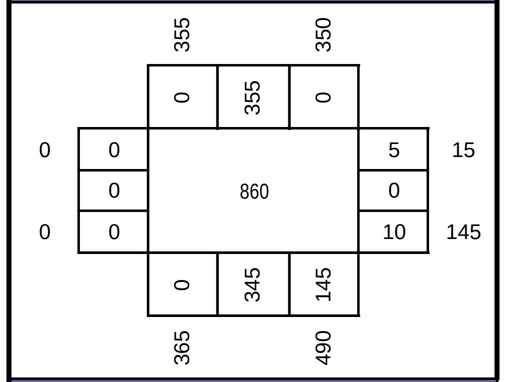
17 **Thorne Ln**
2020 **Gravelly-Thorne Connector Ln**



Thorne Ln
Union Ave



17 **Thorne Ln**
2020 **Gravelly-Thorne Connector Ln**



North-South Street
East-West Street

Count Date: 3/5/2013

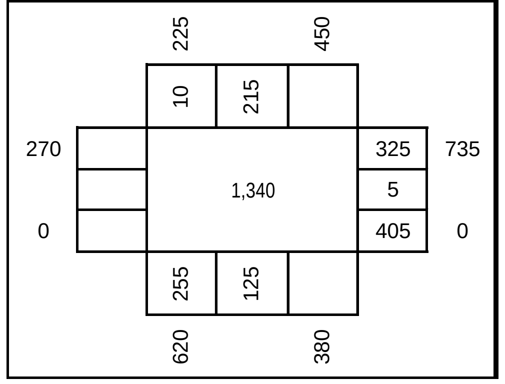
Count Source: TC2

	EB	WB	NB	SB	Total
%HV		5%	6%	5%	
PHF					0.87

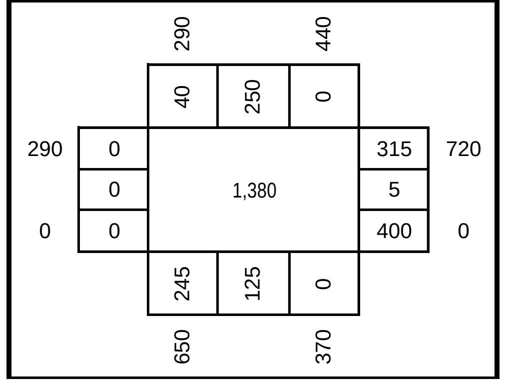
Peak Hour Used:

From 715 To 815

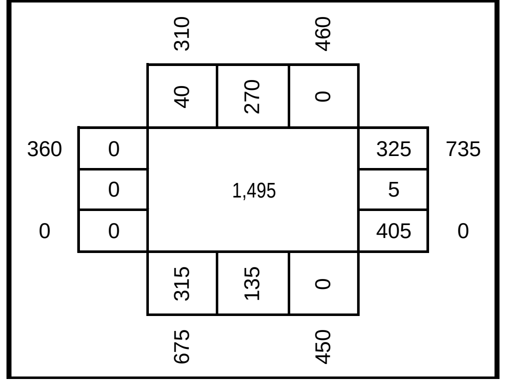
15 **Thorne Ln**
2014 **SB I-5 Ramps**



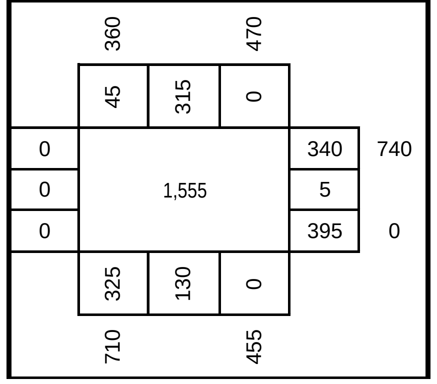
19 **Thorne Ln**
2020 **SB I-5 Ramps**



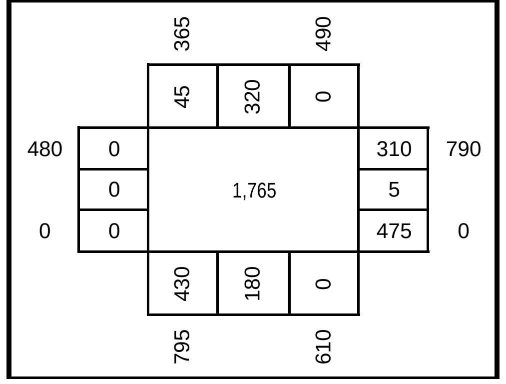
18 **Thorne Ln**
2020 **SB I-5 Ramps**



Thorne Ln
SB I-5 Ramps



18 **Thorne Ln**
2020 **SB I-5 Ramps**



AM PEAK HOUR TURNING MOVEMENT SUMMARY

Post-processed Data
from Mesoscopic Model

Post-Processed	Post-Processed	Post-Processed	Post-Processed	Post-Processed
EXISTING 2013 Model Volumes	NO BUILD P1 2020 Volumes	BUILD RB_sbGLC_noHOV_2020 Volumes	NO BUILD P1 2040 Volumes	BUILD RB_sbGLC_noHOV_2040 Volume
Peak Hour	Peak Hour	Peak Hour	Peak Hour	Peak Hour

North-South Street / East-West Street: Thorne Ln / NB I-5 Ramps

Count Date: 3/5/2013

Count Source: TC2

	EB	WB	NB	SB	Total
%HV	8%		5%	6%	
PHF					0.87

Peak Hour Used:

From 715 To 815

16 · 2014 · Thorne Ln · NB I-5 Ramps

		620		380		
			420	200		
0	10					0
	0		1,380			
185	175					405
			370	205		
		595		575		

20 · 2020 · Thorne Ln · NB I-5 Ramps

		650		370		
		0	420	230		
0	15				0	0
	0		1,490		0	
230	215				0	485
		0	355	255		
		635		610		

19 · 2020 · Thorne Ln · NB I-5 Ramps

		675		450		
		0	430	245		
0	15				0	0
	0		1,565		0	
200	185				0	500
		0	435	255		
		615		690		

Thorne Ln · NB I-5 Ramps

		710		455		
		0	435	275		
	10				0	0
	0		1,735		0	
	225				0	620
		0	445	345		
		660		790		

19 · 2020 · Thorne Ln · NB I-5 Ramps

		795		610		
		0	520	275		
0	25				0	0
	0		1,945		0	
245	220				0	595
		0	585	320		
		740		905		

North-South Street / East-West Street: Gravelly Lake Dr / Pacific Hwy

Count Date: 3/7/2013

Count Source: TC2

	EB	WB	NB	SB	Total
%HV		11%	4%	4%	
PHF					0.95

Peak Hour Used:

From 715 To 815

17 · 2013 · Gravelly Lake Dr · Pacific Hwy

		1,195		965		
			1,080	115		
0					110	200
			2,295			
0					90	160
			855	45		
		1,170		900		

21 · 2020 · Gravelly Lake Dr · Pacific Hwy

		1,290		950		
		0	1,100	190		
0	0				125	215
	0		2,370		0	
0	0				90	230
		0	825	40		
		1,190		865		

21 · 2020 · Gravelly Lake Dr · Pacific Hwy

		1,285		930		
		0	1,035	250		
0	0				125	230
	0		2,360		0	
0	0				105	290
		0	805	40		
		1,140		845		

Gravelly Lake Dr · Pacific Hwy

		1,490		975		
		0	1,265	225		
	0				145	270
	0		2,640		0	
	0				125	275
		0	830	50		
		1,390		880		

21 · 2040 · Gravelly Lake Dr · Pacific Hwy

		1,365		1,060		
		0	1,045	320		
0	0				140	320
	0		2,635		0	
0	0				180	350
		0	920	30		
		1,225		950		

North-South Street / East-West Street: Gravelly Lake Dr / SB I-5 Ramps

Count Date: 3/7/2013

Count Source: TC2

	EB	WB	NB	SB	Total
%HV		4%	3%	2%	
PHF					0.92

Peak Hour Used:

From 715 To 815

18 · 2013 · Gravelly Lake Dr · SB I-5 Ramps

		1,170		900		
		530	640			
590					380	410
			2,160		0	
0					30	0
		60	520			
		670		580		

22 · 2020 · Gravelly Lake Dr · SB I-5 Ramps

		1,190		865		
		580	610	0		
660	0				355	360
	0		2,140		0	
0	0				5	0
		80	510	0		
		615		590		

22 · 2020 · Gravelly Lake Dr · SB I-5 Ramps

		1,115		845		
		560	555	0		
630	0				290	295
	0		2,035		0	
0	0				5	0
		70	555	0		
		560		625		

Gravelly Lake Dr · SB I-5 Ramps

		1,390		880		
		705	685	0		
	0				305	310
	0		2,345		0	
	0				5	0
		70	575	0		
		690		645		

22 · 2040 · Gravelly Lake Dr · SB I-5 Ramps

		1,190		950		
		650	540	0		
715	0				280	280
	0		2,205		0	
0	0				0	0
		65	670	0		
		540		735		

North-South Street / East-West Street: Gravelly Lake Dr / NB I-5 Ramps

Count Date: 3/7/2013

Count Source: TC2

	EB	WB	NB	SB	Total
%HV	2%		5%	2%	
PHF					0.94

Peak Hour Used:

From 715 To 815

19 · 2013 · Gravelly Lake Dr · NB I-5 Ramps

		670		580		
			65	605		
0	465					0
	0		1,375			
565	100					630
			115	25		
		165		140		

23 · 2020 · Gravelly Lake Dr · NB I-5 Ramps

		615		590		
		0	35	580		
0	460				0	0
	0		1,355		0	
570	110				0	620
		0	130	40		
		145		170		

23 · 2020 · Gravelly Lake Dr · NB I-5 Ramps

		560		625		
		0	55	505		
0	505				0	0
	0		1,345		0	
640	135				0	530
		0	120	25		
		190		145		

Gravelly Lake Dr · NB I-5 Ramps

		690		645		
		0	5	685		
	505				0	0
	0		1,490		0	
	110				0	730
		0	140	45		
		115		185		

23 · 2040 · Gravelly Lake Dr · NB I-5 Ramps

		540		735		
		0	105	435		
0	615				0	0
	0		1,405		0	
715	100				0	465
		0	120	30		
		205		150		

PM PEAK HOUR TURNING MOVEMENT SUMMARY

Post-processed Data
from Mesoscopic Model

Post-Processed	Post-Processed	Post-Processed	Post-Processed	Post-Processed
EXISTING	**NO BUILD**	**BUILD**	**NO BUILD**	**BUILD**
2013 Model Volumes	**P1 2020 Volumes**	**RB_sbGLC_noHOV_2020 Volumes**	**P1 2040 Volumes**	**RB_sbGLC_noHOV_2040 Volume**
Peak Hour	Peak Hour	Peak Hour	Peak Hour	Peak Hour

North-South Street
East-West Street

Count Date: 3/5/2013

Count Source: TC2

	EB	WB	NB	SB	Total
%HV	0%	0%	1%	1%	
PHF					0.98

Peak Hour Used:

From 1630 To 1730

3 Center Dr
2013 Wilmington Dr

		675		630		
		10	605	60		
80	5				90	335
	15		1,795		25	
70	50				220	210
		45	535	135		
		875		715		

3 Center Dr
2020 Wilmington Dr

		665		770		
		10	595	60		
90	10				90	455
	20		2,195		30	
90	60				335	345
		50	670	265		
		990		985		

3 Center Dr
2020 Wilmington Dr

		775		625		
		10	710	55		
90	10				90	470
	20		2,110		25	
95	65				355	265
		55	525	190		
		1,130		770		

Center Dr
Wilmington Dr

		650		540		
		10	570	70		
	10				90	460
	20		2,015		25	
	75				345	400
		50	440	310		
		990		800		

3 Center Dr
2040 Wilmington Dr

		700		620		
		10	625	65		
100	10				90	445
	20		2,135		30	
115	85				325	380
		60	520	295		
		1,035		875		

North-South Street
East-West Street

Count Date: 3/5/2013

Count Source: TC2

	EB	WB	NB	SB	Total
%HV		1%	0%	1%	
PHF					0.97

Peak Hour Used:

From 1630 To 1730

4 Center Dr
2013 SB I-5 Ramps

		885		715		
		665	220			
1,105					345	345
			2,040		0	
0					0	0
		440	370			
		220		810		

4 Center Dr
2020 SB I-5 Ramps

		990		985		
		875	115	0		
1,020	0				275	275
	0		2,120		0	
0	0				0	0
		145	710	0		
		115		855		

4 Center Dr
2020 SB I-5 Ramps

		1,130		770		
		1,015	115	0		
1,015	0				85	85
	0		1,900		0	
0	0				0	0
		0	685	0		
		115		685		

Center Dr
SB I-5 Ramps

		990		800		
		875	115	0		
	0				295	295
	0		1,935		0	
	0				0	0
		145	505	0		
		115		650		

4 Center Dr
2040 SB I-5 Ramps

		1,035		875		
		900	135	0		
1,020	0				140	140
	0		2,030		0	
0	0				0	0
		120	735	0		
		135		855		

North-South Street
East-West Street

Count Date: 3/5/2013

Count Source: TC2

	EB	WB	NB	SB	Total
%HV	0%		0%	1%	
PHF					0.90

Peak Hour Used:

From 1630 To 1730

5 Center Dr
2013 NB I-5 Ramps

		220		810		
			220			
0	590					0
			1,035			
590						0
			220			
		220		220		

5 Center Dr
2020 NB I-5 Ramps

		115		855		
		0	0	115		
0	0				550	550
	0		970		0	
0	0				0	115
		0	305	0		
		0		305		

5 Center Dr
2020 NB I-5 Ramps

		115		685		
		0	0	115		
0	0				450	450
	0		800		0	
0	0				0	115
		0	235	0		
		0		235		

Center Dr
NB I-5 Ramps

		115		650		
		0	0	115		
	0				335	335
	0		765		0	
	0				0	115
		0	315	0		
		0		315		

5 Center Dr
2040 NB I-5 Ramps

		135		855		
		0	0	135		
0	0				410	410
	0		990		0	
0	0				0	135
		0	445	0		
		0		445		

North-South Street
East-West Street

Count Date: 2/14/2013

Count Source: TC2

	EB	WB	NB	SB	Total
%HV	0%	0%	2%	1%	
PHF					0.96

Peak Hour Used:

From 1630 To 1730

6 Steilacoom-DuPont Rd
2013 Wilmington Dr

		145		150		
		20	80	45		
245	25				35	675
	110		1,815		50	
265	130				590	620
		175	90	465		
		800		730		

6 Barksdale Ave
2020 Wilmington Dr

		150		170		
		25	85	40		
255	35				30	645
	100		2,020		40	
620	485				575	450
		190	105	310		
		1,145		605		

6 Barksdale Ave
2020 Wilmington Dr

		140		165		
		20	80	40		
400	45				30	790
	135		2,580		50	
745	565				710	660
		330	90	485		
		1,355		905		

Steilacoom-DuPont Rd
Wilmington Dr

		170		140		
		20	100	50		
	25				25	665
	180		2,420		50	
	675				590	665
		180	90	435		
		1,365		705		

6 Barksdale Ave
2040 Wilmington Dr

		165		135		
		25	95	45		
220	25				25	730
	135		2,380		50	
720	560				655	715
		145	85	535		
		1,310		765		

PM PEAK HOUR TURNING MOVEMENT SUMMARY

Post-processed Data from Mesoscopic Model	Post-Processed EXISTING 2013 Model Volumes Peak Hour	Post-Processed NO BUILD P1 2020 Volumes Peak Hour	Post-Processed BUILD RB_sbGLC_noHOV_2020 Volumes Peak Hour	Post-Processed NO BUILD P1 2040 Volumes Peak Hour	Post-Processed BUILD RB_sbGLC_noHOV_2040 Volume Peak Hour

North-South Street
East-West Street

Count Date: 2/14/2013

Count Source: TC2

	EB	WB	NB	SB	Total
%HV		10%	1%	4%	
PHF					0.97

Peak Hour Used:

From 1630 To 1730

7 Steilacoom-DuPont Rd
2013 SB I-5 Ramps

		800		730		
		325	475			
865					165	185
			2,090		0	
0					20	0
		540	565			
		495		1,105		

9 Steilacoom-DuPont Rd
2020 SB I-5 Ramps

		1,145		605		
		325	820	0		
850	0				110	125
	0		2,290		0	
0	0				15	0
		525	495	0		
		835		1,020		

7 Steilacoom-DuPont Rd
2020 SB I-5 Ramps

		1,355		905		
		465	890	0		
950	0				305	325
	0		2,765		0	
0	0				20	0
		485	600	0		
		910		1,085		

Steilacoom-DuPont Rd
SB I-5 Ramps

		1,365		705		
		555	810	0		
	0				130	155
	0		2,635		0	
	0				25	0
		540	575	0		
		835		1,115		

7 Steilacoom-DuPont Rd
2040 SB I-5 Ramps

		1,310		765		
		385	925	0		
810	0				145	180
	0		2,535		0	
0	0				35	0
		425	620	0		
		960		1,045		

North-South Street
East-West Street

Count Date: 2/14/2013

Count Source: TC2

	EB	WB	NB	SB	Total
%HV	2%		0%	3%	
PHF					0.97

Peak Hour Used:

From 1630 To 1730

8 Steilacoom-DuPont Rd
2013 NB I-5 Ramps

		495		1,105		
			85	410		
0	400					0
	10		2,020			
635	225					605
			705	185		
		310		890		

10 Steilacoom-DuPont Rd
2020 NB I-5 Ramps

		835		1,020		
		0	80	755		
0	310				0	0
	10		2,275		0	
520	200				0	975
		0	710	210		
		280		920		

8 Steilacoom-DuPont Rd
2020 NB I-5 Ramps

		910		1,085		
		0	130	780		
0	395				0	0
	10		2,580		0	
630	225				0	1,140
		0	690	350		
		355		1,040		

Steilacoom-DuPont Rd
NB I-5 Ramps

		835		1,115		
		0	105	730		
	400				0	0
	10		2,175		0	
	10				0	945
		0	715	205		
		115		920		

8 Steilacoom-DuPont Rd
2040 NB I-5 Ramps

		960		1,045		
		0	155	805		
0	425				0	0
	10		2,360		0	
555	120				0	1,040
		0	620	225		
		275		845		

North-South Street
East-West Street

Count Date: 2/13/2013

Count Source: TC2 (tube)

	EB	WB	NB	SB	Total
%HV	2%	2%	4%	4%	
PHF					0.98

Peak Hour Used:

From 1630 To 1730

9 41ST DIVISION DR S
2013 I-5 SB Off Ramp

		1,375		840		
		435	940			
435					180	180
			3,225			
225	225					785
			660	785		
		1,165		1,445		

11 41ST DIVISION DR S
2020 I-5 SB Off Ramp

		1,435		740		
		410	1,025	0		
410	0				50	50
	0		2,960		0	
50	50				0	735
		0	690	735		
		1,075		1,425		

9 41ST DIVISION DR S
2020 I-5 SB Off Ramp

		990		660		
		120	870	0		
120	0				165	165
	0		2,195		0	
125	125				0	420
		0	495	420		
		995		915		

41ST DIVISION DR S
I-5 SB Off Ramp

		1,350		730		
		455	895	0		
	0				100	100
	0		2,950		0	
	180				0	690
		0	630	690		
		1,075		1,320		

9 41ST DIVISION DR S
2040 I-5 SB Off Ramp

		1,090		750		
		120	970	0		
120	0				50	50
	0		2,400		0	
120	120				0	440
		0	700	440		
		1,090		1,140		

North-South Street
East-West Street

Count Date: 2/13/2013

Count Source: TC2 (tube)

	EB	WB	NB	SB	Total
%HV	2%	3%	11%	3%	
PHF					0.96

Peak Hour Used:

From 1630 To 1730

10 41ST DIVISION DR S
2013 I-5 NB Off Ramp

		1,195		1,445		
		450	745			
450					60	60
			3,205			
120	120					445
			1,385	445		
		865		1,830		

12 41ST DIVISION DR S
2020 I-5 NB Off Ramp

		1,075		1,425		
		420	655	0		
420	0				25	25
	0		2,985		0	
50	50				0	435
		0	1,400	435		
		705		1,835		

10 41ST DIVISION DR S
2020 I-5 NB Off Ramp

		995		915		
		465	530	0		
465	0				40	40
	0		2,510		0	
80	80				0	520
		0	875	520		
		610		1,395		

41ST DIVISION DR S
I-5 NB Off Ramp

		1,075		1,320		
		455	620	0		
	0				50	50
	0		2,880		0	
	45				0	440
		0	1,270	440		
		665		1,710		

10 41ST DIVISION DR S
2040 I-5 NB Off Ramp

		1,090		1,140		
		490	600	0		
490	0				160	160
	0		2,765		0	
100	100				0	435
		0	980	435		
		700		1,415		

