Summary

Traffic Operations Analysis

I-5 Broadway Weidler Interchange Improvements

Portland, Oregon

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Introduction

As part of the I-5 Broadway-Weidler Interchange Improvements Project, the HDR Consultant Team (Team) evaluated alternatives for the optimal safety and operations design. This report summarizes the evaluation of the alternatives and includes project scope, summary of existing conditions and calibration, alternative model development, final analysis, and side-by-side comparisons of alternatives. All supplemental technical data and output files are provided in the Appendix for reference.

Study Area

I-5 is classified as an Interstate facility, based on FHWA Classification, and a freeway, based on ODOT classifications. It runs north-south along the West Coast of the United States and through the Portland Metropolitan area. The Broadway-Weidler Interchange is located between the I-405 and I-84 interchanges on I-5. It serves as a route for both local through traffic and as a connector for interstate traffic, which is integral to freight operations. At the Fremont Bridge, I-5 connects to the north end of the north-south I-405 loop. A mile south of this intersection, I-5 intersects the west end of east-west bound I-84. Figure 1 shows a schematic of the Study Area. Areas of focus for this project include all ramps on I-5 between Morrison Street and Going Street, the freeway mainline, and surface street intersections at the interchange.

The connection between I-405 and I-84 on I-5 also serves as a critical connection between the economic engine in Washington County and the Portland International Airport. These major job and economic generators include Intel, Nike, Genetech, Solarworld and other valuable industrial and job centers. Improvements at this location assist with regional economic growth.

In addition to the freeway, arterial, and local street network, the Rose Quarter includes several multimodal facilities that support all modes of transportation. Four light rail transit (LRT) lines operate within the project area, and a streetcar line is currently operating on the Broadway-Weidler couplet to connect the N/NE Quadrant with the Pearl District across the river. These facilities serve a large portion of pedestrian traffic, as well as bicyclists, within the Study Area.

Current Network Performance

As detailed in the 2012 *I-5 Broadway-Weidler Interchange Improvements Facility Plan*[1] (see Appendix A), the Broadway-Weidler Interchange experiences some of the highest traffic volumes in the state of Oregon. The heavy congestion in addition to short weave segments and a lack of roadway shoulder for accident recovery on either side of the freeway are direct contributors to the high number of crashes each year. There are significant safety concerns for the area, which are outlined by a crash analysis performed between 2005 and 2009. The aforementioned study found that:

- The I-5 Interchange at Broadway and Weidler was rated as the location with the highest accident rate in the State of Oregon.
- The southbound direction has more frequent crashes than the northbound.
- The most frequent crash types are: rear-end, sideswipe, fixed, and other.

A weaving analysis within the Study Area found that the sections of I-5 Northbound from I-84 Westbound to Weidler Off-ramp and I-5 Southbound from Wheeler On-ramp to I-84 Eastbound Off-ramp both currently

Figure 1 – Traffic Analysis Study Area

[1] URS Corporation, *I-5 Broadway/Weidler Interchange Improvements Facility Plan*, 2012.

perform at a failing level-of-service during the a.m. and p.m. peak periods. The I-5 Southbound section between Wheeler On On-Ramp and I-84 Eastbound Off-Ramp is projected to have the most critical failure in future operations, with bottlenecking that will cause severe queuing back to the Fremont Bridge.

Proposed Improvements

Improvements for the I-5 Corridor and Interchange will focus on increasing safety for all traveling vehicles, cyclists, and pedestrians within the Study Area. The interchange improvements analyzed for this report include additional lanes in both traveling directions on I-5 to help meet future demand and improve safety, as well as ramp reconfigurations to reduce weaving and alleviate congestion for the freeway. The ramp improvements will include significant improvement to the arterial. These improvements are designed to allow for more efficient access on and off the freeway, as well as to provide safer and smoother traveling conditions for bicyclists and pedestrians. These arterial designs are based on an increased focus for pedestrian and bicycle facilities in particular and include many new crosswalks and bike lane improvements to improve pedestrian and bicycle safety and travel time to/from the major transit amenities.

VISSIM Model Development

VISSIM was chosen to evaluate the improvements for this project in this phase. VISSIM is a microsimulation tool that allows the user to model complex geometry, include all modes of travel, and gather data to develop measures of effectiveness (MOE's) that many other tools are limited in. This section summarizes the components that went into developing the existing models for the Study Area. A more detailed report was developed at earlier stages in this project and is included in Appendix B[2]. The development of the VISSIM models followed ODOT's VISSIM Protocol Guidelines.[3]

Intersections and Geometry

The I-5 Broadway-Weidler VISSIM models include I-5 Northbound and Southbound and all ramps on I-5 between Morrison Street and Going Street. A portion of the I-84 mainline was also modeled along with the Grand Avenue on-ramp to eastbound I-84. The arterial network included the following eight Study Area intersections in addition to I-5 Northbound and Southbound:

- Weidler Street/Vancouver Avenue
- Weidler Street/Williams Avenue
- Weidler Street and Victoria Avenue/I-5 NB Off-Ramp
- Broadway/Victoria Avenue
- Broadway and Williams Avenue/I-5 NB On-Ramp
- Broadway/Vancouver Avenue
- Broadway/Flint Avenue
- Wheeler Avenue/Winning Way/I-5 SB On-Ramp

Model Hours

All VISSIM models were developed to analyze these intersections for three study periods (listed below). The first half hour of each VISSIM model was used for "seeding" purposes with data collection occurring during the remainder of the study period.

- Morning Peak – 5:30 a.m. to 10:00 a.m.
- Mid-day – 11:30 a.m. to 2:00 p.m.
- Afternoon Peak – 1:30 p.m. to 6:00 p.m.

Base Model Inputs

This section provides a brief summary of the information gathered in the *Existing Conditions Data Summary*[4] Memo. This Memo is provided in Appendix C for reference.

The Team followed Oregon Department of Transportation's (ODOT) VISSIM Protocol for processing of all model inputs. Multiple data sources were used to develop the data inputs and calibration targets for the VISSIM models for the I-5 Broadway-Weidler project. The VISSIM model data inputs, their sources, and their use relating to the model are shown below in Table 1.

Table 1 – VISSIM Model Data Inputs

Inputs for I-5 Broadway Weidler Improvements		
Data	**Source**	**Use**
Traffic Volumes	ODOT/Portal	Input and Calibration
Origin-Destination	Bluetooth – ODOT	Input
Signal Timing Data	ODOT	Input
Ramp Meter Data	ODOT	Input
Transit Data	TriMet Website	Input
Speed Data	INRIX – ODOT/Portal	Input and Calibration

Traffic Volumes

The Team obtained traffic volumes for the freeway mainline, ramps, arterials, and heavy vehicles from ODOT and Portland State University's (PSU) Portal website. The Team exported mainline volumes for the entire year 2013 (for Tuesdays, Wednesdays, and Thursday, excluding major holidays) and collected volumes for two locations near ramps within the Study Area: Broadway Street Northbound and Broadway Street Southbound. Both locations accurately capture the demand within the Study Area and are outside of the bottleneck location. The team also collected ramp volumes in 2014 at 15-minute intervals using Automatic Traffic Recorder (ATR) road tubes. These multi-daily volumes were averaged to determine one daily volume.

Since arterial a.m. and p.m. volume turning movements were only provided for peak period hours for the majority of the intersections within the Study Area, the Team used Portland Bureau of Transportation's (PBOT) ATR data to obtain volumes for the entire study periods. The Team collected arterial mid-day volumes for this project, eliminating the need for calculations for additional time periods. Balancing was required for data collected over multiple years for all arterial volumes. Additionally, the Team obtained bicycle and pedestrian volumes from PBOT's count website[5]. Since not all hours were available, the Team made conservative assumptions where the data was missing. Heavy vehicle percentages were developed using the short duration (24-hour) classification counts provided by ODOT and fleet distributions for both medium and heavy trucks. Heavy vehicle fleet distributions were calculated using the classification count on

[2] *VISSIM Model Calibration Methodology and Results*, August 2014, HDR Engineering
[3] ODOT VISSIM Protocol: http://www.oregon.gov/odot/td/tp/apm/addc.pdf
[4] *Existing Conditions Data Summary,* August 2014, HDR Engineering
[5] http://www.portlandmaps.com/

I-5 south of Weidler Street, as this location provides a good representation of the types of trucks within our Study Area.

Origin-Destination
ODOT provided a Bluetooth origin-destination (OD) summary. This data was put into TflowFuzzy to create OD matrices for the VISSIM model. The Team developed hourly OD matrices and coded from TflowFuzzy into VISSIM.

Signal Timing
ODOT via PBOT provided signal timing data. Due to the length of the study period, the Team coded multiple coordination patterns to replicate the field operations. Signal timing was coded in VISSIM using the Ring-Barrier Controller (RBC). Detector data was provided for some of the intersections via as-builts. In other cases, the data was interpolated based on standards and signal timing sheets.

Ramp Meter
ODOT provided ramp meter data as saturation flow rates in 15-minute increments. Because the flow rates were similar between 15-minute periods and given the limitation of the number of different timing patterns available in VISSIM, the flow rates were averaged by hour.

Transit
The Team obtained transit data for bus and streetcar operations from TriMet's website. Headways were determined based on the scheduled stops, and average dwell times were based on data provided by TriMet which equated to 25 seconds per stop. Within the Study Area there are four bus lines (4, 17, 44, and 85) and a streetcar (Central Loop) that travel on the both NE Broadway and NE Weidler. Bus line and streetcar stops located within the Study Area are listed below and transit lines are found in Figure 3:

- Bus 4: N Williams/Wheeler, N Williams/NE Broadway, and N Vancouver/Weidler
- Bus 17: NE Broadway/Vancouver and N Weidler/Williams
- Bus 44: N Williams/Wheeler and N Williams/NE Broadway
- Bus 85: No stops in the Study Area but travels through the Study Area
- Streetcar: No stops in the Study Area but travels through the Study Area

Speeds
The Team obtained INRIX data to determine mainline freeway speed distribution. Various data collection points were gathered during "free-flow" periods on I-5 to build a large enough data set to create the profile. Figure 2 shows the calculated profile:

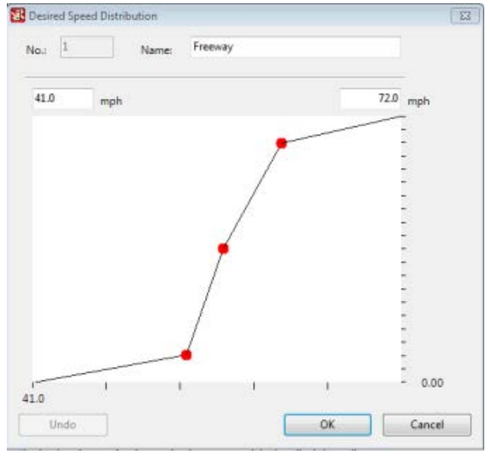
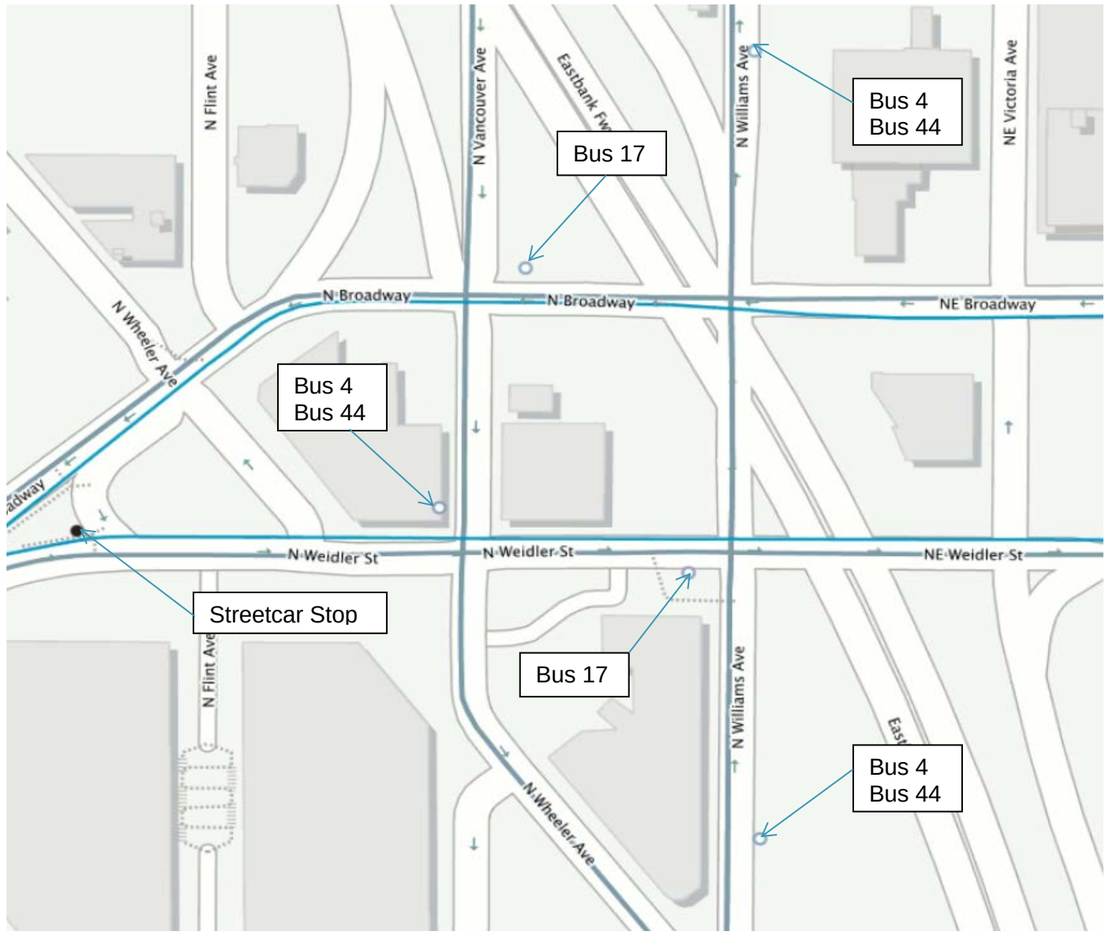


Figure 2 – I-5 Speed Distribution Profile

Speed limits posted in the field provided the basis for arterial speeds. All roadways were 30 miles per hour (mph), with the exception of Flint Road which was 25 mph.

The Team assumed pedestrian speeds to be between 3.5 feet per second (fps) and 5.0 fps with a linear distribution, which matched known typical values and was checked against research done in Portland, Oregon.[6] For bicycles, the Team used local research in Portland, Oregon to set 15th percentile and average speeds (15th = 9.5 fps and 50th = 10.7 fps).[7] To obtain minimum and maximum values, AASHTO standards[8] were evaluated to determine a minimum of 7.0 fps and a maximum of 15 fps as shown in Figure 2 (note values in figure are in mph).

Figure 3 – Transit Stop Locations within the Study Area



[6] http://www.westernite.org/datacollectionfund/2005/psu_ped_summary.pdf
[7] http://web.cecs.pdx.edu/~maf/Conference_Proceedings/A%20Statistical%20Analysis%20of%20Bicycle%20Rider%20Performance.pdf
[8] Average speeds of 12.7, 12.0 and 9.1 ft/s for advanced, basic/beginner and child cyclist are specified, respectively from AASHTO, *Guide for the Development of Bicycle Facilities*. 4th ed. 1999, Washington, D.C.: American Association of State Highway and Transportation Officials, U.S. Department of Transportation.

Calibration

This section summarizes the methods the HDR Team used to calibrate the a.m., p.m., and mid-day peak hour VISSIM models, with a final summary of calibration results. This section includes a brief summary of the *VISSIM Model Calibration Methodology and Results* Memo. The full Memo is included in Appendix B. The Team calibrated freeway speed data to fall within 10% (10 mph) of the field speeds, as per ODOT's VISSIM Protocol. Traffic throughputs were calibrated on both the arterials and freeways using the same ODOT guidelines.

Error Checking

The Team checked data for coding errors before the calibration process began. This included reviewing data inputs such as network geometry, traffic volumes, signal timing and route choices; checking VISSIM error reports such as vehicle removal, signal issues, and end of link errors; and fine-tuning model animations such as checking for abnormal driving behavior or irregular queuing within the network and identifying coding parameters that may have been overlooked or incorrect.

Field Visits

Prior to calibration, the Team conducted field visits to observe operations within the Study Area. The field observations helped identify major lane imbalances, downstream or upstream bottlenecks, major queuing locations and overall driving behaviors the Team had to consider for the models to reflect real world conditions.

Calibration Targets

In order to meet calibration targets the Team used an iterative process of comparing VISSIM data outputs to field-collected data and adjusting the model accordingly. The Team calibrated the I-5 Broadway/Weidler VISSIM model for both traffic volumes and spot speeds. The targets set for calibration were:

- Speeds to be within +/- 10 miles per hour on at least 85% of all freeway links
- Volumes to be within a GEH value of 5.0 for 85% of freeway links
- Volumes to be within a GEH value of 5.0 for all entry and exit locations, all entrance and exit ramps and all intersection turn movements greater than 100 vehicles per hour

As part of the calibration process, adjustments included changes to the driver parameters and lane change distances. These changes were based on field observed vehicle operations. For example, the Team adjusted connector lane change distances to achieve appropriate lane utilization observed in the field and to mimic critical merging and weaving behaviors in congested areas. Driver behavior parameters were adjusted to replicate the less aggressive Oregon drivers, who typically maintain larger gaps between vehicles and operate with more of a "zipper effect".

Speed Calibration

The Team developed spot speed data for comparison against the VISSIM model from INRIX data. The INRIX speed data is based on average weekdays (Tuesdays, Wednesdays, and Thursdays) in 2013. Because the model is not large enough to capture all bottlenecks that affect the Study Area, the INRIX data was also used in calibration to set bottlenecks outside of the calibration area. Table 3 displays the all-day VISSIM model results compared to INRIX data in 15-minute increments along the corridor, broken down by direction. The colors represent speed variations, with green being the greatest speed (over 50 mph) and red being the slowest speed (less than 20 mph).

Volume Calibration

As per ODOT's guidelines the volume output from the model was compared to the traffic volumes using the GEH calculation. GEH is calculated using the following formula[9]:

$$GEH = \sqrt{\frac{2(m-c)^2}{m+c}}$$

Notes:
m = output traffic volume from the simulation model (vph)
c = input traffic volume (vph)

The GEH is scored using the following classification, provided in Table 2[10]

Table 2 – GEH Scoring

GEH < 5.0	**Acceptable fit**
5.0 <= GEH <= 10.0	Caution: possible model error or bad data
GEH > 10.0	Unacceptable

The Team collected model volumes at all entry and exit locations as well as for intersection turn movements and at all freeway locations between ramps in the Study Area. The entry and exit volumes and the freeway volumes were obtained using data collection points, and turn movements were based on the nodal analysis. The Team averaged all modeled volumes over 10 simulation runs, as outlined in the calibration memo in Appendix B.

[9] ODOT VISSIM Protocol, June 2011
[10] ODOT VISSIM Protocol, June 2011

Table 3 – All-Day Speed Comparison Chart

I-5 Broadway/Weidler Existing Scenario Spot Speed Chart

NB Location	6:00 AM	6:15 AM	6:30 AM	6:45 AM	7:00 AM	7:15 AM	7:30 AM	7:45 AM	8:00 AM	8:15 AM	8:30 AM	8:45 AM	9:00 AM	9:15 AM	9:30 AM	9:45 AM	12:00 PM	12:15 PM	12:30 PM	12:45 PM	1:00 PM	1:15 PM	1:30 PM	1:45 PM	2:00 PM	2:15 PM	2:30 PM	2:45 PM	3:00 PM	3:15 PM	3:30 PM	3:45 PM	4:00 PM	4:15 PM	4:30 PM	4:45 PM	5:00 PM	5:15 PM	5:30 PM	5:45 PM
	AM - Northbound Average Speeds - (VISSIM Data)																MD - Northbound Average Speeds - (VISSIM Data)								PM - Northbound Average Speeds - (VISSIM Data)																
I-5 NB 114+04454 Near 84	54.2	52.3	47.5	44.4	45.7	41.6	37.1	33.7	32.1	36.1	38.5	42.5	47.0	47.4	47.8	49.2	47.4	46.5	47.5	47.6	48.4	46.6	46.7	47.8	50.4	51.6	51.9	50.0	51.6	49.7	51.4	45.3	43.9	46.1	45.0	37.6	27.9	24.6	22.8	23.3
I-5 NB 114P04454 Near 84	55.4	54.1	52.3	49.9	50.6	48.2	39.6	33.8	30.9	36.7	42.1	42.6	49.7	51.8	52.4	53.1	52.3	51.7	52.7	52.3	52.9	52.6	51.6	50.2	53.7	54.2	54.2	53.3	54.0	52.7	53.6	51.4	50.6	51.3	50.8	43.2	29.9	24.8	25.0	24.8
I-5 NB 114+04455 Near Multnomah	55.1	52.4	45.5	37.7	34.7	33.6	27.8	26.7	25.3	28.3	32.2	33.8	41.7	49.3	50.2	49.2	49.5	49.0	50.9	47.2	52.7	50.8	47.8	43.5	54.3	54.6	54.5	54.5	54.5	54.1	54.2	49.2	50.8	48.0	47.0	39.7	25.2	22.0	22.5	22.5
I-5 NB 114P04455 Near Weidler	52.7	48.2	44.1	41.2	40.4	41.2	39.6	38.8	39.2	42.0	41.8	42.1	42.2	45.4	46.7	46.1	44.2	44.2	44.6	43.2	45.5	44.0	43.1	43.3	51.3	52.2	52.3	51.3	51.6	50.8	51.3	45.8	45.2	45.4	44.0	35.8	28.2	27.0	32.3	37.4
I-5 NB 114+4456 Bt Broadway/Weidler	53.5	51.0	49.3	47.1	43.0	46.5	46.4	44.5	43.7	47.2	46.7	47.2	44.8	48.7	50.1	49.8	49.3	47.7	47.8	47.5	47.9	48.6	47.4	48.3	52.9	53.1	53.4	52.8	52.8	52.3	52.5	49.7	50.0	50.1	48.0	37.0	27.7	27.3	31.4	37.7
I-5 NB 114P04456 Near Broadway	52.3	48.9	46.1	42.5	40.9	42.9	44.1	41.0	40.9	43.7	43.0	44.7	41.9	46.6	48.2	47.8	48.0	45.8	45.3	45.2	44.6	45.5	45.2	46.5	52.5	52.4	52.9	52.5	52.1	51.7	51.8	48.5	48.9	48.9	45.2	33.5	26.1	25.5	28.1	34.0
I-5 NB 114+04457 BT 405/Weidler	54.9	53.1	52.2	49.3	48.4	47.3	46.7	42.5	42.8	45.1	44.9	47.0	45.3	48.4	48.9	49.4	44.1	42.7	42.7	42.6	41.8	41.6	42.1	43.7	52.1	52.7	52.7	53.3	53.0	52.5	52.7	50.2	49.4	48.1	41.6	30.5	25.0	25.9	26.1	31.5
I-5 NB 114P04457 Near 405	56.2	55.8	55.6	54.9	55.0	55.0	54.8	54.6	54.7	54.8	54.5	54.9	54.0	54.2	54.2	54.5	53.1	53.2	53.1	53.4	53.7	53.6	53.5	53.6	55.0	55.0	55.1	54.7	54.9	54.8	54.7	54.1	53.1	35.9	19.3	16.0	16.1	16.3	16.8	17.3
I-5 NB 114+04458 Near Going	55.6	54.7	53.0	52.0	51.0	50.8	50.1	50.0	50.4	49.7	49.8	50.4	50.8	51.2	52.0	52.0	50.0	49.9	48.6	48.9	49.2	47.7	47.7	47.9	44.0	47.2	45.4	46.5	48.0	46.9	45.8	33.3	14.9	12.6	13.0	12.7	12.3	13.0	12.7	13.2
NB Location	**AM - Northbound Average Speeds - (INRIX Data)**																**MD - Northbound Average Speeds - (INRIX Data)**								**PM - Northbound Average Speeds - (INRIX Data)**																
I-5 NB 114+04454 Near 84	55.3	55.3	54.2	49.7	45.4	44.0	40.4	36.3	34.3	38.0	40.2	41.6	42.8	45.3	47.9	50.3	48.9	49.0	48.5	47.6	46.6	45.7	43.3	43.1	42.8	42.7	42.5	44.2	47.2	48.8	47.9	45.7	44.4	42.9	39.4	36.9	35.0	34.0	32.7	34.1
I-5 NB 114P04454 Near 84	52.4	52.4	50.9	46.1	42.2	42.1	39.5	36.7	35.2	37.6	39.4	40.6	41.4	42.7	45.5	47.4	46.7	46.6	46.1	45.1	43.8	43.2	41.0	40.5	40.4	40.6	40.3	41.5	45.0	46.5	45.4	43.4	42.3	41.3	37.7	35.5	34.3	33.1	31.6	32.8
I-5 NB 114+04455 Near Multnomah	53.9	52.8	50.2	46.6	45.1	45.3	44.7	44.0	43.8	44.5	45.2	45.3	44.6	44.5	46.3	47.2	47.1	46.8	46.3	45.6	45.3	43.5	41.9	41.5	42.0	41.8	41.1	42.0	44.5	45.6	44.4	42.5	42.0	40.3	37.5	35.1	34.1	33.2	32.0	33.2
I-5 NB 114P04455 Near Weidler	56.0	55.4	53.1	50.8	50.6	50.4	50.1	50.4	50.2	50.4	50.5	50.1	49.4	48.8	50.3	50.7	50.4	50.0	49.4	48.6	48.4	46.8	45.6	44.9	45.4	44.3	43.9	44.2	46.1	47.0	45.7	43.2	42.4	40.5	37.0	34.8	33.9	33.7	32.1	32.7
I-5 NB 114+4456 Bt Broadway/Weidler	56.6	56.0	53.8	51.6	51.5	51.3	51.1	51.5	51.2	51.2	51.2	51.0	49.5	48.4	50.0	51.2	50.1	49.9	49.1	47.9	47.6	46.2	44.8	43.9	44.3	43.2	42.5	42.8	46.1	46.9	45.4	42.9	41.9	40.2	36.8	34.5	33.2	33.4	31.8	32.0
I-5 NB 114P04456 Near Broadway	56.2	55.5	53.0	50.8	50.8	50.7	50.6	50.9	50.7	50.7	50.6	50.4	50.0	49.2	50.4	51.1	50.2	50.2	49.6	48.6	48.6	47.5	46.3	45.8	45.8	44.9	44.2	44.2	46.0	46.0	44.3	41.9	41.2	39.2	35.2	33.4	32.8	32.8	31.5	31.8
I-5 NB 114+04457 BT 405/Weidler	55.8	55.3	53.1	51.3	51.4	51.6	51.3	51.3	51.4	51.2	51.2	50.9	51.3	50.7	51.5	52.0	51.7	51.6	51.3	50.5	50.9	49.5	49.0	49.0	49.2	48.5	47.7	47.3	47.7	46.4	44.1	41.9	40.7	38.7	35.5	32.8	32.7	33.4	32.1	32.4
I-5 NB 114P04457 Near 405	57.0	56.9	56.3	55.6	55.6	55.8	55.7	55.5	55.7	55.6	55.4	55.2	55.4	55.1	55.3	55.7	55.1	54.8	54.8	54.5	54.5	53.7	53.5	53.3	52.6	51.7	50.8	49.0	45.0	37.4	32.1	29.0	28.0	25.1	22.2	20.3	20.8	20.7	20.1	21.7
I-5 NB 114+04458 Near Going	58.9	58.5	58.2	57.9	57.8	57.7	57.7	57.4	57.5	57.1	56.8	56.6	56.8	56.6	56.4	57.0	56.1	55.8	56.1	56.1	55.9	55.1	54.7	53.8	52.9	51.2	50.3	45.7	38.5	26.9	22.4	20.9	19.1	17.2	15.6	14.5	14.1	13.1	13.1	14.8
NB Location	**AM - Northbound Speed Difference**																**MD - Northbound Speed Difference**								**PM - Northbound Speed Difference**																
I-5 NB 114+04454 Near 84	1.1	3.1	6.6	5.4	-0.3	2.4	3.4	2.6	2.3	1.9	1.6	-0.9	-4.2	-2.1	0.0	1.1	1.6	2.5	1.1	0.1	-1.8	-0.8	-3.4	-4.8	-7.6	-8.9	-9.5	-5.8	-4.4	-0.9	-3.5	0.4	0.6	-3.2	-5.6	-0.7	7.1	9.5	9.9	10.8
I-5 NB 114P04454 Near 84	-3.1	-1.6	-1.3	-3.8	-8.4	-6.1	-0.1	2.9	4.3	1.0	-2.7	-2.0	-8.4	-9.1	-6.9	-5.7	-5.5	-5.2	-6.6	-7.2	-9.1	-9.4	-10.6	-9.6	-13.3	-13.6	-13.9	-11.8	-9.1	-6.2	-8.2	-8.0	-8.3	-10.0	-13.1	-7.7	4.4	8.3	6.6	8.1
I-5 NB 114+04455 Near Multnomah	-1.2	0.3	4.7	8.9	10.4	11.7	16.9	17.3	18.4	16.3	13.1	11.4	3.0	-4.7	-4.0	-2.0	-2.4	-2.2	-4.6	-1.6	-7.4	-7.4	-5.8	-2.0	-12.3	-12.9	-13.4	-12.5	-10.0	-8.5	-9.8	-6.7	-8.8	-7.7	-9.5	-4.5	8.9	11.3	9.5	10.7
I-5 NB 114P04455 Near Weidler	3.3	7.3	9.1	9.5	10.2	9.2	10.5	11.5	11.0	8.4	8.7	8.0	7.2	3.4	3.6	4.7	6.2	5.8	4.8	5.3	2.9	2.8	2.5	1.6	-5.9	-7.9	-8.4	-7.0	-5.6	-3.8	-5.6	-2.6	-2.9	-4.9	-7.0	-1.0	5.7	6.7	-0.2	-4.7
I-5 NB 114+4456 Bt Broadway/Weidler	3.1	5.0	4.4	4.5	8.5	4.8	4.7	7.0	7.5	4.0	4.4	3.8	4.8	-0.3	-0.1	1.4	0.8	2.2	1.3	0.4	-0.3	-2.4	-2.7	-4.4	-8.6	-9.9	-11.0	-10.0	-6.7	-5.4	-7.1	-6.8	-8.1	-9.9	-11.3	-2.5	5.5	6.1	0.4	-5.6
I-5 NB 114P04456 Near Broadway	3.9	6.6	6.9	8.2	9.9	7.8	6.5	9.9	9.8	7.0	7.7	5.7	8.1	2.6	2.2	3.3	2.2	4.4	4.3	3.4	3.9	2.0	1.2	-0.8	-6.7	-7.5	-8.8	-8.3	-6.2	-5.7	-7.5	-6.5	-7.8	-9.7	-10.0	-0.2	6.7	7.2	3.5	-2.2
I-5 NB 114+04457 BT 405/Weidler	0.9	2.2	0.9	1.9	3.0	4.3	4.6	8.8	8.6	6.1	6.3	3.9	6.0	2.2	2.7	2.6	7.6	8.9	8.6	7.9	9.1	8.0	6.9	5.2	-2.9	-4.2	-5.1	-6.0	-5.3	-6.1	-8.6	-8.3	-8.6	-9.3	-6.2	2.3	7.7	7.4	6.1	0.9
I-5 NB 114P04457 Near 405	0.8	1.1	0.7	0.7	0.6	0.8	0.9	0.9	1.0	0.8	0.9	0.3	1.4	0.9	1.1	1.2	2.1	1.6	1.7	1.1	0.8	0.1	0.0	-0.3	-2.3	-3.3	-4.3	-5.7	-9.9	-17.4	-22.6	-25.1	-25.1	-10.8	2.9	4.3	4.7	4.4	3.3	4.4
I-5 NB 114+04458 Near Going	3.3	3.8	5.1	5.9	6.8	7.0	7.6	7.4	7.1	7.3	7.0	6.2	6.1	5.4	4.4	4.9	6.2	5.9	7.5	7.2	6.7	7.4	7.0	5.9	8.9	4.0	4.8	-0.8	-9.5	-20.0	-23.4	-12.4	4.2	4.6	2.6	1.8	1.8	0.1	0.3	1.6

SB Location	AM - Southbound Average Speeds - (VISSIM Data)																MD - Southbound Average Speeds - (VISSIM Data)								PM - Northbound Average Speeds - (VISSIM Data)																
I-5 SB 114-04457 Near Going	54.2	52.1	51.2	50.7	49.9	49.7	46.0	43.8	36.7	34.5	31.3	30.6	30.1	39.9	43.9	41.5	53.7	53.5	53.0	53.2	53.8	53.9	53.2	53.7	54.0	54.0	53.9	54.0	53.6	48.7	38.1	40.5	40.0	44.5	46.7	50.6	52.2	47.6	26.9	20.1
I-5 SB 114N04457 Near 405	54.4	53.4	52.8	53.3	52.6	52.2	52.1	41.0	29.7	31.6	28.3	25.1	24.5	35.2	42.5	41.2	52.7	52.9	52.1	52.4	52.2	52.6	52.6	48.1	53.2	53.1	53.3	45.7	29.6	21.7	26.8	28.0	28.3	32.1	39.6	42.1	39.6	22.0	18.8	19.0
I-5 SB 114-04456 Bt 405/Broadway	56.1	55.6	55.1	55.2	55.1	54.5	35.2	17.1	16.0	16.6	16.2	16.3	16.5	15.7	18.3	23.1	36.7	42.3	40.9	34.0	33.2	37.4	37.9	27.0	52.9	52.2	36.9	15.5	15.1	15.0	15.7	15.2	15.6	15.3	15.4	15.1	14.0	14.3	14.6	14.0
I-5 SB 114N04456 Near Broadway	53.2	51.1	46.8	46.3	42.4	39.0	29.8	28.6	29.1	28.7	29.1	29.3	29.3	28.4	29.1	29.3	23.8	26.6	26.1	24.6	28.5	29.3	25.9	21.2	39.5	33.2	22.3	19.7	18.0	18.6	19.5	18.8	19.1	19.1	18.8	18.3	15.7	15.1	15.0	14.6
I-5 SB 114-04455 Near Broadway	53.0	52.0	49.5	49.6	48.4	47.0	42.8	40.9	41.1	41.1	42.4	42.4	42.7	39.0	41.4	42.0	40.3	39.0	38.0	37.3	40.0	41.1	35.9	32.7	44.1	39.4	32.9	32.4	27.0	29.8	33.3	30.2	32.8	31.2	30.7	29.0	22.4	19.7	19.2	19.4
I-5 SB 114N04455 Near Moda Center	53.0	51.7	49.4	49.6	48.4	47.1	42.4	40.3	39.1	40.0	41.8	41.3	41.1	37.6	40.2	39.4	37.4	34.3	36.2	35.0	38.7	37.1	32.0	31.1	41.3	36.8	31.3	31.2	27.1	29.5	31.2	29.5	30.1	29.4	27.9	27.8	21.1	19.5	18.8	19.7
I-5 SB 114-04454 Near Multnomah	54.0	52.1	50.4	49.9	45.8	41.8	39.2	38.0	36.7	37.1	39.4	37.6	38.2	38.4	39.3	39.4	34.8	34.0	34.2	34.5	35.1	33.8	33.0	32.7	36.7	35.1	33.5	33.1	33.5	34.3	34.5	34.1	34.0	34.4	33.9	32.9	30.6	29.9	30.4	29.9
I-5 SB 114N04454 Near 84	53.6	52.1	50.3	50.2	46.6	38.4	36.8	36.5	38.4	37.5	36.2	38.5	38.3	43.2	44.6	43.1	47.6	44.9	48.8	47.3	50.1	49.9	49.8	48.1	51.0	50.7	51.2	50.3	49.3	45.4	46.3	46.7	47.0	47.6	47.8	47.9	40.7	50.9	52.6	51.6
I-5 SB 114-04452 Near Morrison	56.5	56.2	55.8	55.9	55.3	54.3	54.4	54.2	54.6	54.5	54.1	54.6	54.7	55.4	55.1	55.0	55.1	55.0	55.3	55.0	55.4	55.4	55.4	55.6	55.7	55.4	55.6	55.5	55.4	55.0	55.1	54.9	54.7	55.1	47.8	43.8	41.4	39.8	40.3	40.5
SB Location	**AM - Southbound Average Speeds - (INRIX Data)**																**MD - Southbound Average Speeds - (INRIX Data)**								**PM - Northbound Average Speeds - (INRIX Data)**																
I-5 SB 114-04457 Near Going	57.1	55.7	52.9	50.9	50.2	48.0	44.3	36.7	34.5	35.4	34.0	32.0	33.6	43.6	46.3	47.7	53.7	54.1	54.2	53.2	53.1	53.2	52.8	52.3	53.0	53.9	53.5	49.8	41.4	38.2	40.3	42.7	42.1	43.9	41.3	41.4	40.9	40.1	37.0	39.4
I-5 SB 114N04457 Near 405	55.3	55.7	54.4	54.2	54.0	52.6	50.5	43.6	40.7	40.7	40.2	34.4	29.9	40.5	44.4	45.8	45.1	46.4	46.2	45.6	45.2	45.8	45.1	41.7	41.1	41.1	40.9	26.7	18.3	18.2	22.2	21.7	22.5	25.0	23.0	25.0	25.9	25.1	21.8	25.5
I-5 SB 114-04456 Bt 405/Broadway	55.8	55.0	53.1	52.7	52.0	50.6	48.1	39.4	36.8	37.1	37.4	31.4	27.0	34.8	40.5	41.0	39.2	40.4	40.5	39.2	39.5	39.4	39.0	33.7	33.3	32.9	33.1	18.4	14.6	15.2	18.6	16.0	17.4	19.3	18.2	19.4	20.8	20.0	17.0	20.5
I-5 SB 114N04456 Near Broadway	57.4	55.9	53.7	53.0	52.0	50.7	48.2	40.2	37.8	37.7	38.5	33.9	30.5	35.8	41.1	41.6	39.4	39.7	39.9	39.2	39.3	39.0	38.9	33.5	33.9	32.7	33.2	20.4	17.3	17.7	20.3	18.1	19.4	21.1	19.6	20.3	21.3	20.7	17.7	21.0
I-5 SB 114-04455 Near Broadway	57.0	55.3	53.1	52.6	51.7	50.5	48.5	43.8	42.0	41.7	41.6	39.1	37.1	40.0	43.6	43.9	42.3	42.8	43.0	42.2	42.2	42.0	41.9	37.8	38.1	36.9	37.1	27.1	23.3	23.0	25.7	23.8	25.4	26.6	24.8	25.3	26.0	25.2	21.4	25.0
I-5 SB 114N04455 Near Moda Center	57.0	55.4	53.2	52.6	51.8	50.4	48.8	45.5	44.1	43.6	43.7	42.3	41.8	43.2	45.5	45.7	45.1	45.1	45.2	44.8	44.8	44.6	44.5	41.1	41.6	40.5	40.5	30.7	26.9	26.1	28.6	26.7	28.3	29.2	27.1	27.5	28.3	27.3	22.5	26.4
I-5 SB 114-04454 Near Multnomah	56.7	55.2	53.2	52.8	52.1	50.8	49.5	47.0	46.0	45.2	44.8	44.2	44.6	45.6	47.1	47.4	46.9	46.9	47.2	46.6	46.7	46.1	46.4	43.8	44.4	43.5	43.0	36.5	32.6	32.1	33.5	32.5	33.2	33.1	31.0	30.5	30.6	29.5	25.0	28.2
I-5 SB 114N04454 Near 84	57.3	56.4	54.5	54.5	54.0	53.3	52.1	50.1	49.4	48.2	48.0	48.0	49.5	49.6	50.6	51.3	51.3	51.3	51.4	51.1	50.8	50.7	51.0	50.0	50.5	50.3	49.9	47.0	46.0	45.6	46.4	46.1	47.0	45.7	44.0	43.0	40.9	39.7	34.7	36.9
I-5 SB 114-04452 Near Morrison	57.2	56.8	55.7	55.7	55.1	54.9	54.3	53.9	54.0	52.9	53.0	53.1	54.0	54.1	54.2	54.2	55.3	55.6	55.5	55.2	55.0	55.2	55.1	54.5	54.8	55.1	54.8	54.5	54.9	54.9	53.8	53.4	52.5	49.9	46.2	43.3	41.9	39.7	38.3	38.9
SB Location	**AM - Southbound Speed Difference**																**MD - Southbound Speed Difference**								**PM - Northbound Speed Difference**																
I-5 SB 114-04457 Near Going	2.9	3.6	1.7	0.2	0.3	-1.7	-1.8	-7.1	-2.1	0.9	2.7	1.3	3.4	3.7	2.3	6.2	0	1	1	0	-1	-1	0	-1	-1.0	-0.1	-0.4	-4.2	-12.2	-10.5	2.2	2.3	2.1	-0.6	-5.4	-9.2	-11.4	-7.4	10.1	19.3
I-5 SB 114N04457 Near 405	0.9	2.4	1.6	0.9	1.4	0.3	-1.5	2.5	11.0	9.2	11.9	9.3	5.4	5.4	1.9	4.6	-8	-7	-6	-7	-7	-7	-8	-6	-12.2	-12.0	-12.4	-18.9	-11.3	-3.5	-4.6	-6.3	-5.8	-7.1	-16.5	-17.0	-13.7	3.1	3.0	6.4
I-5 SB 114-04456 Bt 405/Broadway	-0.3	-0.5	-2.0	-2.5	-3.1	-3.8	12.9	22.4	20.9	20.5	21.2	15.1	10.4	19.1	22.2	17.9	2	-2	0	5	6	2	1	7	-19.6	-19.3	-3.8	2.9	-0.4	0.3	2.9	0.8	1.8	4.0	2.9	4.3	6.8	5.6	2.4	6.6
I-5 SB 114N04456 Near Broadway	4.2	4.8	6.9	6.8	9.7	11.7	18.4	11.6	8.7	9.0	9.4	4.6	1.2	7.4	12.0	12.3	16	13	14	15	11	10	13	12	-5.6	-0.5	10.9	0.8	-0.6	-0.9	0.8	-0.7	0.3	2.0	0.8	2.0	5.6	5.6	2.7	6.4
I-5 SB 114-04455 Near Broadway	4.0	3.3	3.7	3.0	3.3	3.5	5.7	2.9	0.9	0.6	-0.7	-3.2	-5.7	1.0	2.2	2.0	2	4	5	5	2	1	6	5	-6.0	-2.4	4.2	-5.3	-3.7	-6.8	-7.6	-6.4	-7.3	-4.6	-5.9	-3.6	3.7	5.5	2.2	5.6
I-5 SB 114N04455 Near Moda Center	4.0	3.7	3.8	3.1	3.5	3.4	6.4	5.2	5.0	3.6	1.9	1.0	0.7	5.6	5.3	6.2	8	11	9	10	6	8	13	10	0.3	3.7	9.2	-0.5	-0.1	-3.5	-2.6	-2.8	-1.8	-0.2	-0.7	-0.2	7.2	7.7	3.8	6.8
I-5 SB 114-04454 Near Multnomah	2.7	3.1	2.8	2.9	6.2	9.1	10.3	9.0	9.3	8.1	5.5	6.5	6.4	7.2	7.7	8.0	12	13	13	12	12	12	13	11	7.7	8.4	9.4	3.4	-1.0	-2.1	-1.0	-1.6	-0.8	-1.3	-2.9	-2.4	0.0	-0.5	-5.3	-1.7
I-5 SB 114N04454 Near 84	3.7	4.3	4.1	4.4	7.4	14.9	15.3	13.6	11.0	10.7	11.8	9.5	11.2	6.3	6.0	8.2	4	6	3	4	1	1	1	2	-0.5	-0.4	-1.4	-3.2	-3.3	0.2	0.2	-0.6	0.0	-1.9	-3.8	-5.0	0.2	-11.2	-17.8	-14.6
I-5 SB 114-04452 Near Morrison	0.7	0.7	-0.1	-0.2	-0.2	0.6	-0.1	-0.4	-0.6	-1.6	-1.1	-1.5	-0.7	-1.4	-1.0	-0.8	0	1	0	0	0	0	0	-1	-0.9	-0.3	-0.8	-1.0	-0.6	-0.1	-1.3	-1.4	-2.2	-5.2	-1.6	-0.5	0.5	-0.1	-2.1	-1.6

Speed (mph)									Difference in Speed (mph)			
< 20		20-30		30-40		40-50		>50	> 10	10.2	< -10	-10.2

Future Volume Development

The Team obtained future volumes developed for the year 2035 by disaggregating multi-hour data provided by Portland Metro into hourly volumes and then applying the National Cooperative Highway Research Program (NCHRP) Report 255 Methodology. This was accomplished by first obtaining daily profiles, aggregated by the hour from PSU Portal data. These profiles came from data taken from Tuesday, Wednesday, and Thursday from the most current three years, to provide confidence in the averages. The Team used these profiles for the entire I-5 corridor (and more specific locations within the Study Area) to compare and gain confidence in the hourly distributions. Then the Team calculated disaggregated factors for each of Metro's multi-hour models.

The Team used the NCHRP 255 Methodology to develop future traffic demand. Movements not included in the model required adjustment in the volumes through arterial balancing. These turning movements are listed below:

- Flint and Broadway WBR and SBR
- Flint and Broadway NBT, SBR and WBR
- Wheeler and Winning Way EBL, EBT and EBR

Once adjustments were made, the Team balanced the model throughout. The freeway was balanced by isolating the I-5 volumes at the Broadway and Weidler Overpasses, then adding and subtracting the ramp volumes to obtain the additional freeway volumes. The Team also used ramp volumes to balance volumes through the arterial.

Alternative Designs Development

After calibration and future model development, the Team combined data inputs to produce all subsequent models for analysis, beginning with the No Build Model. Two additional alternative designs were originally developed in the facility plan to be compared alongside the No-Build Model: Refined Auxiliary Lane and Refined Auxiliary Lane & Braided Ramps Hybrid. Further analysis showed that the two build options could be refined. Therefore, the Team expanded both to produce several more designs, all of which incorporated variations on the auxiliary lanes or the braided ramps components, and, in some cases, new design elements. The Team then compared them alongside the No Build Option for cost-to-benefit analysis. This section outlines the three-phase process through which multiple options were analyzed and refined to obtain eight final alternatives. The three phases are:

1 **Phase 1 – Facility Plan**

2 **Phase 2 – Design and Refinement/Interactive Workshop**

3 **Phase 3 – Final Options**

1 Phase 1 – Facility Plan

As determined by the traffic analysis work previously conducted and outlined in the I-5 Broadway-Weidler Facility Plan, the Team analyzed three concepts for interchange improvements along the I-5 Corridor: No-build (Option A), Refined Auxiliary Lanes (Option B), and Refined Auxiliary Lanes & Braided Ramp Hybrid (Option C).

The No Build Option does not incorporate design improvements to the freeway. The initial Option B design includes an additional auxiliary lane in the southbound direction between the NE Broadway Off-Ramp and the City Center Off-Ramp (Morrison Off-Ramp), resulting in three lanes of traffic between these ramps. An auxiliary lane would also be added in the northbound direction between the I-84 On-Ramp and the Greeley Off-Ramp resulting in three lanes of traffic between those ramps.

The initial Option C design also incorporates the auxiliary lane in the southbound direction between the NE Broadway Off-Ramp and the Morrison Off-Ramp, but with an additional braided ramp north of the Wheeler-On-Ramp for I-84 Eastbound Off-Ramp traffic. In the northbound direction, NE Weidler Off-Ramp shifts further south and meets with I-84 Westbound On-Ramp to form a Collector-Distributor (CD) Road, on which merging I-84 traffic and diverging NE Weidler traffic weave to their respective destinations.

While initial analysis showed that the two alternative options would alleviate congestion on I-5 for the current year, it also revealed that additional refinement would be necessary to mitigate congestion for the future design year 2035. This resulted in the modification of the original alternatives. The Team implemented these modifications through an iterative process by which new concepts were developed, applied, tested, and refined until the optimal design schemes were developed. This refinement process took place during the Interactive Workshop, which is detailed below.

2 Phase 2 – Design Refinement/Interactive Workshop

HDR and ODOT partnered during a week-long interactive workshop, aimed at improving the alternative design options and developing additional alternatives for final analysis. During this workshop, the Team developed two new design options, Grand Ramp Removal and Lane Comparison for I-84 Westbound On-Ramp Design. Additionally, the Team expanded Option B and Option C into one or more additional designs. All options were analyzed and compared with respect to parameters such as travel time and unserved percentage. The Team developed over ten different designs and ran VISSIM models for comparison. After testing and analyzing the benefits and drawbacks of these design elements, the Team developed eight final alternatives to be compared in the cost-to-benefit analysis. The following section details the design elements that were devised and tested during the interactive workshop.

Grand Ramp Removal

The first new scenario considered during the workshop was the removal of the Grand Ramp from I-5 Southbound to I-84 Eastbound. This scenario was chosen to provide insight into the paths of diverting traffic after removing the Grand Ramp. Table 4 below shows the results from the VISUM analysis performed on this scenario for peak p.m. hours. Figure 4 also shows the volume diversion plot for the Non-Grand Ramp VISUM model. Network label and link color are coded based on the volume differences between Non-Grand scenario and the Base scenario.

Table 4 – Grand Ramp Removal Peak PM VISUM Analysis

Future Year 2035 No Build PM Scenario (four hours)						
Location	Volumes Before Removing Grand	Volumes After Removing Grand	Capacity	Number of Lanes	Shifted Volume	Shifted volume in Percentage[1]
I-84 South Entry	5029	5711	5250	1	682	14%
I-84 North Entry	10447	11184	10500	2	737	7%
I-84 16th On-ramp	1465	2221	2853	1	756	52%
I-84 39th On-ramp	2808	2575	3324	1	230	8%
Arterial	n/a	n/a	n/a	n/a	495	17%

[1]Shifted volumes = shifted volume/volumes

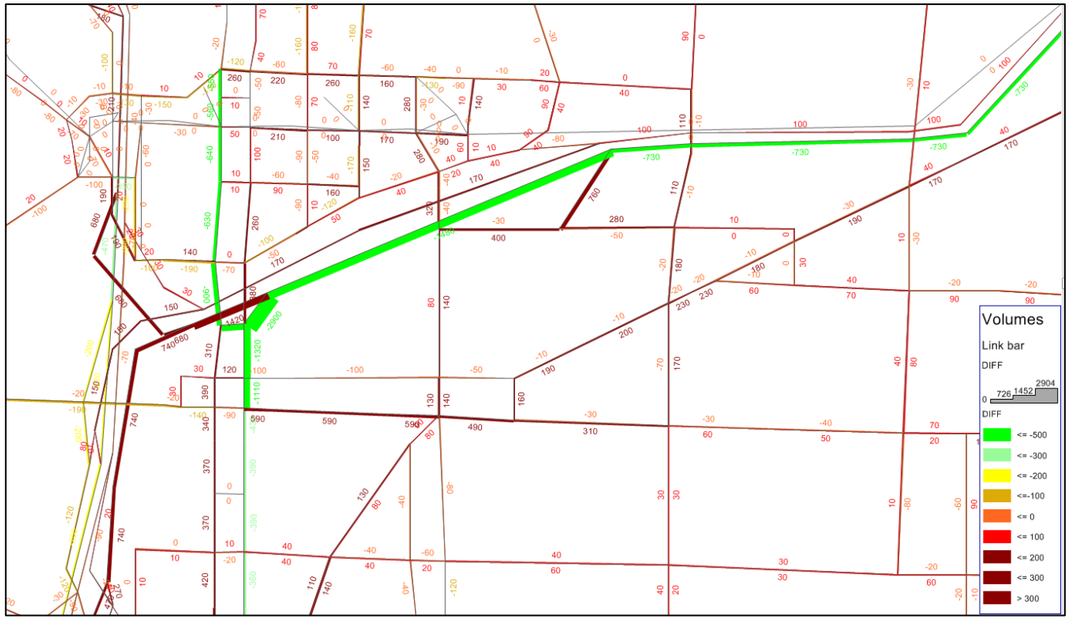


Figure 4 – Future Year 2035 Grand Volume Diversion Plot

As shown in Table 4, VISUM results showed some key shifts in traffic patterns between I-5 and I-84. Sizeable shifts in volume are detailed below:

- 14% traffic demand shifted from SB I-5 to I-84 on-ramp
- 7% traffic demand shifted from NB I-5 to I-84 on-ramp,
- 52% traffic demand shifted to NE 16th on-ramp of I-84
- 8% traffic demand shifted to NE 39th on-ramp of I-84
- 17% traffic demand stays on arterials such as NE Sandy
- I-84 North and South Entry volumes exceed the capacity

A concern with the Grand Ramp Removal was the capacity of the critical weaving section between the Weidler On-Ramp and the I-84 Off-Ramp, which would have to accommodate more than 600 additional vehicles in the southbound direction during the p.m. peak period. This would add to the queuing on the arterials a ramp meter controls the flow of these vehicles. The Grand Ramp Removal would uncork the merging situation at the Grand On-Ramp but would make the heavy weaving section worse.

After analyzing the VISUM results, the Team ruled out this option. The ramp removal caused the traffic to divert to a pre-existing heavy weaving section with Weidler and the I-84 Southbound to Eastbound Ramp, decreasing the safety and operations of the roadway section.

Two versus One Lane from I-84 Westbound to Northbound I-5

The second geometric change evaluated was a comparison of a two-lane on-ramp with a one-lane on-ramp from I-84 Westbound to I-5 Northbound. The Team created a VISSIM model to verify that the number of lanes (one versus two) for the I-84 On-Ramp to I-5 Northbound was not a critical factor in the design and that, regardless of number of lanes, the demand could still be served. Based on this analysis, the Team determined the majority of the demand could be served regardless of a one- or two-lane scenario. Further observation showed that the demand could not be met in either design during the later part of the p.m. peak hours due to congestion on I-84, which prevented access to the ramp altogether. Table 5 shows the VISSIM analysis of these two ramp scenarios:

Table 5 – Two Lane versus One Lane I-84 On-Ramp Comparison

I-84 On-Ramp Volume Comparison			
Start Time	End Time	Double Lane Volume	Single Lane Volume
2:00 PM	2:15 PM	307	304
2:15 PM	2:30 PM	312	307
2:30 PM	2:45 PM	307	313
2:45 PM	3:00 PM	313	312
3:00 PM	3:15 PM	286	291
3:15 PM	3:30 PM	289	291
3:30 PM	3:45 PM	285	278
3:45 PM	4:00 PM	255	289
4:00 PM	4:15 PM	295	309
4:15 PM	4:30 PM	313	307
4:30 PM	4:45 PM	308	293
4:45 PM	5:00 PM	319	313
5:00 PM	5:15 PM	324	300
5:15 PM	5:30 PM	333	291
5:30 PM	5:45 PM	316	301
5:45 PM	6:00 PM	334	284

Option B Refinement

The original Option B scheme included a one-lane I-84 Off-Ramp with an auxiliary lane between the Weidler On-Ramp and I-84 Off-Ramp. During the interactive workshop, the Team split Option B into two scenarios for comparison: Option B One-Lane to I-84 and Option B Two-Lanes to I-84. Once modeled, analysis of the VISSIM results provided lane-by-lane comparisons of vehicle speeds for each scheme. Figure 5 shows the comparison between the two scenarios for the p.m. peak hours of 5:00-6:00 p.m.