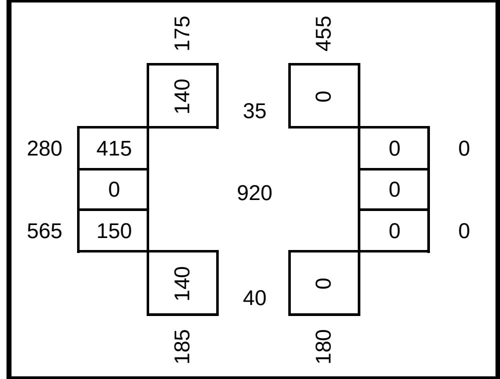
PM PEAK HOUR TURNING MOVEMENT SUMMARY

Post-processed Data
from Mesoscopic Model

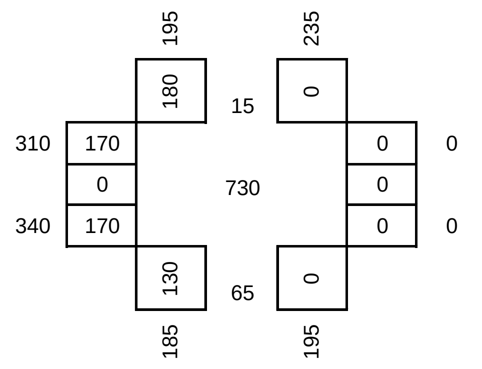
	Post-Processed EXISTING 2013 Model Volumes Peak Hour	Post-Processed NO BUILD P1 2020 Volumes Peak Hour	Post-Processed BUILD RB_sbGLC_noHOV_2020 Volumes Peak Hour	Post-Processed NO BUILD P1 2040 Volumes Peak Hour	Post-Processed BUILD RB_sbGLC_noHOV_2040 Volume Peak Hour
North-South Street East-West Street			11 Berkeley Ave 2020 Berkeley Interchange Ramp		11 Berkeley Ave 2040 Berkeley Interchange Ramp

NEW INTERSECTION
BUILD ALTERNATIVE

11 — 2020 — Berkeley Ave / Berkeley Interchange Ramp (BUILD RB_sbGLC_noHOV_2020)



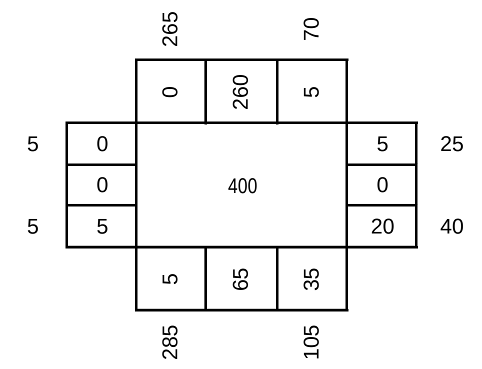
11 — 2040 — Berkeley Ave / Berkeley Interchange Ramp (BUILD RB_sbGLC_noHOV_2040)



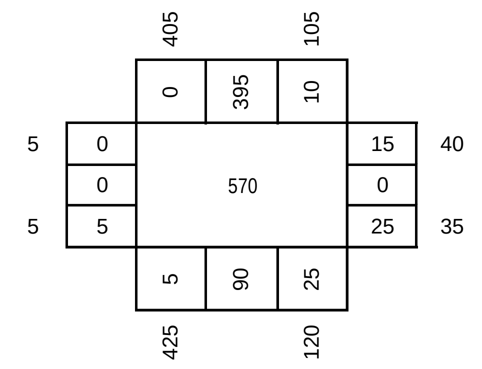
North-South Street East-West Street	11A Berkeley St 2020 Washington Ave	14 Berkeley St 2020 Washington Ave	12 Berkeley Ave 2020 Washington Ave	Berkeley St Washington Ave	12 Berkeley Ave 2040 Washington Ave

TRUCK DATA NOT AVAILABLE

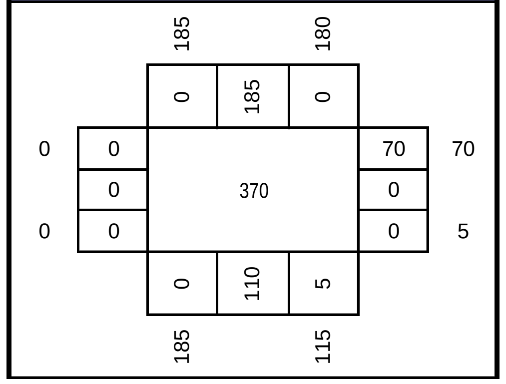
11A — 2020 — Berkeley St / Washington Ave (EXISTING)



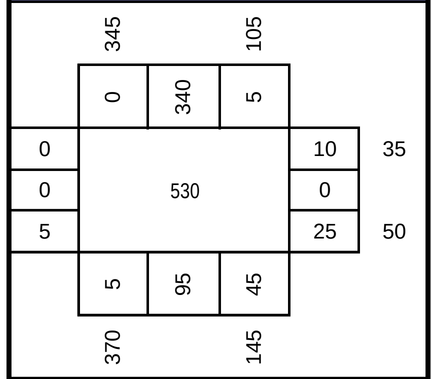
14 — 2020 — Berkeley St / Washington Ave (NO BUILD P1 2020)



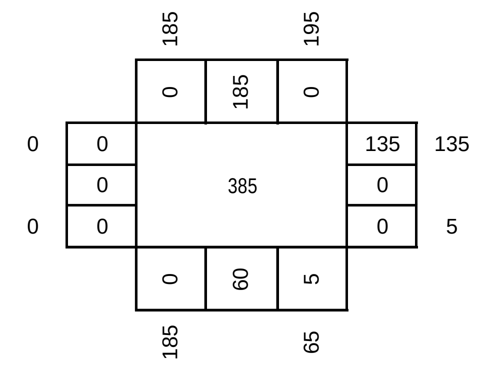
12 — 2020 — Berkeley Ave / Washington Ave (BUILD RB_sbGLC_noHOV_2020)



Berkeley St / Washington Ave (NO BUILD P1 2040)



12 — 2040 — Berkeley Ave / Washington Ave (BUILD RB_sbGLC_noHOV_2040)



North-South Street East-West Street	11 Berkeley St 2013 Union Ave	14 Berkeley St 2020 Union Ave	13 Berkeley Ave 2020 Union Ave	Berkeley St Union Ave	13 Berkeley Ave 2040 Union Ave

Count Date: 2/14/2013

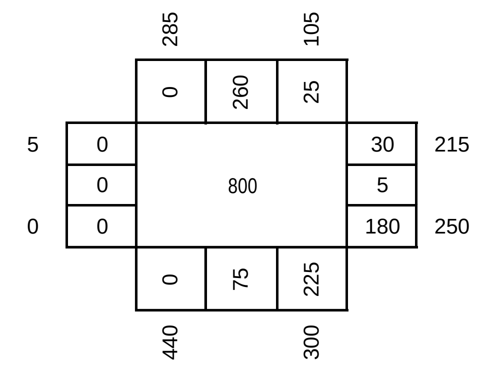
Count Source: TC2

	EB	WB	NB	SB	Total
%HV	0%	0%	1%	5%	
PHF					0.96

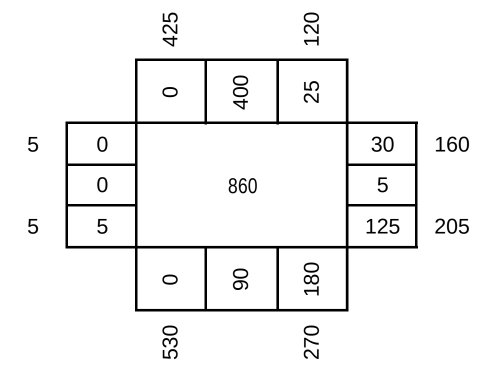
Peak Hour Used:

From 1630 To 1730

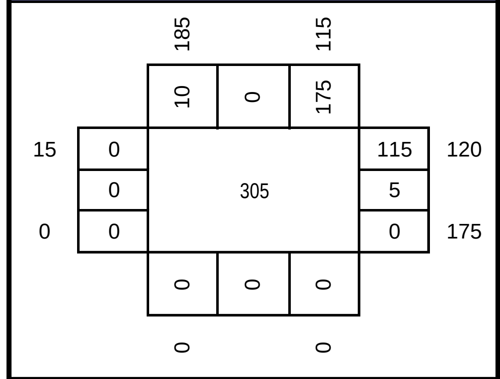
11 — 2013 — Berkeley St / Union Ave (EXISTING)



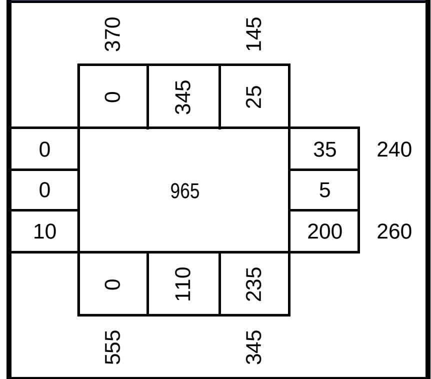
14 — 2020 — Berkeley St / Union Ave (NO BUILD P1 2020)



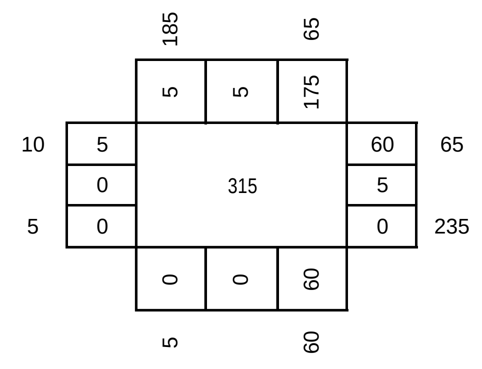
13 — 2020 — Berkeley Ave / Union Ave (BUILD RB_sbGLC_noHOV_2020)



Berkeley St / Union Ave (NO BUILD P1 2040)



13 — 2040 — Berkeley Ave / Union Ave (BUILD RB_sbGLC_noHOV_2040)



North-South Street East-West Street	12 Berkeley St 2013 SB I-5 Ramps	15 Berkeley St 2020 SB I-5 Ramps	14 Berkeley Ave 2020 SB I-5 Ramps	Berkeley St SB I-5 Ramps	14 Berkeley Ave 2040 SB I-5 Ramps

Count Date: 2/14/2013

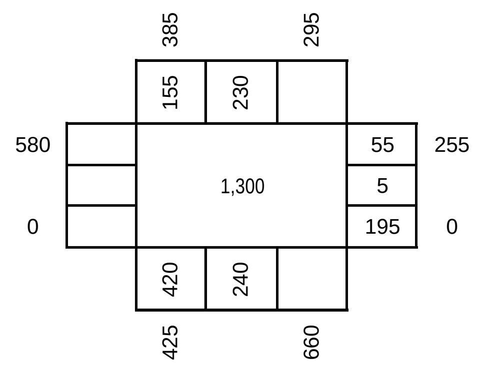
Count Source: TC2

	EB	WB	NB	SB	Total
%HV		1%	0%	1%	
PHF					0.95

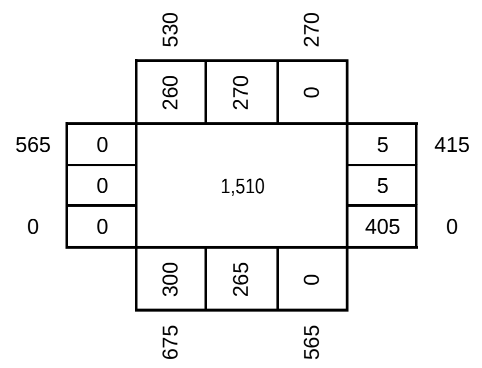
Peak Hour Used:

From 1630 To 1730

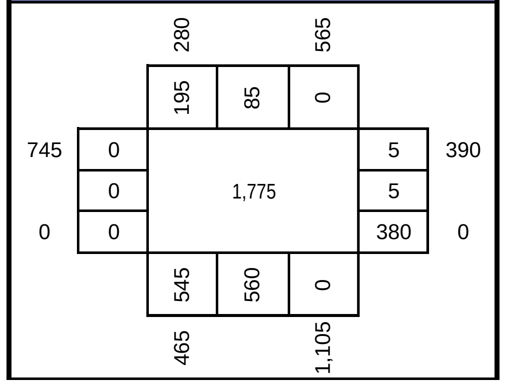
12 — 2013 — Berkeley St / SB I-5 Ramps (EXISTING)



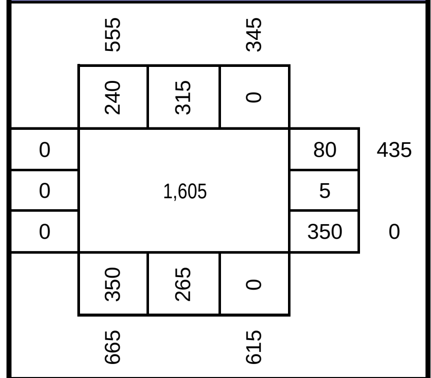
15 — 2020 — Berkeley St / SB I-5 Ramps (NO BUILD P1 2020)



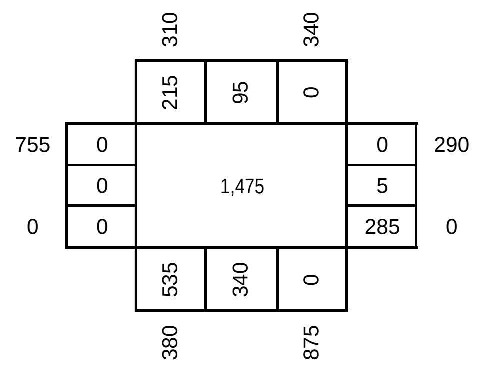
14 — 2020 — Berkeley Ave / SB I-5 Ramps (BUILD RB_sbGLC_noHOV_2020)



Berkeley St / SB I-5 Ramps (NO BUILD P1 2040)



14 — 2040 — Berkeley Ave / SB I-5 Ramps (BUILD RB_sbGLC_noHOV_2040)



PM PEAK HOUR TURNING MOVEMENT SUMMARY

Post-processed Data
from Mesoscopic Model

Post-Processed
EXISTING
2013 Model Volumes
Peak Hour

Post-Processed
NO BUILD
P1 2020 Volumes
Peak Hour

Post-Processed
BUILD
RB_sbGLC_noHOV_2020 Volumes
Peak Hour

Post-Processed
NO BUILD
P1 2040 Volumes
Peak Hour

Post-Processed
BUILD
RB_sbGLC_noHOV_2040 Volume
Peak Hour

North-South Street
East-West Street

Count Date: 3/5/2013

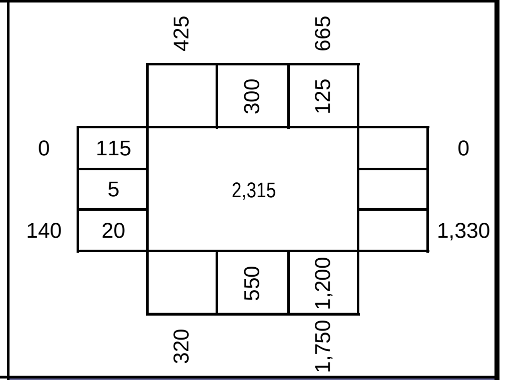
Count Source: TC2

	EB	WB	NB	SB	Total
%HV	0%		1%	1%	
PHF					0.97

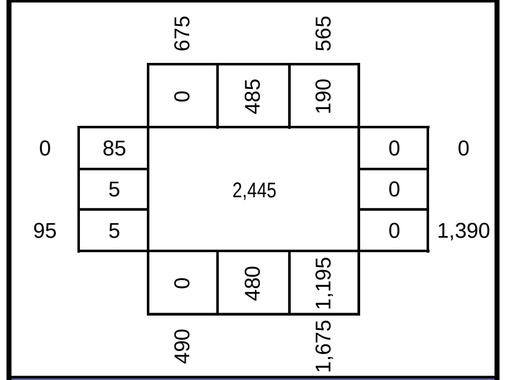
Peak Hour Used:

From 1630 **To** 1730

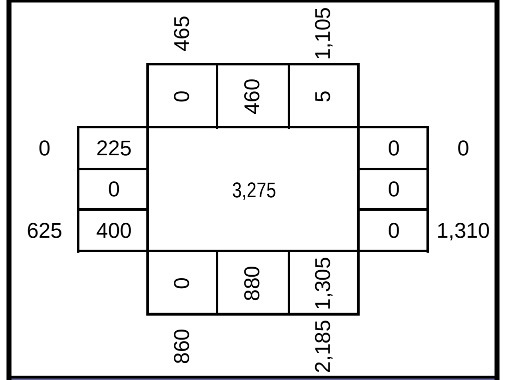
13 Berkeley St
2013 NB I-5 Ramps



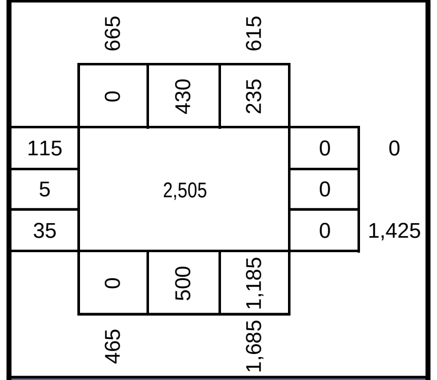
16 Berkeley St
2020 NB I-5 Ramps



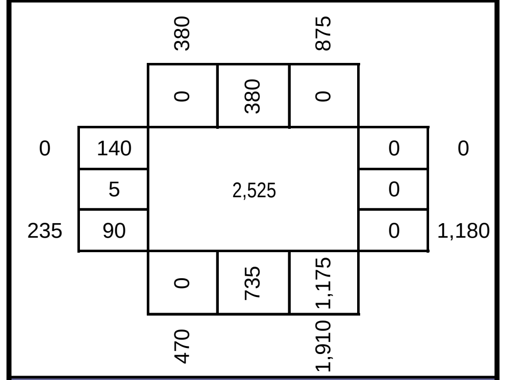
15 Berkeley Ave
2020 NB I-5 Ramps



Berkeley St
NB I-5 Ramps



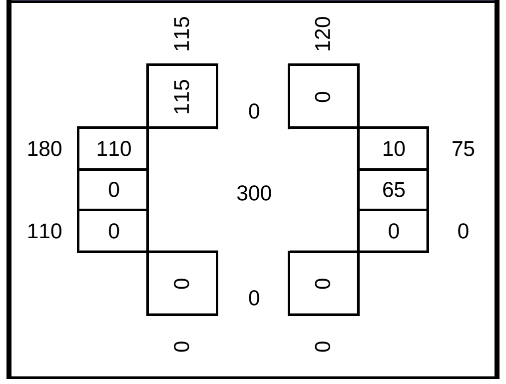
15 Berkeley Ave
2040 NB I-5 Ramps



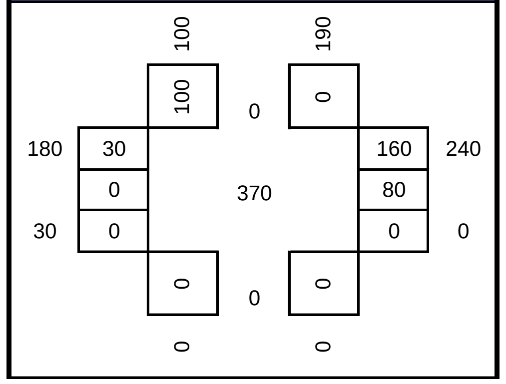
North-South Street
East-West Street

NEW INTERSECTION
BUILD ALTERNATIVE

16 Gravelly-Thorne Connector Ln
2020 Union Ave



16 Gravelly-Thorne Connector Ln
2040 Union Ave



North-South Street
East-West Street

Count Date: 3/5/2013

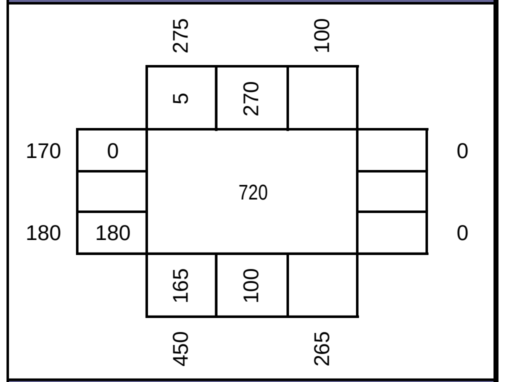
Count Source: TC2

	EB	WB	NB	SB	Total
%HV	0%		1%	0%	
PHF					0.96

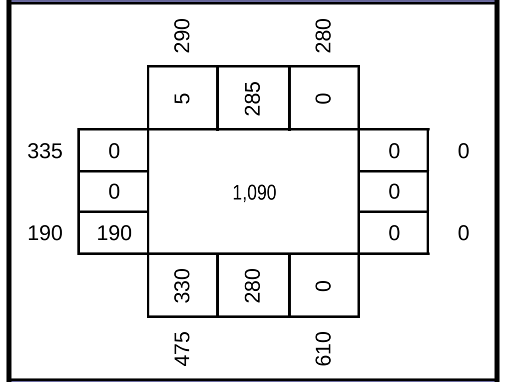
Peak Hour Used:

From 1630 **To** 1730

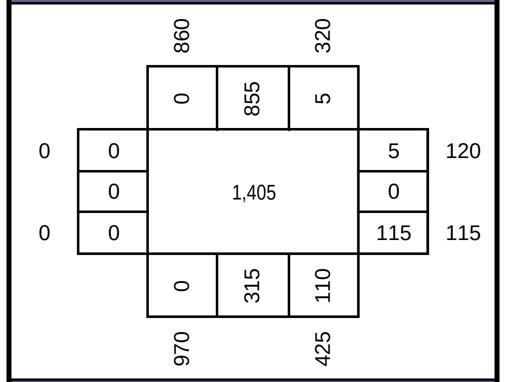
14 Thorne Ln
2014 Union Ave



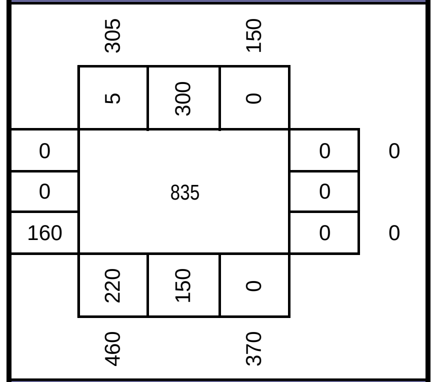
18 Thorne Ln
2020 Gravelly-Thorne Connector Ln



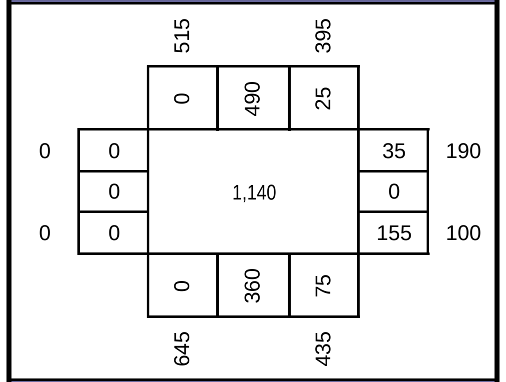
17 Thorne Ln
2020 Gravelly-Thorne Connector Ln



Thorne Ln
Union Ave



17 Thorne Ln
2040 Gravelly-Thorne Connector Ln



North-South Street
East-West Street

Count Date: 3/5/2013

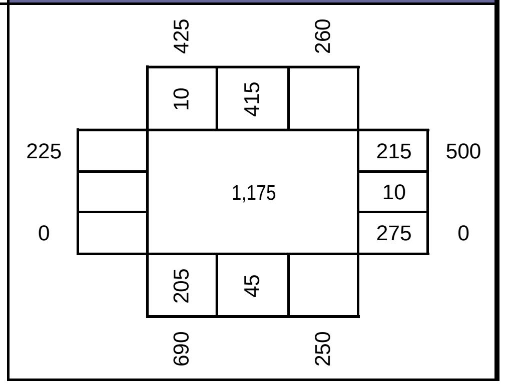
Count Source: TC2

	EB	WB	NB	SB	Total
%HV		1%	2%	1%	
PHF					0.98

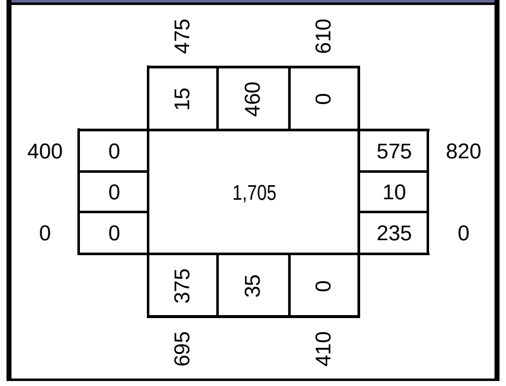
Peak Hour Used:

From 1630 **To** 1730

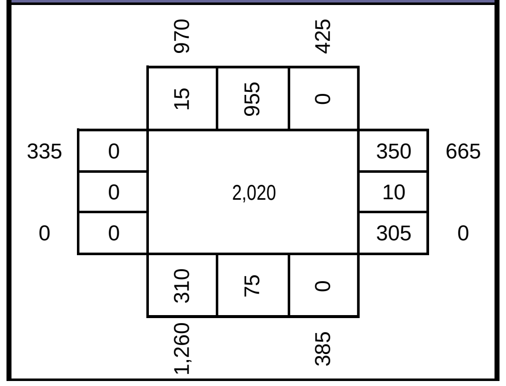
15 Thorne Ln
2014 SB I-5 Ramps



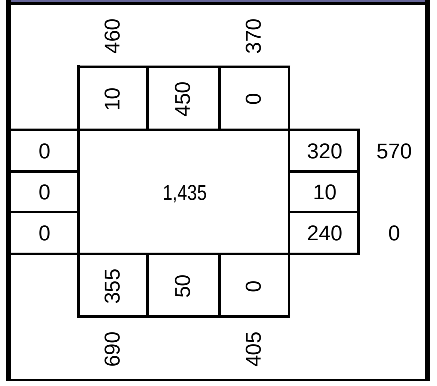
19 Thorne Ln
2020 SB I-5 Ramps



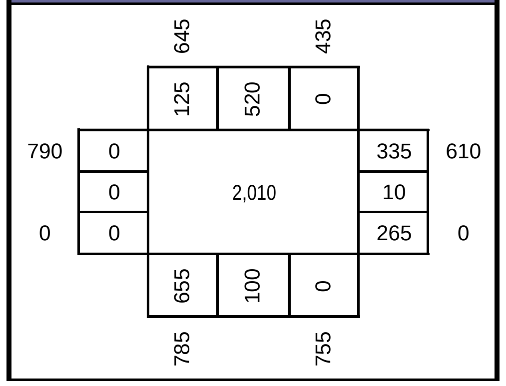
18 Thorne Ln
2020 SB I-5 Ramps



Thorne Ln
SB I-5 Ramps



18 Thorne Ln
2040 SB I-5 Ramps



PM PEAK HOUR TURNING MOVEMENT SUMMARY

Post-processed Data
from Mesoscopic Model

Post-Processed
EXISTING
2013 Model Volumes
Peak Hour

Post-Processed
NO BUILD
P1 2020 Volumes
Peak Hour

Post-Processed
BUILD
RB_sbGLC_noHOV_2020 Volumes
Peak Hour

Post-Processed
NO BUILD
P1 2040 Volumes
Peak Hour

Post-Processed
BUILD
RB_sbGLC_noHOV_2040 Volume
Peak Hour

North-South Street
East-West Street

Count Date: 3/5/2013

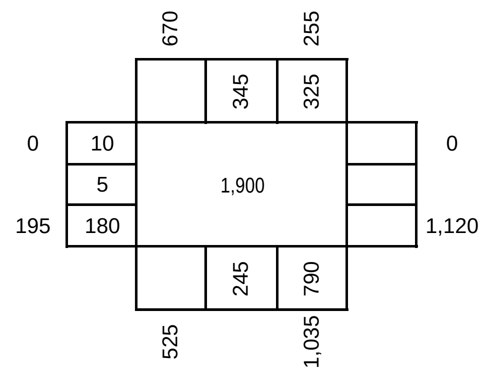
Count Source: TC2

	EB	WB	NB	SB	Total
%HV	3%		2%	1%	
PHF					0.98

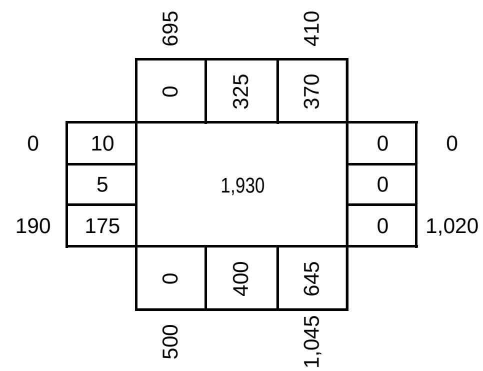
Peak Hour Used:

From 1630 **To** 1730

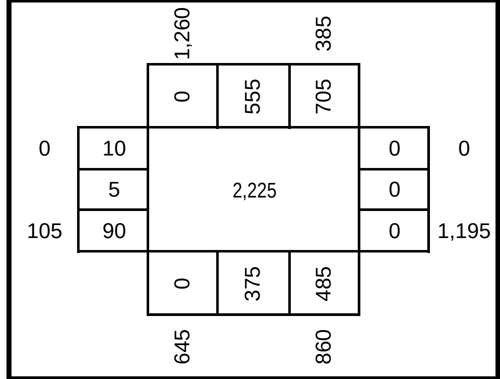
16 **Thorne Ln**
2014 **NB I-5 Ramps**



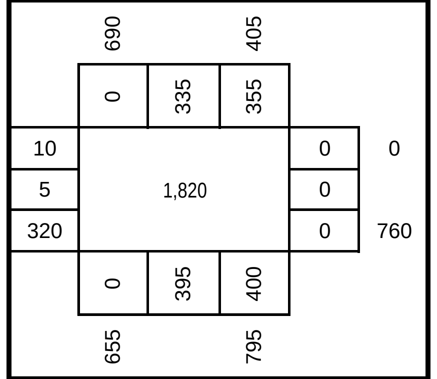
20 **Thorne Ln**
2020 **NB I-5 Ramps**



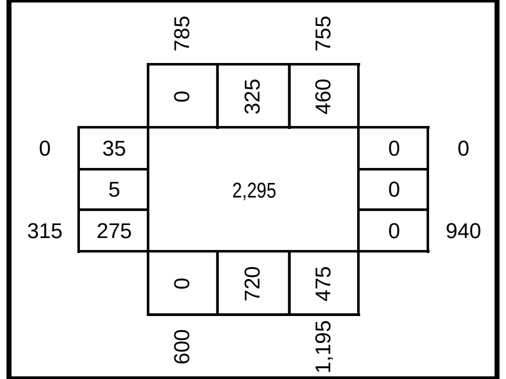
19 **Thorne Ln**
2020 **NB I-5 Ramps**



Thorne Ln
NB I-5 Ramps



19 **Thorne Ln**
2040 **NB I-5 Ramps**



North-South Street
East-West Street

Count Date: 3/7/2013

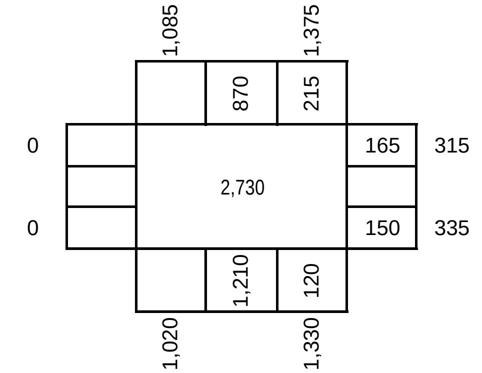
Count Source: TC2

	EB	WB	NB	SB	Total
%HV		2%	2%	2%	
PHF					0.95

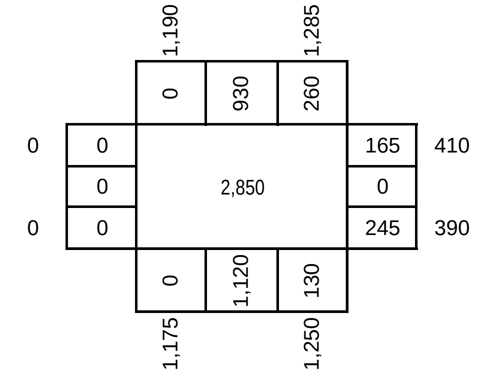
Peak Hour Used:

From 1630 **To** 1730

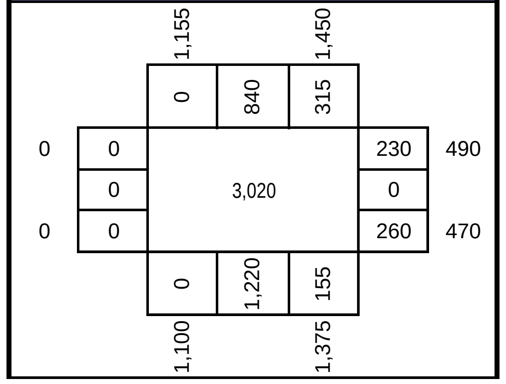
17 **Gravelly Lake Dr**
2013 **Pacific Hwy**



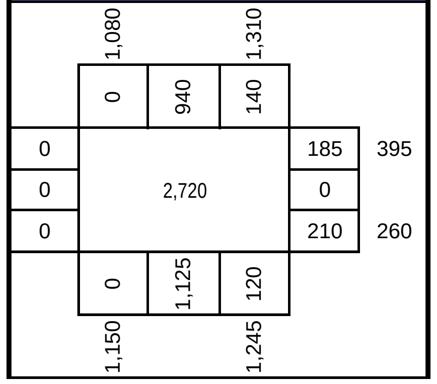
21 **Gravelly Lake Dr**
2020 **Pacific Hwy**



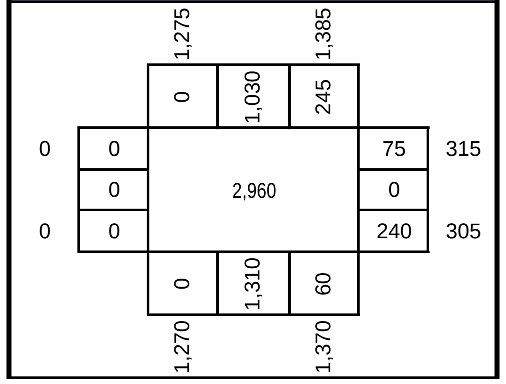
21 **Gravelly Lake Dr**
2020 **Pacific Hwy**



Gravelly Lake Dr
Pacific Hwy



20 **Gravelly Lake Dr**
2040 **Pacific Hwy**



North-South Street
East-West Street

Count Date: 3/7/2013

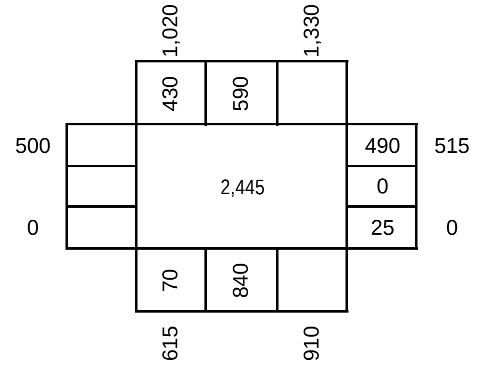
Count Source: TC2

	EB	WB	NB	SB	Total
%HV		3%	1%	1%	
PHF					0.98

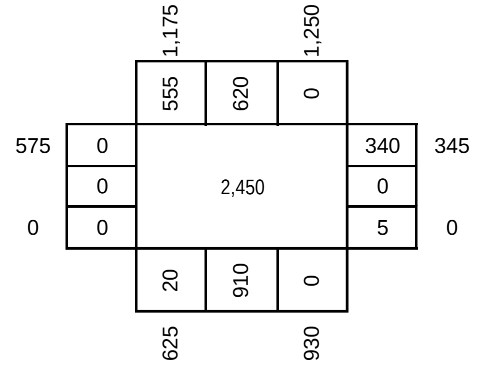
Peak Hour Used:

From 1630 **To** 1730

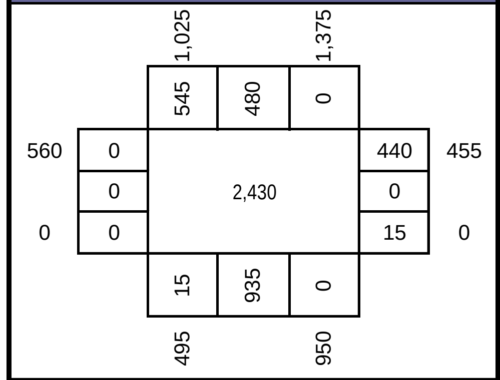
18 **Gravelly Lake Dr**
2013 **SB I-5 Ramps**



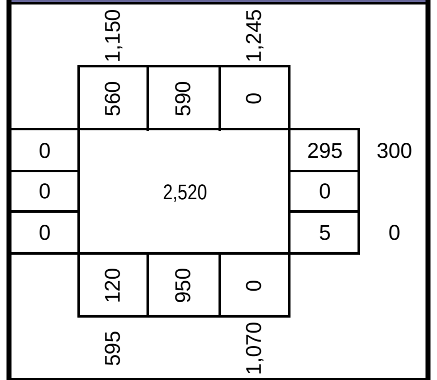
22 **Gravelly Lake Dr**
2020 **SB I-5 Ramps**



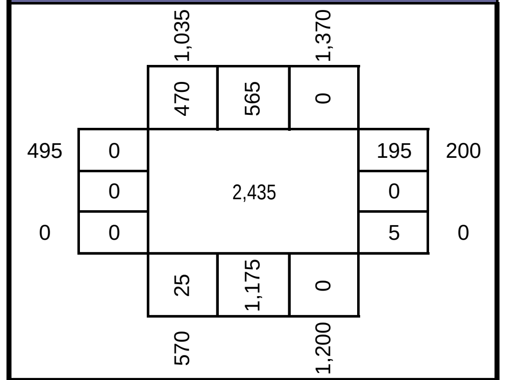
22 **Gravelly Lake Dr**
2020 **SB I-5 Ramps**



Gravelly Lake Dr
SB I-5 Ramps



21 **Gravelly Lake Dr**
2040 **SB I-5 Ramps**



North-South Street
East-West Street

Count Date: 3/7/2013

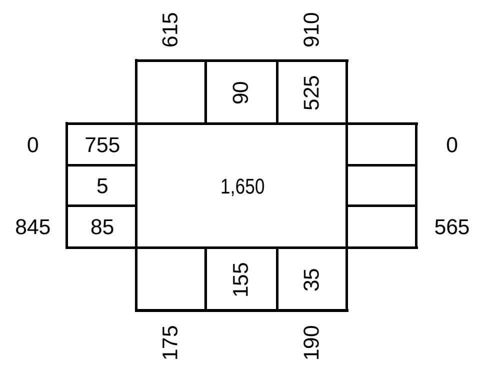
Count Source: TC2

	EB	WB	NB	SB	Total
%HV	1%		1%	2%	
PHF					0.93

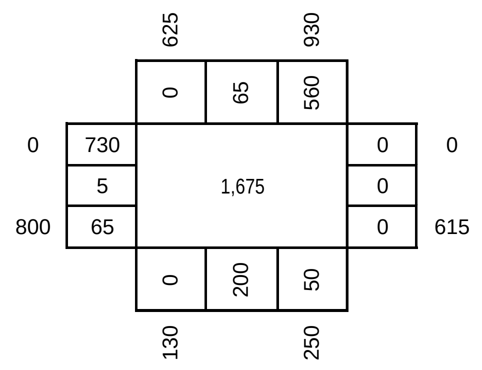
Peak Hour Used:

From 1630 **To** 1730

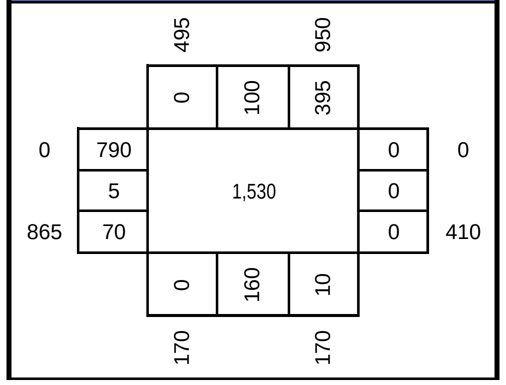
19 **Gravelly Lake Dr**
2013 **NB I-5 Ramps**



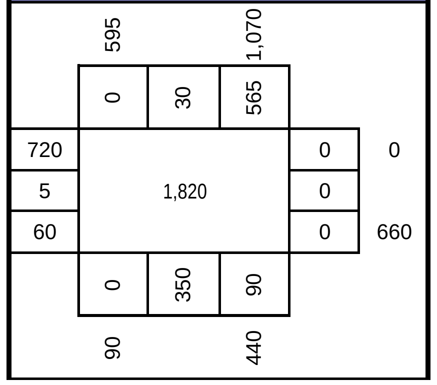
23 **Gravelly Lake Dr**
2020 **NB I-5 Ramps**



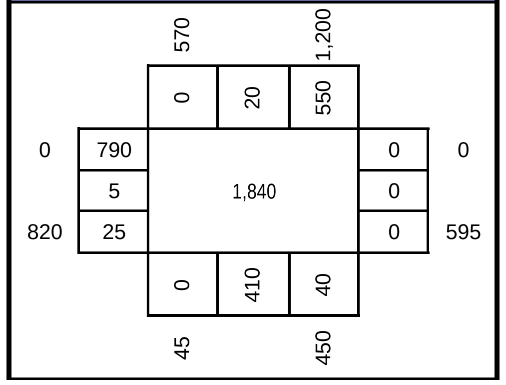
23 **Gravelly Lake Dr**
2020 **NB I-5 Ramps**



Gravelly Lake Dr
NB I-5 Ramps



22 **Gravelly Lake Dr**
2040 **NB I-5 Ramps**



Appendix C

No Build Alternative

Intersection Analysis Summary

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Intersection Analysis Summary - 2020 No Build