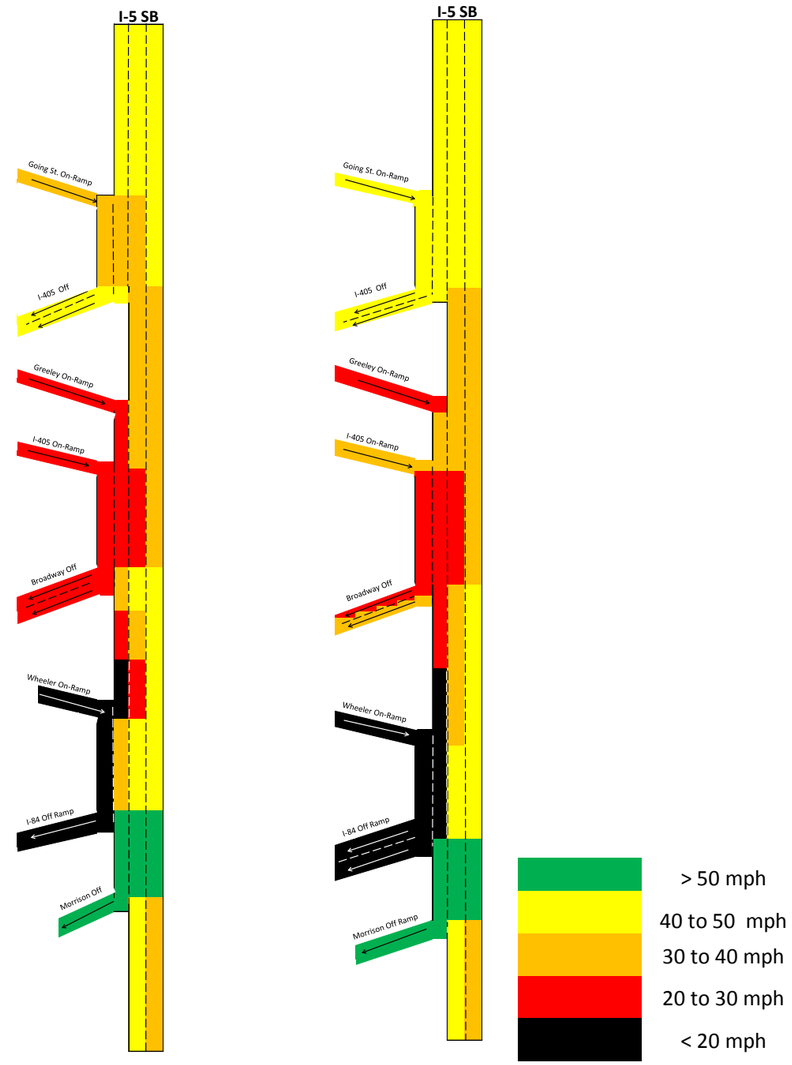


Figure 5 – Option B One Lane versus Two Lanes to I-84 (5-6 p.m.)

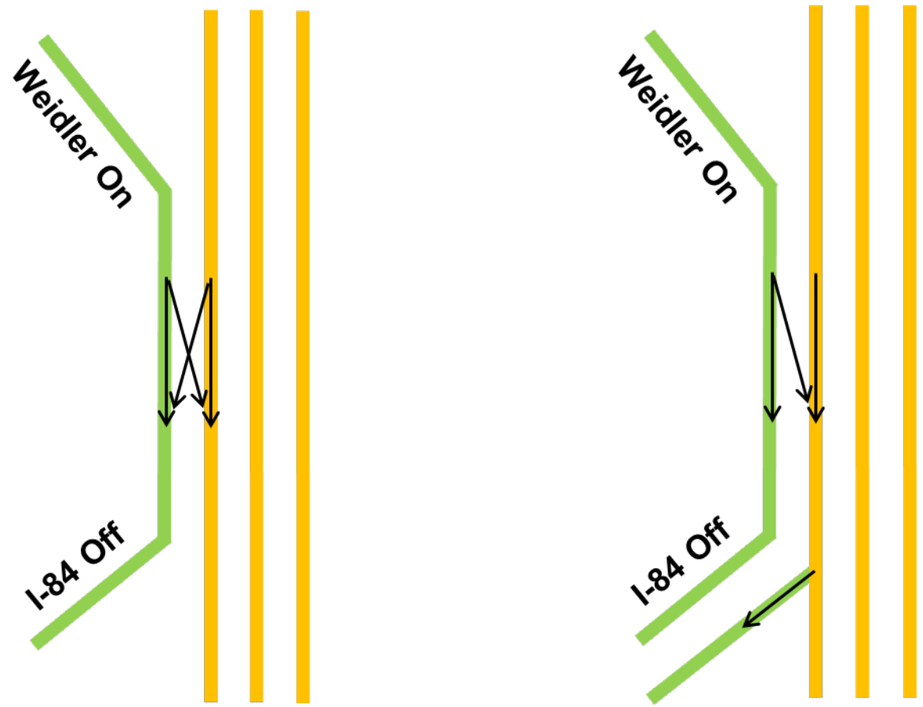


Figure 6 – Weaving Section in One Lane versus Two Lanes to I-84

The Option B Southbound speed comparisons show a range of colors that correlate with vehicle speed, as detailed in the legend. As the comparison shows, the Two-Lane to I-84 scheme has slower speeds, or greater congestion, in the third-to-right lane leading to the I-84 Off-Ramp. This can be contributed to the additional exit lane from I-5 to I-84 which more vehicles will utilize to exit. Although the speeds are lower in this lane, the speeds are gradually faster further upstream, all the way to the Greeley On-Ramp. The additional exit lane has the potential to reduce the amount of weaving in the section by eliminating the need to exit on the outside left lane, thus allowing the speeds to remain more consistent leading up to this point on the freeway. The different weaving sections are shown in Figure 6. As shown, Option B Two-Lanes to I-84 has the potential for improved safety since there are ideally fewer weaving movements required. While the VISSIM model for this option does show some weaving instances from I-5 Southbound to the auxiliary lane between Weidler On and I-84 Off, the amount is significantly reduced from the original One-Lane to I-84 design.

Option C Refinement

The original braided ramp scenario of Option C from the facility plan utilizes a braided ramp between the Weidler On-Ramp and I-84 Off-Ramp in the southbound direction. The Team evaluated this option in depth during the Interactive Workshop, to determine the potential design optimizations and improvements for this scenario. The most complex and detailed version of this option utilized a double braided scenario that included both the Morrison Off-Ramp and the Weidler On-Ramp in the braid. Additional options that the Team evaluated included one with an express lane as well as a bifurcation scenario. The bifurcation concept focused on moving all local traffic accessing the ramps to the right side of the freeway and all the through traffic traveling in the furthest left lane.

The Federal Highway Association (FHWA) defines this type of scenario as managed lanes, which are lanes controlled or managed for specific purposes.[11] These lanes can be controlled through signing, tolling, or limiting access. The VISSIM model assumed that all through traffic would stay in the left lane and would not weave into the ramp traffic lanes and vice versa. Analysis of managed lane concept showed very little improvement over a similar double braid concept.

Below is a list of the various features of braided ramps that were explored during the Interactive Workshop:

- Double Braid with two local lanes one express lane (various starting locations for the express lane)
- Double Braid with three local lanes one express lane (various starting locations for the express lane)
- Double Braid with deceleration lane to I-84
- Double Braid with I-84 drop lane
- Single Braid optimize design for ramp locations to maximize space between ramps
- Double Braid optimize design for ramp locations to maximize space between ramps
- Single Braid two lane flyover for I-84
- Double Braid two lane flyover for I-84
- Auxiliary Lane with two lane flyover for I-84

As shown in Figure 7, both the Greeley On-Ramp and I-405 On-Ramp contribute significantly to the congestion on the southbound freeway for both the Double Braid and Double Braid Express scenarios. This congestion is not alleviated through the express option any more than the original double braid. The Team determined through the analysis that an express lane option would not benefit the design as initially expected. Yet, it was determined through the workshop that certain ramp locations optimized the designs, with a potential cost to benefit improvement for a two lane flyover for I-84 for all scenarios.

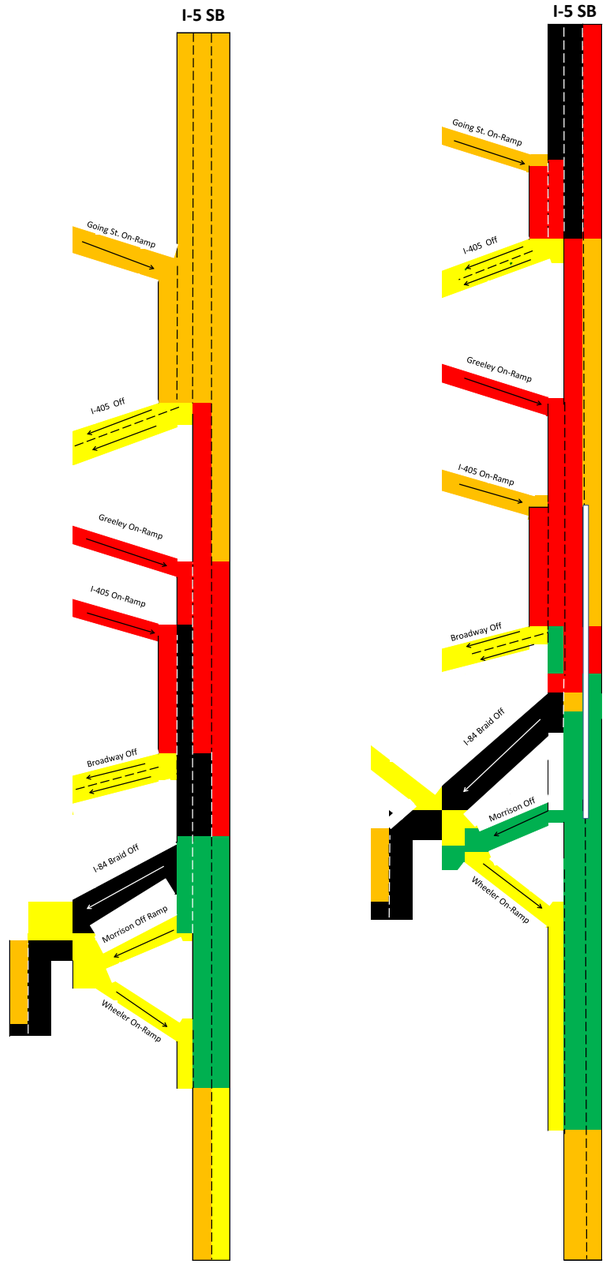


Figure 7 – Option C Double Braid versus Double Braid Express (5-6 p.m. Southbound)

[11] http://ops.fhwa.dot.gov/publications/managelanes_primer/

3 Final Options

After refinement and analysis of all the options developed during Phase 2, the Team chose eight final options to be evaluated in further detail. Option C was split into two scenarios

- Option A1: No-build
- Option A2: No-build with two lane flyover
- Option B1: Auxiliary lanes
- Option B2: Auxiliary lanes with two lane flyover
- Option C1: Single braid
- Option C2: Single braid with two lane flyover
- Option D1: Double Braid
- Option D2: Double Braid with two lane flyover

These options include optimized ramp locations for auxiliary lanes and braided ramps, as well as each design with and without a two lane flyover.

Beyond the freeway configuration, the No-Build Options (Option A1 and Option A2) include improvements of the removal of the southbound slip ramp at the I-5 southbound ramp with Vancouver/Weidler and an additional bike lane on N Williams Ave, which are both under construction or to be added in the near future. The improvements to the six Build Options have a new intersection at N Winning Way and N Vancouver Ave, as well as a change to the intersection of NE Wheeler Ave and N Williams Ave. This design extends N Vancouver further south to intersect with N Winning Way perpendicularly. NE Wheeler Ave will then begin at the intersection of N Winning Way and N Williams Ave and will travel in a SE direction and function as the On-Ramp for I-5 SB. Figure 8 shows the proposed arterial configuration. The northbound movement from Williams through Weidler and Broadway was adjusted to match the recent North Williams Bikeway project with a left side bike lane by placing the bike lane in the middle of the north bound lanes.

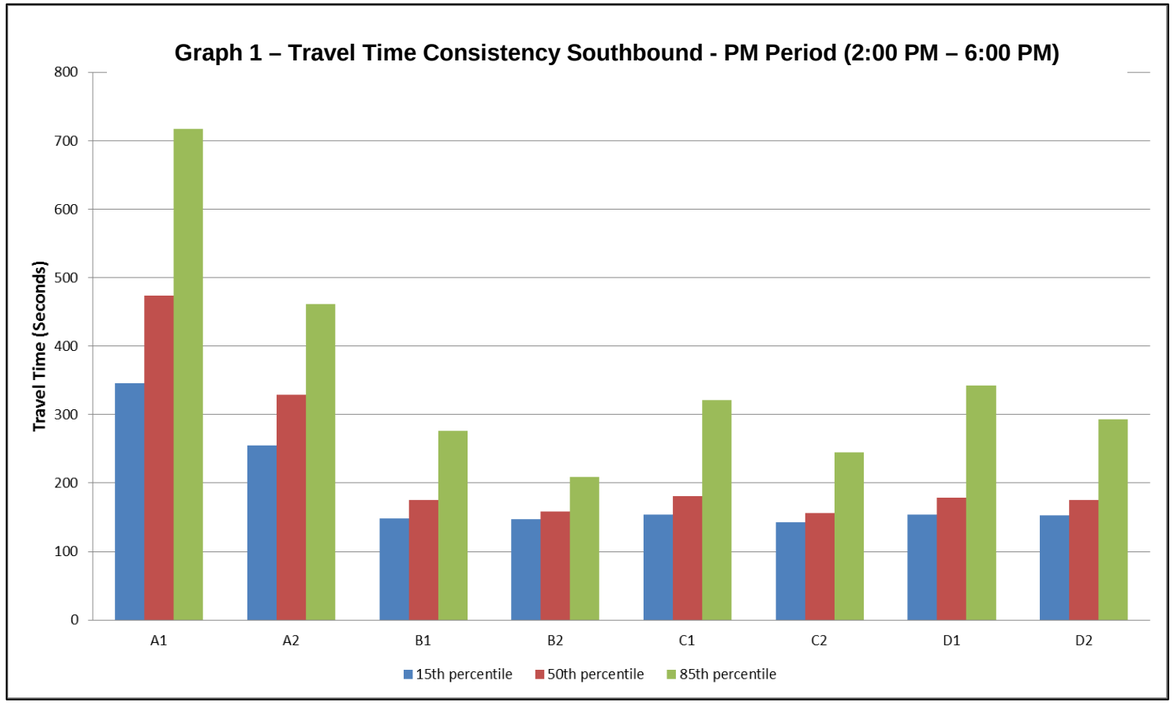
Figure 8 – No-Build Options Arterial Configuration

Analysis of Final Options

The Team compared the results for all eight options using the parameters of travel time, travel time reliability, speed, volume throughput, emergency braking incidents, congestion, and intersection analysis. This section details how each parameter was obtained through model outputs and the level of analysis applied to each option for comparison. All eight design options include changes to the arterials at the Broadway-Weidler Interchange. All results are based on 10 simulation runs averaged.

Travel Time Consistency

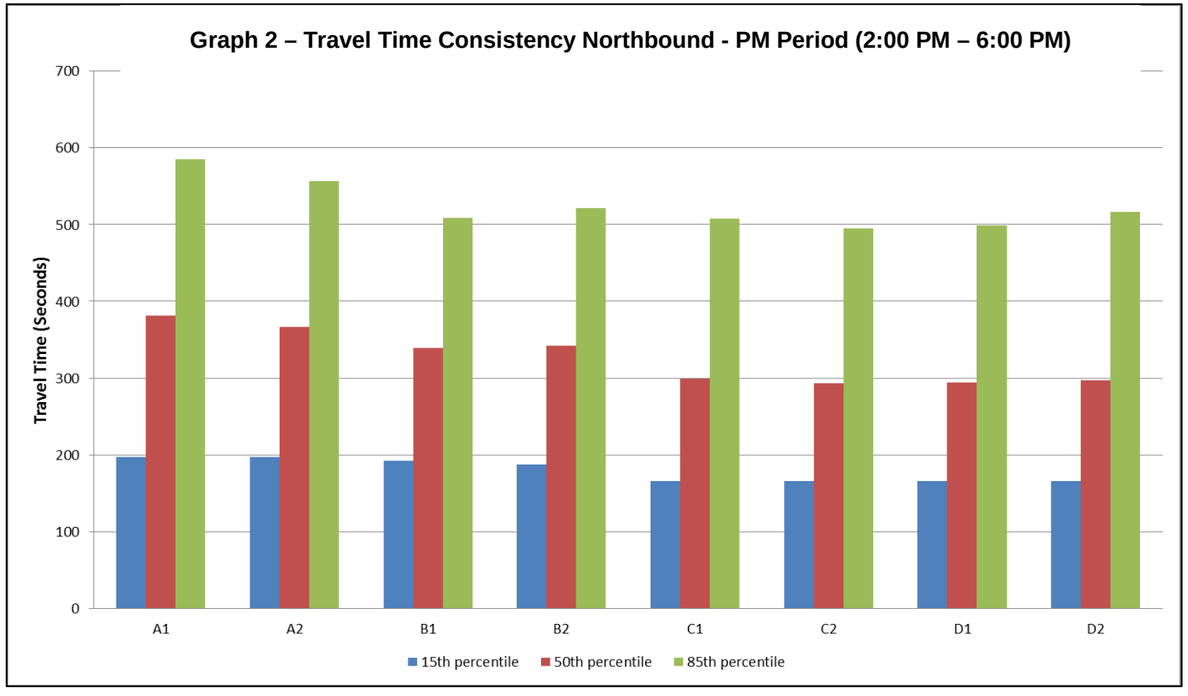
The Team collected second-by-second information from 10 model runs for all vehicles traveling northbound and southbound on the interstate. Travel times were recorded for these vehicles and sorted into northbound and southbound routes. Using the starting and ending time of each vehicle along a route, the Team calculated median speed (50th percentile) and standard deviations (15th and 85th percentile speeds) by hour for all the vehicles traveling either route. Graph 1 and Graph 2 show the consistency results of these routes for 10 simulation runs over 10 hours. As shown in Graph 1 for the southbound direction, Option A1 – No Build has both a long travel time and less consistency, as the 15th and 85th percentile travel times vary significantly from the median speed. This shows that there is a greater variation in the travel times throughout the p.m. peak period, thus deeming this option less reliable to drivers. For all build options, both the travel times and the consistencies show significant improvement from the No Build option. For the northbound direction in Graph 2, Option A1 – No Build also shows long travel times and less consistency. When compared to this option, all of the build options show slight improvement in travel times, yet their reliabilities do not improve significantly. This is to be expected as there will be fewer design improvements to the northbound section of I-5. More detailed travel time consistency information is provided in Appendix E.



Travel Time

The Team chose six routes to compare the travel times of vehicles for all eight options. These routes reflect common travel routes for commuter and freight traffic. Figure 9 below shows the routes that were used in the model for comparison.

The Team then compared Travel Times for each option to Option A1 – No Build in order to better understand the percentage improvement each option provided throughout the day. Table 6 shows the travel time percent differentiations from Option A1; the table is color coded; refer to the legend for details. Please note that negative values represent a percentage decrease in travel time. The table shows that the travel times are not significantly improved with Option A2, but are improved with all the build options for the majority of the routes. Both Option B1 and Option B2, however, do get worse for Route F. This is because under no-build conditions there currently is a three to two-lane drop just south of the southbound Broadway Off-Ramp. This limits the traffic that currently can access the weaving area between the Broadway-Weidler interchange area and the I-84 southbound to eastbound ramp. While this project will improve that weave by adding weaving distance, the project will also remove the three to two lane drop, allowing more vehicles to access the weave area, thus resulting in a slower travel time for southbound vehicles leaving the interchange area on the freeway.



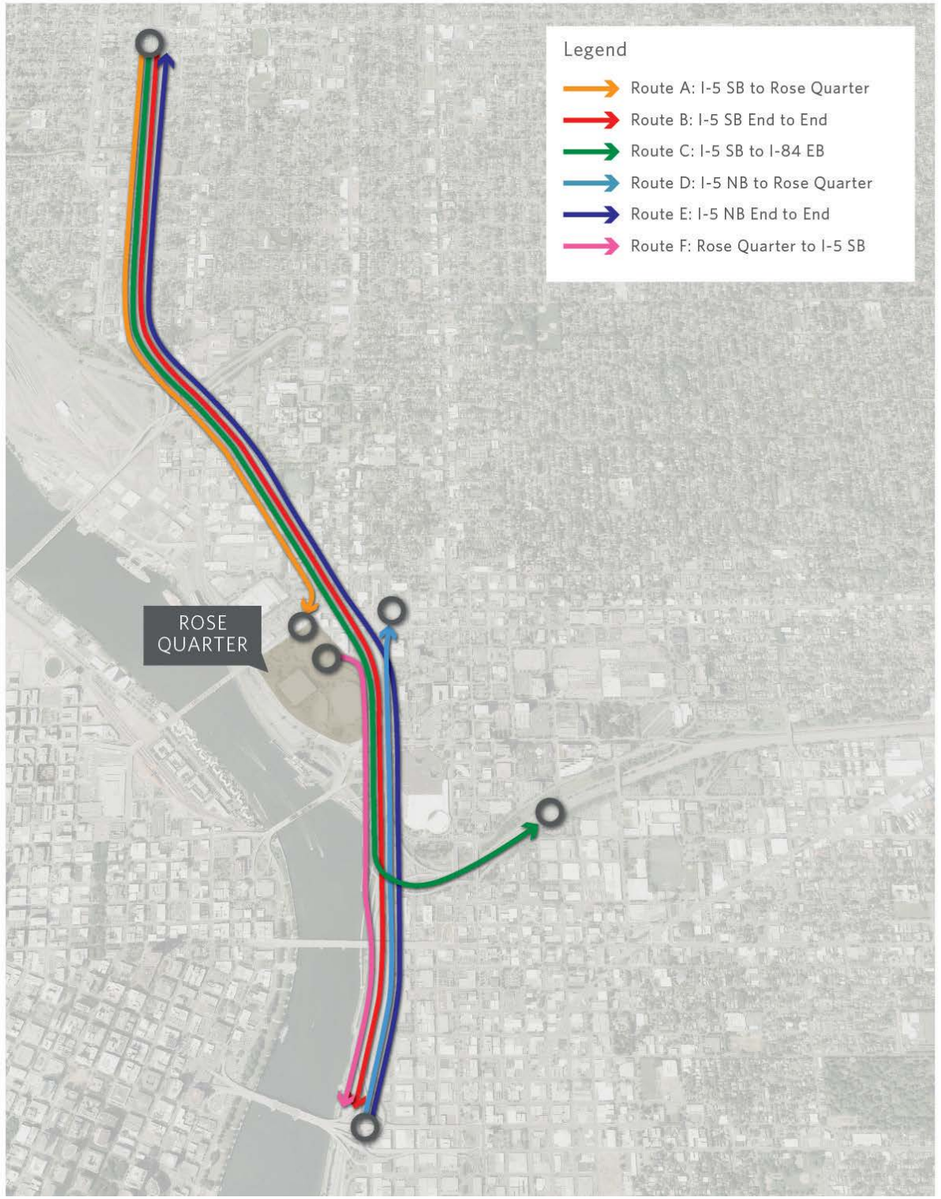


Figure 9 – Travel Time Routes

Table 6 – Travel Time Comparison to A1 No Build

Vehicular Travel Time Routes Comparison to A1 No-Build											
Route	Option	6-7 am	7-8am	8-9am	9-10am	12-1pm	1-2pm	2-3pm	3-4pm	4-5pm	5-6pm
Option A2	Route A	1%	-2%	-2%	-8%	-32%	-33%	-34%	-26%	-24%	-20%
	Route B	0%	-3%	-1%	-9%	-33%	-25%	-34%	-28%	-27%	-10%
	Route C	-3%	-3%	0%	-8%	-25%	2%	-16%	-22%	-19%	1%
	Route D	0%	-2%	-5%	-7%	-17%	14%	1%	1%	-2%	-8%
	Route E	0%	-3%	-2%	-2%	-15%	-14%	0%	-1%	-3%	-4%
	Route F	-21%	-21%	-16%	-13%	-35%	-18%	-28%	-27%	-29%	20%
Option B1	Route A	0%	-63%	-64%	-66%	-54%	-15%	-56%	-49%	-67%	-15%
	Route B	-5%	-59%	-66%	-65%	-54%	-44%	-53%	-57%	-63%	-50%
	Route C	-1%	-32%	-31%	-47%	-27%	-8%	-20%	-34%	-44%	-19%
	Route D	-11%	-35%	-40%	-36%	-41%	87%	-7%	-5%	-25%	-35%
	Route E	-6%	-22%	-24%	-23%	-29%	-31%	-4%	-3%	-7%	-12%
	Route F	-7%	-29%	16%	0%	25%	65%	151%	84%	-2%	67%
Option B2	Route A	1%	-64%	-74%	-73%	-60%	-69%	-68%	-69%	-68%	-41%
	Route B	-5%	-59%	-69%	-68%	-58%	-61%	-61%	-63%	-63%	-59%
	Route C	-5%	-37%	-30%	-45%	-32%	-3%	-14%	-16%	-42%	-12%
	Route D	-11%	-36%	-40%	-37%	-39%	67%	-7%	-7%	-26%	-42%
	Route E	-6%	-23%	-24%	-23%	-29%	-33%	-4%	-3%	-6%	-11%
	Route F	-7%	-38%	-31%	-34%	-38%	78%	51%	46%	-24%	85%
Option C1	Route A	1%	-63%	-55%	-64%	-58%	-31%	-49%	-65%	-68%	-21%
	Route B	-3%	-58%	-52%	-59%	-53%	-28%	-45%	-62%	-63%	-26%
	Route C	0%	-27%	-11%	-42%	-30%	6%	-20%	-48%	-48%	-3%
	Route D	-12%	-34%	-38%	-37%	-42%	53%	-8%	-8%	-24%	-43%
	Route E	-7%	-21%	-23%	-23%	-29%	-33%	-4%	-5%	-8%	-11%
	Route F	0%	-42%	-41%	-47%	-44%	-54%	-12%	-12%	-18%	-64%
Option C2	Route A	0%	-64%	-75%	-69%	-60%	-57%	-65%	-65%	-68%	-37%
	Route B	-4%	-58%	-68%	-64%	-57%	-51%	-58%	-61%	-63%	-42%
	Route C	-1%	-32%	-22%	-38%	-31%	3%	-14%	-16%	-41%	-6%
	Route D	-11%	-34%	-38%	-37%	-47%	33%	-7%	-6%	-24%	-46%
	Route E	-7%	-21%	-23%	-22%	-30%	-19%	-4%	-4%	-9%	-14%
	Route F	11%	-34%	-35%	-43%	-36%	-48%	-13%	-13%	-19%	-64%
Option D1	Route A	1%	-63%	-64%	-66%	-58%	-36%	-46%	-66%	-69%	-14%
	Route B	-5%	-61%	-59%	-61%	-53%	-30%	-41%	-61%	-64%	-20%
	Route C	0%	-31%	-20%	-45%	-31%	1%	-17%	-47%	-48%	1%
	Route D	-11%	-35%	-40%	-37%	-43%	74%	-7%	-9%	-24%	-44%
	Route E	-6%	-22%	-23%	-23%	-29%	-32%	-4%	-4%	-9%	-13%
	Route F	-2%	-52%	-50%	-51%	-44%	-53%	-16%	-15%	-20%	-64%
Option D2	Route A	1%	-64%	-73%	-69%	-60%	-59%	-61%	-62%	-68%	-29%
	Route B	-5%	-61%	-68%	-64%	-58%	-47%	-55%	-58%	-62%	-33%
	Route C	-1%	-30%	-17%	-32%	-29%	2%	-13%	-13%	-34%	0%
	Route D	-12%	-34%	-39%	-36%	-42%	77%	-7%	-6%	-24%	-43%
	Route E	-6%	-21%	-23%	-23%	-29%	-31%	-4%	-4%	-8%	-9%
	Route F	-2%	-52%	-50%	-51%	-44%	-56%	-16%	-15%	-20%	-64%

Legend	<-20%	-20%to -10%	-10%to 0%	0%to10%	>10%

Speed

The Team collected speed data at multiple locations along the corridor on both a segment level and a lane-by-lane level. This allowed for an evaluation of the variability of speed for each option during all model hours (a.m., p.m., & m.d.). Output from the VISSIM model also allowed the Team to develop Spot Speed comparisons (Brainscans) for all of the alternatives.