No.	Intersection	Control Type	Approach Road	Movement	AM PEAK HOUR						PM PEAK HOUR					
					Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)	Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)
						Approach		Movement				Approach		Movement		
3	I-5 NB Ramps / Center Drive	Stop Control on EB Center Drive from Base (I-5 Off Loop Ramp as thru trips)		Overall	1,160	B	13.2				970	B	12.0			
			Center Drive	EB-L	15	B	13.2	B	13.2	3			0.0			
			Center Drive	EB-T							550			A	0.0	
			Center Drive	EB-R												
			I-5 Off Loop Ramp	NB-L			0.0					B	12.0			
			I-5 Off Loop Ramp	NB-T	685			A	0.0		305			B	12.5	50
			I-5 Off Loop Ramp	NB-R												
			Center Drive	SB-L			0.0									
			Center Drive	SB-T	460						115			A	0.0	
			Center Drive	SB-R												
4	I-5 SB Ramps / Center Drive	Two-way Stop Control on Ramps		Overall	1,795	C	18.6				2,120	C	15.2			
			I-5 Off-ramp	WB-L	0	C	18.6				0	C	15.2			
			I-5 Off-ramp	WB-T	0						0					
			I-5 Off-ramp	WB-R	295			C	18.6	70	275			C	15.2	50
			Center Drive	NB-L	10		0.2	A	8.5		145		1.7	A	7.7	6
			Center Drive	NB-T	690			A	0.1		710			A	0.5	
			Center Drive	NB-R	0						0					
			Center Drive	SB-L	0		0.0				0					
			Center Drive	SB-T	460			A	0.0		115			A	0.0	
			Center Drive	SB-R	340			A	0.0		875			A	0.0	
5	Center Drive / Wilmington Drive	Signal	Wilmington Drive	Overall	1,920	B	16.0				2,195	C	20.5			
			Wilmington Drive	EB-L	5	B	15.8	B	15.5	7	10	B	12.6	B	12.4	10
			Wilmington Drive	EB-T	15			B	15.9	25	20			B	12.6	26
			Wilmington Drive	EB-R	60			B	15.9	25	60					
			Wilmington Drive	WB-L	125	B	19.9	C	21.5	66	335	C	28.5	C	34.1	#208
			Wilmington Drive	WB-T	15			B	15.8	21	30			B	12.8	34
			Wilmington Drive	WB-R	35			B	15.8	21	90					
			Center Drive	NB-L	100	B	16.6	E	68.8	#94	50	C	20.7	F	125.3	41
			Center Drive	NB-T	620			A	10.7	#185	670			B	15.1	#183
			Center Drive	NB-R	265			A	10.7	#185	265					
			Center Drive	SB-L	60	B	14.1	E	61.8	#56	60	B	15.6	E	59.7	#52
			Center Drive	SB-T	610			A	9.4	125	595			B	11.2	113
			Center Drive	SB-R	10			A	9.4	125	10					
6	I-5 NB Ramps / DuPont-Steilacoom Road	Signal		Overall	2,055	D	41.2				2,275	D	43.4			
			I-5 Off-ramp	EB-L	370	C	26.3	E	67.8	#459	310	D	47.8	E	77.5	#425
			I-5 Off-ramp	EB-T	5			E	67.8	#459	10			E	77.5	#425
			I-5 Off-ramp	EB-R	615			A	1.0	0	200			A	0.2	0
			Clark Road	NB-L	0	E	63.0				0	D	43.7			
			Clark Road	NB-T	365			E	68.9	#443	710			D	50.0	#784
			Clark Road	NB-R	75			C	34.1	33	210			C	22.4	73
			Steilacoom-DuPont	SB-L	215	D	49.5	C	32.7	m142	755	D	40.3	D	40.6	m388
			Steilacoom-DuPont	SB-T	410			E	57.0	m#384	80			D	40.0	m391
			Steilacoom-DuPont	SB-R	0						0					
7	I-5 SB Ramps / DuPont-Steilacoom Road	Signal		Overall	2,300	D	54.3				2,290	D	37.5			
			I-5 Off-ramp	WB-L	175	E	65.7	C	29.8	175	15	D	53.0	D	53.4	33
			I-5 Off-ramp	WB-T	0						0					
			I-5 Off-ramp	WB-R	655			E	75.3	#651	110			D	52.9	56
			Steilacoom-DuPont	NB-L	180	E	64.2	E	64.2	m#779	525	C	21.6	C	21.6	m#969
			Steilacoom-DuPont	NB-T	555			E	64.2	m#779	495			C	21.6	m#969
			Steilacoom-DuPont	NB-R	0						0					
			Steilacoom-DuPont	SB-L	0	C	31.4				0	D	49.9			
			Steilacoom-DuPont	SB-T	450			D	51.2	m234	820			E	69.6	#476
			Steilacoom-DuPont	SB-R	285			A	0.2	m0	325			A	0.3	0

Intersection Analysis Summary - 2020 No Build

No.	Intersection	Control Type	Approach Road	Movement	AM PEAK HOUR						PM PEAK HOUR					
					Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)	Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)
						Approach		Movement				Approach		Movement		
8	DuPont-Steilacoom Road / Barksdale Avenue / Wilmington Drive	Signal		Overall	2,130	E	72.6				2,020	B	19.5			
			Barksdale Avenue	SB-L	20	D	47.0	E	61.5	43	40	C	32.2	C	34.4	62
			Barksdale Avenue	SB-T	65			D	43.7	104	85			C	31.4	121
			Barksdale Avenue	SB-R	20			D	73.7	104	25			C	31.4	121
			Steilacoom-DuPont	NB-L	240	F	74.7	D	39.7	m189	190	C	23.1	C	27.2	194
			Steilacoom-DuPont	NB-T	65			C	28.3	m41	105			C	21.3	105
			Steilacoom-DuPont	NB-R	905			F	87.3	m247	310			C	21.2	67
			Wilmington Drive	EB-L	10	B	17.6	D	38.2	25	35	A	7.5	C	30.3	52
			Wilmington Drive	EB-T	60			D	38.2	91	100			C	33.2	119
			Wilmington Drive	EB-R	80			A	0.1	0	485			A	0.5	0
			Steilacoom-DuPont	WB-L	590	F	85.1	F	85.1	#500	575	C	24.6	C	24.6	305
			Steilacoom-DuPont	WB-T	60			F	85.2	#506	40			C	24.5	303
			Steilacoom-DuPont	WB-R	15			F	85.2	#506	30			C	24.5	303
11	I-5 NB Ramps / 41st Division Drive (Main Gate)	Cloverleaf Merge / Diverge		Overall	2,310	Cloverleaf merge/diverge Not Applicable for Synchro Analysis					2,985	Cloverleaf merge/diverge Not Applicable for Synchro Analysis				
			I-5 Off Loop Ramp	EB-R	305						50					
			I-5 Off-Ramp	WB-R	75						25					
			41st Division Drive	NB-T	450						1,400					
			41st Division Drive	NB-R	260						435					
			41st Division Drive	SB-T	920						655					
			41st Division Drive	SB-R	300						420					
12	I-5 SB Ramps / 41st Division Drive (Main Gate)	Cloverleaf Merge / Diverge		Overall	2,050	Cloverleaf merge/diverge Not Applicable for Synchro Analysis					2,960	Cloverleaf merge/diverge Not Applicable for Synchro Analysis				
			I-5 Off Loop Ramp	EB-R	120						50					
			I-5 Off-ramp	WB-R	390						50					
			41st Division Drive	NB-T	320						690					
			41st Division Drive	NB-R	205						735					
			41st Division Drive	SB-T	830						1,025					
			41st Division Drive	SB-R	185						410					
13	I-5 NB Ramps / Berklely Avenue	Signal		Overall	2,545	C	23.5				2,445	C	20.4			
			I-5 Off-ramp	EB-L	170	C	20.3	F	91.3	#262	85	E	56.9	E	60.0	124
			I-5 Off-ramp	EB-T	0						5			E	60.0	124
			I-5 Off-ramp	EB-R	620			A	0.8	0	5			A	0.0	0
			Berkeley Ave	NB-L	0	D	54.7				0	B	17.9			
			Berkeley Ave	NB-T	235			E	60.0	336	480			D	53.2	#516
			Berkeley Ave	NB-R	450			D	52.0	111	1,195			A	3.6	0
			Berkeley Ave	SB-L	55	A	5.8	A	5.8	104	190	C	21.4	C	21.4	128
			Berkeley Ave	SB-T	1,015			A	5.8	104	485			C	21.4	128
			Berkeley Ave	SB-R	0											
14	I-5 SB Ramps / Berklely Avenue	Signal		Overall	1,675	D	42.8				1,510	C	33.9			
			I-5 Off-ramp	WB-L	905	D	44.4	D	47.9	578	405	E	63.7	E	65.0	#282
			I-5 Off-ramp	WB-T	0						5			E	63.0	#274
			I-5 Off-ramp	WB-R	140			C	29.4	45	5			C	42.6	0
			Berkeley Ave	NB-L	125	C	30.3	C	30.3	153	300	B	13.8	B	13.8	84
			Berkeley Ave	NB-T	280			C	30.3	153	265			B	13.8	84
			Berkeley Ave	NB-R	0						0					
			Berkeley Ave	SB-L	0	E	57.5				0	C	32.1			
			Berkeley Ave	SB-T	165			E	59.7	257	270			D	43.8	288
			Berkeley Ave	SB-R	60			D	51.4	35	260			D	35.4	67
15	Berklely Avenue / Union Avenue	All-way Stop Control		Overall	790	B	11.7				860	B	14.4			
			Militia Dr	EB-L	5	A	9.9	A	9.9	2	0	A	8.8			
			Militia Dr	EB-T	5			N	9.5	-	0					
			Militia Dr	EB-R	0						5			A	8.8	0
			Union Ave	WB-L	115	B	11.1	B	12.0	15	125	B	11.1	B	11.8	20
			Union Ave	WB-T	5			A	9.0	6	5			A	8.8	4
			Union Ave	WB-R	45			A	9.0	6	30			A	8.8	4
			Berkeley Ave	NB-L	5	B	12.2	B	14.0	60	0	A	9.2			
			Berkeley Ave	NB-T	285			A	9.6	25	90			A	9.3	10
			Berkeley Ave	NB-R	200			A	9.6	25	180			A	9.2	20
			Berkeley Ave	SB-L	10	B	10.9	B	10.9	25	25	C	19.0	C	19.0	102
			Berkeley Ave	SB-T	110			B	10.9	25	400			C	19.0	102
			Berkeley Ave	SB-R	5						0					

Intersection Analysis Summary - 2020 No Build

No.	Intersection	Control Type	Approach Road	Movement	AM PEAK HOUR						PM PEAK HOUR					
					Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)	Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)
						Approach		Movement				Approach		Movement		
17	Berklely Avenue/ Washington Avenue	Two-way Stop Control on Washington Avenue		Overall	470	B	12.6				570	B	12.4			
			Washington Ave	EB-L	0	A	8.8				0	B	10.8			
			Washington Ave	EB-T	0						0					
			Washington Ave	EB-R	5			A	8.8	0	5			B	10.8	0
			Washington Ave	WB-L	35	B	12.6	B	12.6	10	25	B	12.4	B	12.4	6
			Washington Ave	WB-T	0						0					
			Washington Ave	WB-R	5			B	12.6	10	15			B	12.4	6
			Berkeley Ave	NB-L	5	A	0.1	A	7.4	0	5	A	0.3	A	8.2	0
			Berkeley Ave	NB-T	320			A	0.0		90			A	0.0	
			Berkeley Ave	NB-R	10			A	0.0		25				0.0	
			Berkeley Ave	SB-L	5	A	0.4	A	8.0	0	10	A	0.2	A	7.5	0
			Berkeley Ave	SB-T	85			A	0.0		395			A	0.0	
			Berkeley Ave	SB-R	0						0					
18	I-5 NB Ramps / Thorne Lane	Signal		Overall	1,490	D	35.8				1,930	D	38.4			
			I-5 Off-ramp	EB-L	15	D	44.9	D	44.3	32	10	D	43.7	D	43.3	31
			I-5 Off-ramp	EB-T	0			D	44.3	32	5			D	43.8	64
			I-5 Off-ramp	EB-R	215			D	45.0	65	175			D	43.8	64
			Thorne Ln	NB-L	0	E	56.9				0	D	54.9			
			Thorne Ln	NB-T	355			E	71.1	#482	400			E	74.0	#499
			Thorne Ln	NB-R	255			D	37.0	61	645			D	43.1	232
			Thorne Ln	SB-L	230	B	12.7	B	12.7	m115	370	B	12.1	B	12.1	145
			Thorne Ln	SB-T	420			B	12.7	m115	325			B	12.1	145
			Thorne Ln	SB-R	0						0					
19	I-5 SB Ramps / Thorne Lane	Signal		Overall	1,380	E	55.4				1,705	D	45.4			
			I-5 Off-ramp	WB-L	400	E	58.2	E	77.2	#540	235	D	48.7			
			I-5 Off-ramp	WB-T	5			E	77.2	#540	10			E	59.7	#334
			I-5 Off-ramp	WB-R	315			C	33.4	61	575			D	44.0	121
			Thorne Ln	NB-L	245	D	43.8	C	25.9	m155	375	C	26.0	C	26.0	m150
			Thorne Ln	NB-T	125			C	25.9	m155	35			C	26.0	m150
			Thorne Ln	NB-R	0						0					
			Thorne Ln	SB-L	0	F	102.9				0	E	56.4			
			Thorne Ln	SB-T	250			F	93.3	#373	460			E	57.2	#915
			Thorne Ln	SB-R	40			D	40.4	0	15			C	30.5	0
20	Union Ave / Union Avenue Loop	Tee with Stop Sign on Union Avenue		Overall	730	B	10.4				1,090	B	11.6			
			Union Ave	EB-L		B	10.4					B	11.6			
			Union Ave	EB-T												
			Union Ave	EB-R	125			B	10.4	15	190			B	11.6	20
			Thorne Ln	NB-L	230	-	4.4	A	8.4	15	330	-	4.8	A	8.9	20
			Thorne Ln	NB-T	210			A	0.0	-	280			A	0.0	
			Thorne Ln	NB-R	0						0					
			Thorne Ln	SB-L	0	-	0.0				0	-	0.0			
			Thorne Ln	SB-T	165			-	-	-	285					
			Thorne Ln	SB-R	0						5					
22	I-5 NB Ramps / Gravelly Lake Drive	Signal		Overall	1,355	C	27.8				1,695	D	41.6			
			I-5 Off-ramp	EB-L	460	D	48.7	D	53.5	#449	745	E	64.6	E	65.1	#714
			I-5 Off-ramp	EB-T	0						5			E	64.1	#701
			I-5 Off-ramp	EB-R	110			D	43.8	#309	65			E	64.1	#701
			Gravelly Lk Dr	NB-L	0	D	48.6				0	E	67.3			
			Gravelly Lk Dr	NB-T	130			D	48.6	93	205			E	67.3	178
			Gravelly Lk Dr	NB-R	40			D	48.6	93	45			E	67.3	178
			Gravelly Lk Dr	SB-L	580	A	2.7	A	2.8	m21	560	A	1.7	A	1.9	m1
			Gravelly Lk Dr	SB-T	35			A	0.1	m0	70			A	0.1	m0
			Gravelly Lk Dr	SB-R	0						0					

Intersection Analysis Summary - 2020 No Build

No.	Intersection	Control Type	Approach Road	Movement	AM PEAK HOUR						PM PEAK HOUR					
					Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)	Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)
						Approach		Movement				Approach		Movement		
23	I-5 SB Ramps / Gravelly Lake Drive	Signal		Overall	2,120	D	39.3				2,480	D	37.2			
			I-5 Off-ramp	WB-L	5	D	48.1	D	46.1	15	10	E	62.7			
			I-5 Off-ramp	WB-T	0						0			E	61.0	29
			I-5 Off-ramp	WB-R	355			D	48.1	91	340			E	62.7	103
			Gravelly Lk Dr	NB-L	60	A	7.0	A	7.0	44	40	A	8.4			
			Gravelly Lk Dr	NB-T	510			A	7.0	44	910			A	8.4	86
			Gravelly Lk Dr	NB-R	0						0					
			Gravelly Lk Dr	SB-L	0	D	52.7				0	D	52.8			
			Gravelly Lk Dr	SB-T	610			E	56.6	#764	620			E	57.4	#894
			Gravelly Lk Dr	SB-R	580			D	48.5	259	560			D	47.7	408
25	Gravelly Lake Drive / Pacific Highway	Signal		Overall	2,370	C	33.0				2,840	D	37.1			
			Pacific Hwy	WB-L	90	D	53.2	D	54.1	63	250	E	68.3	E	71.1	175
			Pacific Hwy	WB-T	0						0					
			Pacific Hwy	WB-R	125			D	52.5	60	150			E	63.5	132
			Gravelly Lk Dr	NB-L	0	D	47.5				0	B	13.7			
			Gravelly Lk Dr	NB-T	825			D	47.9	361	1,125			B	14.8	174
			Gravelly Lk Dr	NB-R	40			D	40.1	m19	125			A	4.1	m7
			Gravelly Lk Dr	SB-L	190	C	19.8	B	14.9	138	260	D	51.2	D	41.0	295
			Gravelly Lk Dr	SB-T	1,100			C	20.7	437	930			D	54.1	542
			Gravelly Lk Dr	SB-R	0											

Note: For Two-way Stop Control InterscetionS - Overall LOS and delay is based on worse approach/movement

Signalized and Non-signalized intersections analyzed with Synchro software

Rounadabout interscetion analyzed with Sidra software

Intersection Analysis Summary - 2040 No Build

No.	Intersection	Control Type	Approach Road	Movement	AM PEAK HOUR						PM PEAK HOUR					
					Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)	Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)
						Approach		Movement				Approach		Movement		
3	I-5 NB Ramps / Center Drive	Stop Control on EB Center Drive from Base (I-5 Off Loop Ramp as thru trips)		Overall	1,335	B	12.7				765	B	12.2			
			Center Drive	EB-L	20	B	12.7	B	12.7	3	315	B	12.2	B	12.2	50
			Center Drive	EB-T												
			Center Drive	EB-R												
			I-5 Off Loop Ramp	NB-L		A	0.0					A	0.0			
			I-5 Off Loop Ramp	NB-T	890			A	0.0		335			A	0.0	
			I-5 Off Loop Ramp	NB-R												
			Center Drive	SB-L		A	0.0					A	0.0			
			Center Drive	SB-T	425						115					
			Center Drive	SB-R												
4	I-5 SB Ramps / Center Drive	Two-way Stop Control on Ramps		Overall	2,085	E	35.0				1,935	B	13.2			
			I-5 Off-ramp	WB-L	0	E	35.0	A	0.0		0	B	13.2	A	0.0	
			I-5 Off-ramp	WB-T	0						0					
			I-5 Off-ramp	WB-R	345			E	35.0	150	295			B	13.2	40
			Center Drive	NB-L	10	A	0.2	A	8.4		145	A	2.0	A	7.7	6
			Center Drive	NB-T	900			A	0.1		505			A	0.3	
			Center Drive	NB-R	0						0					
			Center Drive	SB-L	0	A	0.0				0	A	0.0	A	0.0	
			Center Drive	SB-T	425			A	0.0		115					
			Center Drive	SB-R	405			A	0.0		875					
5	Center Drive / Wilmington Drive	Signal	Wilmington Drive	Overall	2,250	C	21.7				2,015	C	20.2			
			Wilmington Drive	EB-L	5	B	15.1	B	14.7	7	10	B	12.4	B	12.2	10
			Wilmington Drive	EB-T	20			B	15.1	28	20			B	12.5	28
			Wilmington Drive	EB-R	75			B	15.1	28	75			B	12.5	28
			Wilmington Drive	WB-L	170	C	24.3	C	27.0	89	345	C	30.6	D	36.6	#219
			Wilmington Drive	WB-T	15			B	14.9	21	25			B	12.6	32
			Wilmington Drive	WB-R	35			B	14.9	21	90			B	12.6	32
			Center Drive	NB-L	105	C	23.4	F	93.7	#101	50	B	16.4	E	71.9	40
			Center Drive	NB-T	710			B	16.9	#284	440			B	12.7	95
			Center Drive	NB-R	430			B	16.9	#284	310			B	12.7	95
			Center Drive	SB-L	90	B	18.8	E	76.3	#91	70	B	19.0	F	80.2	#62
			Center Drive	SB-T	585			B	10.1	122	570			B	11.6	11
			Center Drive	SB-R	10			B	10.1	122	10			B	11.6	11
6	I-5 NB Ramps / DuPont-Steilacoom Road	Signal		Overall	1,885	F	89.9				2,175	F	90.7			
			I-5 Off-ramp	EB-L	400	C	29.4	E	56.5	#324	400	F	90.8	F	92.9	#499
			I-5 Off-ramp	EB-T	5			E	56.5	#324	10			F	92.9	#499
			I-5 Off-ramp	EB-R	380			A	0.5	0	10			A	0.0	0
			Clark Road	NB-L	0	C	27.8				0	D	44.2			
			Clark Road	NB-T	400			C	30.2	236	715			D	51.1	#693
			Clark Road	NB-R	80			B	16.0	21	205			C	20.1	53
			Steilacoom-DuPont	SB-L	205	F	214.6	D	43.6	#198	730	F	141.8	F	143.1	m#525
			Steilacoom-DuPont	SB-T	415			F	286.9	#512	105			F	140.5	m#525
			Steilacoom-DuPont	SB-R	0											
7	I-5 SB Ramps / DuPont-Steilacoom Road	Signal		Overall	2,520	F	152.6				2,635	D	48.5			
			I-5 Off-ramp	WB-L	165	F	337.0	C	21.5	115	25	D	45.9	D	46.7	43
			I-5 Off-ramp	WB-T	0						0					
			I-5 Off-ramp	WB-R	785			F	403.2	#660	130			D	45.8	56
			Steilacoom-DuPont	NB-L	175	E	71.6	E	71.6	m#409	540	E	76.1			
			Steilacoom-DuPont	NB-T	625			E	71.6	m#409	575			E	76.1	m#1033
			Steilacoom-DuPont	NB-R	0						0					
			Steilacoom-DuPont	SB-L	0	A	9.4				0	C	26.2			
			Steilacoom-DuPont	SB-T	455			B	15.6	112	810			D	43.7	#358
			Steilacoom-DuPont	SB-R	315			A	0.4	0	555			A	0.7	0