These spot speed charts show a comparison of freeway speed between each alternative and Option A1 – No Build for eighteen points throughout the length of the freeway on the northbound (nine points) and southbound sides (nine points). Tables 7 and 8 show the Spot Speed results for all eight Options. Spreadsheets with lane-by-lane speed variations are provided in Appendix F.

Table 7 – Spot Speed Data for All Options Northbound

NB Location	6:00 AM	6:15 AM	6:30 AM	6:45 AM	7:00 AM	7:15 AM	7:30 AM	7:45 AM	8:00 AM	8:15 AM	8:30 AM	8:45 AM	9:00 AM	9:15 AM	9:30 AM	9:45 AM	12:00 PM	12:15 PM	12:30 PM	12:45 PM	1:00 PM	1:15 PM	1:30 PM	1:45 PM	2:00 PM	2:15 PM	2:30 PM	2:45 PM	3:00 PM	3:15 PM	3:30 PM	3:45 PM	4:00 PM	4:15 PM	4:30 PM	4:45 PM	5:00 PM	5:15 PM	5:30 PM	5:45 PM
Option A1: No-build (Northbound Average Speeds)																																								
I-5 NB Near 84	49	48	48	49	35	30	29	28	30	31	31	33	33	36	38	38	40	37	30	29	28	29	29	28	47	48	48	47	42	41	42	41	33	32	31	31	29	25	25	24
I-5 NB Near 84	53	52	53	53	44	32	30	29	29	33	33	35	32	39	43	44	51	40	28	28	27	26	27	26	53	53	53	53	51	51	51	50	47	43	40	39	33	28	27	25
I-5 NB Near Multnomah	50	48	49	49	32	25	25	25	26	25	26	28	24	24	26	27	45	29	22	24	22	22	22	22	50	53	53	53	50	52	50	46	42	37	34	32	27	24	24	24
I-5 NB Near Weidler	47	46	45	45	41	38	38	40	39	40	40	40	39	37	38	38	42	37	35	36	35	35	35	35	48	50	50	49	47	48	47	47	43	41	41	40	39	39	41	43
I-5 NB Bt Broadway/Weidler	51	50	50	50	47	43	44	46	47	47	46	47	44	41	42	44	47	38	37	39	38	37	37	38	51	52	52	52	51	51	51	50	48	47	48	46	45	43	46	47
I-5 NB Near Broadway	47	47	47	46	43	41	41	43	43	43	44	44	41	39	38	41	44	35	36	36	37	34	34	35	50	51	51	51	50	49	50	49	47	45	46	43	42	40	44	46
I-5 NB BT 405/Weidler	50	48	50	48	45	43	43	44	44	44	44	46	43	44	42	43	43	39	38	38	40	38	39	39	51	52	51	52	50	50	51	51	48	48	47	42	39	38	40	44
I-5 NB Near 405	56	55	55	55	55	54	55	55	55	55	54	55	54	54	54	54	54	53	53	53	53	54	54	53	55	55	55	55	55	55	55	54	44	28	18	17	20	24	26	
I-5 NB Near Going	52	53	52	51	47	47	46	46	45	47	45	47	46	48	47	47	45	43	42	44	41	41	41	42	40	41	41	40	39	38	23	15	13	13	13	13	12	13	13	13
Option A2: No-build with two lane flyover (Northbound Average Speeds)																																								
I-5 NB Near 84	49	48	48	48	35	31	28	29	31	32	32	32	36	38	39	40	42	36	37	35	38	35	32	28	47	48	48	47	42	41	41	41	33	32	30	30	30	26	25	25
I-5 NB Near 84	54	53	53	53	44	32	32	30	32	34	33	36	38	38	42	46	50	45	35	36	37	31	29	25	53	53	53	53	51	51	50	50	47	43	40	43	37	28	27	27
I-5 NB Near Multnomah	51	49	47	49	33	25	25	26	26	26	26	26	26	23	27	28	42	32	24	24	23	25	22	22	50	53	53	53	50	52	49	46	43	36	34	35	29	24	24	25
I-5 NB Near Weidler	47	46	46	45	42	39	40	40	40	40	40	40	39	37	38	38	42	39	38	39	39	41	41	41	48	50	50	49	47	48	47	47	43	42	42	41	40	41	39	39
I-5 NB Bt Broadway/Weidler	50	50	49	50	48	46	47	47	46	46	46	45	44	41	42	42	48	45	42	45	45	46	47	46	51	52	52	51	51	51	51	50	49	48	49	47	46	45	43	44
I-5 NB Near Broadway	48	47	47	46	45	44	45	45	43	43	43	43	40	37	38	38	46	41	40	43	43	44	46	44	50	51	51	51	50	49	49	49	47	47	47	45	44	43	41	42
I-5 NB BT 405/Weidler	50	50	50	50	47	45	46	45	45	47	45	46	43	44	42	42	45	42	45	43	45	45	47	45	51	52	51	52	51	51	51	51	48	48	48	45	43	41	42	40
I-5 NB Near 405	56	55	55	55	55	55	55	55	54	55	55	55	54	54	54	54	54	53	54	53	54	54	54	54	55	55	55	55	55	55	55	54	47	36	21	17	20	24	25	
I-5 NB Near Going	52	52	52	52	47	47	46	47	46	47	47	47	47	47	47	46	46	43	43	44	42	42	42	44	41	40	41	40	40	38	27	15	14	13	13	13	13	13	13	14
Option B1: Auxiliary Lanes (Northbound Average Speeds)																																								
I-5 NB Near 84	47	46	47	47	35	34	34	34	35	35	35	35	36	36	36	36	38	36	35	35	36	36	35	33	44	44	46	45	39	39	38	37	35	34	33	34	34	34	34	34
I-5 NB Near 84	56	55	56	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	50	46	37	56	55	56	55	55	55	55	55	55	55	55	55	55	55	53	51
I-5 NB Near Multnomah	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	52	42	37	30	56	56	56	55	56	55	55	55	55	55	55	55	55	55	52	45
I-5 NB Near Weidler	55	54	54	54	54	53	53	54	54	54	54	54	54	54	54	54	54	54	53	53	53	53	52	52	55	55	55	55	55	55	55	55	54	54	54	54	54	51	51	
I-5 NB Bt Broadway/Weidler	55	54	55	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	53	54	54	54	54	54	55	55	55	55	55	55	55	55	54	54	54	54	55	53	52	52
I-5 NB Near Broadway	53	53	53	53	53	52	52	52	53	53	53	53	52	52	52	52	53	53	52	52	53	53	53	53	54	55	55	54	54	54	54	54	54	54	54	53	53	51	51	49
I-5 NB BT 405/Weidler	53	52	53	53	51	51	51	51	52	52	51	51	52	51	52	52	51	50	49	50	51	52	53	52	55	54	54	55	54	54	55	54	54	53	53	52	51	47	47	46
I-5 NB Near 405	56	55	55	55	55	54	54	54	55	55	55	54	54	54	54	54	53	53	53	53	53	54	54	54	55	55	55	55	55	55	55	54	41	29	26	18	18	19	24	
I-5 NB Near Going	53	53	52	51	48	48	46	46	46	47	47	46	47	47	47	46	45	43	41	42	40	42	42	44	41	41	42	41	40	40	26	14	14	13	13	13	13	13	13	13
Option B2: Auxiliary lanes with two lane flyover (Northbound Average Speeds)																																								
I-5 NB Near 84	47	45	46	46	35	34	34	34	35	35	35	36	36	37	37	36	38	36	35	35	36	37	36	35	44	44	46	45	39	39	38	37	35	34	33	34	34	34	34	34
I-5 NB Near 84	56	55	56	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	52	53	47	56	55	56	55	55	55	55	55	55	55	55	55	55	54	52	52
I-5 NB Near Multnomah	55	55	55	55	55	55	55	54	55	55	55	55	55	55	55	55	55	55	54	51	41	38	33		56	56	56	55	56	55	55	55	55	55	55	55	55	54	52	52	51
I-5 NB Near Weidler	55	54	54	54	54	54	53	53	54	54	54	54	54	54	54	53	54	54	53	53	53	53	53	52	55	55	55	55	55	55	55	54	54	54	54	54	53	52	51	50
I-5 NB Bt Broadway/Weidler	55	54	55	54	54	54	54	54	54	54	54	54	54	54	54	53	54	54	54	54	54	54	53	53	55	55	55	55	55	55	55	55	54	54	54	54	53	49	49	49
I-5 NB Near Broadway	53	53	53	53	53	52	52	52	53	53	53	53	52	52	53	52	53	53	52	52	53	53	53	53	54	55	55	54	54	54	55	54	54	54	54	51	51	48	48	47
I-5 NB BT 405/Weidler	53	53	53	53	52	51	51	52	52	51	51	51	51	51	52	51	51	50	50	50	51	52	52	53	54	55	55	54	54	55	54	54	54	54	52	50	47	44	45	44
I-5 NB Near 405	55	55	55	55	55	54	54	54	55	54	54	54	54	54	54	54	54	53	53	53	53	54	54	54	55	55	55	55	55	55	55	54	47	29	20	23	21	22	22	
I-5 NB Near Going	52	52	52	52	48	47	46	46	47	46	46	46	47	47	48	47	45	43	42	43	41	41	42	44	41	42	42	42	40	40	25	15	14	13	13	13	13	12	13	
Option C1: Single Braid (Northbound Average Speeds)																																								
I-5 NB Near 84	48	46	47	47	35	34	33	33	34	34	34	34	35	36	37	37	39	36	36	35	37	37	36	36	44	46	46	45	40	39	39	37	34	33	33	33	33	34	33	33
I-5 NB Near 84	56	55	56	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	52	51	43	55	55	56	55	55	55	55	55	55	55	55	55	55	55	53	52
I-5 NB Near Multnomah	55	55	55	55	55	55	54	54	55	55	55	55	55	55	55	55	55	55	55	54	53	44	38	34	56	56	56	56	55	56	55	55	55	55	55	55	55	53	51	49
I-5 NB Near Weidler	55	54	55	54	54	54	53	53	54	54	54	54	54	54	54	53	54	54	53	53	53	53	53	53	55	55	55	55	55	55	55	54	54	54	54	54	53	51	51	49
I-5 NB Bt Broadway/Weidler	55	54	55	55	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	55	55	55	55	55	55	54	54	54	54	54	54	54	54	51	51	51	48
I-5 NB Near Broadway	53	53	53	53	53	52	53	52	53	53	53	52	52	52	52	52	53	53	52	52	53	53	53	53	54	55	55	54	54	54	54	54	53	53	53	51	50	46	46	46
I-5 NB BT 405/Weidler	53	53	53	53	51	51	51	52	52	51	51	50	51	51	51	51	51	50	50	51	51	51	51	53	55	55	55	55	54	54	54	54	53	53	52	50	46	44	44	43
I-5 NB Near 405	56	55	55	55	55	54	54	55	55	54	54	54	54	54	54	54	54	53	53	53	53	54	54	54	55	55	55	55	55	55	55	55	54	46	36	25	22	18	17	19
I-5 NB Near Going	53	52	52	51	48	46	45	47	46	47	46	45	47	47	48	47	45	42	41	43	40	42	42	44	41	42	42	41	41	39	23	15	15	13	12	13	13	13	13	13
Option C2: Single Braid with two lane flyover (Northbound Average Speeds)																																								
I-5 NB Near 84	48	46	47	47	35	34	33	33	34	34	34	34	36	36	37	37	42	39	40	40	42	39	38	33	44	46	46	45	39	39	39	38	34	33	33	34	34	34	34	34
I-5 NB Near 84	56	55	56	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	49	41	32	55	55	56	55	55	55	55	55	55	55	55	55	55	54	54	54
I-5 NB Near Multnomah	56	55	55	55	55	54	54	54	55	55	55	55	55	55	55	55	55	54	55	54	51	45	31	23	56	56	56	55	55	56	55	55	55	55	55	55	55	55	53	49
I-5 NB Near Weidler	55	54	54	54	54	53	54	53	54	54	54	54	54	54	54	53	54	53	53	53	53	53	52	51	55	55	55	55	55	55	54	55	54	54	54	54	54	53	51	49
I-5 NB Bt Broadway/Weidler	55	54	54	54	54	54	54	54	54	54	54	54	54	54	54	53	54	54	53	54	54	54	53	53	55	55	55	55	55	55	55	55	54	54	54	54	54	52	51	48
I-5 NB Near Broadway	53	53	53	53	53	52	53	52	53	53	53	52	52	52	52	52	53	52	52	52	53	53	52	52	54	55	54	54	54	54	54	54	53	53	53	53	51	49	47	47
I-5 NB BT 405/Weidler	53	52	53	53	52	51	52	51	51	51	51	51	51	51	51	51	51	50	50	51	51	51	52	53	55	55	55	54	54	54	54	54	53	53	54	50	48	46	46	43
I-5 NB Near 405	56	55	55	55	54	55	54	54	55	54	54	54	54	54	54	54	54	53	53	53	53	54	53	54	55	55	55	55	55	55	55	55	54	48	32	28	21	22	22	22
I-5 NB Near Going	53	52	53	51	48	47	46	46	46	47	46	45	47	48	48	46	45	43	42	42	42	42	42	45	42	41	42	40	39	39	24	15	14	13	13	13	13	12	13	
Option D1: Double Braid (Northbound Average Speeds)																																								
I-5 NB Near 84	47	46	47	46	35	34	34	34	35	35	34	35	36	36	37	36	39	37	37	36	37	37	36	34	44	46	45	45	40	39	39	37	34	33	33	33	34	34	34	34
I-5 NB Near 84	56	55	56	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	53	52	34	55	55	56	55	55	55	55	55	55	55	55	55	55	54	54	
I-5 NB Near Multnomah	55	55	55	55	55	55	54	54	55	55	55	54	55	55	55	55	55	55	55	55	52	45	38	29	55	55	56	55	55	55	55	55	55	55	55	55	54	53	49	
I-5 NB Near Weidler	55	54	54	54	54	54	54	54	54	54	54	54	54	54	54	53	54	53	53	53	53	53	53	53	55	55	55	55	55	55	55	55	54	54	54	54	54	52	51	
I-5 NB Bt Broadway/Weidler	55	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	55	55	55	55	55	55	55	55	54	54	54	54	54	53	51	50
I-5 NB Near Broadway	53	53	53	53	53	53	52	52	53	53	52	52	53	53	52	52	53	53	52	52	53	53	53	54	54	54	54	54	54	54	54	54	53	54	53	52	51	49	45	
I-5 NB BT 405/Weidler	53	52	53	53	51	51	51	52	52	50	51	51	51	51	51	52	51	50	51	50	51	51	52	53	54	55	54	54	54	55	55	54	54	53	54	52	50	45	44	43
I-5 NB Near 405	56	55	55	55	55	54	54	54	55	54	54	54	54	54	54	54	54	53	53	53	53	54	54	54	55	55	55	55	55	55	55	54	46	32	24	19	21	21	20	
I-5 NB Near Going	53	52	52	51	48	47	45	47	46	47	46	47	47	48	48	47	45	43	43	44	41	40	42	46	41	41	43	41	39	38	24	15	14	12	13	13	13	12	13	13
Option D2: Double Braid with two lane flyover (Northbound Average Speeds)																																								
I-5 NB Near 84	48	45	47	45	36	34	34	34	35	35	34	35	36	36	36	35	39	37	36	36	38	36	35	33	44	46	46	45	39	39	38	37	34	33	34	33	34	34	34	34
I-5 NB Near 84	56	55	56	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	52	50	41	55	55	56	55	55	55	55	55	55	55	55	55	55	54	53	
I-5 NB Near Multnomah	56	55	55	55	55	55	54	54	55	55	55	55	55	55	55	55	55	55	55	55	52	44	36	33	56	56	56	55	55	55	55	55	55	55	55	55	55	54	52	48
I-5 NB Near Weidler	55	54	54	55	54	53	54	54	54	54	54	54	54	54	54	53	54	54	53	53	53	53	54	54	55	55	55	55	55	55	55	55	54	54	54	54	54	54	51	47
I-5 NB Bt Broadway/Weidler	55	54	55	55	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	55	55	55	55	55	55	55	55	54	54	54	54	54	54	54	54	53	50	48	
I-5 NB Near Broadway	54	53	53	53	53	52	52	53	53	53	53	52	52	52	53	52	53	53	52	52	53	53	54	54	54	54	55	54	54	54	54	54	54	54	54	53	50	49	47	45
I-5 NB BT 405/Weidler	53	52	51	54	51	50	50	51	52	51	51	51	51	52	51	52	52	51	50	50	51	52	53	54	54	55	54	54	54	55	54	54	53	53	54	50	46	41	42	39
I-5 NB Near 405	56	55	55	55	55	54	54	55	55	55	55	55	55	54	54	54	54	53	53	53	53	54	54	54	55	55	55	55	55	55	55	54	47	31	26	19	19	21	21	
I-5 NB Near Going	53	53	52	51	49	47	45	47	47	46	47	46	47	48	49	47	45	43	42	43	41	42	43	45	41	41	41	40	39	39	25	14	14	13	13	13	13	12	13	

Table 8 – Spot Speed Data for All Options Southbound

SB Location	6:00 AM	6:15 AM	6:30 AM	6:45 AM	7:00 AM	7:15 AM	7:30 AM	7:45 AM	8:00 AM	8:15 AM	8:30 AM	8:45 AM	9:00 AM	9:15 AM	9:30 AM	9:45 AM	12:00 PM	12:15 PM	12:30 PM	12:45 PM	1:00 PM	1:15 PM	1:30 PM	1:45 PM	2:00 PM	2:15 PM	2:30 PM	2:45 PM	3:00 PM	3:15 PM	3:30 PM	3:45 PM	4:00 PM	4:15 PM	4:30 PM	4:45 PM	5:00 PM	5:15 PM	5:30 PM	5:45 PM
Option A1: No-build (Southbound Average Speeds)																																							
I-5 SB Near Going	52	50	50	48	42	41	33	25	22	23	25	26	25	24	27	29	52	49	44	33	25	25	23	21	52	50	38	26	25	28	31	31	30	31	29	29	30	22	19	19
I-5 SB Near 405	53	53	53	53	52	45	26	20	21	21	22	21	21	23	23	23	52	50	33	24	23	22	21	19	49	34	22	21	21	23	26	24	26	28	27	26	22	21	18	19
I-5 SB Bt 405/Broadway	55	54	55	55	40	19	15	14	15	15	15	15	15	16	15	16	48	23	16	15	15	15	14	14	24	16	15	15	15	17	16	16	17	16	16	16	15	14	14	15
I-5 SB Near Broadway	48	46	45	46	30	20	18	19	19	20	20	20	20	20	20	21	34	19	20	19	20	19	17	17	20	19	19	20	18	21	20	21	20	19	20	19	16	15	15	16
I-5 SB Near Broadway	50	49	49	50	44	36	31	31	33	38	39	38	38	40	37	40	44	35	38	31	34	33	28	24	36	32	30	37	32	39	38	40	38	34	34	34	24	19	18	19
I-5 SB Near Moda Center	51	49	50	50	44	34	30	29	32	37	38	36	36	37	35	39	42	34	33	29	32	29	27	23	35	30	28	35	31	38	36	38	35	33	32	32	22	19	17	18
I-5 SB Near Multnomah	52	50	50	51	39	28	27	29	29	31	31	32	32	34	35	35	38	34	33	32	33	32	32	30	34	33	33	35	34	36	35	36	36	35	34	34	31	30	30	30
I-5 SB Near 84	53	51	52	52	40	26	24	26	27	29	26	31	30	36	39	38	49	49	46	44	46	49	48	49	50	50	50	49	48	45	45	44	47	46	48	48	41	52	54	52
I-5 SB Near Morrison	56	55	55	56	54	53	53	53	54	53	53	54	54	54	54	54	55	55	54	55	55	55	55	56	55	55	56	55	55	55	55	54	55	55	47	44	40	40	41	40
Option A2: No-build with two lane flyover (Southbound Average Speeds)																																							
I-5 SB Near Going	51	50	50	49	42	41	34	25	22	24	25	26	24	25	30	36	51	49	50	43	39	40	32	25	52	52	50	45	38	38	36	37	34	38	40	45	51	43	22	18
I-5 SB Near 405	53	53	53	53	52	44	28	20	20	21	22	21	20	23	26	28	52	52	44	31	27	26	24	22	53	51	38	29	25	30	28	29	33	37	41	41	42	27	18	18
I-5 SB Bt 405/Broadway	55	55	55	55	40	17	14	15	15	16	15	15	15	16	16	16	50	30	19	16	16	16	15	14	31	17	16	16	17	17	17	17	17	18	17	17	17	14	13	13
I-5 SB Near Broadway	47	45	46	46	28	20	19	19	19	20	21	21	20	21	21	21	35	22	21	21	21	21	20	17	23	22	22	22	22	22	22	22	22	22	22	22	19	14	13	13
I-5 SB Near Broadway	50	49	49	50	47	42	33	31	33	38	44	42	41	45	46	46	48	46	47	46	46	45	38	28	47	47	45	46	47	47	47	47	47	47	47	47	37	20	17	18
I-5 SB Near Moda Center	51	50	51	51	49	43	30	28	32	38	43	40	40	47	47	48	49	48	48	48	48	46	37	27	47	47	44	46	47	48	48	48	48	48	48	48	34	17	16	16
I-5 SB Near Multnomah	54	54	54	54	47	35	21	21	23	29	28	31	27	40	43	46	49	48	49	49	50	45	30	19	50	49	44	49	43	50	48	49	48	46	47	45	28	16	15	16
I-5 SB Near 84	52	51	52	52	42	28	24	25	26	30	28	31	27	30	37	39	49	49	49	48	51	50	48	50	50	52	50	50	48	49	47	48	48	46	46	45	49	52	53	52
I-5 SB Near Morrison	56	55	55	56	55	54	53	53	53	54	53	54	54	54	54	54	55	55	55	55	55	55	56	56	55	56	56	55	55	55	55	55	55	55	47	43	42	42	41	42
Option B1: Auxiliary Lanes (Southbound Average Speeds)																																							
I-5 SB Near Going	52	51	50	50	40	42	41	41	35	33	32	34	36	41	39	41	51	49	50	50	47	45	34	29	52	52	52	50	47	42	44	44	42	43	45	47	52	52	34	24
I-5 SB Near 405	53	53	53	53	52	52	52	52	52	52	52	52	50	51	52	52	52	52	51	50	48	40	28	25	53	53	53	51	48	45	48	52	53	53	53	53	53	45	23	25
I-5 SB Bt 405/Broadway	54	54	54	54	53	49	52	50	48	44	43	43	46	49	50	52	52	51	51	48	38	25	18	16	50	45	29	25	25	27	31	39	45	49	49	50	47	26	15	20
I-5 SB Near Broadway	54	54	54	55	53	52	53	52	51	47	45	46	50	53	51	52	53	52	51	46	45	43	40	39	50	38	27	26	32	48	51	52	53	53	53	44	41	48	41	
I-5 SB Near Broadway	54	54	54	54	53	52	52	51	48	44	42	44	45	49	49	50	52	47	38	34	34	36	34	34	44	31	26	24	26	40	47	49	51	51	52	50	35	29	43	36
I-5 SB Near Moda Center	54	54	54	54	53	52	51	46	43	42	40	40	42	46	47	50	51	43	34	31	32	32	32	31	40	30	27	25	27	36	43	46	50	50	51	49	33	26	38	35
I-5 SB Near Multnomah	55	55	55	55	51	48	43	49	50	51	49	46	50	53	53	53	55	54	54	53	54	54	55	55	55	55	55	54	54	53	54	54	55	55	54	54	55	56	56	56
I-5 SB Near 84	55	55	55	55	51	48	43	49	50	51	49	46	50	53	53	53	55	54	54	53	54	54	55	55	55	55	55	54	54	53	54	54	55	55	54	54	55	56	56	56
I-5 SB Near Morrison	56	56	56	56	54	54	54	54	54	54	54	54	54	55	55	55	56	55	55	55	56	56	56	56	55	55	55	55	54	54	54	54	54	54	46	42	41	41	42	41
Option B2: Auxiliary lanes with two lane flyover (Southbound Average Speeds)																																							
I-5 SB Near Going	52	51	48	50	41	40	38	39	35	31	34	33	37	41	41	41	51	49	50	50	49	48	48	45	52	52	52	50	48	42	44	44	42	43	45	47	52	54	48	27
I-5 SB Near 405	53	53	53	53	52	52	52	52	52	52	52	52	52	52	52	52	52	52	51	52	52	52	50	37	53	53	53	52	53	52	53	53	53	53	53	53	53	51	34	20
I-5 SB Bt 405/Broadway	54	54	54	55	53	52	52	52	51	52	51	50	53	52	53	52	52	51	52	52	52	51	39	20	51	51	49	47	43	44	47	51	51	50	50	51	50	42	18	15
I-5 SB Near Broadway	55	54	55	55	53	53	53	53	53	53	51	52	53	54	53	54	53	53	53	53	53	51	34	19	53	52	49	45	43	49	53	54	54	53	53	53	51	37	26	42
I-5 SB Near Broadway	54	54	54	54	53	52	53	52	52	52	50	50	50	51	53	53	52	51	52	52	52	45	27	19	51	49	45	38	37	45	51	52	53	52	52	52	48	28	22	36
I-5 SB Near Moda Center	54	54	54	54	53	53	52	52	52	52	50	49	49	51	52	53	52	52	52	51	41	27	22		51	49	42	37	36	42	49	52	53	52	52	53	46	29	24	29
I-5 SB Near Multnomah	55	55	55	55	51	46	45	44	44	50	48	46	51	54	53	54	54	54	54	53	53	52	51	51	54	54	53	52	51	51	52	54	54	54	54	54	54	53	54	54
I-5 SB Near 84	55	55	55	55	51	46	45	44	44	50	48	46	51	54	53	54	54	54	54	53	53	52	51	51	54	54	53	52	51	51	52	54	54	54	54	54	54	53	54	54
I-5 SB Near Morrison	56	56	56	56	54	53	54	53	53	54	54	54	55	55	55	55	55	55	55	56	56	56	56	56	55	55	55	55	55	54	54	54	54	54	46	42	41	40	41	42
Option C1: Single Braid (Southbound Average Speeds)																																							
I-5 SB Near Going	51	51	49	49	45	39	43	42	36	32	31	29	34	41	40	42	50	49	49	49	50	43	35	24	52	52	52	49	48	43	43	43	41	43	44	48	52	46	21	18
I-5 SB Near 405	53	53	53	53	52	52	52	52	49	43	42	41	45	49	51	52	52	52	51	52	49	36	27	23	53	52	48	49	48	51	53	53	53	53	53	54	52	28	17	18
I-5 SB Bt 405/Broadway	55	54	55	55	53	52	53	48	36	30	32	32	35	42	49	51	53	53	52	39	30	22	17	16	48	30	26	25	25	40	47	52	51	50	50	51	39	13	13	14
I-5 SB Near Broadway	55	55	55	55	53	52	51	46	36	37	38	40	38	47	52	54	54	53	47	31	27	21	19	17	41	30	28	25	33	49	52	54	53	53	53	52	30	13	13	13
I-5 SB Near Broadway	52	52	52	52	48	47	44	41	32	34	34	34	35	39	45	49	47	41	34	28	25	24	23	22	32	26	26	24	29	40	46	47	49	48	48	45	30	23	25	23
I-5 SB Near Moda Center	55	55	55	55	54	53	53	53	53	52	53	52	51	53	54	54	54	54	54	53	53	53	54	53	54	54	54	53	53	54	54	54	54	54	54	54	55	55	56	55
I-5 SB Near Multnomah	54	54	54	54	52	52	52	51	52	51	51	50	49	53	53	53	54	53	53	52	53	53	53	53	54	54	53	53	52	53	53	53	54	53	54	53	54	55	55	55
I-5 SB Near 84	54	53	53	53	45	43	43	39	45	44	42	40	42	49	51	52	53	52	52	50	51	52	53	53	53	53	53	52	51	51	52	52	52	52	52	52	53	53	54	54
I-5 SB Near Morrison	56	55	55	55	54	54	54	54	54	54	53	53	54	55	55	55	55	55	55	56	56	56	56	56	55	55	55	55	55	54	54	54	54	54	46	41	40	40	41	41
Option C2: Single Braid with two lane flyover (Southbound Average Speeds)																																							
I-5 SB Near Going	52	50	50	50	44	41	44	40	37	36	34	32	37	41	38	39	49	49	50	50	50	48	47	33	52	52	52	50	48	42	44	44	42	43	45	47	52	52	37	18
I-5 SB Near 405	53	53	53	54	52	52	52	52	52	52	52	52	50	50	51	52	52	52	52	52	52	51	42	26	53	53	53	52	47	52	53	53	53	53	53	53	52	46	21	19
I-5 SB Bt 405/Broadway	55	54	54	55	53	51	53	52	51	51	51	50	49	50	50	53	53	52	52	53	53	52	47	25	16	52	51	43	35	28	38	45	51	52	50	51	51	47	30	13	15
I-5 SB Near Broadway	55	55	54	55	53	52	53	52	53	52	51	49	50	51	53	53	54	53	53	53	53	53	39	21	17	53	51	38	30	34	45	51	51	53	53	53	53	48	21	14	14
I-5 SB Near Broadway	53	52	52	53	50	50	49	49	48	48	46	45	47	47	48	49	48	46	48	48	45	37	31	31	48	44	37	35	36	41	46	48	49	49	49	49	45	33	32	32
I-5 SB Near Moda Center	55	55	55	55	54	54	54	53	53	54	53	53	54	54	54	54	54	54	54	54	54	54	54	54	54	55	54	54	53	53	54	54	54	54	54	54	55	55	55	55
I-5 SB Near Multnomah	54	54	54	54	52	52	52	48	50	52	52	51	53	53	53	53	53	53	54	54	53	53	53	53	53	54	54	54	53	53	52	53	53	53	53	54	54	54	55	55
I-5 SB Near 84	54	53	53	54	45	41	39	36	40	42	44	44	49	51	51	51	53	52	52	51	52	52	52	53	52	53	52	52	50	52	51	52	52	52	52	52	53	53	53	53
I-5 SB Near Morrison	56	56	55	56	54	53	54	54	53	54	53	54	55	55	55	55	55	55	56	55	55	56	56	56	55	55	55	55	54	54	53	54	54	54	46	42	40	40	39	40
Option D1: Double Braid (Southbound Average Speeds)																																							
I-5 SB Near Going	51	50	50	49	46	41	42	37	31	32	30	32	36	39	44	45	50	49	50	50	50	47	37	24	52	52	52	50	46	40	44	44	43	44	46	47	52	45	20	19
I-5 SB Near 405	53	53	53	53	52	52	52	52	51	50	47	48	49	47	50	52	52	51	52	51	50	39	30	24	53	51	42	45	47	51	53	53	53	53	53	50	27	18	19	
I-5 SB Bt 405/Broadway	55	54	55	55	53	52	52	49	45	41	40	37	40	46	49	53	53	53	52	41	33	24	21	18	46	31	27	27	27	43	49	52	52	52	52	52	40	15	14	16
I-5 SB Near Broadway	55	55	55	55	54	54	53	50	41	44	42	41	42	48	53	54	54	53	51	36	28	24	21	19	41	30	29	28	33	51	53	54	54	54	54	53	32	15	14	16
I-5 SB Near Broadway	52	52	52	53	49	50	47	42	28	31	31	32	31	39	44	49	46	41	30	24	18	16	13	13	26	18	18	16	21	35	45	49	50	49	50	46	21	11	11	12
I-5 SB Near Moda Center	54	54	55	55	52	52	52	51	47	48	48	48	49	51	52	53	54	52	50	47	48	48	48	48	51	50	50	50	51	53	54	54	54	54	54	51	51	50	50	
I-5 SB Near Multnomah	56	56	56	56	55	55	55	55	54	55	54	55	55	56	55	56	56	56	56	55	55	55	55	55	55	55	55	54	55	55	55	55	55	55	55	55	56	56	56	56
I-5 SB Near 84	56	56	56	56	55	55	55	55	55	55	55	55	55	56	56	56	56	56	56	56	56	56	56	56	55	55	55	55	55	55	55	55	55	55	55	55	56	56	56	56
I-5 SB Near Morrison	56	56	55	56	54	55	54	54	53	54	53	54	54	55	55	55	55	55	55	55	55	56	56	56	55	55	55	54	53	53	54	54	54	54	46	41	40	40	42	40
Option D2: Double Braid with two lane flyover (Southbound Average Speeds)																																							
I-5 SB Near Going	50	51	50	49	43	39	40	35	39	35	36	29	37	36	44	42	50	49	50	50	50	49	46	32	52	52	52	49	47	44	44	44	42	43	45	47	51	49	31	19
I-5 SB Near 405	53	53	54	53	53	52	52	52	52	52	52	52	44	41	44	45	52	51	52	52	52	51	40	23	53	53	52	51	46	51	53	53	53	53	53	54	52	41	21	21
I-5 SB Bt 405/Broadway	55	54	55	55	54	53	53	52	53	51	42	40	40	40	40	40	53	53	52	53	52	43	24	17	52	52	37	31	29	37	42	46	50	50	51	51	46	25	15	16
I-5 SB Near Broadway	55	55	55	55	54	54	54	54	54	54	49	41	39	40	48	48	54	53	54	53	51	37	24	22	54	50	34	29	34	42	48	49	51	52	54	52	44	20	14	16
I-5 SB Near Broadway	52	52	52	52	51	50	50	50	46	47	38	29	30	33	39	37	46	43	45	41	36	20	16	16	46	34	23	21	22	30	39	43	46	45	47	47	37	14	10	11
I-5 SB Near Moda Center	55	54	55	55	54	53	53	53	52	52	50	49	50	51	48	48	54	53	53	52	52	49	48	49	54	53	50	50	50	50	52	53	54	53	53	54	53	51	52	51
I-5 SB Near Multnomah	57	56	56	56	56	56	55	56	55	56	56	55	56	56	56	55	56	56	56	56	56	55	55	56	56	55	55	55	55	55	55	55	55	55	55	55	56	56	56	56
I-5 SB Near 84	56	56	56	56	56	56	55	56	55	56	56	55	56	56	56	55	56	56	56	56	56	56	56	56	56	55	55	55	55	55	55	55	55	55	55	55	56	56	57	57
I-5 SB Near Morrison	56	56	56	56	55	55	54	54	54	54	54	54	55	55	55	54	55	55	55	55	55	56	55	56	55	55	54	54	54	53	53	54	54	54	45	40	40	39	41	41

Legend	< 20 mph	19	20-30 mph	25	30-40 mph	35	40-50 mph	45	>50 mph	51.0

Emergency Braking

HDR developed a new methodology that evaluates the correlation between "emergency braking" events and crashes on the freeway in order to analyze and compare the different options for potential safety improvements. An emergency braking instance is defined by a vehicle deceleration rate faster than 14.8 ft/s^2. *A Policy on Geometric Design of Highways and Streets*[12] notes that the majority of drivers decelerate at a rate of 11.2 ft/s^2 when confronted by an unexpected object, however, the Team chose 14.8 ft/s^2 as a more conservative threshold.

The emergency braking analysis was based on the assumption that higher frequency of emergency braking events correlates with greater likelihood of vehicle crashes. In order to capture each of these events within the models, the Team collected second-by-second data for all vehicles on the network during the a.m., m.d., and p.m. peak periods. This data captured vehicle characteristics such as location on the freeway, speed, acceleration, and various other attributes.

Once these characteristics were compiled, the Team grouped all vehicles that experienced an emergency braking event, or a deceleration rate greater than 14.8 ft/s^2, according to location and mapped the locations in GIS to generate a network-wide heat map of the freeways, highlighting the most concentrated areas of emergency braking events. The braking event data for each option was sorted by direction and segmented into two sections on the northbound and southbound directions of the freeway and then compared with Option A2 – No Build, as shown in Table 9. As shown, the emergency braking events are greatly reduced in many of the build options when compared to No Build. More emergency braking data can be found in Appendix G.

To verify that the frequency of emergency braking events correlate to a higher likelihood of crashes, the Team compared the output of the calibrated existing conditions VISSIM model to a summary of crash data in the same area over the last five years.

The Team utilized the VISSIM model to summarize the emergency braking events on I-5 between the Going Street ramps and the Morrison Bridge ramps. The Team compiled 10 hours worth of model data to determine the total number of crashes by direction for these segments. The crash data over the last five years was also sorted within the same 10-hour period and for the same locations: between the Going Street ramps and the Morrison Bridge ramps.

Graph 3 shows the comparison of the crash data with the emergency braking events observed in the VISSIM model. Based on this sample, it can be concluded there is a correlation between the emergency braking events and number of crashes; however, it should be noted that this is a small sample set.

Graph 3 – Emergency Braking and Crash Data Correlation

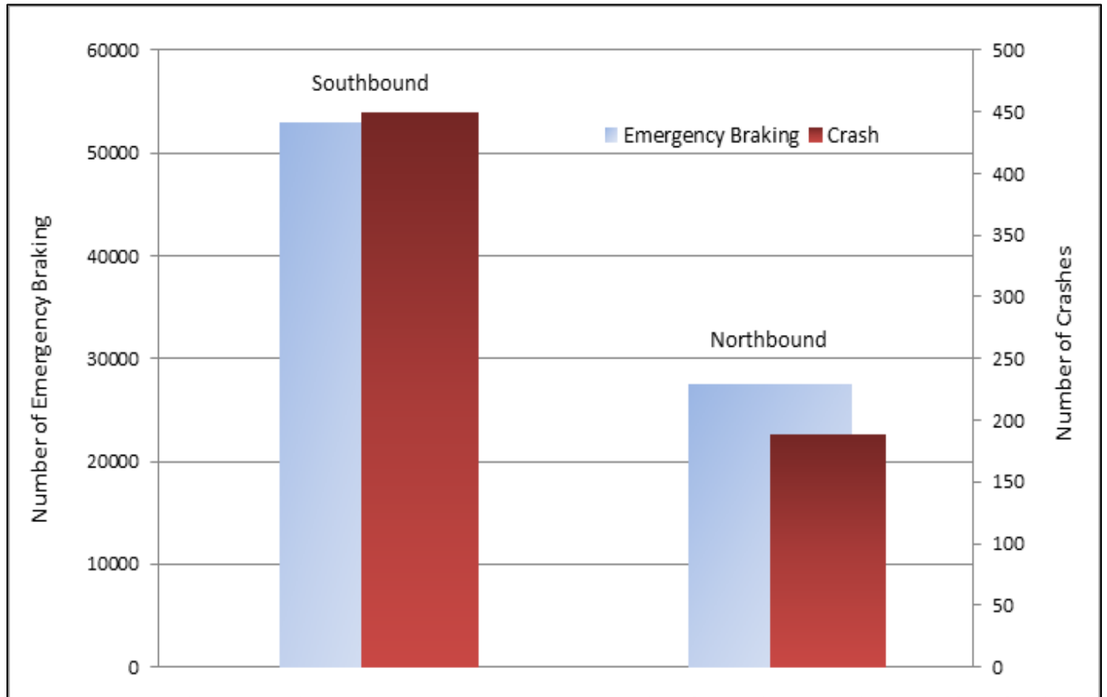


Table 9 – Emergency Braking Events

BUILD OPTIONS EMERGENCY BRAKING REDUCTION PERCENTAGE						
Option A2: No-build	-	-	-	-	-	-
Option A1: No-build with two lane flyover	5-20%	<5%	5-20%	<5%	5-20%	5-20%
Option B1: Auxiliary lanes with two lane flyover	>60%	<5%	>60%	<5%	>60%	40-60%
Option B2: Auxiliary Lanes	>60%	<5%	>60%	<5%	>60%	40-60%
Option C1: Double Braid with two lane flyover	>60%	>60%	>60%	<5%	>60%	5-20%
Option C2: Double Braid	>60%	40-60%	>60%	<5%	>60%	40-60%
Option c1: Single Braid with two lane flyover	>60%	>60%	>60%	<5%	>60%	5-20%
Option c2: Single Braid	>60%	40-60%	>60%	<5%	>60%	40-60%

[12] AASHTO, *Policy on Geometric Design of Highways and Streets,* 6th Edition, 2011

Volume Throughput

The Team used volume output files from VISSIM to determine volume of the freeway for all peak period hours in the form of percentage of demand unserved. Table 10 and Table 11 show the Northbound and Southbound percentage of traffic that was not served at the exit points of each direction within the model compared to the demand for the freeway. The tables show that the 1:00 to 2:00 p.m. and 5:00 to 6:00 p.m. peak hours for southbound traffic and the 4:00 to 6:00 p.m. peak hours for northbound traffic are the most congested with the highest number of vehicles not being served in those hours.

The overall southbound demand is met better under Option B1, B2, C1, C2, D1, and D2 with generally more traffic being served with the two lane flyover for I-84. The overall northbound traffic did not see improvement. Unserved traffic demand in the northbound direction is caused by a bottleneck north of the Study Area.

Table 10 – Percent Unserved I-5 Southbound

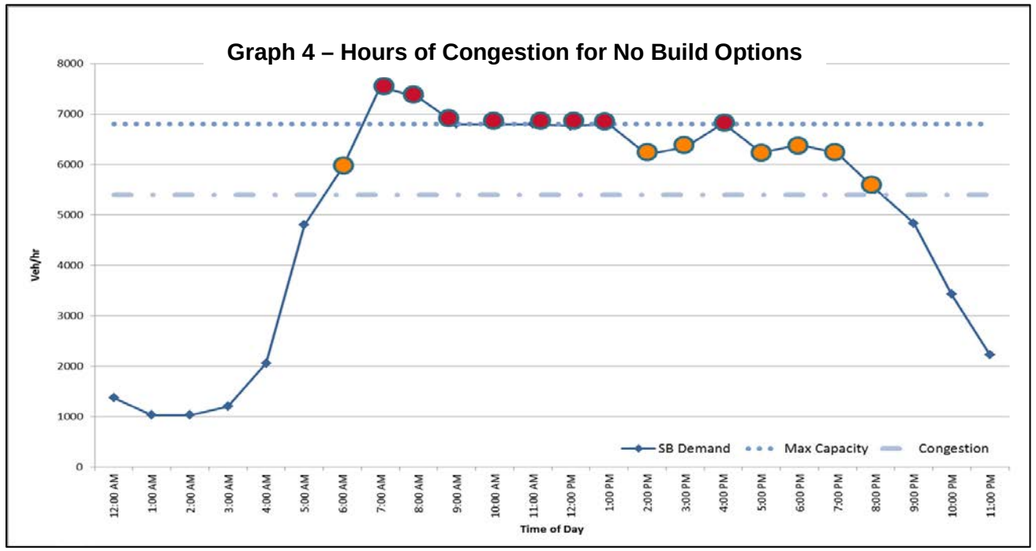
Time	Option A1 Served Vol	Option A2 Served Vol	Option B1 Served Vol	Option B2 Served Vol	Option C1 Served Vol	Option C2 Served Vol	Option c1 Served Vol	Option c2 Served Vol
6:00 AM	2%	2%	2%	2%	2%	3%	2%	2%
7:00 AM	20%	21%	8%	9%	7%	8%	8%	8%
8:00 AM	17%	18%	6%	8%	7%	8%	5%	10%
9:00 AM	3%	4%	2%	0%	2%	1%	4%	-1%
12:00 PM	9%	13%	3%	7%	4%	6%	3%	5%
1:00 PM	12%	15%	12%	15%	16%	15%	12%	15%
2:00 PM	10%	15%	6%	11%	7%	9%	6%	8%
3:00 PM	9%	13%	4%	4%	4%	3%	4%	4%
4:00 PM	4%	11%	5%	5%	3%	4%	5%	6%
5:00 PM	34%	32%	30%	35%	31%	35%	29%	34%
Total Unserved	12%	14%	7%	9%	8%	8%	7%	9%

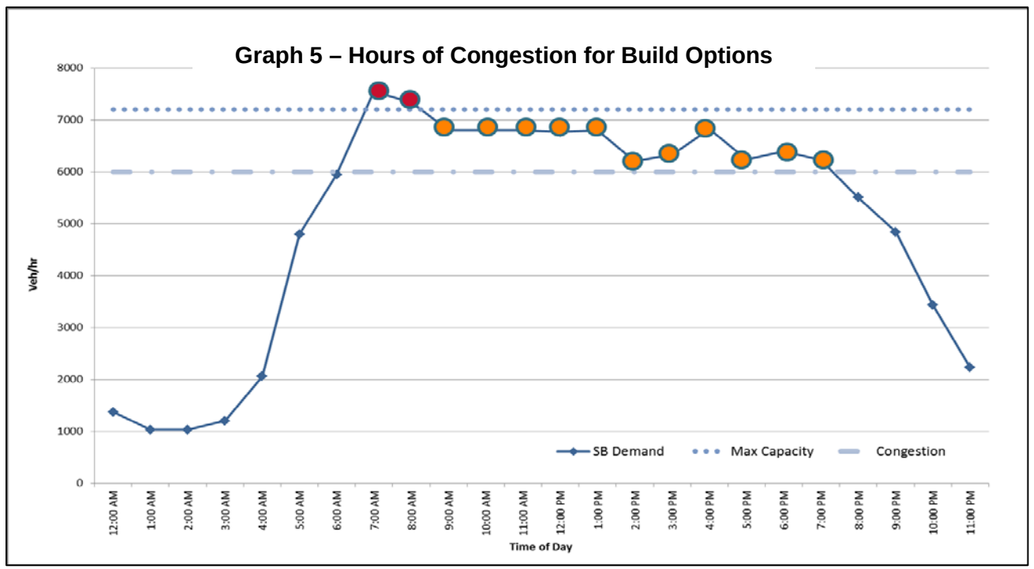
Table 11 – Percent Unserved Northbound

Time	Option A1 Served Vol	Option A2 Served Vol	Option B1 Served Vol	Option B2 Served Vol	Option C1 Served Vol	Option C2 Served Vol	Option c1 Served Vol	Option c2 Served Vol
6:00 AM	2%	2%	2%	2%	2%	2%	2%	2%
7:00 AM	6%	5%	5%	5%	5%	5%	5%	5%
8:00 AM	3%	3%	3%	3%	2%	2%	3%	2%
9:00 AM	0%	0%	1%	1%	1%	1%	1%	0%
12:00 PM	4%	3%	2%	2%	2%	2%	2%	2%
1:00 PM	4%	1%	2%	3%	3%	2%	4%	2%
2:00 PM	1%	1%	1%	1%	1%	1%	1%	1%
3:00 PM	8%	8%	8%	9%	8%	8%	8%	8%
4:00 PM	30%	30%	31%	31%	30%	30%	30%	30%
5:00 PM	30%	30%	30%	30%	30%	30%	30%	35%
Total Unserved	10%	9%	9%	10%	10%	9%	10%	10%

Hours of Congestion

To better understand the amount of time a vehicle would be stuck in traffic, the Team evaluated the daily Hours of Congestion for each option on I-5 near the Broadway and Weidler overpasses. This analysis was based on VISUM data to help build the demand curve and VISSIM to help identify the capacity and congestion levels. Since the freeway has similar capacities for all the build options in this location, the hours of congestion are represented as No Build and Build, with No Build representing Option A1 and Option A2, and Build representing all other options. Graph 4 and Graph 5 show that the hours of congestion do not decrease significantly, but the hours of severe congestion or traffic demand above capacity decrease under the build scenario.





Intersection Analysis

The Team analyzed the arterial network at the Broadway-Weidler Interchange to determine the operational performance of each option. The criteria for the overall performance included Level-of-Service (LOS) and vehicle delay at each intersection. The Team compared the criteria at an hour-by-hour level. The build options also included signal timing improvements. Intersection reconfigurations in conjunction with the signal timing improvements will generally lead to shorter delay periods for vehicles and safer continuous connections for bicyclists and pedestrians. Appendix H provides the summary of the intersection analysis.

Shoulder Benefits

This section compiles non-simulation based analysis and research to provide an operational summary of potential improvements due to adding wider shoulders along the length of the corridor within the project area. On I-5, the shoulder widths vary greatly along the corridor. Many locations have narrow shoulders, ranging from 4-ft. to 7-ft. wide in the northbound direction and 5-ft to 7-ft. wide in the southbound direction. These locations are proposed for widening in order to improve the operations, safety, and incident recovery time on this corridor.

Safety and Incident Recovery

When traffic incidents occur on a freeway, the size of the roadway shoulder can greatly impact the freeway capacity and cause delay long after that incident has occurred. Narrow shoulders inhibit efficient accident recovery, first by preventing emergency vehicles from quickly accessing the location and second by forcing accident recovery to remain on the mainline, thus closing one or more lanes[13]. For I-5, recent incidents and their subsequent recovery periods greatly reduce the capacity and increase delay along the corridor, which reduces overall travel time reliability. From 2011 to 2013, incident data was collected from ODOT for the I-5 mainline. These incidents are reported in Tables 12 and 13 below:

Table 12 - Average Time per Year Spent with One or More Lanes Closed

Direction	Average Incidents per Year	Average Hours of Delay per Year (days)
NB	40	164 (7)
SB	71	279 (11)

Source: ODOT Incident Reporting 2011 to 2013

These reported incidents occurred between the Greeley On-Ramp and the Morrison Off-Ramp in the southbound direction and between the I-84 On-Ramp and the Greeley Off-Ramp in the northbound direction. The amount of reported delay per incident shows the average amount of time incident response vehicles needed to clear the incident after arriving and does not include wait times before the response teams arrives or wait times from the vehicles in the spillback. When looking at the average amount of time lost on I-5 from lane closures, the delay per year are significantly high, as seen in Table 14. For one or more lanes closed per incident, drivers lost an average of almost 7 and 12 days of driving per year for I-5 Northbound and Southbound, respectively. Similarly, Table 15 shows the amount of delay spent during all medium and high impact incidents for the three year period.

Table 13 – I-5 Medium or High Impact Incidents 2011-2013

Direction	Lanes Affected	Number of Incidents	Average Minutes of Delay (hours)
I-5 Northbound	Zero lanes affected	20	234 (3.9)
	One lane affected	17	249 (4.2)
	More than one lane affected	6	240 (4.0)
I-5 Southbound	Zero lanes affected	27	237 (4.0)
	One lane affected	61	236 (3.9)
	More than one lane affected	9	240 (4.0)

Source: ODOT Incident Reporting 2011 to 2013

As shown, even when zero lanes are affected (or closed) because of the incident, the average incident delay can last up to four hours minimum. These incidents occur more frequently in the southbound direction, which is to be expected, but the average delay in the northbound direction is longer. The inside shoulder in the northbound direction is particularly narrow, only 4-ft. at many points, particularly between the I-405 Off-Ramp and the Greeley On-Ramp.

The Federal Highway Administration (FHWA) recommends a minimum shoulder width of 8-ft on the mainline in order to efficiently and safely facilitate traffic during roadway incidents. Currently, the I-5 Corridor has a varying range of shoulder widths along the length of the Study Area. In certain areas, the outer (right-side) shoulders are as narrow as 5-ft.and the inner (left-side) shoulders are as narrow as 4-ft. Conversely, portions of the freeway have shoulders as wide as 15-ft. Consistent and wide shoulders along the length of the corridor would greatly benefit drivers on the freeway and allow for smoother accident recovery, thus increasing the overall reliability of travel time. As cited in the Highway Capacity Manual (HCM) 2010, not only does the blocked lane reduce capacity, it reduces a percentage of capacity greater than the proportion of the roadway that is blocked. Drivers' reactions to blocked lanes such as partaking in "rubbernecking", where drivers slow to observe the incident, contribute to this high loss of capacity. The addition of shoulders restores 45% of lost capacity for two-lane freeways and 35% of lost capacity for three-lane freeways. This increase is shown below in Figure 10.

[13] http://safety.fhwa.dot.gov/geometric/pubs/mitigationstrategies/chapter3/3_shoulderwidth.htm

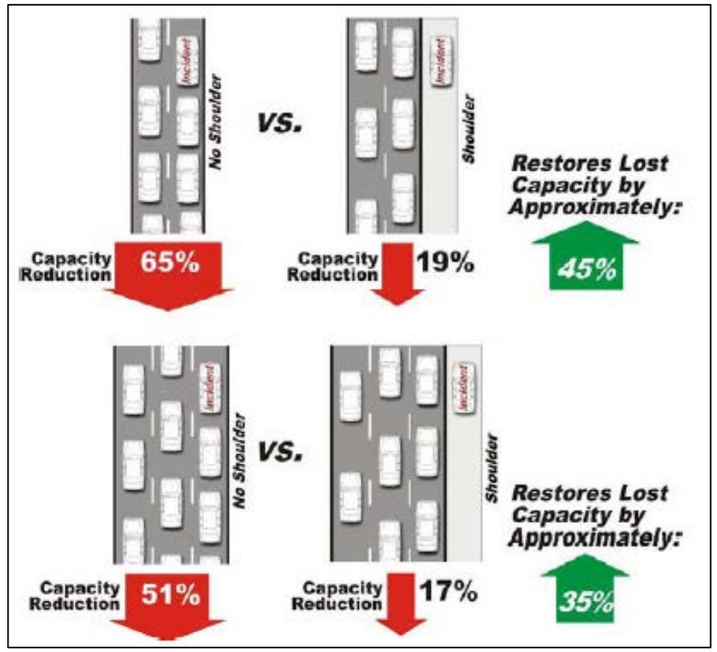


Image Source: OR 217 Interchange Management Study, DKS & Associates
Data Source: HCM 2010, Exhibit 10-17, Transportation Research Board

Figure 10 – Capacity Increase with Addition of Shoulder

Shoulder Widening

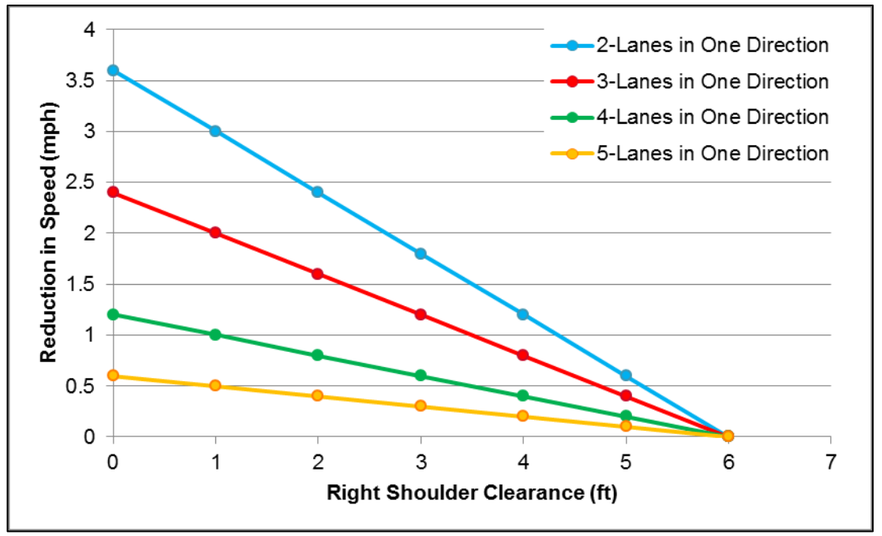
Shoulder width does not only impact the efficiency of accident recovery, but also plays a large role in the operational efficiency of a freeway during uninterrupted flow. As shown in Table 14 and Graph 6, as referenced from the HCM 2010 Manual, shoulder width greatly affects the free-flow speed of vehicles traveling on a freeway. Shoulder widths less than 6-ft. show a linear reduction in free flow speed for every foot lost of shoulder width. Based on this relationship, many sections of I-5 prevent vehicles from utilizing their maximum potential free flow speeds.