Intersection Analysis Summary - 2040 No Build

No.	Intersection	Control Type	Approach Road	Movement	AM PEAK HOUR						PM PEAK HOUR					
					Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)	Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)
						Approach		Movement				Approach		Movement		
8	DuPont-Steilacoom Road / Barksdale Avenue / Wilmington Drive	Signal		Overall	2,490	F	125.0				2,420	C	20.9			
			Barksdale Avenue	SB-L	25	D	37.5	D	44.6	42	50	C	33.2	C	35.3	62
			Barksdale Avenue	SB-T	75			C	35.7	105	100			C	32.3	113
			Barksdale Avenue	SB-R	25			C	35.7	105	20			C	32.3	113
			Steilacoom-DuPont	NB-L	265	F	166.6	C	31.1	248	180	C	25.8	C	31.0	159
			Steilacoom-DuPont	NB-T	75			B	17.7	69	90			C	23.5	80
			Steilacoom-DuPont	NB-R	1,070			F	210.6	#824	435			C	24.1	73
			Wilmington Drive	EB-L	15	C	23.9	C	31.2	28	25	A	7.9	C	26.3	35
			Wilmington Drive	EB-T	165			D	39.8	175	180			C	31.6	168
			Wilmington Drive	EB-R	115			A	0.1	0	675			A	0.9	0
			Steilacoom-DuPont	WB-L	580	F	97.7	F	100.5	#473	590	C	29.7	C	29.6	#350
			Steilacoom-DuPont	WB-T	60			C	94.8	#469	50			C	29.8	#356
11	I-5 NB Ramps / 41st Division Drive (Main Gate)	Cloverleaf Merge / Diverge		Overall	2,380	Cloverleaf merge/diverge Not Applicable for Synchro Analysis					2,880	Cloverleaf merge/diverge Not Applicable for Synchro Analysis				
			I-5 Off Loop Ramp	EB-R	355						45					
			I-5 Off-Ramp	WB-R	135						50					
			41st Division Drive	NB-T	515						1,270					
			41st Division Drive	NB-R	305						440					
			41st Division Drive	SB-T	855						620					
			41st Division Drive	SB-R	215						455					
12	I-5 SB Ramps / 41st Division Drive (Main Gate)	Cloverleaf Merge / Diverge		Overall	2,000	Cloverleaf merge/diverge Not Applicable for Synchro Analysis					2,950	Cloverleaf merge/diverge Not Applicable for Synchro Analysis				
			I-5 Off Loop Ramp	EB-R	290						180					
			I-5 Off-ramp	WB-R	75						100					
			41st Division Drive	NB-T	405						630					
			41st Division Drive	NB-R	245						690					
			41st Division Drive	SB-T	780						895					
			41st Division Drive	SB-R	205						455					
13	I-5 NB Ramps / Berklely Avenue	Signal		Overall	2,610	B	12.9				2,505	B	16.3			
			I-5 Off-ramp	EB-L	205	C	20.1	E	78.1	#286	115	D	38.1	D	49.3	157
			I-5 Off-ramp	EB-T	0						5					
			I-5 Off-ramp	EB-R	615			A	0.8	0	35			A	0.0	0
			Berkeley Ave	NB-L	0	C	20.0				0	B	17.0			
			Berkeley Ave	NB-T	280			E	56.4	#361	500			D	46.2	#562
			Berkeley Ave	NB-R	525			A	0.6	0	1,185			A	4.7	0
			Berkeley Ave	SB-L	70	A	1.0				235	A	9.3			
			Berkeley Ave	SB-T	915			A	1.0	21	430			A	9.3	80
			Berkeley Ave	SB-R	0											
14	I-5 SB Ramps / Berklely Avenue	Signal		Overall	1,790	D	38.4				1,605	C	27.6			
			I-5 Off-ramp	WB-L	825	D	47.1	D	52.1	#505	350	D	47.5	D	50.4	#263
			I-5 Off-ramp	WB-T	0						5			D	50.4	#254
			I-5 Off-ramp	WB-R	235			C	29.1	49	80			D	36.9	35
			Berkeley Ave	NB-L	120	B	16.3	B	16.3	105	350	A	6.7	A	6.7	32
			Berkeley Ave	NB-T	365			B	16.3	105	265			A	6.7	32
			Berkeley Ave	NB-R	0						0					
			Berkeley Ave	SB-L	0	D	44.8				0	D	35.1			
			Berkeley Ave	SB-T	160			D	47.7	201	315			D	39.1	#367
			Berkeley Ave	SB-R	85			D	39.4	43	240			C	29.7	66
15	Berklely Avenue / Union Avenue	All-way Stop Control		Overall	920	C	15.2				965	C	19.6			
			Militia Dr	EB-L	5	B	10.3	B	10.3	10	0	A	10.0			
			Militia Dr	EB-T	5			B	10.3	10	0					
			Militia Dr	EB-R	0						10			A	10.0	0
			Union Ave	WB-L	120	B	11.8	B	12.8	61	200	C	16.1	C	17.4	70
			Union Ave	WB-T	5			A	9.4	17	5			A	9.6	12
			Union Ave	WB-R	45						35			A	9.6	12
			Berkeley Ave	NB-L	5	C	17.1	C	20.9	111	0	B	12.3	B	11.1	38
			Berkeley Ave	NB-T	385			A	9.9	18	110			B	12.9	23
			Berkeley Ave	NB-R	210						235					
			Berkeley Ave	SB-L	10	B	11.7.	B	11.7	39	25	D	29.0	D	29.0	127
			Berkeley Ave	SB-T	125						345			D	29.0	127
			Berkeley Ave	SB-R	5						0					

Intersection Analysis Summary - 2040 No Build

No.	Intersection	Control Type	Approach Road	Movement	AM PEAK HOUR						PM PEAK HOUR					
					Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)	Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)
						Approach		Movement				Approach		Movement		
17	Berklely Avenue/ Washington Avenue	Two-way Stop Control on Washington Avenue		Overall	590	B	14.3				520	B	12.2			
			Washington Ave	EB-L		A	8.8					B	10.4			
			Washington Ave	EB-T												
			Washington Ave	EB-R	5			A	8.8	0	5			B	10.4	0
			Washington Ave	WB-L	40	B	14.3	B	14.3	8	25	B	12.2	B	12.2	5
			Washington Ave	WB-T												
			Washington Ave	WB-R	10			B	14.3	8						
			Berkeley Ave	NB-L	5		0.1	A	7.4	0	5		0.1	A	8.0	
			Berkeley Ave	NB-T	415				0.0		340				0.0	
			Berkeley Ave	NB-R	15				0.0							
			Berkeley Ave	SB-L	5		0.4	A	8.3	0	5		0.3	A	7.5	
			Berkeley Ave	SB-T	95			A	0.0		95				0.0	
			Berkeley Ave	SB-R							45				0.0	
18	I-5 NB Ramps / Thorne Lane	Signal		Overall	1,735	C	31.7				1,820	C	34.8			
			I-5 Off-ramp	EB-L	10	D	48.5	D	48.1	25	10	D	48.8	D	48.3	32
			I-5 Off-ramp	EB-T	0						5			D	48.3	32
			I-5 Off-ramp	EB-R	225			D	48.5	66	320			D	48.9	78
			Thorne Ln	NB-L	0	D	47.0				0	D	52.4			
			Thorne Ln	NB-T	445			E	60.5	#596	395			E	72.0	#559
			Thorne Ln	NB-R	345			C	29.7	101	400			C	33.1	92
			Thorne Ln	SB-L	275	A	9.1				355	A	7.6			
			Thorne Ln	SB-T	435			A	9.1	m90	335			A	7.6	m97
			Thorne Ln	SB-R	0						0					
19	I-5 SB Ramps / Thorne Lane	Signal		Overall	1,555	E	56.0				1,435	D	45.0			
			I-5 Off-ramp	WB-L	395	E	69.7	E	101.0	#594	240	E	60.1	F	86.7	#397
			I-5 Off-ramp	WB-T	5			E	101.0	#594	10			F	86.7	#397
			I-5 Off-ramp	WB-R	340			C	32.9	69	320			D	39.3	76
			Thorne Ln	NB-L	325	A	4.5	A	4.5	m55	355	A	4.7	A	4.7	m51
			Thorne Ln	NB-T	130			A	4.5	m55	50			A	4.7	m51
			Thorne Ln	NB-R	0						0					
			Thorne Ln	SB-L	0	F	92.8				0	E	61.7			
			Thorne Ln	SB-T	315			F	101.2	#489	450			E	62.5	#612
			Thorne Ln	SB-R	45			C	34.1	4	10			C	24.5	0
20	Union Ave / Union Avenue Loop	Tee with Stop Sign on Union Avenue		Overall	830	B	11.2				835	B	12.8			
			Union Ave	EB-L		B	11.2					B	12.8			
			Union Ave	EB-T												
			Union Ave	EB-R	140			B	11.2	20	160			B	12.8	18
			Thorne Ln	NB-L	250	-	4.6	A	8.7	20	220		5.4	A	9.0	14
			Thorne Ln	NB-T	220			A	0.0		150			A	0.0	
			Thorne Ln	NB-R												
			Thorne Ln	SB-L		-	0.0						0.0			
			Thorne Ln	SB-T	220						300					
			Thorne Ln	SB-R							5					
22	I-5 NB Ramps / Gravelly Lake Drive	Signal		Overall	1,490	C	33.0				1,820	D	50.4			
			I-5 Off-ramp	EB-L	505	E	57.8	E	63.2	#544	720	E	56.7	E	57.2	#654
			I-5 Off-ramp	EB-T	0						5			E	57.2	#654
			I-5 Off-ramp	EB-R	110			D	52.2	#395	60			E	56.1	#638
			Gravelly Lk Dr	NB-L	0	E	58.8				0	F	103.8			
			Gravelly Lk Dr	NB-T	140			E	58.8	120	350			F	108.3	#344
			Gravelly Lk Dr	NB-R	45			E	58.8	120	90			F	108.3	#344
			Gravelly Lk Dr	SB-L	685	A	4.0	A	4.1	m29	565	A	2.7	A	2.9	m2
			Gravelly Lk Dr	SB-T	5			A	0.0	m0	30			A	0.1	m0
			Gravelly Lk Dr	SB-R	0						0					

Intersection Analysis Summary - 2040 No Build

No.	Intersection	Control Type	Approach Road	Movement	AM PEAK HOUR						PM PEAK HOUR					
					Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)	Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)
						Approach		Movement				Approach		Movement		
23	I-5 SB Ramps / Gravelly Lake Drive	Signal		Overall	2,345	D	43.3				2,520	D	41.5			
			I-5 Off-ramp	WB-L	5	E	57.0	E	55.3	17	5	E	58.1	E	56.5	17
			I-5 Off-ramp	WB-T	0						0			E	56.5	17
			I-5 Off-ramp	WB-R	305			E	57.1	93	295			E	58.1	90
			Gravelly Lk Dr	NB-L	70	A	4.7	A	4.7	36	120	A	9.0			
			Gravelly Lk Dr	NB-T	575			A	4.7	36	950			A	9.0	m87
			Gravelly Lk Dr	NB-R	0						0					
			Gravelly Lk Dr	SB-L	0	E	58.1				0	E	67.4			
			Gravelly Lk Dr	SB-T	685			E	72.9	#958	590			F	88.6	#857
			Gravelly Lk Dr	SB-R	705			D	43.7	477	560			D	45.1	339
25	Gravelly Lake Drive / Pacific Highway	Signal		Overall	2,640	D	36.6				2,720	D	47.6			
			Pacific Hwy	WB-L	125	D	43.1	D	44.1	70	210	E	67.7	E	70.5	150
			Pacific Hwy	WB-T	0						0					
			Pacific Hwy	WB-R	145			D	42.3	58	185			E	64.4	135
			Gravelly Lk Dr	NB-L	0	E	61.9				0	D	52.4			
			Gravelly Lk Dr	NB-T	830			E	63.9	#425	1,125			D	54.6	638
			Gravelly Lk Dr	NB-R	50			C	28.2	37	120			C	31.3	86
			Gravelly Lk Dr	SB-L	225	C	20.4	B	14.1	138	140	C	34.9	C	27.0	158
			Gravelly Lk Dr	SB-T	1,265			C	21.5	448	940			D	36.0	541
			Gravelly Lk Dr	SB-R	0											

Note: For Two-way Stop Control InterscetionS - Overall LOS and delay is based on worse approach/movement
Signalized and Non-signalized intersections analyzed with Synchro software
Rounadabout interscetion analyzed with Sidra software

Appendix D

Summary of I-5 Mainline and Ramp Volumes

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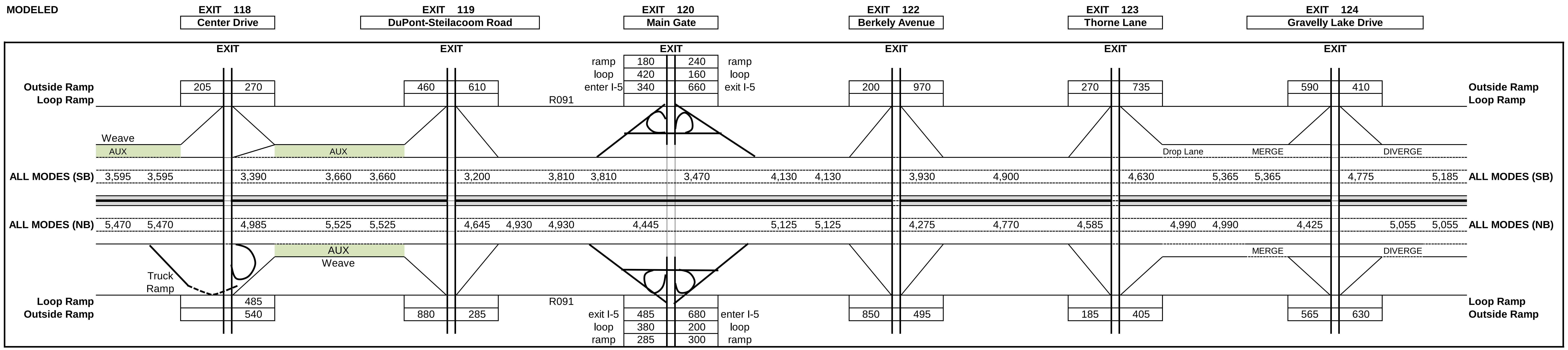
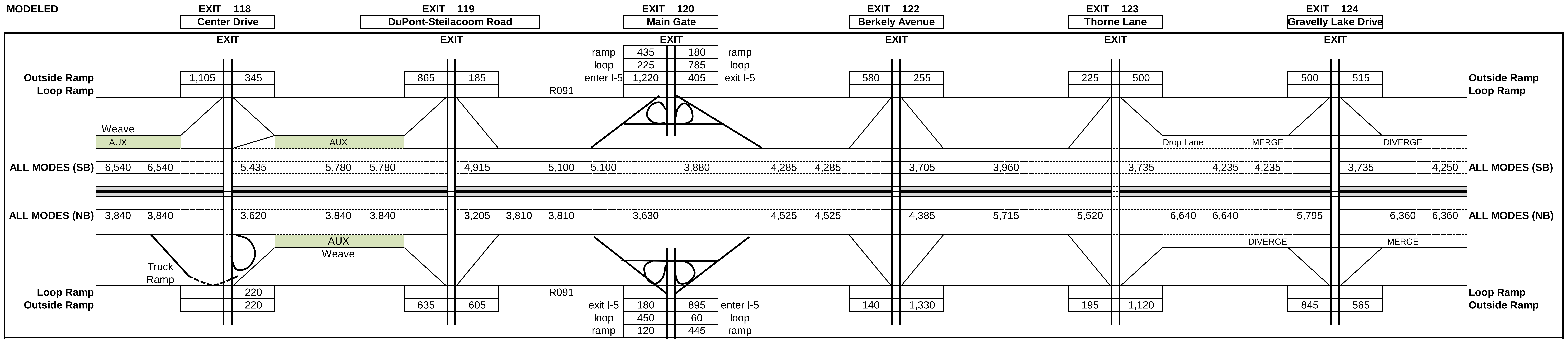
I-5 Mainline and Ramp Volumes

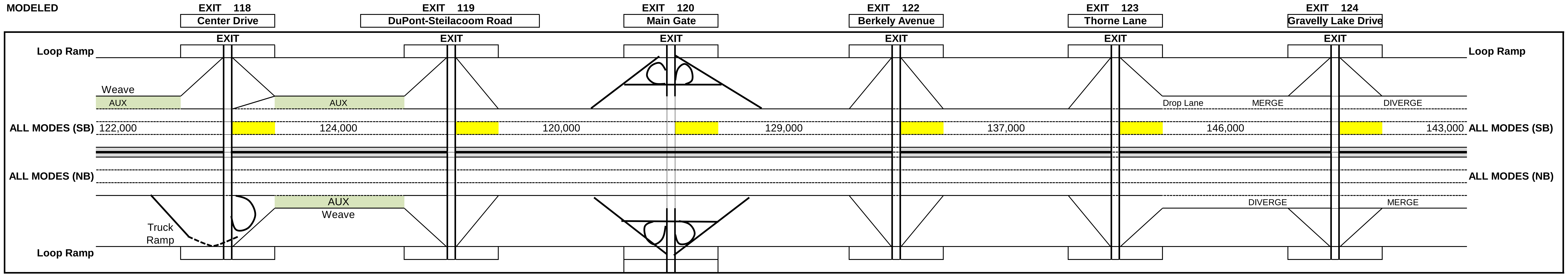
2013 AM PEAK HOUR - P0 - EXISTING CONDITIONS -- VOLUMES -- MESO - ALL MODE - Post Processed



2013 PM PEAK HOUR - P0 - EXISTING CONDITIONS -- VOLUMES -- MESO - ALL MODE - Post Processed

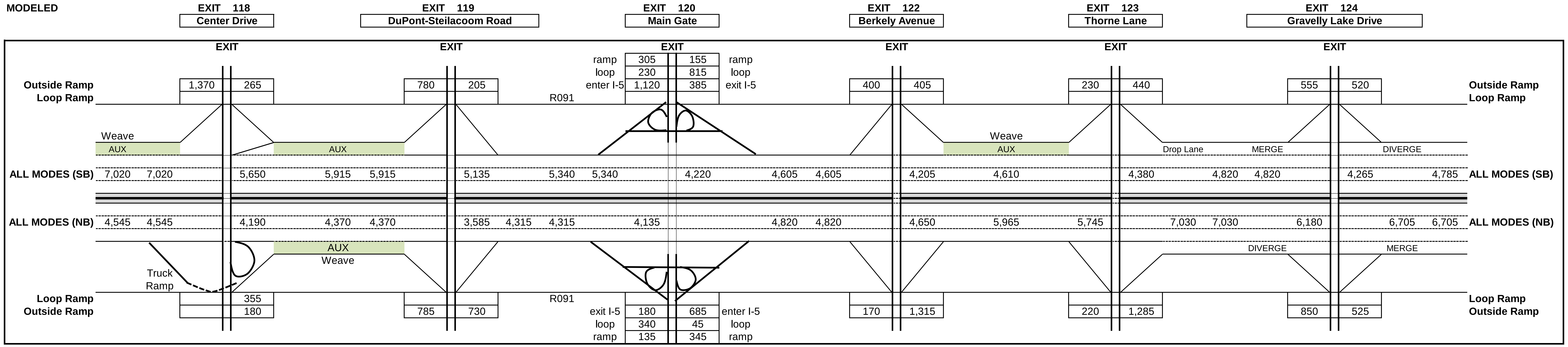


2013 ADT - P0 - EXISTING CONDITIONS -- VOLUMES - ALL MODES



I-5 Mainline and Ramp Volumes

2020 AM PEAK HOUR - P1 - BASE CONDITIONS WITH TIP IMPROVEMENTS -- VOLUMES -- MESO - ALL MODE - Post Processed



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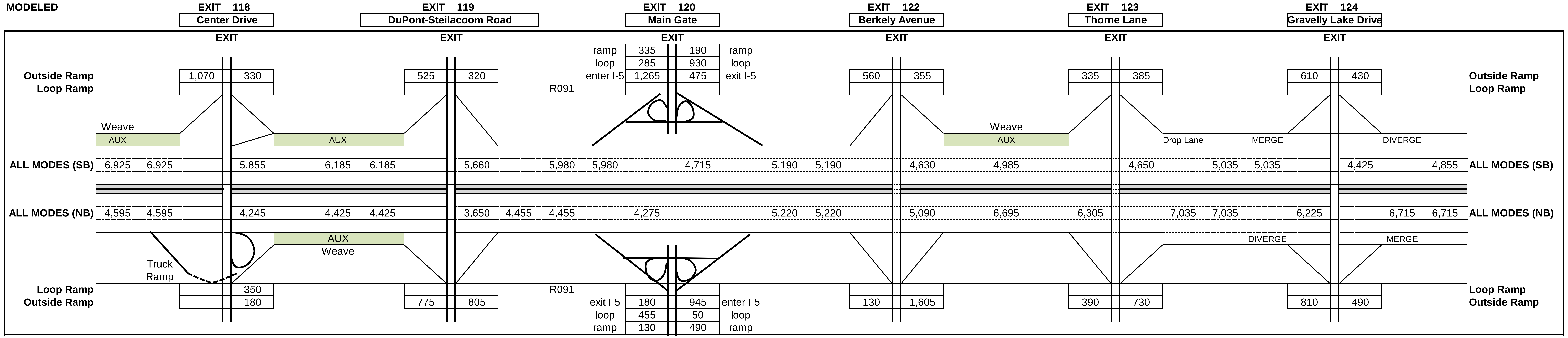
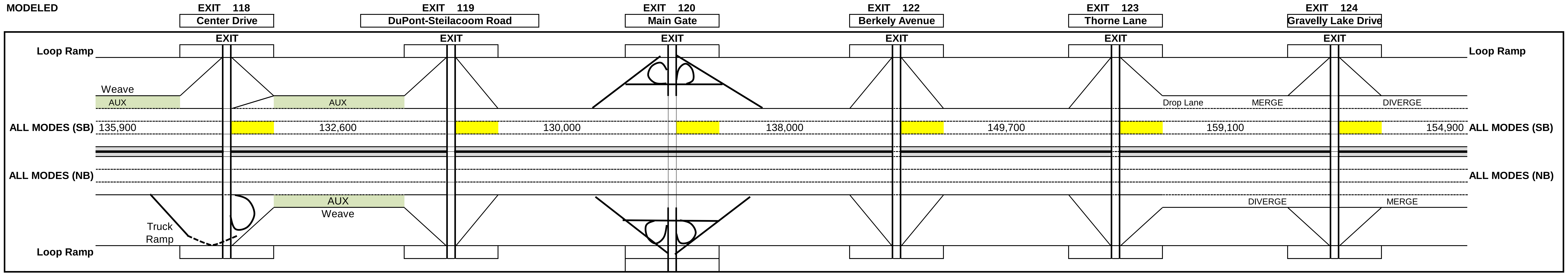
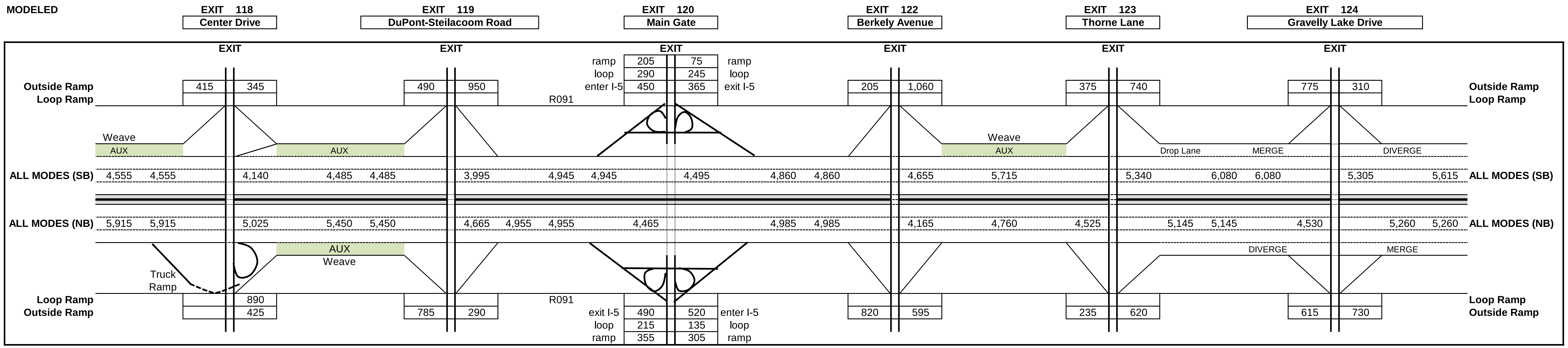


2020 ADT - P0 - EXISTING CONDITIONS -- VOLUMES - ALL MODES

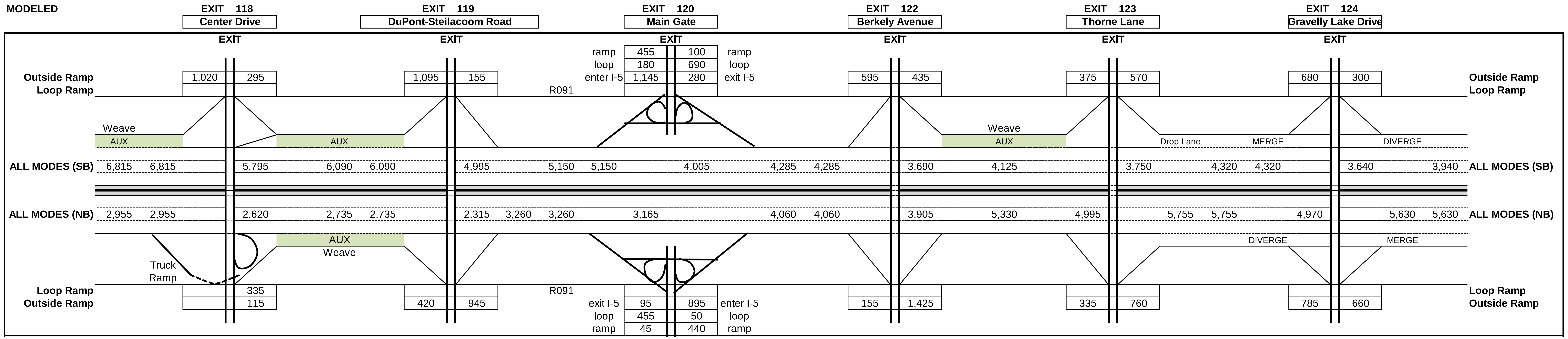


I-5 Mainline and Ramp Volumes

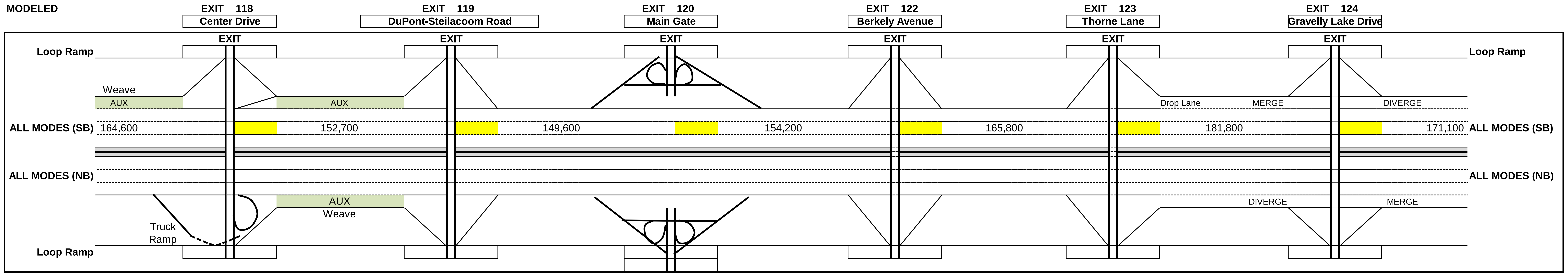
2040 AM PEAK HOUR - P1 - BASE CONDITIONS WITH TIP IMPROVEMENTS -- VOLUMES -- MESO - ALL MODE - Post Processed



2040 PM PEAK HOUR - P1 - BASE CONDITIONS WITH TIP IMPROVEMENTS-- VOLUMES -- MESO - ALL MODE - Post Processed

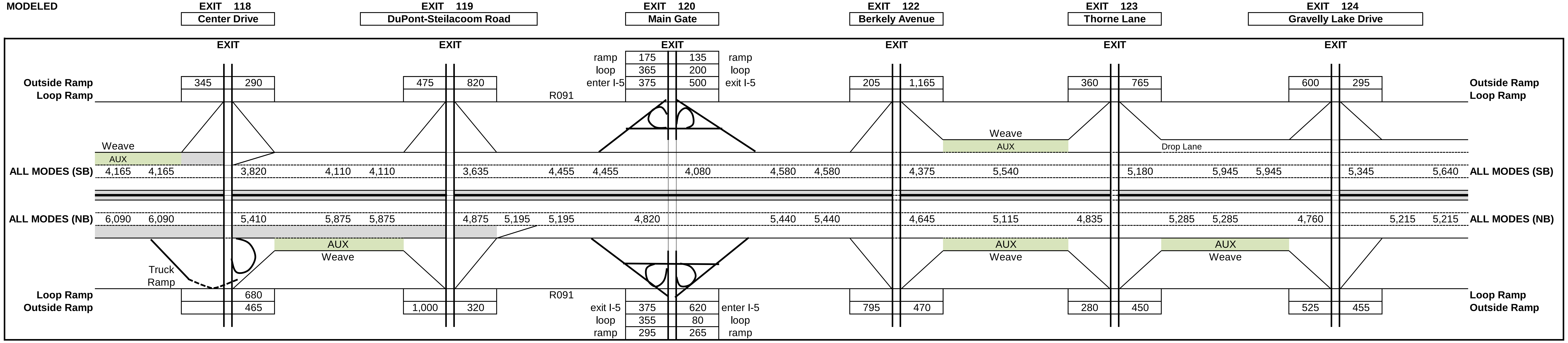


2040 ADT - P0 - EXISTING CONDITIONS -- VOLUMES - ALL MODES

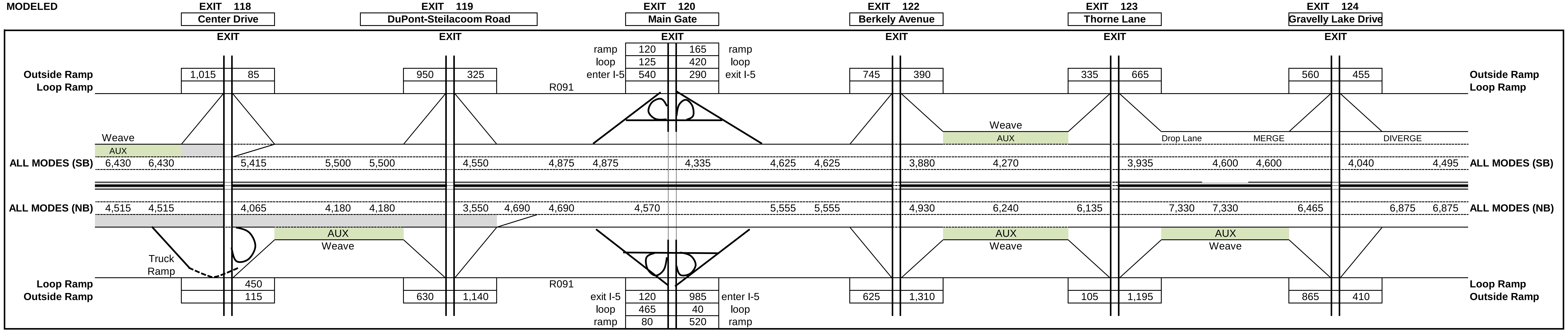


I-5 Mainline and Ramp Volumes

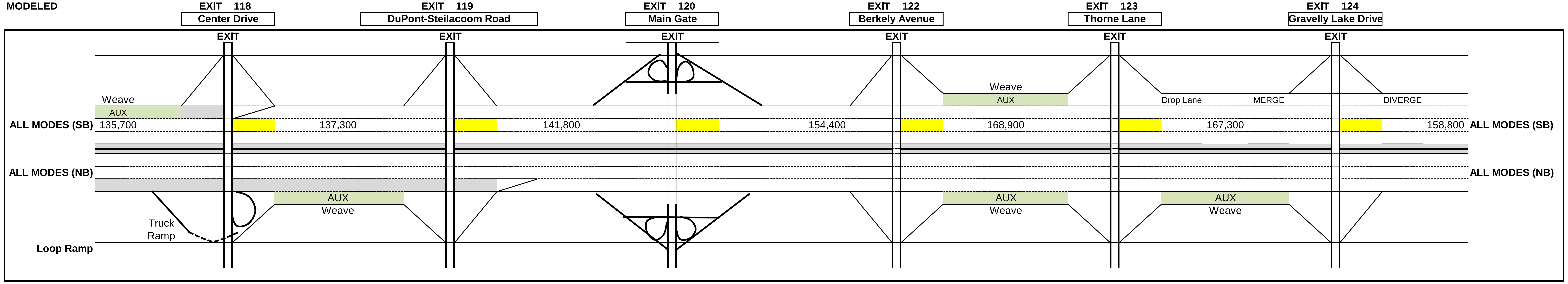
2020 AM PEAK HOUR - REVISED BUILD ALTERNATIVE IMPROVEMENTS -- VOLUMES -- MESO - ALL MODE - Post Processed



2020 PM PEAK HOUR - REVISED BUILD ALTERNATIVE IMPROVEMENTS -- VOLUMES -- MESO - ALL MODE - Post Processed

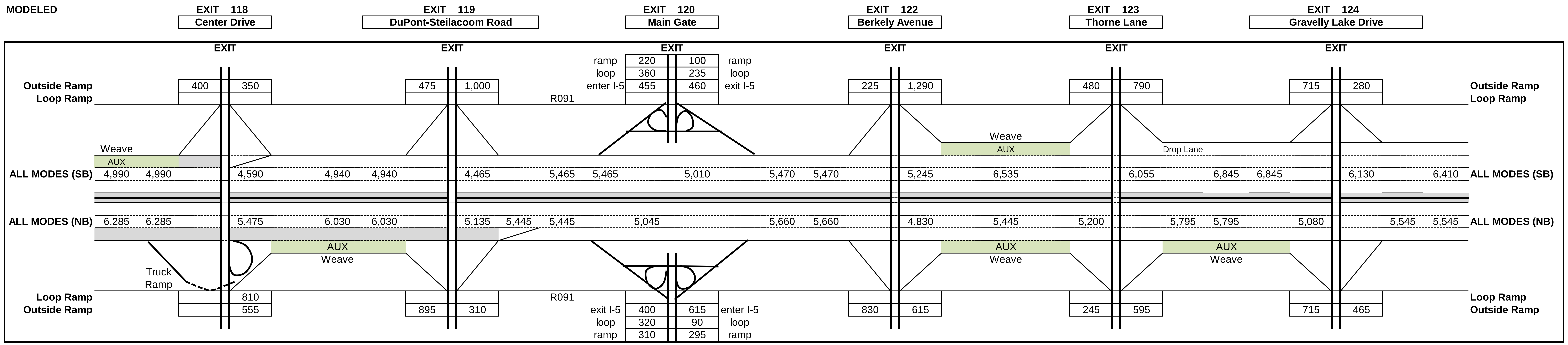


2020 ADT - REVISED BUILD ALTERNATIVE IMPROVEMENTS -- VOLUMES -- ALL MODE



I-5 Mainline and Ramp Volumes

2040 AM PEAK HOUR - REVISED BUILD ALTERNATIVE IMPROVEMENTS -- VOLUMES -- MESO - ALL MODE - Post Processed



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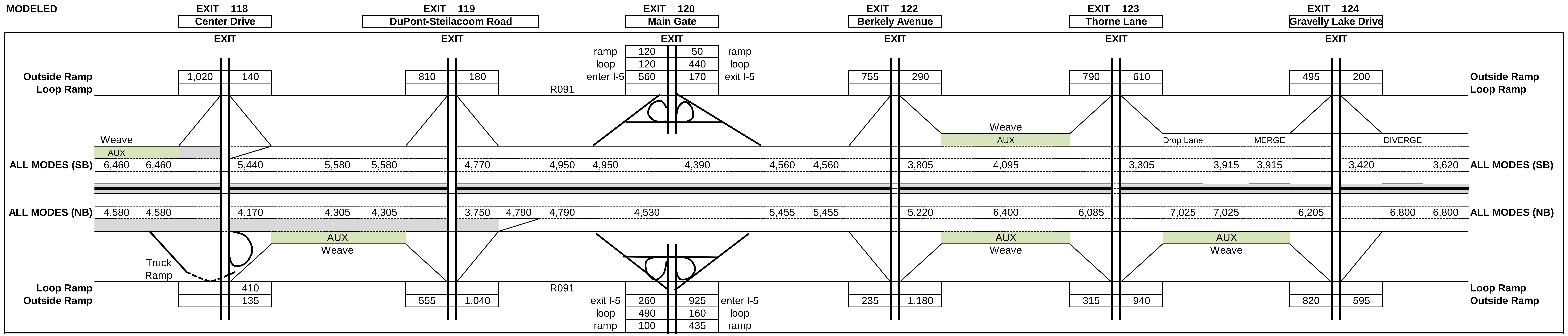
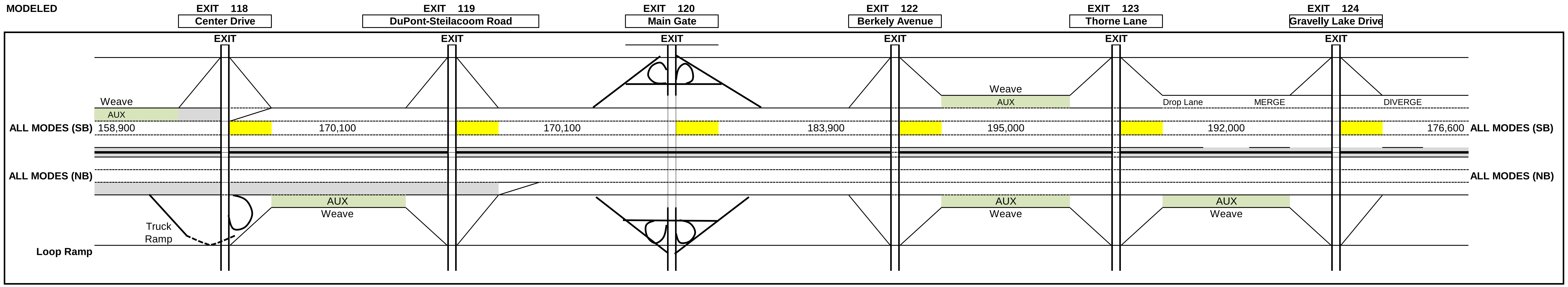


2040 ADT - REVISED BUILD ALTERNATIVE IMPROVEMENTS -- VOLUMES -- ALL MODE



Appendix E

Description of Alternative Packages

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Description of the Phase 2 Alternative Packages

The alternative packages evaluated as part of the Phase 2 study effort are described below.

P1: No Action Alternative – 2020 and 2040:

The No Action Alternative in 2020 and 2040 is similar to the 2013 existing conditions with the addition of TIGER III Grant projects and the Madigan Access Improvements, as well as projects affecting the area from TIP and STIP programs. In addition, there are other off-I-5 improvements including various JBLM gate changes. Both the opening of the new Integrity Gate and modifications to the Mounts Road Gate may affect traffic volumes at the I-5 interchanges.

Transit service enhancements identified in PSRC's *Transportation 2040* regional plan are also assumed to be in place in this alternative. These enhancements focus primarily on the long-term plans of Sound Transit and include the extension of Sounder Commuter Rail to DuPont. For 2020, existing transit service is assumed.

P2: Enhanced Transit Alternative – 2020 and 2040:

This package contains all elements of the P1 – No Action Alternative. It would also add enhanced transit service including the following new bus routes with 15-minute headways during peak commute periods:

- Lacey to DuPont P&R to Main Gate to Lakewood
- Lacey to Yelm to East Gate to Spanaway or Puyallup
- Lacey to SR 512 park-and-ride lot to Downtown Tacoma
- Spanaway to Lakewood to Lacey
- Lacey to Main Gate to Lakewood

These new routes represent what would essentially be a doubling of existing service along the I-5 corridor. Alternative P2 also assumes an expanded shuttle bus system on JBLM that matches the off-Base transit schedule, thus facilitating a smooth and connected trip to and from the base.

P3: Alternative with Local Road Improvements with Enhanced Transit Service – 2020 and 2040: This package contains all elements of the P2 – Enhanced Transit Alternative and would also include the following local road improvements, as illustrated in Figure 1:

- B-3: Gravelly Lake Connector – Add a new 2-lane urban road west of and parallel to I-5 between Thorne Lane and Gravelly Lake Drive.
- B-13: SR 507 – Widen 507 to four lanes from McKenna to East Gate Road.
- B-17: New High Speed Road – Construct a new highway/high speed arterial road from the Joint Base Connector Road to 176th Street SE.
- C-7: South A Road Extension – Extend South A Road from Jackson Road to Logistics Gate.
- C-8: Joint Base Connector Phase 2 – Add a new 4-lane higher speed connection between Lewis Main and McChord Field.