Table 14 – Operational Effects of Freeway Shoulder Widths

Right-Shoulder Lateral Clearance (ft)	Lanes in One Direction			
	2	3	4	≥5
≥6	0.0	0.0	0.0	0.0
5	0.6	0.4	0.2	0.1
4	1.2	0.8	0.4	0.2
3	1.8	1.2	0.6	0.3
2	2.4	1.6	0.8	0.4
1	3.0	2.0	1.0	0.5
0	3.6	2.4	1.2	0.6

Data Source: HCM 2010, Exhibit 11-9, Transportation Research Board

Graph 6 – Linear Relationship of Free Flow Speed Reduction and Shoulder Width of Freeway



Data Source: HCM 2010, Exhibit 11-9, Transportation Research Board

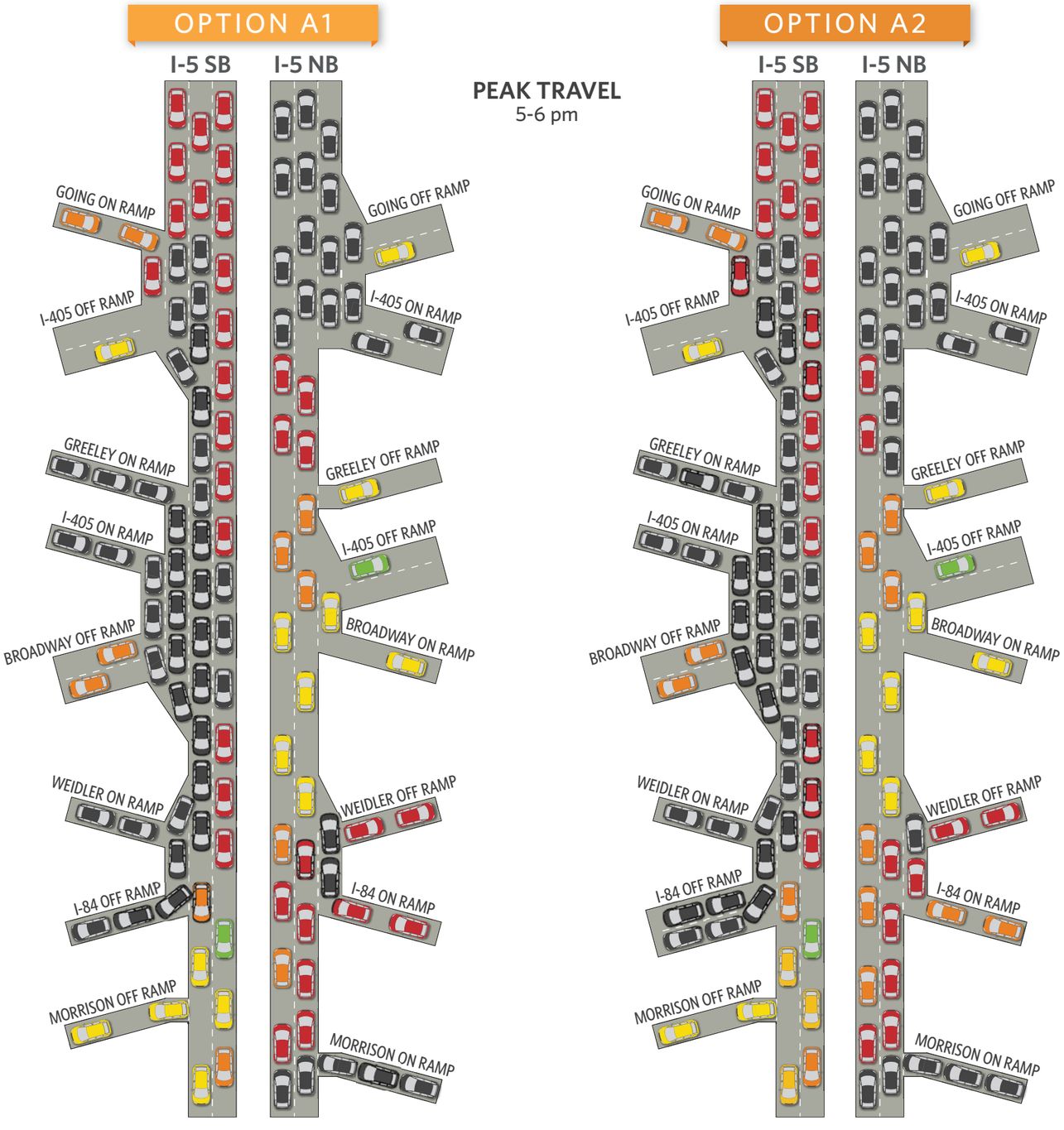
It is recommended that wider shoulders be placed on both the right and left side of the I-5 Corridor. These shoulders will greatly improve travel time reliability, especially during incidents, and will reduce the delay across the length of the corridor.

Comparison of Alternatives

The following section provides side-by-side comparisons (Figures 11 through 14) of some key measures of effectiveness for each option with and without the two lane flyover. These measures are lane-by-lane speeds in the p.m. peak hour from 5:00 p.m. to 6:00 p.m. and the vehicle delay, emergency braking instances, and unmet demand, each for the 10-hour model period. Table 15 provides a summary of options compared with Option A1 – No-Build. These comparisons show whether each option performs worse, the same, or better than Option A2 for travel time, travel time reliability, speed, volume throughput, emergency braking incidents, congestion, and intersection analysis.

I-5 BROADWAY/WEIDLER

Figure 11: Option A1 and A2



A1: NO BUILD

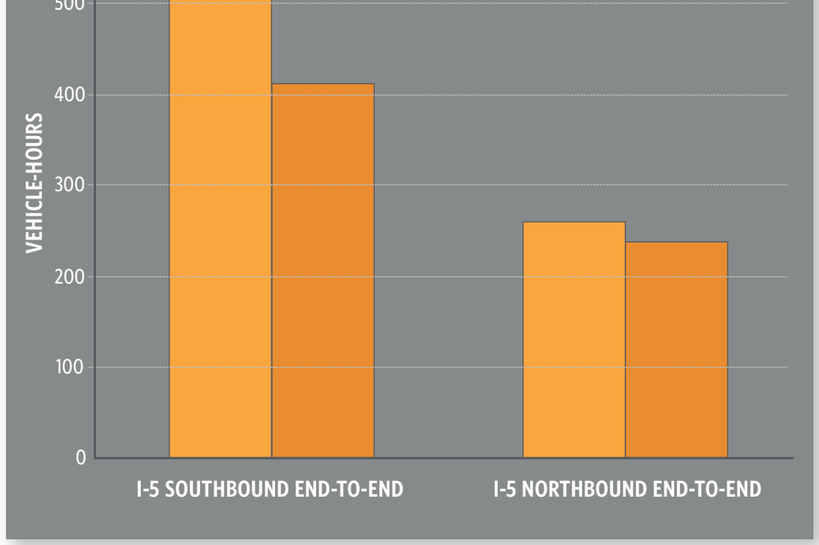
- Over 2,200 southbound and over 2,800 northbound vehicles cannot access this corridor and must take different routes, modes, or not make the trip per day.
- Has a potential 53% increase in southbound crashes compared to current crash rates and a potential 10% increase in northbound crashes.

A2: WITH 2 LANE FLYOVER

- Almost 2,000 southbound and almost 3,300 northbound vehicles cannot access this corridor and must take different routes, modes, or not make the trip per day.
- Has a potential 16% reduction in southbound crashes compared to No Build and a potential 6% reduction in northbound crashes.

COST BENEFIT: $102M

10-HOUR VEHICLE DELAY

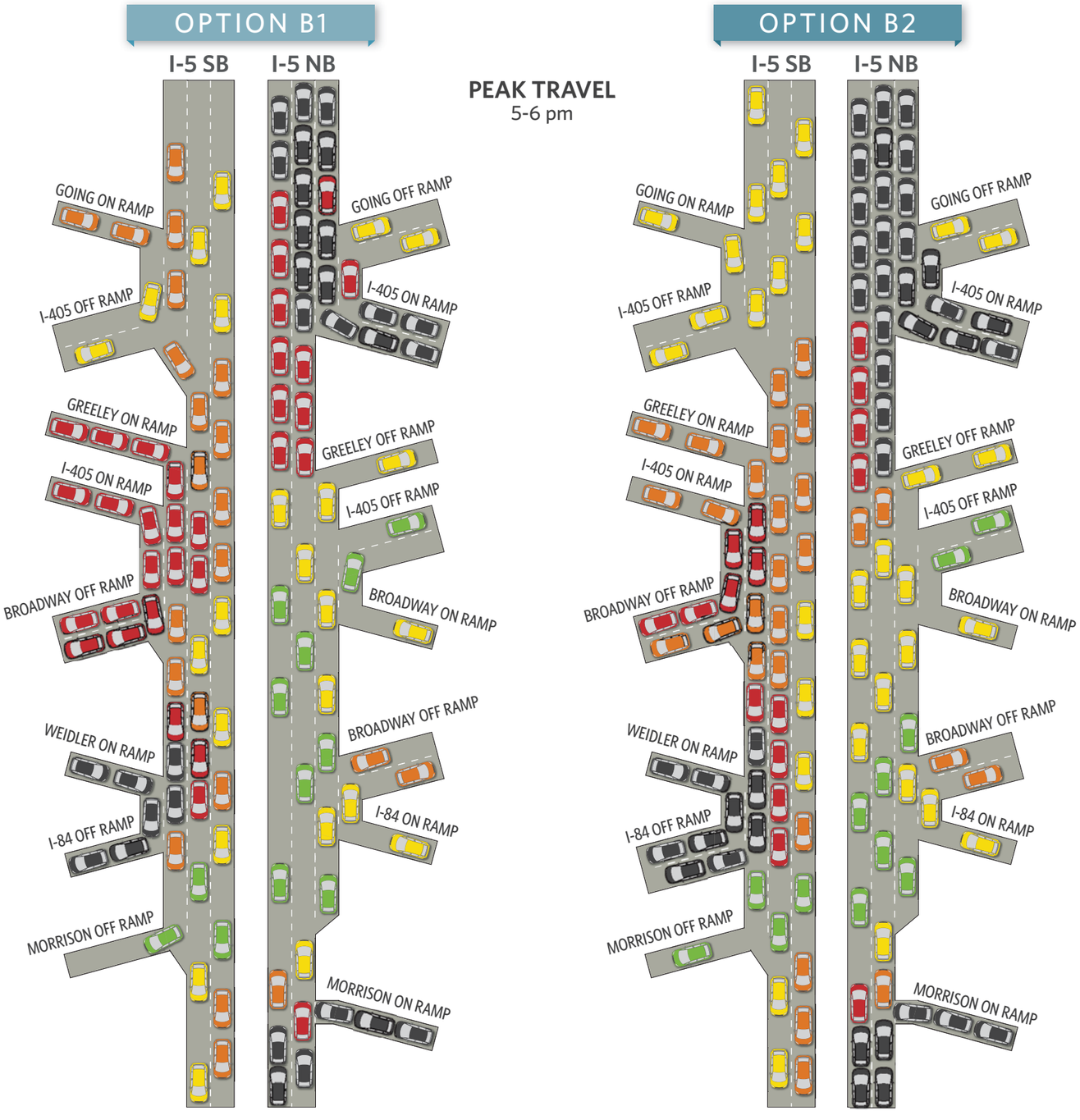


LEGEND

> 50 mph | 40 to 50 mph | 30 to 40 mph | 20 to 30 mph | < 20 mph

I-5 BROADWAY/WEIDLER

Figure 12: Option B1 and B2



B1: AUXILIARY LANES

- Almost 1,300 southbound and almost 3,300 northbound vehicles cannot access this corridor and must take different routes, modes, or not make the trip per day.
- Has a potential 58% reduction in southbound crashes compared to No Build and a potential 21% reduction in northbound crashes.

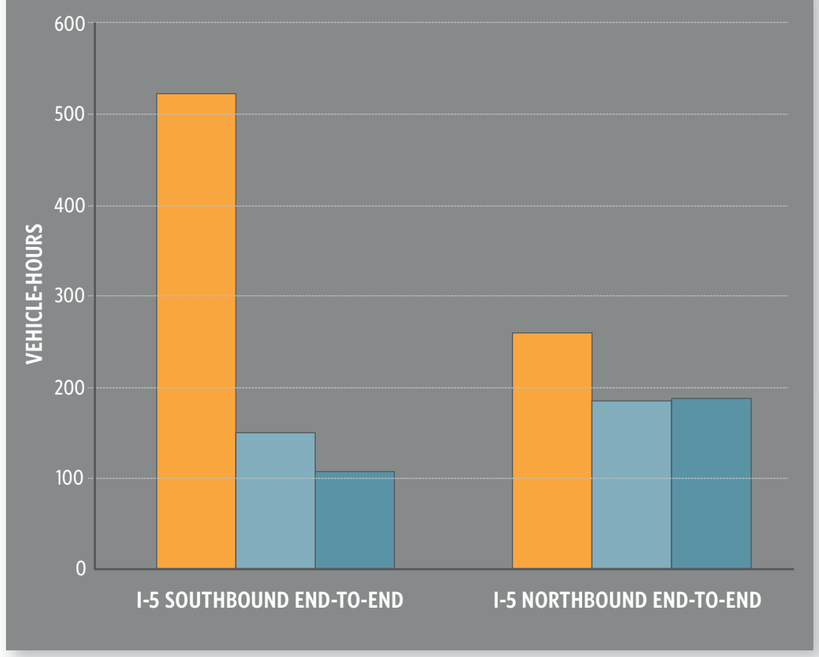
COST BENEFIT: $372M

B2: WITH 2 LANE FLYOVER

- Almost 1,000 southbound and almost 2,900 northbound vehicles cannot access this corridor and must take different routes, modes, or not make the trip per day.
- Has a potential 63% reduction in southbound crashes compared to No Build and a potential 20% reduction in northbound crashes.

COST BENEFIT: $430M

10-HOUR VEHICLE DELAY



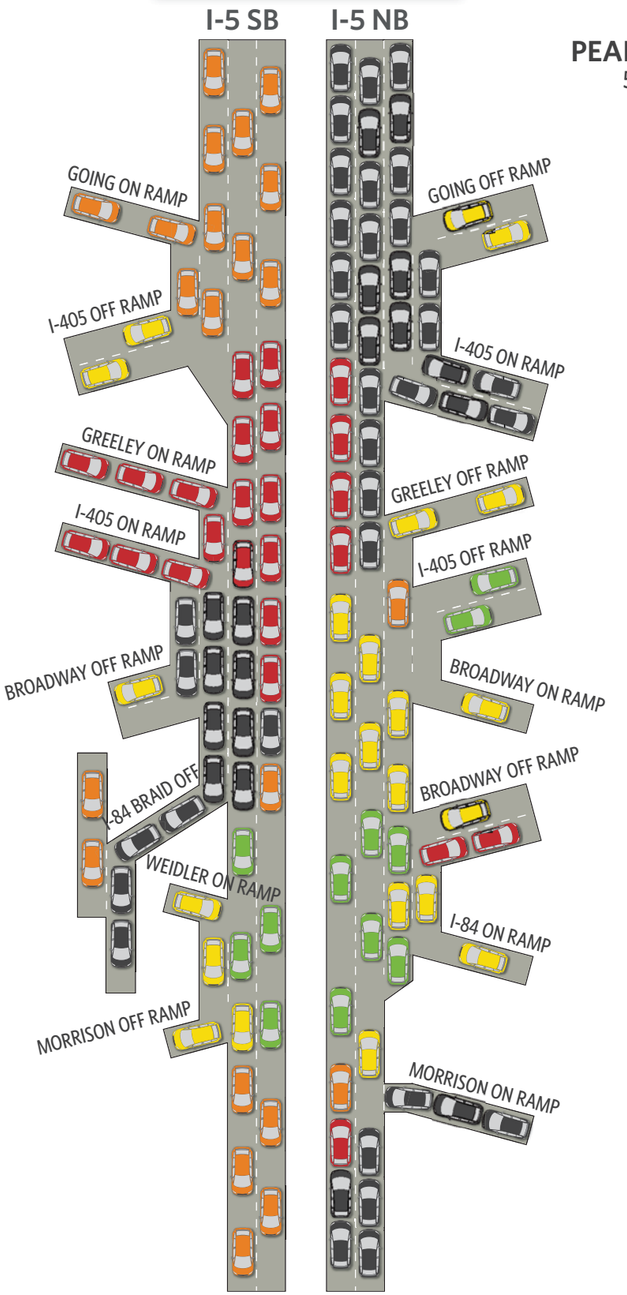
LEGEND

> 50 mph | 40 to 50 mph | 30 to 40 mph | 20 to 30 mph | < 20 mph

I-5 BROADWAY/WEIDLER

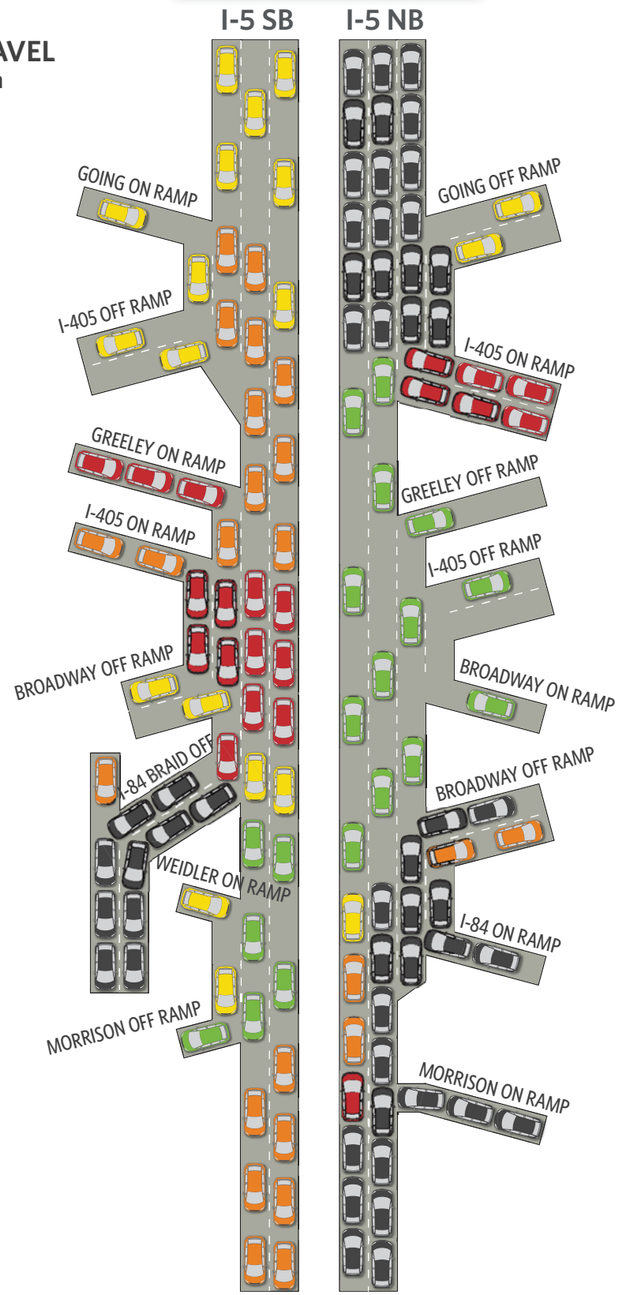
Figure 13: Option C1 and C2

OPTION C1



PEAK TRAVEL
5-6 pm

OPTION C2



C1: SINGLE BRAID

- Almost 1,300 southbound and almost 2,900 northbound vehicles cannot access this corridor and must take different routes, modes, or not make the trip per day.
- Has a potential 69% reduction in southbound crashes compared to No Build and a potential 18% reduction in northbound crashes.

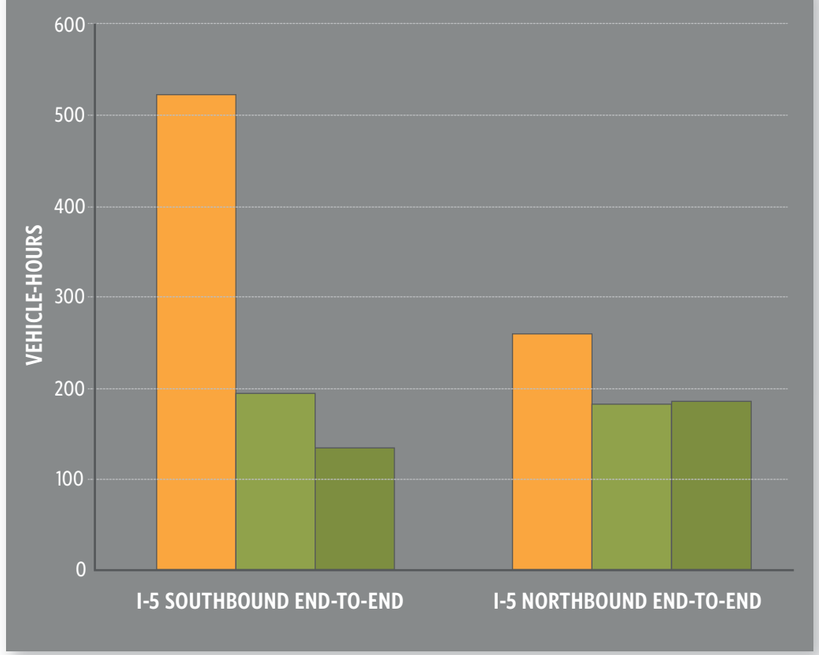
COST BENEFIT: $381M

C2: WITH 2 LANE FLYOVER

- Almost 1,600 southbound and almost 3,300 northbound vehicles cannot access this corridor and must take different routes, modes, or not make the trip per day.
- Has a potential 53% reduction in southbound crashes compared to No Build and a potential 21% reduction in northbound crashes.

COST BENEFIT: $441M

10-HOUR VEHICLE DELAY



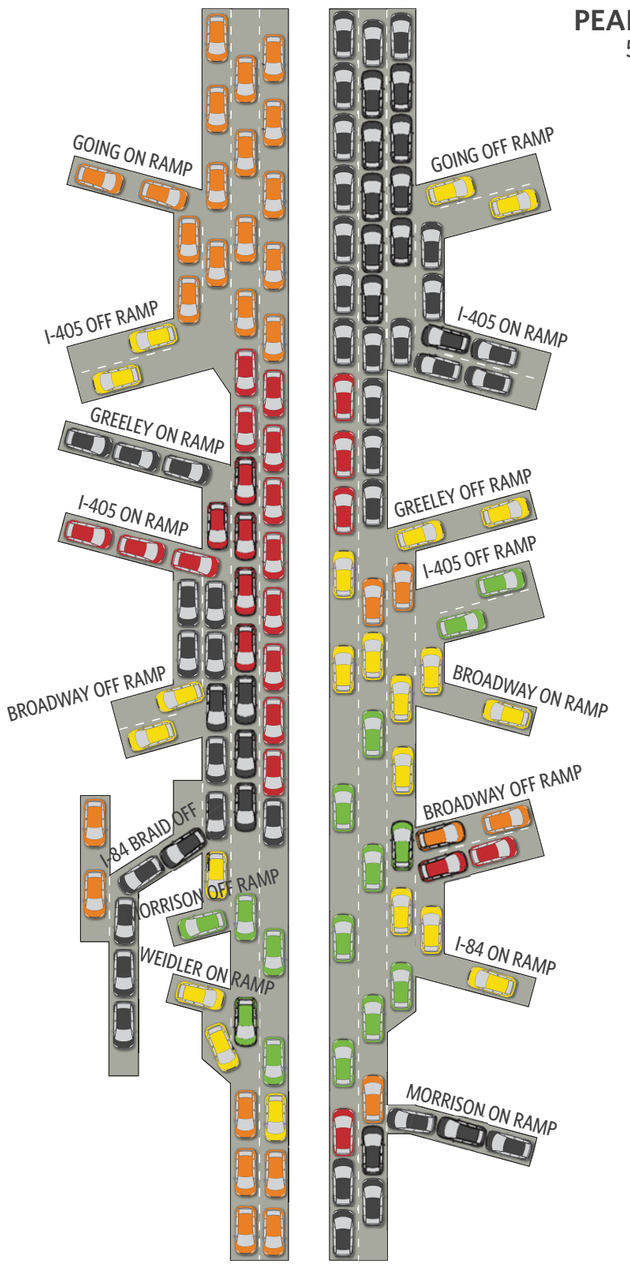
LEGEND

> 50 mph | 40 to 50 mph | 30 to 40 mph | 20 to 30 mph | < 20 mph

I-5 BROADWAY/WEIDLER

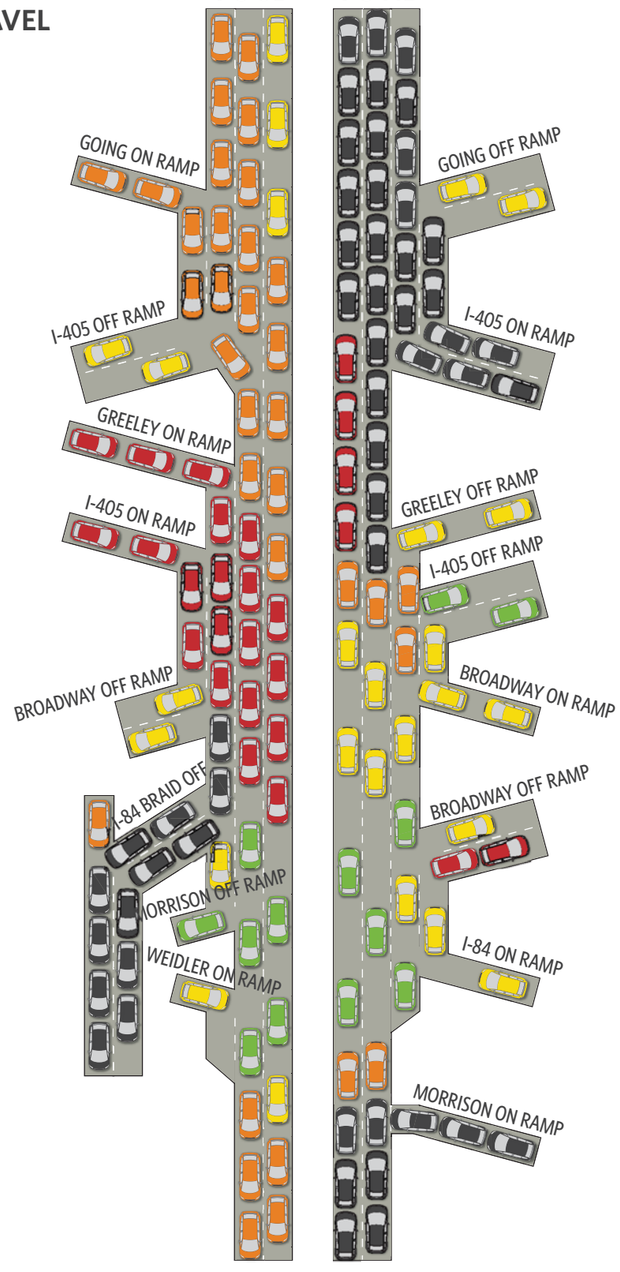
Figure 14: Option D1 and D2

OPTION D1



PEAK TRAVEL
5-6 pm

OPTION D2



D1: DOUBLE BRAID

- Almost 1,500 southbound and almost 3,300 northbound vehicles cannot access this corridor and must take different routes, modes, or not make the trip per day.
- Has a potential 56% reduction in southbound crashes compared to No Build and a potential 21% reduction in northbound crashes.