- C-9: Fairway Road Extension – Improve and extend Fairway Road as 2-lane road from the new Joint Base Connector to Bridgeport Way.
- C-15b: New arterial – Add a two-lane urban road close to the I-5 corridor, from Mounts Road to Jackson Avenue.
- C-21: New JBLM Collector Street, DuPont Gate to East Gate – Construct or improve a new two-lane road, following the rail alignment and combat vehicle trail.
- C-30: On-Base Signalization Improvements – Synchronize existing traffic signal operations in the Pendleton Avenue/Jackson Avenue corridor.

P4: I-5 Express Lanes Alternative – 2020 and 2040:

Alternative P4 would add two I-5 express lanes in each direction. The express lanes would extend from north of the Center Drive Interchange to north of the Gravelly Lake Drive Interchange. These express lanes would be 'managed lanes' and can evolve over time to best address demand, technology, and future conditions. Some possible options for the managed lanes could include: congestion pricing, High Occupancy Vehicle (HOV) lane(s), High Occupancy and Toll (HOT) lane(s), "truck only" lane(s), and/or "smart car only" lane(s).

For analysis purposes, it was assumed that the express lanes would include an HOV lane and a GP lane in each direction. For the 2020 analysis, one of the existing GP lanes north of the Gravelly Lake Drive Interchange was assumed to be converted to an HOV lane. In the 2040 configuration, an HOV lane would be added to the existing four GP lanes north of Thorne Lane and would be added to the existing three lanes at the south end of the project into Thurston County.

P4a: I-5 Express Lanes Alternative with Local Road Improvements – 2020 and 2040:

This alternative package would include all the improvements in the P4 – Express Lane Alternative and would add the three local road improvements listed below:

- B-3: Gravelly Lake Connector – A new 2-lane urban road west of and parallel to I-5 between Thorne Lane and Gravelly Lake Drive
- C-8: Joint Base Connector – A new 4-lane higher speed connection between Fort Lewis and McChord Field.
- C-9: Fairway Road Extension – Improve and extend Fairway Road as 2-lane road from the new Joint Base Connector to Bridgeport Way.

These local improvements would provide alternative on-Base and off-Base local routes for travel between downtown Lakewood and the Tillicum neighborhood without using I-5, for internal travel between the Lewis Main and McChord Field areas of JBLM, and for travel from Lewis Main to Lakewood without using I-5.

P5: I-5 HOV and CD/Auxiliary Lanes Alternative – 2020 and 2040:

Alternative P5 would add an HOV lane in each direction and two sets of CD Lanes connected by auxiliary lanes. One set of CD lanes would link the ramps at the Mounts Road, Center Drive, and Steilacoom-

DuPont Road Interchanges. The other set would use an auxiliary lane to link ramps at the Berkeley Street and Thorne Lane Interchanges to Gravelly Lake Drive. These two sets of CD lanes would be connected with auxiliary lanes between the Steilacoom-DuPont CD lanes and the Berkeley CD lanes. For the 2020 analysis one of the existing GP lanes north of the Thorne Lane Interchange is assumed to be converted to an HOV lane. In the 2040 configuration, an HOV lane would be added to the existing four GP lanes at the north end and to the existing three lanes at the south end of the project.

P5a: I-5 HOV and CD/Auxiliary Lanes Alternative with Local Road Improvements – 2020 and 2040:

This alternative package would include all the improvements in the P5 – HOV and CD Lanes Alternative and would add the three local road improvement projects associated with Alternative Package P4a.

P6: I-5 HOV and GP Lanes Alternative – 2020 and 2040:

Alternative P6 would add an HOV lane and a GP lane in each direction along I-5. A fourth GP lane would be added from Mounts Road to Thorne Lane in each direction. For the 2020 analysis, the HOV lanes would end south of the Steilacoom-DuPont Road Interchange and one of the existing GP lanes north of the Thorne Lane Interchange is assumed to be converted to an HOV lane. In the 2040 configuration, an HOV lane would be added to the existing four GP lanes at the north end of the project, and to the existing three lanes at the south end. For modelling purposes in 2040, the HOV lane is assumed to extend from Thurston County to Tacoma.

P6a: I-5 HOV and GP Lanes Alternative with Local Road Improvements – 2020 and 2040:

This alternative package would include all the improvements in the P6 – HOV and GP Lanes Alternative and would add the three local road improvements associated with Alternative Package P4a.

P7: I-5 HOV Lane Alternative – 2020 and 2040:

Alternative P7 would add an HOV lane in each direction along I-5. For 2020, the extra lanes would begin and end at the Center Drive Interchange and the inside northbound lane would become an HOV lane at the Steilacoom-DuPont Road Interchange. For the 2020 analysis one of the existing GP lanes north of the Thorne Lane Interchange is assumed to be converted to an HOV lane. In the 2040 configuration, an HOV lane would be added to the existing four GP lanes at the north end and to the existing three lanes at the south end of the project. For 2040 modelling purposes, the I-5 configuration assumes the HOV lanes extend from Thurston County to Tacoma. An existing GP lane in each direction north of the Thorne Lane Interchange would be converted into an HOV lane.

P7a: I-5 HOV Lane Alternative with Local Road Improvements and Transit Enhancements – 2020 and 2040:

This alternative package would include all the improvements in the P7 – HOV Lanes Alternative and would add the enhanced transit improvements included in Alternative P2. It would also add the three local road improvement projects associated with Alternative Package P4a.

P7b: I-5 HOV Lane Alternative with Local Road Improvements – 2020 and 2040:

This alternative package is the same as Alternative P7a except the enhanced transit improvements would not be not included.

Figure 1: Selected Local Road Improvements in Alternative Package P3

* C-30 is synchronization of signals on Pendleton Ave and Jackson Ave

Appendix F

Build Alternative
Intersection Analysis Summary

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Intersection Analysis Summary - 2020 Revised Build

No.	Intersection	Control Type	Approach Road	Movement	AM PEAK HOUR						PM PEAK HOUR					
					Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)	Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)
						Approach		Movement				Approach		Movement		
3	I-5 NB Ramps / Center Drive	Stop Control on EB Center Drive from Base (I-5 Off Loop Ramp as thru trips)		Overall	510	B	12.3				350	B	10.9			
			Center Drive	EB-L												
			Center Drive	EB-T												
			Center Drive	EB-R												
			I-5 Off Loop Ramp	NB-L	20	B	12.3	B	12.3	6	235	B	10.9	B	10.9	32
			I-5 Off Loop Ramp	NB-T												
			I-5 Off Loop Ramp	NB-R	15											
			Center Drive	SB-L		A	0.0						0.0			
			Center Drive	SB-T	475						115					
			Center Drive	SB-R												
4	I-5 SB Ramps / Center Drive	Two-way Stop Control on Ramps		Overall	1,780	C	15.3				1,900	B	11.4			
			I-5 Off-ramp	WB-L	0	C	15.3					B	11.4			
			I-5 Off-ramp	WB-T	0											
			I-5 Off-ramp	WB-R	295			C	15.3	62	85			B	11.4	12
			Center Drive	NB-L	0	A	0.0	A	0.0		0		0.0			
			Center Drive	NB-T	675			A	0.0		685			A	0.0	
			Center Drive	NB-R	0											
			Center Drive	SB-L	0	A	0.0						0.0			
			Center Drive	SB-T	475			A	0.0		115			A	0.0	
			Center Drive	SB-R	335			A	0.0		1,015			A	0.0	
5	Center Drive / Wilmington Drive	Signal	Wilmington Drive	Overall	1,920	B	13.0				2,110	B	18.6			
			Wilmington Drive	EB-L	5	B	15.6	B	15.2	8	10	B	12.1	B	11.8	10
			Wilmington Drive	EB-T	20			B	15.6	31	20			B	12.1	27
			Wilmington Drive	EB-R	70			B	15.6	31	65			B	12.1	27
			Wilmington Drive	WB-L	135	B	18.7	B	19.9	76	355	C	25.0	C	29.2	#224
			Wilmington Drive	WB-T	15			B	15.4	23	25			B	12.2	32
			Wilmington Drive	WB-R	35			B	15.4	23	90			B	12.2	32
			Center Drive	NB-L	105	B	10.3	C	27.5	70	55	B	17.2	E	55.1	#52
			Center Drive	NB-T	585			A	8.2	151	525			B	14.3	138
			Center Drive	NB-R	280			A	8.2	151	190			B	14.3	138
			Center Drive	SB-L	55	B	15.0	F	82.1	45	55	B	16.9	E	55.1	#52
			Center Drive	SB-T	605			A	9.0	130	710			B	14.0	153
			Center Drive	SB-R	10			A	9.0	130	10			B	14.0	153
6	I-5 NB Ramps / Steilacoom - DuPont Road	Signal		Overall	2,125	C	22.3				2,580	D	43.8			
			I-5 Off-ramp	EB-L	380	B	18.4	D	47.6	#358	395	E	60.6	F	94.2	#541
			I-5 Off-ramp	EB-T	5			D	47.6	#358	10			F	94.2	#541
			I-5 Off-ramp	EB-R	640			A	0.8	0	225			A	0.2	0
			Clark Road	NB-L	0	D	44.7					E	58.3			
			Clark Road	NB-T	360			D	48.7	#335	690			E	74.1	#812
			Clark Road	NB-R	80			C	26.7	34	350			C	27.2	131
			Steilacoom-DuPont	SB-L	255	B	13.4	A	8.6	m166	780	B	15.6	B	16.0	m28
			Steilacoom-DuPont	SB-T	405			B	15.9	#427	130			B	15.2	m27
			Steilacoom-DuPont	SB-R	0											
7	I-5 SB Ramps / Steilacoom - DuPont Road	Signal		Overall	2,330	D	37.2				2,765	D	41.2			
			I-5 Off-ramp	WB-L	185	D	54.7	C	24.2	141	20	D	52.9	D	52.3	39
			I-5 Off-ramp	WB-T	0			C	24.2	141				D	52.3	39
			I-5 Off-ramp	WB-R	660			E	63.3	#485	305			D	53.0	90
			Steilacoom-DuPont	NB-L	190	D	43.3	D	43.3	#574	485	C	33.0	C	33.0	m#958
			Steilacoom-DuPont	NB-T	550			D	43.3	#574	600			C	33.0	m#958
			Steilacoom-DuPont	NB-R	0											
			Steilacoom-DuPont	SB-L	0	B	11.4					D	45.0			
			Steilacoom-DuPont	SB-T	475			B	17.8	m23	890			E	68.2	#516
			Steilacoom-DuPont	SB-R	270			A	0.2	m0	465			A	0.5	0

Intersection Analysis Summary - 2020 Revised Build

No.	Intersection	Control Type	Approach Road	Movement	AM PEAK HOUR						PM PEAK HOUR					
					Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)	Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)
						Approach		Movement				Approach		Movement		
8	Steilacoom - DuPont Road / Barksdale Avenue / Wilmington Drive	Signal		Overall	2,555	D	46.9				2,580	D	37.4			
			Wilmington Drive	EB-L	20	D	38.7	D	43.4	33	40	D	53.0	D	55.0	68
			Wilmington Drive	EB-T	70			D	37.6	88	80			D	52.2	125
			Wilmington Drive	EB-R	20			D	37.6	88	20			D	52.2	125
			Steilacoom-DuPont	WB-L	245	D	42.7	C	30.7	m116	330	E	59.1	E	62.2	m275
			Steilacoom-DuPont	WB-T	75			C	22.7	m31	90			D	36.4	m56
			Steilacoom-DuPont	WB-R	890			D	47.7	m78	485			E	61.1	m64
			Steilacoom-DuPont	NB-L	10	C	20.2	D	37.5	20	45	B	13.7	D	48.5	70
			Steilacoom-DuPont	NB-T	75			D	41.0	82	135			E	56.5	170
			Steilacoom-DuPont	NB-R	85			A	0.1	0	565			A	0.7	0
			Barksdale Avenue	SB-L	985	E	56.7	E	57.0	#656	710	C	32.2	C	32.4	430
			Barksdale Avenue	SB-T	65			E	56.4	#666	50			C	32.1	421
			Barksdale Avenue	SB-R	15			E	56.4	#666	30			C	32.1	421
11	I-5 NB Ramps / 41st Division Drive (Main Gate)	Cloverleaf Merge / Diverge		Overall		Cloverleaf merge/diverge Not Applicable for Synchro Analysis						Cloverleaf merge/diverge Not Applicable for Synchro Analysis				
			I-5 Off Loop Ramp	EB-R												
			I-5 Off-Ramp	WB-R												
			41st Division Drive	NB-T												
			41st Division Drive	NB-R												
				SB-L												
			41st Division Drive	SB-T												
			41st Division Drive	SB-R												
12	I-5 SB Ramps / 41st Division Drive (Main Gate)	Cloverleaf Merge / Diverge		Overall		Cloverleaf merge/diverge Not Applicable for Synchro Analysis						Cloverleaf merge/diverge Not Applicable for Synchro Analysis				
			I-5 Off Loop Ramp	EB-R												
			I-5 Off-ramp	WB-R												
			41st Division Drive	NB-T												
			41st Division Drive	NB-R												
			41st Division Drive	SB-T												
			41st Division Drive	SB-R												
13	I-5 NB Ramps / Berkelely Avenue	RAB		Overall	2,665	A	4.4				3,275	A	5.2			
			I-5 Off-ramp	EB-L	170	A	1.7	A	7.5	24	225	A	2.3	A	6.4	26
			I-5 Off-ramp	EB-T							0			A	6.4	26
			I-5 Off-ramp	EB-R	630			A	0.1		400			A	0.0	
			Berkeley Ave	NB-L		A	2.7					A	6.2			
			Berkeley Ave	NB-T	240			A	5.4	27	880			B	10.8	146
			Berkeley Ave	NB-R	445			A	1.3	19	1,305			A	3.1	146
			Berkeley Ave	SB-L	60	A	7.0	A	7.4		5	A	4.2	A	4.3	
			Berkeley Ave	SB-T	1,120			A	7.2		460			A	4.2	
			Berkeley Ave	SB-R												
14	I-5 SB Ramps / Berklely Avenue	RAB		Overall	1,830	B	13.2				1,775	A	9.1			
			I-5 Off-ramp	WB-L	1,020	B	15.2	B	15.3	144	380	A	8.7	A	8.7	30
			I-5 Off-ramp	WB-T							5			A	8.1	30
			I-5 Off-ramp	WB-R	185			B	14.9	144	5			A	8.1	30
			Berkeley Ave	NB-L	140	A	4.2	A	4.2		545	A	6.8	A	7.1	
			Berkeley Ave	NB-T	270			A	4.3		560			A	6.6	
			Berkeley Ave	NB-R												
			Berkeley Ave	SB-L		B	19.3					B	18.6			
			Berkeley Ave	SB-T	160			B	19.3	70	85			B	18.6	95
			Berkeley Ave	SB-R	55			B	19.3	70	195			B	18.6	95
15	Berkelely Avenue / Union Avenue	two-way Stop Control		Overall	385	C	15.2				305	A	9.0			
			Militia Dr	EB-L	5	C	15.2	C	15.2	3						
			Militia Dr	EB-T	5			C	15.2	3						
			Militia Dr	EB-R	0											
			Union Ave	WB-L	0	A	9.1					A	9.0			
			Union Ave	WB-T	5			A	9.1		5			A	9.0	
			Union Ave	WB-R	150			A	9.1	15	115			A	9.0	11
			Berkeley Ave	SB-L	205	A	7.2	A	7.2	14	175	A	7.2	A	7.2	12
			Berkeley Ave	SB-T												
			Berkeley Ave	SB-R	15			A	7.2	14	10			A	7.2	12

Intersection Analysis Summary - 2020 Revised Build

No.	Intersection	Control Type	Approach Road	Movement	AM PEAK HOUR						PM PEAK HOUR					
					Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)	Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)
						Approach		Movement				Approach		Movement		
16	Berkelely Avenue/ Jackson Extension	New All-way Stop Control		Overall	760	B	13.9				920	C	23.8			
			RAMP	EB-L	280	C	16.4	C	16.4	125	415	D	31.7	D	31.7	250
			RAMP	EB-T												
			RAMP	EB-R	175			C	16.4	125	150			D	31.7	250
			Berkeley Ave	NB-L	150	B	10.4	B	11.0	28	140	B	11.3	B	11.9	30
			Berkeley Ave	NB-T	45			A	8.3	7	40			A	8.9	5
			Berkeley Ave	NB-R												
			Berkeley Ave	SB-L		A	9.5					B	11.1			
			Berkeley Ave	SB-T	45			A	9.5	10	35			B	11.1	27
			Berkeley Ave	SB-R	65			A	9.5	10	140			B	11.1	27
17	Berkelely Avenue/ Washington Avenue	Stop Control on Washington (Right in/out)		Overall	420	A	9.3				370	A	9.2			
			Washington Ave	EB-L												
			Washington Ave	EB-T												
			Washington Ave	EB-R												
			Washington Ave	WB-L	0	A	9.3	A	9.3	4		A	9.2			
			Washington Ave	WB-T	0			A	9.3	4						
			Washington Ave	WB-R	45			A	9.3	4	70			A	9.2	7
			Berkeley Ave	NB-L									0.0			
			Berkeley Ave	NB-T	150						110					
			Berkeley Ave	NB-R	5						5					
			Berkeley Ave	SB-L									0.0			
			Berkeley Ave	SB-T	220					0	185					
			Berkeley Ave	SB-R						0						
18	I-5 NB Ramps / Thorne Lane	RAB		Overall	1,565	A	5.5				2,225	A	7.1			
			I-5 Off-ramp	EB-L	15	A	9.8	A	9.8	35	10	B	10.4	B	10.4	23
			I-5 Off-ramp	EB-T							5			B	10.4	23
			I-5 Off-ramp	EB-R	185			A	9.8	35	90			B	10.4	23
			Thorne Ln	NB-L		A	4.9					A	5.5			
			Thorne Ln	NB-T	435			A	7.7	74	375			B	12.5	124
			Thorne Ln	NB-R	255			A	0.0		485			A	0.1	0
			Thorne Ln	SB-L	245	A	4.9	A	5.1		705	A	7.9	A	8.2	0
			Thorne Ln	SB-T	430			A	4.9		555			A	7.5	0
			Thorne Ln	SB-R												
19	I-5 SB Ramps / Thorne Lane	RAB		Overall	1,765	A	8.8				2,020	B	14.6			
			I-5 Off-ramp	WB-L	315	A	9.5	A	9.2	84	305	A	8.0	A	8.6	63
			I-5 Off-ramp	WB-T	5			A	9.2	84	10			A	8.6	63
			I-5 Off-ramp	WB-R	405			A	10.0	74	350			A	7.5	62
			Thorne Ln	NB-L	405	A	7.0	A	7.0		310	A	6.3	A	6.3	
			Thorne Ln	NB-T	325			A	7.0		75			A	6.3	
			Thorne Ln	NB-R												
			Thorne Ln	SB-L		A	9.6					C	22.3			
			Thorne Ln	SB-T	270			A	9.8	50	955			C	22.3	266
			Thorne Ln	SB-R	40			A	8.8	50	15			C	20.7	266
20	Thorne Lane / Union Avenue (Union Ave Loop)	Tee with Stop Sign on Union Avenue		Overall	205	A	9.6				300	B	11.2			
			Union Ave	EB-L	20	A	9.6	A	9.6	2	110	B	11.2	B	11.2	18
			Union Ave	EB-T												
			Union Ave	EB-R	0						0					
			Thorne Ln	NB-L	25	A	7.7	A	7.7	2	65	A	7.6	A	7.6	4
			Thorne Ln	NB-T	0						10			A	7.6	4
			Thorne Ln	NB-R												
			Thorne Ln	SB-L												
			Thorne Ln	SB-T	0						0					
			Thorne Ln	SB-R	160						115					
21	New Thorne Lane - Union Avenue Loop	RAB		Overall	771	A	6.5				1,405	C	21.1			
			Union Loop	WB-L	20	A	4.5	A	4.5	3	115	A	5.2	A	72.3	18
			Union Loop	WB-T				A	4.5	3						
			Union Loop	WB-R	1						5			A	10.6	18
			Thorne Ln	NB-L		A	7.0					A	7.0			
			Thorne Ln	NB-T	300			A	7.3	80	315			A	7.0	93
			Thorne Ln	NB-R	160			A	6.6	80	110			A	7.0	93
			Thorne Ln	SB-L	0			A	4.9	48	5			C	8.3	599

Intersection Analysis Summary - 2020 Revised Build

No.	Intersection	Control Type	Approach Road	Movement	AM PEAK HOUR						PM PEAK HOUR					
					Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)	Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)
						Approach		Movement				Approach		Movement		
			Thorne Ln	SB-T	290	A	5.7	A	5.7	48	855	C	30.4	C	8.3	599
			Thorne Ln	SB-R												
22	I-5 NB Ramps / Gravelly Lake Drive	Signal		Overall	1,230	C	24.0				1,460	C	35.0			
			I-5 Off-ramp	EB-L	380	D	41.3	D	44.9	#361	790	D	50.9	D	51.1	#651
			I-5 Off-ramp	EB-T	0			D	37.5	214	5			D	50.8	#642
			I-5 Off-ramp	EB-R	145			D	37.5	214	0			D	50.8	#642
			Gravelly Lk Dr	NB-L	0	D	43.4					D	52.4			
			Gravelly Lk Dr	NB-T	120			D	43.4	76	160			D	52.4	111
			Gravelly Lk Dr	NB-R	25			D	43.4	76	10			D	52.4	111
			Gravelly Lk Dr	SB-L	505	A	2.7	A	2.9	m51	395	A	1.1	A	1.2	m1
			Gravelly Lk Dr	SB-T	55			A	0.1	m0	100			A	0.6	m0
			Gravelly Lk Dr	SB-R	0											
23	I-5 SB Ramps / Gravelly Lake Drive	Signal		Overall	2,035	D	38.4				2,430	D	37.9			
			I-5 Off-ramp	WB-L	5	D	44.0	D	42.6	13	15	D	53.8	D	51.7	33
			I-5 Off-ramp	WB-T	0			D	42.6	13				D	51.7	33
			I-5 Off-ramp	WB-R	290			D	44.0	76	440			D	53.9	109
			Gravelly Lk Dr	NB-L	70	A	9.2				15	A	3.1	A	3.1	43
			Gravelly Lk Dr	NB-T	555			A	9.2	64	935			A	3.1	43
			Gravelly Lk Dr	NB-R	0											
			Gravelly Lk Dr	SB-L	0	D	53.3					E	63.2			
			Gravelly Lk Dr	SB-T	555			E	60.8	#728	480			E	74.9	#651
			Gravelly Lk Dr	SB-R	560			D	45.9	232	545			D	52.8	252
25	Gravelly Lake Drive / Pacific Highway	Signal		Overall	2,345	B	12.6				3,020	B	17.9			
			Pacific Hwy	WB-L	110	D	48.3	D	49.3	69	260	E	57.2	E	60.0	156
			Pacific Hwy	WB-T	0											
			Pacific Hwy	WB-R	105			D	47.3	53	230			D	54.1	142
			Gravelly Lk Dr	NB-L	0	A	4.5					B	10.4			
			Gravelly Lk Dr	NB-T	805			A	4.6	138	1,220			B	11.1	185
			Gravelly Lk Dr	NB-R	40			A	1.4	m2	155			A	5.0	m8
			Gravelly Lk Dr	SB-L	250	B	12.0	D	51.2	248	315	B	10.3	C	28.1	230
			Gravelly Lk Dr	SB-T	1,035			A	2.5	106	840			A	3.6	133
			Gravelly Lk Dr	SB-R												

Note: For Two-way Stop Control InterscetionS - Overall LOS and delay is based on worse approach/movement
Signalized and Non-signalized intersections analyzed with Synchro software
Rounadabout interscetion analyzed with Sidra software

Intersection Analysis Summary - 2040 Revised Build

No.	Intersection	Control Type		Movement	AM PEAK HOUR						PM PEAK HOUR					
					Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)	Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)
						Approach		Movement				Approach		Movement		
3	I-5 NB Ramps / Center Drive	Stop Control on EB Center Drive from Base (I-5 Off Loop Ramp as thru trips)		Overall	575	B	13.3				580	C	15.0			
			Center Drive	EB-L		B	13.3				445	C	15.0	C	15.0	97
			Center Drive	EB-T	20			B	13.3	4						
			Center Drive	EB-R												
			I-5 Off Loop Ramp	NB-L												
			I-5 Off Loop Ramp	NB-T												
			I-5 Off Loop Ramp	NB-R												
			Center Drive	SB-L			0.0						0.0			
			Center Drive	SB-T	555			A	0.0		135					
			Center Drive	SB-R												
4	I-5 SB Ramps / Center Drive	Two-way Stop Control on Ramps		Overall	2,135	C	21.0				2,340	F	63.1			
			I-5 Off-ramp	WB-L	0	C	21.0				140	F	36.3	F	166.2	201
			I-5 Off-ramp	WB-T	0						0					
			I-5 Off-ramp	WB-R	350			C	21.0	108	310			C	16.8	74
			Center Drive	NB-L	0		0.0	A	0.0		120	A	2.4	A	5.6	17
			Center Drive	NB-T	830			A	0.0		735			A	0.0	
			Center Drive	NB-R	0						0					
			Center Drive	SB-L	0		0.0				0	A	0.0			
			Center Drive	SB-T	555			A	0.0		135			A	0.0	
			Center Drive	SB-R	400			A	0.0		900			A	0.0	
5	Center Drive / Wilmington Drive	Signal	Wilmington Drive	Overall	2,295	B	13.7				2,135	B	18.7			
			Wilmington Drive	EB-L	5	B	18.1	B	17.7	8	10	B	12.3	B	12.1	10
			Wilmington Drive	EB-T	20			B	18.1	35	20			B	12.4	30
			Wilmington Drive	EB-R	75			B	18.1	35	85			B	12.4	30
			Wilmington Drive	WB-L	165	C	26.8	C	29.5	102	325	C	26.5	C	31.7	#203
			Wilmington Drive	WB-T	15			B	17.9	26	30			B	12.5	34
			Wilmington Drive	WB-R	35			B	17.9	26	90			B	12.5	34
			Center Drive	NB-L	120	B	11.0	C	24.7	85	60	B	16.4	E	57.2	#52
			Center Drive	NB-T	710			A	9.4	201	520			B	13.4	123
			Center Drive	NB-R	350			A	9.4	201	295			B	13.4	123
			Center Drive	SB-L	70	B	13.8	D	51.4	59	65	B	17.6	E	70.3	#57
			Center Drive	SB-T	715			B	10.2	160	625			B	12.3	118
			Center Drive	SB-R	15			B	10.2	160	10			B	12.3	118
6	I-5 NB Ramps / Steilacoom - DuPont Road	Signal		Overall	2,010	C	28.6				2,360	D	49.3			
			I-5 Off-ramp	EB-L	395	C	25.5	E	56.6	426	425	E	66.7	F	85.1	#563
			I-5 Off-ramp	EB-T	5			E	56.6	426	10			F	85.1	#563
			I-5 Off-ramp	EB-R	495			A	0.5	0	120			A	0.1	0
			Clark Road	NB-L	0	E	55.5				0	E	68.0			
			Clark Road	NB-T	400			E	58.0	433	620			F	82.0	#753
			Clark Road	NB-R	70			D	37.0	35	225			C	29.2	90
			Steilacoom-DuPont	SB-L	235	B	13.4	A	9.0	m210	805	C	22.8	C	22.7	m#49
			Steilacoom-DuPont	SB-T	410			B	15.5	m#655	155			C	23.0	m#51
			Steilacoom-DuPont	SB-R	0						0					
7	I-5 SB Ramps / Steilacoom - DuPont Road	Signal		Overall	2,570	F	82.2				2,535	C	30.9			
			I-5 Off-ramp	WB-L	160	F	108.5	C	28.6	155	35	E	55.3	E	58.2	64
			I-5 Off-ramp	WB-T	0			C	28.6	155	0			E	58.2	64
			I-5 Off-ramp	WB-R	840			F	123.7	#965	145			D	54.6	#7
			Steilacoom-DuPont	NB-L	185	F	98.5	F	98.5	#1039	425	C	23.1	C	23.1	m#198
			Steilacoom-DuPont	NB-T	610			F	98.5	#1039	620			C	23.1	m#198
			Steilacoom-DuPont	NB-R	0						0					
			Steilacoom-DuPont	SB-L	0	C	31.4				0	C	33.8			
			Steilacoom-DuPont	SB-T	485			D	50.0	#318	925			D	47.7	#510
			Steilacoom-DuPont	SB-R	290			A	0.2	0	385			A	0.4	0

Intersection Analysis Summary - 2040 Revised Build

No.	Intersection	Control Type		Movement	AM PEAK HOUR						PM PEAK HOUR					
					Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)	Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)
						Approach		Movement				Approach		Movement		
8	Steilacoom - DuPont Road/ Barksdale Avenue / Wilmington Drive	Signal		Overall	2,460	D	50.3				2,415	C	28.5			
			Wilmington Drive	EB-L	25	E	63.1	E	67.6	54	45	D	53.4	D	48.8	69
			Wilmington Drive	EB-T	75			E	62.0	136	110			D	55.0	157
			Wilmington Drive	EB-R	25			E	62.0	136	20			D	55.0	157
			Steilacoom-DuPont	WB-L	245	D	53.9	C	33.7	m137	180	D	47.3	D	43.1	m125
			Steilacoom-DuPont	WB-T	80			C	26.1	m40	110			D	39.1	m71
			Steilacoom-DuPont	WB-R	1,125			E	60.3	m214	530			E	50.5	m43
			Steilacoom-DuPont	NB-L	10	C	29.0	E	56.5	26	25	B	11.5	E	58.6	49
			Steilacoom-DuPont	NB-T	90			E	62.9	135	135			D	48.2	172
			Steilacoom-DuPont	NB-R	115			A	0.1	0	570			A	0.7	0
			Barksdale Avenue	SB-L	585	D	47.0	D	47.0	#483	620	B	17.7	C	24.3	320
			Barksdale Avenue	SB-T	70			D	47.0	#486	50			B	11.1	311
			Barksdale Avenue	SB-R	15			D	47.0	#486	20			B	11.1	311
11	I-5 NB Ramps / 41st Division Drive (Main Gate)	Merge / Diverge		Overall	0	Cloverleaf merge/diverge Not Applicable for Synchro Analysis						Cloverleaf merge/diverge Not Applicable for Synchro Analysis				
				EB-R												
				WB-R												
				NB-T												
				NB-R												
				SB-T												
				SB-R												
12	I-5 SB Ramps / 41st Division Drive (Main Gate)	Merge / Diverge		Overall		Cloverleaf merge/diverge Not Applicable for Synchro Analysis						Cloverleaf merge/diverge Not Applicable for Synchro Analysis				
				EB-R												
				WB-R												
				NB-L												
				NB-T												
				NB-R												
				SB-L												
				SB-T												
				SB-R												
13	I-5 NB Ramps / Berkelely Avenue	RAB		Overall	2,865	A	4.5				2,520	A	4.6			
			I-5 Off-ramp	EB-L	170	A	1.7	A	7.7	25	140	A	3.1	A	5.1	14
			I-5 Off-ramp	EB-T							0			A	5.1	14
			I-5 Off-ramp	EB-R	660			A	0.1	0	90			A		
			Berkeley Ave	NB-T	265	A	2.8	A	5.7	31	735	A	4.9	A	8.8	99
			Berkeley Ave	NB-R	530			A	1.4	23	1,175			A	2.5	79
			Berkeley Ave	SB-T	1,155	A	7.6	A	7.6		380	A	3.9	A	3.9	
			Berkeley Ave	SB-R							0					
14	I-5 SB Ramps / Berkelely Avenue	RAB		Overall	1,995	B	16.7				1,475	A	8.7			
			I-5 Off-ramp	WB-L	1,055	B	18.1	B	18.2	180	285	A	7.1	A	7.1	21
			I-5 Off-ramp	WB-T							5			A	6.7	21
			I-5 Off-ramp	WB-R	235			B	17.7	180	0			A	6.7	21
			Berkeley Ave	NB-L	140	A	4.4	A	4.2		535	A	6.1	A	6.4	
			Berkeley Ave	NB-T	295			A	4.4		340			A	5.6	
			Berkeley Ave	NB-R							0					
			Berkeley Ave	SB-L		C	29.6				0	B	17.6			
			Berkeley Ave	SB-T	185			C	29.6	112	95			B	17.6	99
			Berkeley Ave	SB-R	85			C	29.6	112	215			B	17.6	99
15	Berkelely Avenue / Union Avenue	Two-way Stop Control		Overall	410	C	15.5				250	B	13.2			
			Militia Dr	EB-L	10	C	15.5	C	15.5	4	5	B	13.2	B	13.5	1
			Militia Dr	EB-T	5			C	15.5	4						
			Militia Dr	EB-R	0						0					
			Union Ave	WB-L		A	9.3					A	8.9			
			Union Ave	WB-T	5			A		0	5			A	8.9	
			Union Ave	WB-R	180			A	9.3	19	60			A	8.9	5
			Berkeley Ave	SB-L	195	A	7.2	A	7.2	13	175	A	7.4	A	7.4	12
			Berkeley Ave	SB-T				A	7.2	13						
			Berkeley Ave	SB-R	15						5			A	7.4	12

Intersection Analysis Summary - 2040 Revised Build

No.	Intersection	Control Type		Movement	AM PEAK HOUR						PM PEAK HOUR					
					Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)	Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)
						Approach		Movement				Approach		Movement		
16	Berkelely Avenue/ Jackson Extension (Interchange Ramp)			Overall	775	B	12.3				730	B	10.9			
			RAMP	EB-L	210	B	14.2	B	14.2	80	170	B	12.4	B	12.4	57
			RAMP	EB-T												
			RAMP	EB-R	165			B	14.2	80	170			B	12.4	57
			Berkeley Ave	NB-L	190	B	11.1	B	11.8	40	130	A	9.5	B	10.1	23
			Berkeley Ave	NB-T	50			A	8.2	7	65			A	8.3	10
			Berkeley Ave	NB-R												
			Berkeley Ave	SB-L		A	9.9					A	9.6			
			Berkeley Ave	SB-T	45			A	9.9	25	15			B	9.6	28
			Berkeley Ave	SB-R	115			A	9.9	25	180			B	9.6	28
17	Berkelely Avenue/ Washington Avenue	Two-way Stop Control on Washington Avenue		Overall	455	A	9.6				385	A	9.2			
			Washington Ave	WB-L		A	9.6					A	9.2			
			Washington Ave	WB-T												
			Washington Ave	WB-R	55			A	9.6	6	135			A	9.2	13
			Berkeley Ave	NB-L			0.0						0.0			
			Berkeley Ave	NB-T	185						60					
			Berkeley Ave	NB-R	5						5					
			Berkeley Ave	SB-L			0.0						0.0			
			Berkeley Ave	SB-T	210			A	0.0		185			A	0.0	
			Berkeley Ave	SB-R												
18	I-5 NB Ramps / Thorne Lane	RAB		Overall	1,945	A	7.0				2,295	B	11.9			
			I-5 Off-ramp	EB-L	25	B	12.1	B	12.1	52	35	B	15.3	B	15.3	81
			I-5 Off-ramp	EB-T	0						5			B	15.3	81
			I-5 Off-ramp	EB-R	220			B	12.1	52	275			B	15.3	81
			Thorne Ln	NB-L	0	A	7.1				0	B	15.1			
			Thorne Ln	NB-T	585			B	10.9	134	720			C	25.1	400
			Thorne Ln	NB-R	320			A	0.0		475			A	0.1	
			Thorne Ln	SB-L	275	A	5.4	A	5.5		460	A	5.6	A	5.7	
			Thorne Ln	SB-T	520			A	5.3		325			A	5.3	
			Thorne Ln	SB-R	0						0					
19	I-5 SB Ramps / Thorne Lane	Signal		Overall	1,765	B	12.6				2,010	B	17.7			
			I-5 Off-ramp	WB-L	475	B	13.5	B	13.7	163	265	B	13.0	B	14.5	104
			I-5 Off-ramp	WB-T	5			B	13.7	163	10			B	14.5	104
			I-5 Off-ramp	WB-R	310			B	13.2	163	335			B	11.8	107
			Thorne Ln	NB-L	430	A	9.3	A	9.3		655	B	12.4	B	12.4	
			Thorne Ln	NB-T	180			A	9.3		100			B	12.4	
			Thorne Ln	NB-R	0						0					
			Thorne Ln	SB-L	0	B	16.3	B	16.5	96	0	C	28.2			
			Thorne Ln	SB-T	320			B	14.7	96	520			C	28.9	256
			Thorne Ln	SB-R	45						125			C	25.6	256
20	Thorne Lane/Union Avenue	Tee with Stop Sign on Union Avenue		Overall	190	A	9.6				370	B	12.0			
			Union Ave	EB-L	5	A	9.6				30	B	12.0	B	12.0	6
			Union Ave	EB-T												
			Union Ave	EB-R	0			A	9.6	1	0					
			Thorne Ln	NB-L	30	A	5.8	A	5.8	2	80	A	2.5	A	2.5	5
			Thorne Ln	NB-T	10				0.0		160			A	0.0	
			Thorne Ln	NB-R												
			Thorne Ln	SB-L									0.0			
			Thorne Ln	SB-T	0						0					
			Thorne Ln	SB-R	145						100					
21	Thorne Lane / Union Avenue Loop	New RAB Intersection		Overall	860	A	6.9				1,140	A	9.1			
			Union Loop	WB-L	10	A	4.7	A	4.7	3	155	A	6.5	A	6.5	33
			Union Loop	WB-T										A	6.5	33
			Union Loop	WB-R	5			A	4.7	3	35					
			Thorne Ln	NB-L		A	7.5					A	7.4			
			Thorne Ln	NB-T	345			A	7.7	88	360			A	7.4	90
			Thorne Ln	NB-R	145			A	6.9	88	75			A	7.4	90
			Thorne Ln	SB-L	0	A	6.3	A	5.4	63	25	B	11.4	B	11.4	133
			Thorne Ln	SB-T	355			A	6.3	63	490			B	11.4	133
			Thorne Ln	SB-R												

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No.	Intersection	Control Type		Movement	AM PEAK HOUR						PM PEAK HOUR					
					Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)	Post-Process Volume (vph)	LOS	Delay (sec)	LOS	Delay (sec)	95th Queue (ft)
						Approach		Movement				Approach		Movement		
22	I-5 NB Ramps / Gravelly Lake Drive	Signal		Overall	1,405	C	26.1				1,845	D	50.2			
			I-5 Off-ramp	EB-L	615	D	40.6	D	43.4	#483	790	D	53.0	D	53.0	#668
			I-5 Off-ramp	EB-T	0			D	37.8	336	5			D	52.5	#666
			I-5 Off-ramp	EB-R	100			D	37.8	336	25					
			Gravelly Lk Dr	NB-L	0	D	47.9				0	F	105.7			
			Gravelly Lk Dr	NB-T	120			D	47.9	85	410			F	105.7	#356
			Gravelly Lk Dr	NB-R	30			D	47.9	85	40					
			Gravelly Lk Dr	SB-L	435	A	0.8	A	0.9	m0	555	A	2.9	A	3.0	m2
			Gravelly Lk Dr	SB-T	105			A	0.0	m0	20			A	0.0	m0
			Gravelly Lk Dr	SB-R	0						0					
23	I-5 SB Ramps / Gravelly Lake Drive	Signal		Overall	2,205	D	47.0				2,435	D	39.3			
			I-5 Off-ramp	WB-L	0	D	50.5				5	E	58.9	E	58.0	17
			I-5 Off-ramp	WB-T	0						0					
			I-5 Off-ramp	WB-R	280			D	50.5	0	195			E	59.0	74
			Gravelly Lk Dr	NB-L	65	A	4.3	A	4.3	35	25	B	14.1			
			Gravelly Lk Dr	NB-T	670			A	4.3	35	1,175			B	14.1	m145
			Gravelly Lk Dr	NB-R	0						0					
			Gravelly Lk Dr	SB-L	0	E	72.6				0	E	68.4			
			Gravelly Lk Dr	SB-T	540			E	78.4	#706	565			F	85.6	#820
			Gravelly Lk Dr	SB-R	650			E	67.8	329	470			D	39.8	260
25	Gravelly Lake Drive / Pacific Highway	Signal		Overall	2,640	B	15.8				2,960	B	12.8			
			Pacific Hwy	WB-L	145	D	52.6	D	54.5	92	240	E	63.9	E	66.2	159
			Pacific Hwy	WB-T												
			Pacific Hwy	WB-R	180			D	51.0	71	75			D	56.6	69
			Gravelly Lk Dr	NB-L		A	4.4					A	6.5			
			Gravelly Lk Dr	NB-T	920			A	4.5	78	1,310			A	6.7	56
			Gravelly Lk Dr	NB-R	30			A	0.0	m0	60			A	2.4	m1
			Gravelly Lk Dr	SB-L	320	B	15.1	E	55.2	327	245	A	7.0	C	20.9	161
			Gravelly Lk Dr	SB-T	1,045			A	2.7	124	1,030			A	3.7	163
			Gravelly Lk Dr	SB-R												

Note: For Two-way Stop Control InterscetionS - Overall LOS and delay is based on worse approach/movement

Synchro Analysis for Signalized and non-signalized intersections

Sidra Analysis for roundabouts

Appendix G

Collision Summary of ISATe Model Results

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Summary of ISATe model results per scenario

			Mainline		Ramps		Terminals		Total Crashes	Total Crashes Per MVM
Study Year	Data Source	Scenario	Crashes	Crashes Per MVM	Crashes	Crashes Per MVM	Crashes	Crashes Per MEV		
2014	Existing Data	No Build	330	0.88	52	2.16	10	0.11	392	1.09
2014	Model outputs	No Build	319	0.85	26	1.09	35	0.41	380	1.06
2020	Model outputs	No Build	364	0.89	27	1.13	40	0.39	431	1.11
2040	Model outputs	No Build	443	0.96	25	1.05	45	0.43	513	1.14
2020	Model outputs	Build	377	0.91	30	1.15	42	0.41	449	1.06
2040	Model outputs	Build	491	0.96	30	1.13	42	0.40	563	1.10

MVM = Million Vehicle Miles

MEV = Million Entering Vehicle