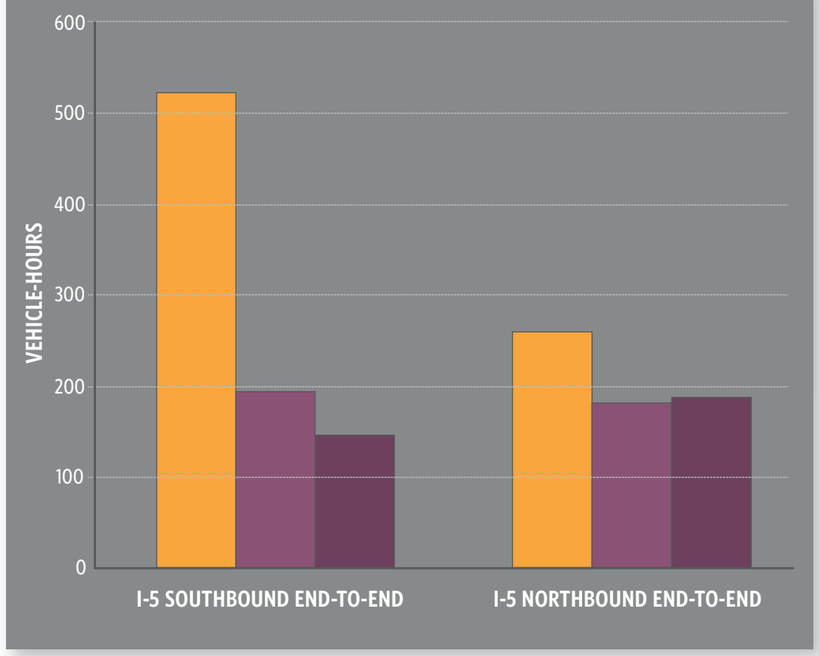
COST BENEFIT: $383M

D2: WITH 2 LANE FLYOVER

- Almost 1,600 southbound and almost 2,900 northbound vehicles cannot access this corridor and must take different routes, modes, or not make the trip per day.
- Has a potential 67% reduction in southbound crashes compared to No Build and a potential 16% reduction in northbound crashes.

COST BENEFIT: $413M

10-HOUR VEHICLE DELAY

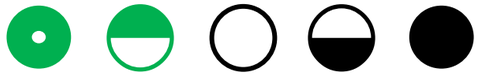


LEGEND

> 50 mph | 40 to 50 mph | 30 to 40 mph | 20 to 30 mph | < 20 mph

Table 15 – Design Options Summary

	Option A1	Option A2	Option B1	Option B2	Option C1	Option C2	Option D1	Option D2
Network Performance								
Travel Time								
Travel Time Reliability								
Congestion								
Spot Speed								
Percent Unmet Demand								
Emergency Braking								



Better  **Worse**

Compared to Option A1 - No Build

APPENDIX A: I-5 BROADWAY WEIDLER FACILITY PLAN

N/NE Quadrant and I-5 Broadway/Weidler Plans

Facility Plan

I-5 Broadway/Weidler Interchange Improvements

October 2012

Recommended Draft

CENTRAL CITY 2035

N/NE QUADRANT

CITY OF PORTLAND, OREGON 1851

Oregon Department of Transportation

Facility Plan:
I-5 Broadway/Weidler Interchange Improvements

The overall project purpose is to...

Improve safety and operations on I-5 in the vicinity of the Broadway/Weidler interchange.

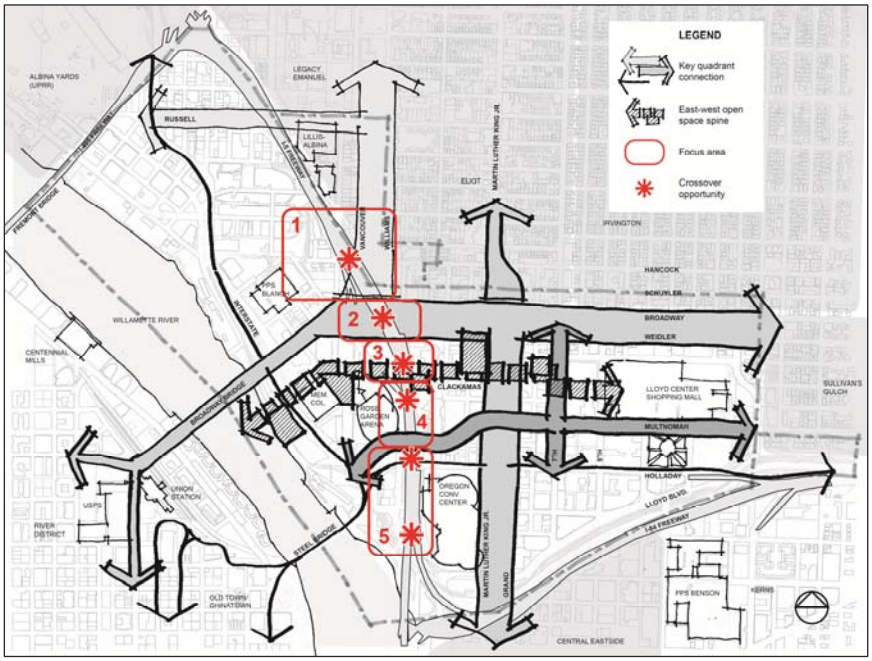
OBJECTIVES:

ODOT and the City of Portland, through the Stakeholder Advisory Community (SAC) and extensive public outreach, explored and found solutions to meet the following objectives:

EASE CONGESTION LEVELS AND IMPROVE SAFETY

ENHANCE PEDESTRIAN AND BICYCLE ROUTES

IMPROVE FREIGHT MOVEMENT



Integration of Transportation and Land Use Concepts in the N/NE Quadrant Plan

Acknowledgments

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Gary Eichman, Portland Freight Committee, Co-Chair (past)

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Acronyms and Abbreviations

BPS	Bureau of Planning and Sustainability, City of Portland
CoP	City of Portland
MMA	Multimodal Mixed-use Area
ODOT	Oregon Department of Transportation
PBOT	Portland Bureau of Transportation, City of Portland
SAC	Stakeholder Advisory Committee
TDM	Transportation Demand Management
TMA	Transportation Management Area
TMP	Traffic Management Plan
TSM	Transportation System Management

The Facility Plan

Study Area

The project study area is at the crossroads of the Portland freeway system, as shown in Figure 1. I-5 is the north-south freeway facility and extends through the metropolitan area; in fact, it runs the full length of the west coast of the United States from Canada to Mexico. Within the project area, I-84 intersects I-5 and extends east across the U.S. A mile and a quarter north of I-84, I-405 connects to I-5 at the Fremont Bridge interchange. This interchange is the northerly connection of the I-405 loop around the west side of downtown Portland, with the southerly connection at the west end of the Marquam Bridge. Within the overlap section, I-5 serves through traffic as well as connecting traffic between I-84 and I-405.

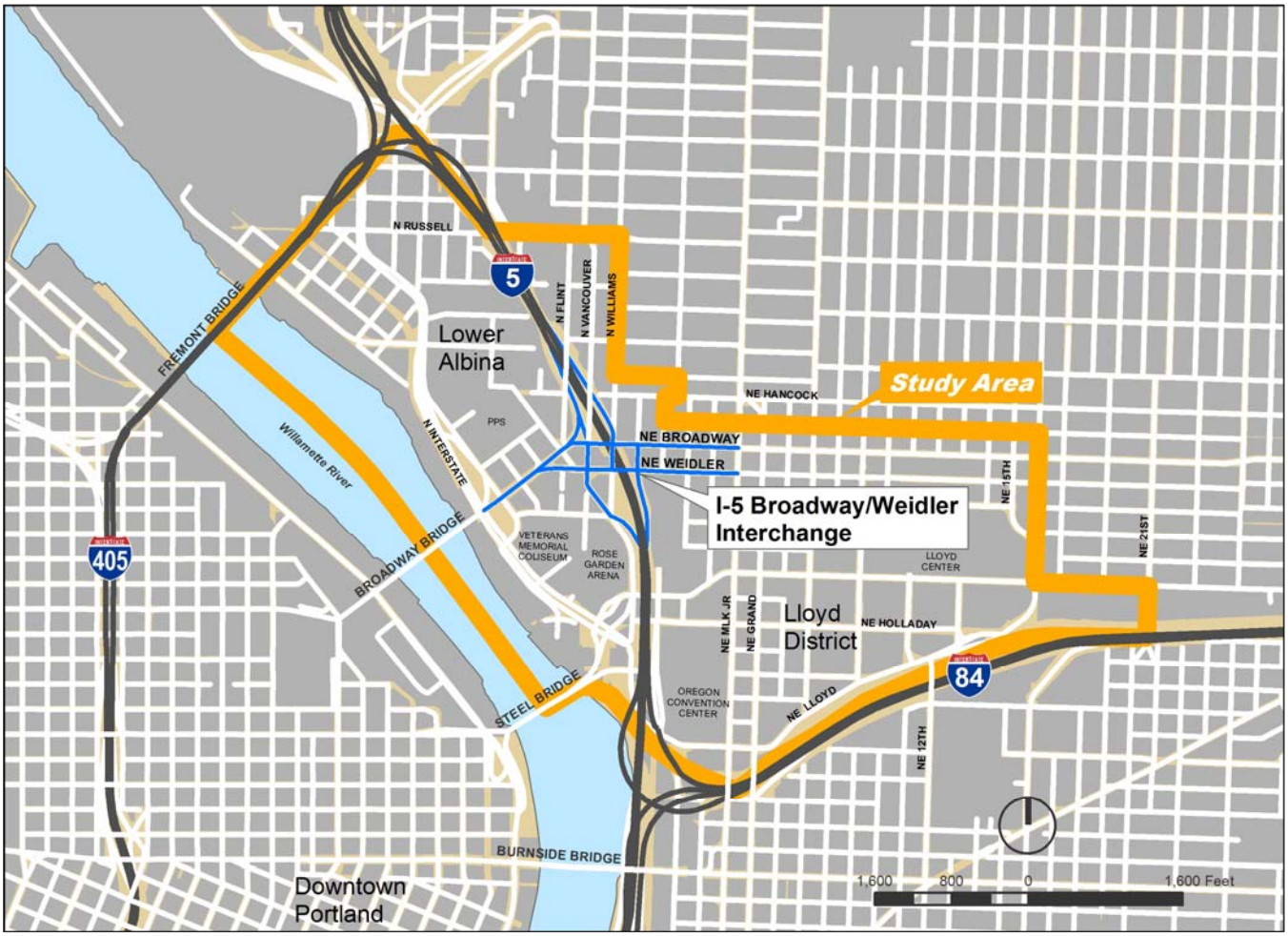


Figure 1: Study Area and Vicinity Map

Facility Function

- I-5 is classified as an Interstate facility and is both a Freight Route and a Truck Route.
- I-84 is classified as an Interstate facility and is both a Freight Route and a Truck Route.
- I-405 is classified as an Interstate facility and is both a Freight Route and a Truck Route.

Interchange Function

The I-5 Broadway/Weidler Interchange is located on I-5, in between I-405 to the north and I-84 to the south. The function of the I-5 Broadway/Weidler Interchange is to serve the Portland central city, which includes the industrial area of Lower Albina and the commercial activity along the Broadway/Weidler corridor, regional attractions such as the Rose Garden Arena and the Lloyd Center mall, and the surrounding community.

Purpose

The purpose of the I-5 Broadway/Weidler Interchange Improvement Plan is to improve the safety and operations on I-5 in the vicinity of the I-5 Broadway/Weidler Interchange.

Project Problem/Issues

Congestion and Bottleneck

In the context of the regional freeway network, the city's N/NE Quadrant sits at a crossroads of three regionally-significant freight and commuter routes. As a result, the freeway interchanges experience some of the highest traffic volumes in the state. Table 1 shows the average daily traffic volumes entering and exiting I-5 over the two-mile segment within the N/NE Quadrant.

Table 1: Average Daily Traffic Volumes Entering and Exiting I-5 in the Study Area

I-5 Direction	Total Ramp Volumes Entering I-5	Total Ramp Volumes Exiting I-5
Northbound	29,970	37,530
	Includes entrance ramps from: • I-84 • Broadway/Williams Avenue	Includes exit ramps to: • Weidler Street/Victoria Avenue • I-405 • Greeley Avenue
Southbound	34,020	47,200
	Includes entrance ramps from: • Greeley Avenue • I-405 • Wheeler/Winning/Williams	Includes exit ramps to: • Broadway/Vancouver Avenue • I-84 • Morrison Bridge/Hwy 99E

Highest Accident Rate in the State of Oregon

An analysis of the reported crashes on I-5 in the study area was performed for the five-year period from 2005 through 2009. Both frequency (number of crashes) and crash rate (number of crashes per million vehicle miles) were calculated per 1/10-mile segments.

- I-5 Southbound direction has more frequency of crashes than I-5 Northbound
- The top three locations with highest frequency of crashes and crash rates are:
    1) I-5 Southbound at Holladay Street (weave between the Winning/Wheeler On-ramp and the I-84 Eastbound Off-ramp)
    2) I-5 N at Multnomah (weave between the I-84 W On-ramp and the Weidler Off-ramp)
    3) I-5 S at Thompson Street (weave between the I-405 on-ramp and the Broadway Off-ramp)
- I-5 within the study area has the highest crash rate within the entire state
- Three times the crash rates at the I-5 Terwilliger curves
- The type of crashes in order of ranking from highest are: rear-end, sideswipe, fixed and other.

The attributing factors to the high number of crashes and safety problems in the study area are:

- Heavy congestion
- Short weaving distances
- Lack of shoulders for accident/incident recovery

Operational Friction and Congestion Caused by Heavy Weaving

Weaving analysis and field observations were performed for the four weaving sections on I-5 within the study area:

- I-5 Northbound between I-84 Westbound and Weidler Off-ramp
- I-5 Northbound between Broadway On-ramp and I-405 Off-ramp
- I-5 Southbound between I-405 On-ramp and Broadway Off-ramp
- I-5 Southbound between Winning/Wheeler On-ramp and I-84 Eastbound Off-ramp

I-5 Northbound Weaving Section between Broadway On-ramp and I-405 Off-ramp

Two weaving sections currently perform at failing level-of-service during the AM and PM Peak periods:

- I-5 Southbound between Winning/Wheeler On-ramp and I-84 Eastbound Off-ramp
- I-5 Northbound between I-84 Westbound and Weidler Off-ramp

I-5 Southbound Weaving Section between Winning/Wheeler On-ramp and I-84 Eastbound Off-ramp

The failing operations will be exacerbated in the future, with the most critical failure being the weave from I-5 Southbound from the Winning/Wheeler On-ramp to the I-84 Eastbound Off-ramp. This bottleneck will cause queuing that extends beyond the weaving section to the north and onto the Fremont Bridge.

The Land Use-Transportation Connection

The N/NE Quadrant of the central city includes considerable multimodal infrastructure to support all types of travelers on all modes. In addition to the I-5 freeway and the local street network, four light rail transit (LRT) lines run through the area, converging on the Rose Quarter Transit Center next to the Rose Garden Arena. The City of Portland is constructing streetcar lines on Broadway/Weidler to connect with the Pearl District and the central east side of Portland. Eight TriMet bus lines also connect at the transit center.

The I-5 Broadway/Weidler Interchange Improvements Facility Plan proposes many new crosswalks that will improve pedestrian safety and connections to and from these major transit amenities. Two major bicycle commute routes run through the area: 1) the major east-west route along Broadway and Weidler, and 2) the major north-south route along Williams and Vancouver. The plan proposes a new east-west pedestrian and bicycle overcrossing at Clackamas Street to connect the Lloyd District with the Rose Quarter. The plan also includes a new Hancock/Dixon overcrossing structure and freeway lid that will allow for effective construction staging, improve viability of the PPS Blanchard site and provide a supplementary crossing to the north of "the Box" near the I-5 Broadway/Weidler Interchange.

The Lloyd Transportation Management Area (TMA) is one of the most successful TMAs in the Portland metropolitan region. The area is currently predominantly commercial and industrial. However, the proposed changes to land use designations in the N/NE Quadrant Plan will encourage a much greater mix of uses, especially in the central Lloyd District where significant density and mix of uses are anticipated.

The City of Portland and ODOT have jointly developed this freeway and local transportation plan, and have integrated the transportation and land use components. The transportation components were developed assuming existing zoning, except for changes at the Portland Public Schools (PPS) Blanchard site and some changes to allow more diverse uses in the central Lloyd District. The overall trip vehicle trip generation for the district is expected to be the same or lower than under previous zoning entitlements. The changes related to land use and the transportation recommended by this plan have been analyzed, and queues are not anticipated on the I-5 exit ramp deceleration areas (see Table 2).

Table 2: Available Storage and Predicted Queues for Exit Ramps at I-5 Broadway/Weidler Interchange

Direction	Storage Available	Predicted Queue
Southbound	955 feet	500 feet
Northbound	1130 feet	350 feet

Multimodal Mixed-use Area

The I-5 Broadway/Weidler Interchange is within ¼-mile of an existing interchange. ODOT staff concurs that the Multimodal Mixed-use Area (MMA) designation is appropriate for the city's companion N/NE Quadrant Plan and ODOT must be consulted prior to any future plan amendments within the MMA boundary and will remain in effect as long as progress is being made towards the implementation of project elements.

Summary of the Recommended Concept and Elements

The Recommended Concept, supported by a majority of the Stakeholder Advisory Committee (SAC) via a consensus-driven process, and its elements are based on technical assessments of bicycle and pedestrian operations, urban design/land use potential, traffic operations and safety. Table 3 describes the Facility Plan elements and their outcomes and Figure 2 and Figure 3 illustrate the extent of improvements included in the Recommended Concept. Figure 4 shows aerial perspectives of the existing conditions in the Rose Quarter and how the area would look with the improvements included in the Recommended Concept.

The Facility Plan Element 1, **Transportation System Management (TSM)** and **Transportation Demand Management (TDM) Strategies,** is designed to optimize the overall performance of the transportation system and to reduce vehicle demand, especially for commuter trips in the peak periods.

TSM measures are designed to make maximum use of existing transportation facilities, and include:

- Traffic engineering measures (e.g., such as signal timing changes, provision of turn lanes, turn restrictions and restriction of on-street parking to increase the number of travel lanes without road widening) that improve the operations and efficiency of streets and intersections;
- System monitoring and traveler information systems (e.g., Intelligent Transportation Systems (ITS), variable message signs, etc.);
- Facility management systems (e.g., ramp meters, special use lanes, signal priority for special users such as transit); and
- Incident management systems (e.g., incident response and recovery teams).

TDM strategies are most effective in areas with high concentrations of employment and where a robust transit system exists. Generally, the strategies are easiest to implement where there are large employers or where a TMA has been established to pool the efforts of many smaller employers. TDM measures include strategies that: 1) shift modes like carpooling, vanpooling, transit, bicycling and walking programs; 2) shift trips to non-peak periods, such as flexible work schedules and off-peak shifts; and 3) include telecommuting, which eliminates trips.

Components of these TSM and TDM measures are in use today. The City of Portland and ODOT will continue to monitor, adjust and implement the strategies as needed.

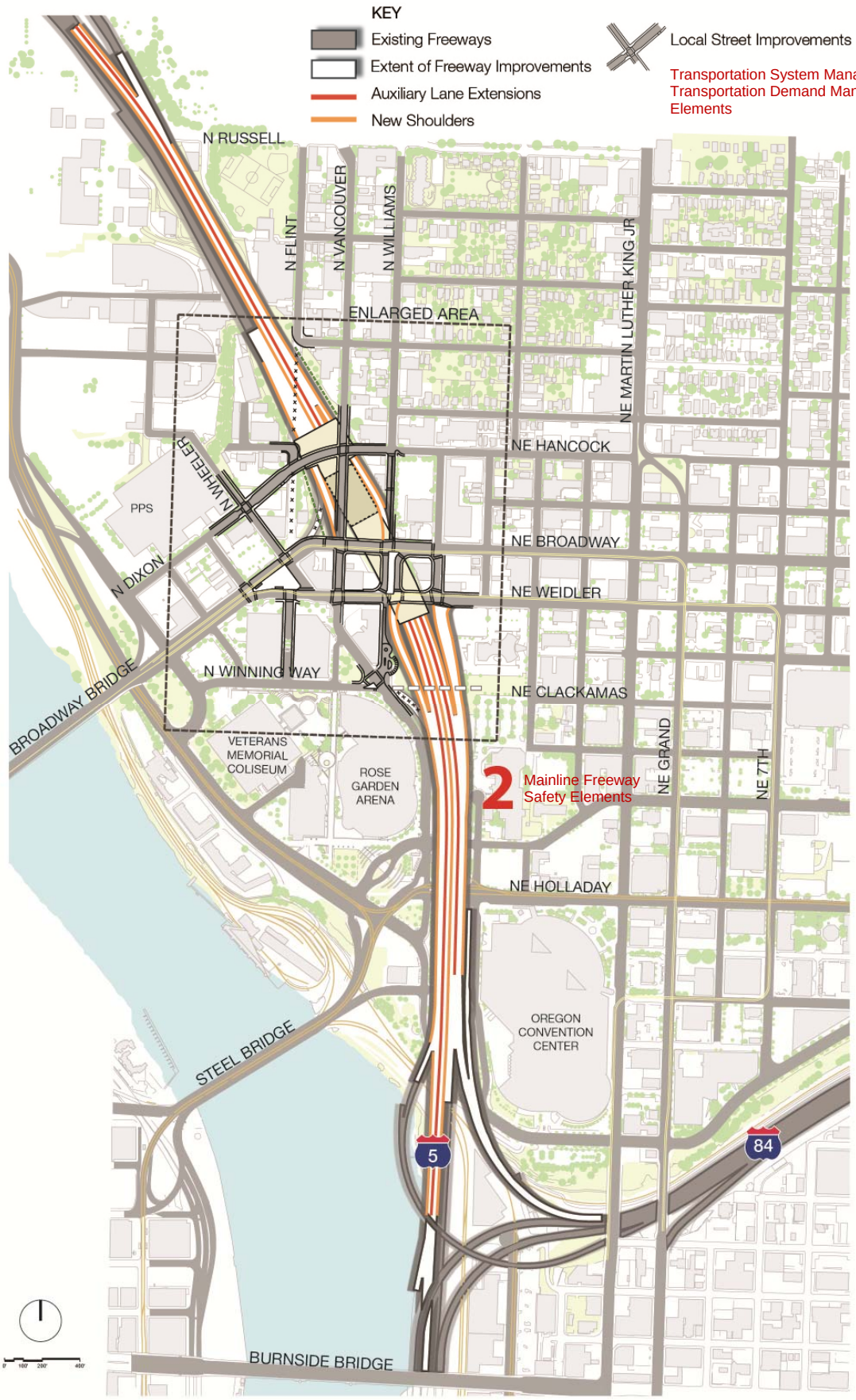


Figure 2: Overall Project Extent of the Recommended Concept

Table 3: I-5 Broadway/Weidler Interchange Recommended Concept Facility Plan Elements

Facility Plan Elements	Outcome
1. Implement Transportation System Management (TSM) and **Transportation Demand Management (TDM) Strategies**	Improve freeway operations and reduce automobile trips.
2. Construct Mainline Freeway Safety Elements	Improve freeway operations and reduce accidents 30-50 percent.
a. Extend auxiliary lanes in both directions.	
b. Add full-width shoulders in both directions.	
3. Re-construct Three Freeway Structures and Lid The Mainline Freeway Safety Elements require rebuilding the Weidler, Broadway and Williams structures over I-5; the new structures will be designed to meet seismic and clearance standards.	The new structures improve facilities for all modes; the lid allows for more effective construction staging, improves the urban design of the interchange area and improves the area's development potential.
4. Relocate I-5 Southbound On-Ramp to Weidler/Williams (from current location at Wheeler/Winning Way/Williams)	Increases weave distance, removes ramp traffic from local streets, Wheeler and Winning Way. Allows pedestrian/bicycle-only overcrossing at Clackamas.
5. Convert Williams to a Reverse Traffic-Flow Connection between Broadway and Weidler Includes a barrier-separated pedestrian/bicycle path in the middle.	Allows more efficient signal timing, improves bike and pedestrian connections through interchange and simplifies vehicular movements.
6. Construct Clackamas Pedestrian/Bicycle Overcrossing Establishes connection over I-5 from Winning Way to Clackamas.	Increases multimodal connectivity across I-5, links central Lloyd District to the Rose Quarter, provides supplementary crossing south of "the Box."
7. Re-construct the Vancouver Structure; **Remove the Flint Structure;** **Reconfigure streets North of Broadway to include Hancock/Dixon Structure and Lid**	The Vancouver structure must be replaced to accommodate mainline freeway improvements. The Hancock/Dixon structure and freeway lid allow for effective construction staging, improve viability of the PPS Blanchard site and provide a supplementary crossing to the north of "the Box."
North of Broadway elements include:	
1. Rebuild Vancouver Avenue structure	
2. Implement traffic calming at Williams/Hancock	
3. Remove Flint between Tillamook and Broadway	
4. Maintain Wheeler in front of the Leftbank as one-way	
5. Connect Flint as a two-way street south of Weidler	
6. Add signals at Broadway/Wheeler and Broadway/Ross	

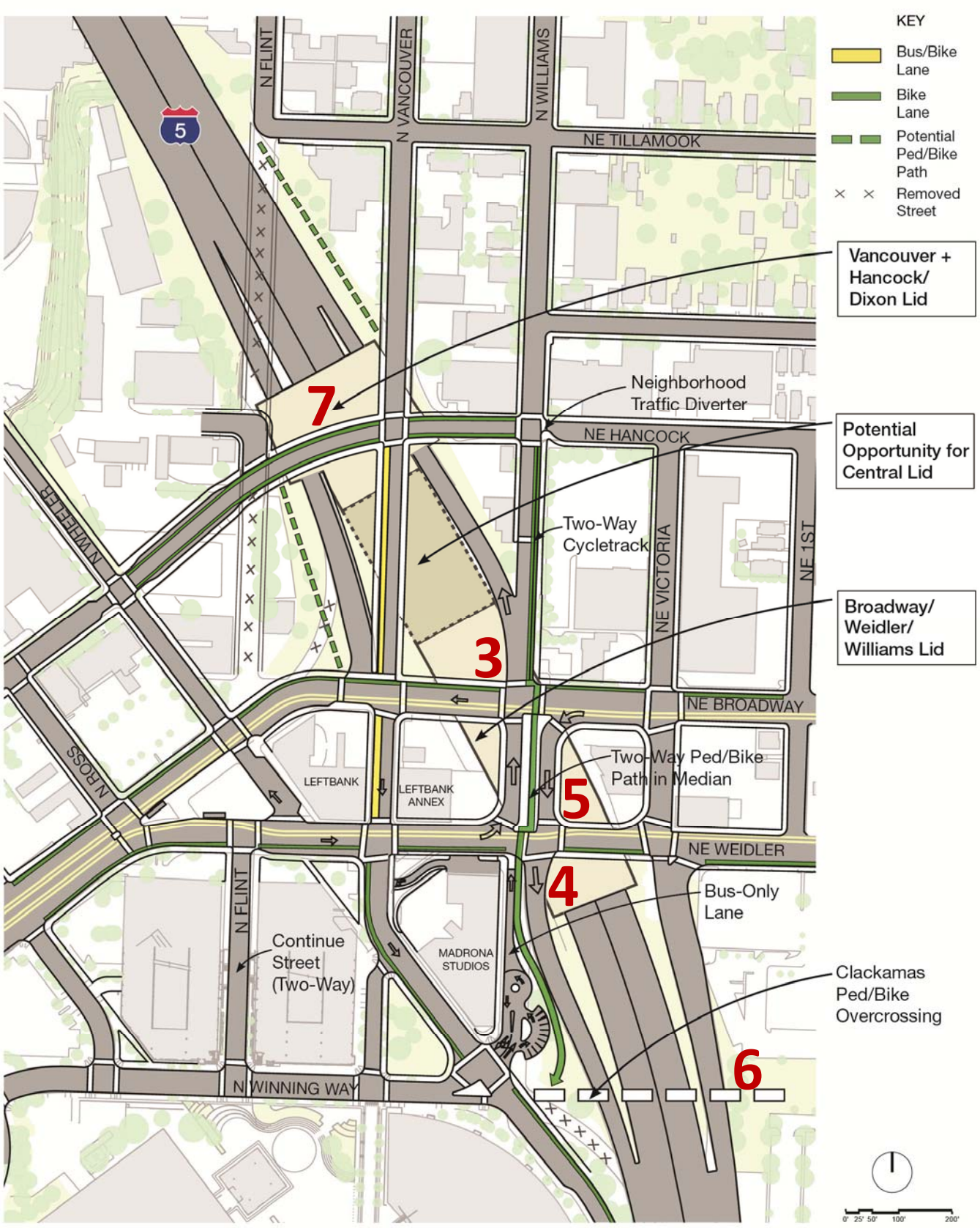
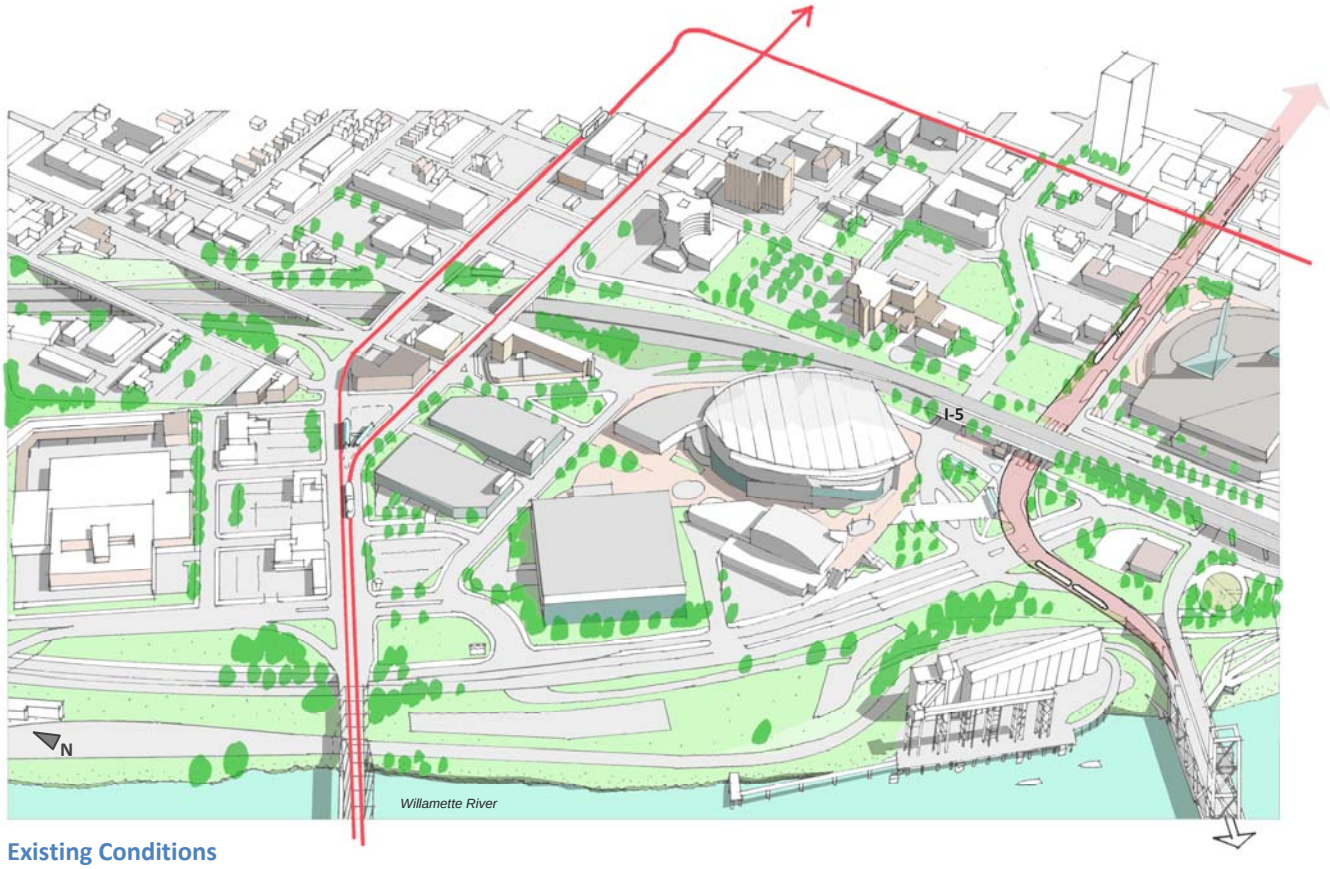
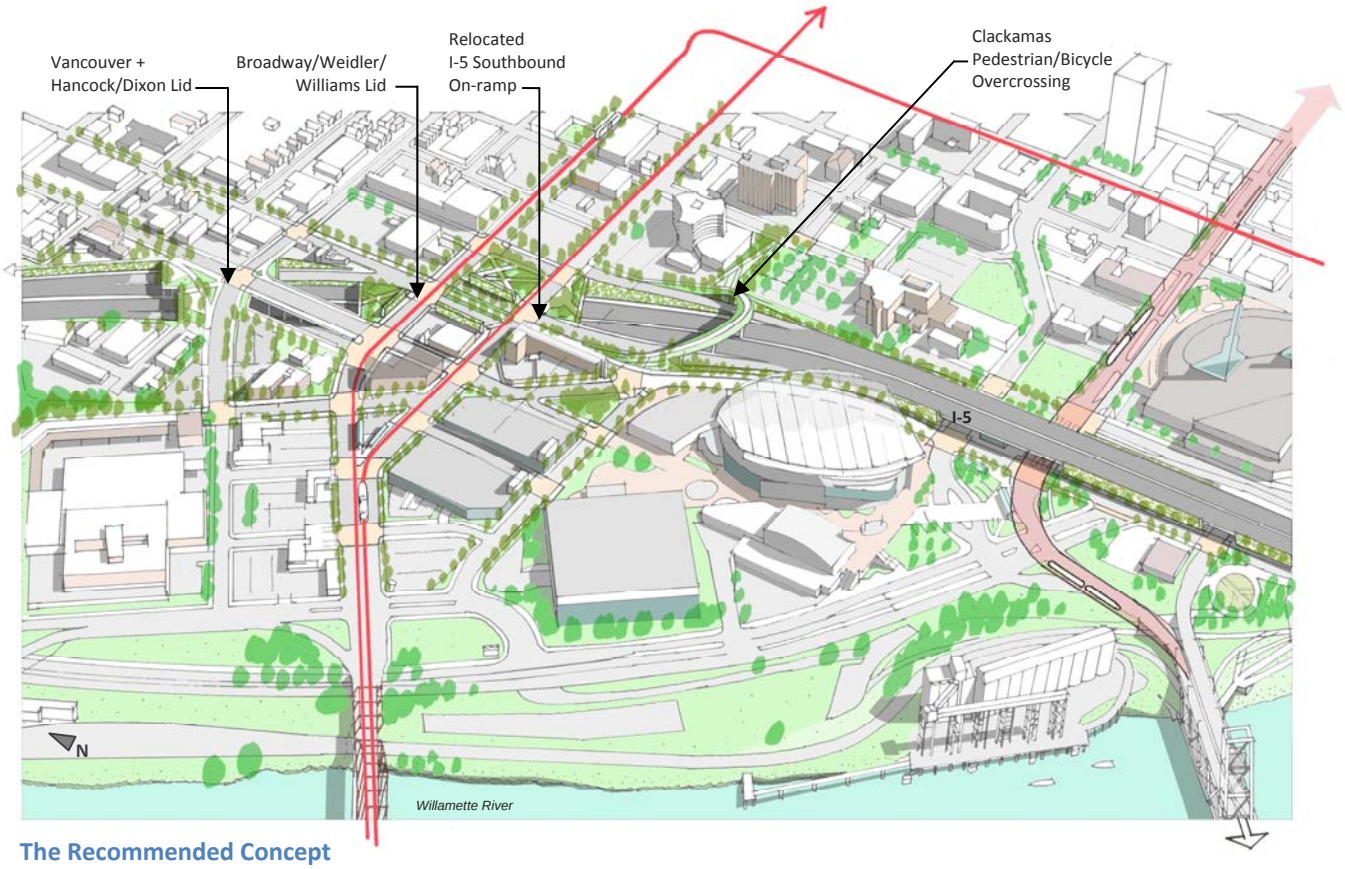


Figure 3: Enlarged "Box" Area of the Recommended Concept



Existing Conditions



The Recommended Concept

Figure 4: Aerial Perspectives of Existing Conditions and the Recommended Concept

Project Monitors and Future Project Development

The Facility Plan elements of the Recommended Concept (Table 3) are expected to significantly improve I-5 mainline operations and safety as well as improve interchange operations at the I-5 Broadway/Weidler Interchange. Once the Facility Plan elements are completed, ODOT and the City of Portland will continue to monitor the freeway operations in the I-5 Broadway/Weidler Interchange area (refer to Table 4).

Table 4: Project Monitors and Future Project Development

Project Monitors	Notes
1. Safety and Operational Performance **- Southbound Braided Ramp or other freeway safety improvements**	Upon completion of the Recommended Concept Facility Plan elements described above, ODOT and the City of Portland will monitor the performance of the completed project for achieving safety and operational goals. If safety and operational issues remain on the freeway after construction of the Recommended Concept Facility Plan elements, ODOT will work with the City of Portland to initiate a public process to consider additional measures such as a southbound braided ramp from Broadway to I-84 or other options developed through a public process. A southbound braided ramp should not be precluded by the construction of the Recommended Concept Facility Plan elements.

Implementation Actions

Project Development and Project Management

1. Proceed with next phase of project development and complete Preliminary Engineering (PE) and environmental phases for federal funding.
2. Continue project management partnership between the City of Portland and ODOT.
   - Develop work scope and schedule.
   - Define environmental process
   - Develop intergovernmental agreement for completion of PE/environmental studies.
3. Develop public involvement process for PE/environmental phase and actions to resolve issues identified in the I-5 Broadway/Weidler Interchange Improvement Plan.
4. Special considerations will be discussed and identified during Preliminary Engineering and recommended as part of the Final Design/Engineering. These include:
   - Construction management strategies that can provide incentives to minimize construction periods, impacts, and costs;
   - Incentives for minority hiring; and
   - Strategies to support local businesses.

Preliminary Engineering

The following are key products at the completion of Preliminary Engineering:

1. Complete PE level of engineering:
   - Develop project cost estimates.
   - Complete environmental documentation.
   - Identify potential construction phasing.
   - If phasing is required, the City of Portland and ODOT will work together to match phases to the funding sources available.

2. Project agreements at the completion of PE:
   - Signals will continue to be timed so as to avoid queues backing up into the deceleration area of the I-5 Southbound exit ramp at Broadway.
   - Crosswalks will be provided at all signalized locations and should be provided at all safe and feasible locations.
   - The Rose Quarter Traffic Management Plan (TMP) should be updated with the participation of ODOT, City of Portland and the Rose Garden Arena prior to construction.
   - A preliminary construction mitigation plan will be developed that would include efforts to minimize impacts, support local businesses and support minority hiring.

Specific Design Coordination

Property impacts are of great concern to the neighborhoods, businesses and agencies working in this area. The following are issues that will require further examination by ODOT and the City of Portland as part of Preliminary Engineering with community involvement:

1. Seek a viable single lid design solution over I-5 between Weidler and Hancock by exploring mitigation measures for freeway noise and vehicle emissions, and by addressing the need for open space and economic development.
2. Develop specific measures to address property and parking impacts to the Paramount Apartments, the Portland Public Schools Blanchard site and other sites related to the proposed Hancock/Dixon connection. The number of parking spaces should be the same or more than existing conditions at the Paramount Apartments, the Leftbank Building, the Leftbank Annex and the Madrona Studios.

3. Develop a network of alternative safe and convenient bicycle/pedestrian connections to include:
    a. Enhanced facilities (including bicycle lanes, two-way cycle track, sidewalks and protected marked crossings) along Broadway, Weidler Street, Vancouver Avenue and Williams Avenue to include a wide, grade-separated multi-use path for Williams Avenue between Broadway and Weidler.
    b. The development of a new pedestrian/bicycle connection between the Flint Avenue/Tillamook Street intersection to the proposed Hancock/Dixon overcrossing.
    c. The development of a new pedestrian/bicycle connection from Hancock Street to Broadway while providing for potential parking mitigation, open space and redevelopment opportunities.
4. Define appropriate Eliot neighborhood traffic mitigation measures for the recommended Hancock/Dixon connection between Vancouver Avenue and Dixon Street to discourage cut-through traffic.
5. Refine a street design and circulation plan for the area in the vicinity of the I-5 Broadway/Weidler Interchange. The refined street design and circulation plan should address the following issues:
    a. Develop design elements that provide for safe and convenient access to the Leftbank Building and the Leftbank Annex.
    b. Develop and evaluate circulation alternatives and design elements for the area north of Broadway, south of North Wheeler Place and west of I-5 to:
        1. Address the changes to access and circulation around the Paramount Apartments by Investigating treatments for Wheeler Avenue, between Broadway and Hancock Street, in order to minimize cut through traffic at the west side of the Paramount but maintain access to the Lower Albina industrial district.
        2. Enhance bicycle access and safety to the proposed Hancock/Dixon connection over I-5 to the Broadway Bridge.
        3. Determine appropriate multimodal access and circulation to this area and Lower Albina.
    c. Develop and evaluate circulation alternatives for Wheeler Avenue, Winning Way, Center Court, Flint Avenue and Williams Avenue to:
        1. Enhance circulation in the area for all modes.
        2. Provide flexibility to manage event ingress and egress.
        3. Open up opportunities for redevelopment and placemaking.
    d. Develop design elements that address the changes to access and circulation to the Madrona Studios:
        1. Refine street design for Williams Avenue between Weidler Street and Wheeler Avenue to address access and circulation and on-street parking needs for the Madrona while also providing for bus, bike and pedestrian circulation.
        2. Provide for sufficient pedestrian and vehicle access to the Williams Avenue entrance to the Madrona Studios.
        3. Prepare an appropriate design treatment for the Weidler Street/Williams Avenue intersection for safe pedestrian and bicycle crossing.
        4. Visual or acoustic screening will be examined, designed and implemented between the Madrona Studios and the relocated on-ramp to I-5 at Weidler/Williams.
6. Develop design plans with TriMet for safe transit operation through the I-5 Broadway/Weidler Interchange.
7. Refine and finalize design for the Clackamas Overcrossing structure.
    a. Coordinate design with future access connections east of I-5.
    b. Coordinate design with future changes to traffic circulation west of I-5 and the relocation of the I-5 southbound on-ramp to Weidler/Williams.
    c. Study and implement an event parking management plan for the Rose Quarter area, including the area adjacent to the future Clackamas Pedestrian/Bicycle Overcrossing on the east side of I-5. The exact boundaries and scope of the study will be determined at a later date.
8. Evaluate visual and environmental impacts of the proposed widening of the elevated segment of the I-5 freeway, including over the Rose Quarter Transit Center and near Peace Park, and identify mitigation measures as needed.

APPENDIX B: VISSIM MODEL CALIBRATION METHODOLOGY AND RESULTS

Memo

Date:	Tuesday, August 26, 2014
Project:	I-5 Broadway Weidler
To:	Chi Mai, ODOT Jon Makler, ODOT
From:	Miranda Wells, HDR Andy Johnson, HDR
Subject:	DRAFT VISSIM Model Calibration Methodology and Results

This technical memorandum summarizes the methods used to calibrate the p.m., a.m. and mid-day peak hour VISSIM models for the I-5 Broadway-Weidler project and provides a summary of the calibration results. Please note this document is aimed for a technical, internal audience.

Project Scope

The I-5 Broadway-Weidler VISSIM models include all ramps on I-5 between Morrison Street and Going Street, excluding the I-84 westbound to I-5 southbound on-ramp, and cover the freeway mainline and the entry and exit portions of the ramps to and from the mainline. A portion of the I-84 mainline was also modeled along with the Grand Avenue on-ramp to eastbound I-84. The arterial network included the following study area intersections:

- Weidler Street/Vancouver Avenue
- Weidler Street/Williams Avenue
- Weidler Street and Victoria Avenue/I-5 NB Off-Ramp
- Broadway/Victoria Avenue
- Broadway and Williams Avenue/I-5 NB On-Ramp
- Broadway/Vancouver Avenue
- Broadway/Flint Avenue
- Wheeler Avenue/Winning Way/I-5 SB On-Ramp

As outlined in the *Existing Conditions Data Summary* memo, VISSIM models will be developed for three study periods:

- Morning Peak – 5:30 a.m. to 10:00 a.m.
- Mid-day – 11:30 a.m. to 2:00 p.m.
- Afternoon Peak – 1:30 a.m. to 6:00 p.m.

The first half an hour of the modeling was used for “seeding” purposes with data collection occurring during the remainder of the study period. Future year VISSIM models will be developed using the calibrated existing year models.

Data Inputs

Multiple data sources were used to develop the data inputs and calibration targets used in the VISSIM models for the I-5 Broadway-Weidler project. The VISSIM model data inputs, how they were collected and what they were used for are shown below in Table 1.

Table 1: VISSIM Model Data Inputs

Data	Source	Use
Traffic Volumes	ODOT/Portal	Input and Calibration
Origin-Destination	Bluetooth – ODOT	Input
Signal Timing Data	ODOT	Input
Ramp Meter Data	ODOT	Input
Transit Data	TriMet Website	Input
Speed Data	INRIX – ODOT/Portal	Input and Calibration

Detailed information on the development of data inputs for existing conditions is provided in the *Existing Conditions Data Summary* memo, dated August 12, 2014[1].

Error Checking

The error checking process focused on fixing coding errors before the calibration process began. This process involved reviewing data inputs, VISSIM error reports and model animations. Although primarily performed during model development, error checking is still an important process that should be performed during calibration. When making changes to driver behavior or other model parameters, error checking helps ensure that these changes do not have unintended consequences in the model.

Data inputs included network geometry, traffic volumes, signal timing and route choices and were reviewed by the model developer as well as a quality control reviewer. VISSIM produces an error file after each simulation run with multiple error types. This can include vehicle removal, signal issues, end of link errors and various others. Critical errors in the model were accounted for and corrected during this step. Visual checking of the animation file was performed to check for abnormal driving behavior or irregular queuing within the network and to identify coding parameters that may have been overlooked or are incorrect.

Field Visits

Prior to calibration, field visits were conducted to observe operations within the study area. The field visits helped identify major lane imbalances, downstream or upstream bottlenecks, major queuing locations and overall driving behaviors that needed to be accounted for in order for the models to reflect real world conditions. Key findings are discussed below, with a complete summary of the field visits included in the Appendix A.

[1] *Existing Conditions Data Summary,* August 2014, HDR Engineering

During the p.m. peak period, at the I-5 SB Broadway Exit, the shared-use lane drops approximately 300 feet from the off-ramp gore point. Traffic in the shared-use lane was observed merging at the first indication of the lane drop, especially during congested conditions. At the Broadway off-ramp and Vancouver Avenue intersection, lane imbalances were observed early in the peak period, with the majority of traffic in the left lane. Modeling the lane utilization as observed in the field resulted in significant queuing onto mainline I-5. A subsequent field visit was performed later in the p.m. peak, where better lane utilization was observed and the model adjusted to reduce queuing in the left lane of the exit ramp (see Figure 1).

In addition to the Broadway off-ramp, a critical observation during the p.m. peak field visit was the lane utilization and weaving behaviors north of the I-84 eastbound exit. As shown in Figure 2, there is a significant amount of slow moving and queued traffic in the right lane compared to the left lane. In the weaving area between the Wheeler on-ramp and the I-84 eastbound off-ramp, traffic was observed changing lanes immediately downstream of the on-ramp, which contributes to the upstream queuing.

Figure 1 – PM Field Visit Photos (I-5 SB / Broadway Off-Ramp)

(Left: Broadway Off-Ramp and Vancouver; Right: I-5 SB 302A Broadway Exit)

Figure 2 – PM Field Visit Photos (I-5 SB / South of Weidler Street Bridge)

(Left: I-5 SB north of Wheeler On-Ramp; Right: I-5 SB at Wheeler On-Ramp)

Due to the relatively low Broadway off-ramp volumes during the a.m. and mid-day peak periods, the lane use is more imbalanced compared to the p.m. peak. During the a.m. peak period, the I-5 SB off-ramp to the Morrison Bridge cannot accommodate the demand, resulting in traffic queuing onto the freeway (see Figure 3). Traffic in the left lane, however, is relatively free flowing.

Congestion on I-5 SB was also observed at the north end of the study area during the a.m. peak, with stop and go traffic from the Interstate Bridge to the Going/Killingsworth area. Once traffic passed Killingsworth, where the necessary lane changes had been made for the I-5/I-405 split, speeds increased. I-5 NB traffic experiences stop and go congestion upstream of the Morrison on-ramp and again at the I-84 westbound on-ramp. Once vehicles passed through the turbulence, however, traffic speeds increased.

During the mid-day peak period, no significant congestion was observed on I-5. As with the other peak periods, drivers had a tendency to change lanes immediately downstream of the gore point or well in advance of an exit only lane or downstream lane drop. An increase in truck traffic was also evident during the mid-day peak, supporting the vehicle classification data used in the models. Although there was little congestion observed on the freeway, traffic volumes on the arterials were relatively high, with moderate to significant queuing in some locations (see Figure 4).

Figure 3 – AM Field Visit Photos (Broadway Off-Ramp and I-5 SB Morrison Exit)

(Left: Broadway off-ramp and Vancouver; Right: I-5 SB 300B Morrison Exit)

Figure 4 – Mid-day Field Visit Photos (Vancouver Avenue and I-5 NB)

(Left: Vancouver Ave at Broadway; Right: I-5 NB north of Broadway)

Calibration

Once the field visits and error checking process was complete, an iterative process of making adjustments in the model and comparing the VISSIM data outputs to the field collected data was conducted until calibration targets were met. Additionally, animations were reviewed in order to verify that the model is accurately reflecting operations observed in the field. The following section outlines the calibration targets and the results for the p.m. peak period with this being a working document in add the a.m. and mid-day details when complete.

Calibration Targets

The I-5 Broadway/Weidler VISSIM model was calibrated for both traffic volumes and spot speeds. The targets set for calibration were:

- Volumes to be within a GEH value of 5.0 for 85% of freeway links
- Volumes to be within a GEH value of 5.0 for all entry and exit locations, all entrance and exit ramps and all intersection turn movements greater than 100 vehicles per hour
- Speeds to be within +/- 10 miles per hour on at least 85% of all freeway links

Simulation output from an average of 10 simulation runs were compared against balanced traffic demands and INRIX speed data. Data collection points were used at all entry and exit locations and at all entrance and exit ramps to determine mainline and ramp volumes. Node evaluation was used on all arterial intersections to determine turning movement volumes. Data collection points were also used to capture spot speed data at all INRIX station locations within the study area.

In addition to the required calibration targets, the following model components were included in the calibration process:

- Heavy vehicle percentages
- Origin-destination
- Signal timing

Heavy Vehicles

Short duration (24-hour) classification counts[2] collected by ODOT were used to develop heavy vehicle percentages and fleet distributions for both medium and heavy trucks. Classification counts within the study area were provided at the following locations:

- I-5, MP 300.37 – Marquam Bridge ATR
- I-5, MP 302.25 – I-5 south of Weidler Street
- I-84, MP 0.49 – West Banfield ATR
- I-405, MP 3.05 – Fremont Bridge ATR

Heavy vehicle percentages on I-5 were calculated using the classification count south of Weidler Street. For the on-ramps within the study area it was assumed that the heavy vehicle percentages were the same as for the adjacent mainline. ODOT provided values for medium and heavy truck percentages for the arterials. The heavy vehicle percentage data that was collected in the field was compared to the heavy vehicle percentage collected at the same location (near Broadway and Weidler) in the model. As can be seen in Table 2, these values are very close and the variation is within a typical day or seasonal variation that may occur on I-5.

[2] Provided electronically week of August 25, 2014 to Joseph Auth, Simon Eng, and Jon Makler

Table 2 – Peak Vehicle Classification Comparison

Direction		Total Volume	Non-Trucks	% Non-Trucks	Medium Trucks	% Medium Trucks	Heavy Trucks	% Heavy Trucks
		AM Peak 6:00 a.m. to 10:00 a.m.						
Model Average	Southbound	11,789	10,316	87.5%	624	5.3%	849	7.2%
	Northbound	12,489	11,376	91.1%	383	3.1%	730	5.8%
ATR Average	Southbound	12,548	10,849	86.5%	705	5.6%	994	7.9%
	Northbound	12,497	11,051	88.4%	499	4.0%	947	7.6%
		Mid-day Peak 12:00 p.m. to 2:00 p.m.						
Model Average	Southbound	5,798	5,053	87.2%	231	4%	514	8.9%
	Northbound	6,212	5,500	88.5%	257	4.1%	455	7.3%
ATR Average	Southbound	6,264	5,650	90.2%	202	3.2%	412	6.6%
	Northbound	6,117	5,390	88.1%	229	3.7%	498	8.1%
		PM Peak 2:00 p.m. to 6:00 p.m.						
Model Average	Southbound	10,853	9,961	91.8%	324	3.0%	569	5.2%
	Northbound	10,491	9,607	91.6%	354	3.4%	530	5.0%
ATR Average	Southbound	11,287	10,340	91.6%	307	2.7%	640	5.7%
	Northbound	11,082	9,905	89.4%	412	3.7%	765	6.9%

Source: Data collection results (.mes) averaged over 10 simulations runs (1 through 10)
Cars – FHWA Class 1-3, Medium Trucks – FHWA Class 4-5, Heavy Trucks – FHWA Class 6-13

Origin-Destination

A Bluetooth origin-destination (OD) summary was provided by ODOT[3] for a portion of the study area, but because it was not for the entire study area, it could not be used as an input into the model. The OD data was used as a back check to the OD developed using Tflowfuzzy (see

[3] ODOT provided Bluetooth Study Data Validation report (see Appendix B)

Table **3**). In order to develop the OD matrix to be used in VISSIM, invalid movements were identified and assigned in VISUM prior to running Tflowfuzzy. Hourly OD matrices were developed and coded into VISSIM.

Table 3 – Peak Origin Destination Comparison

Time	PM Peak Bluetooth OD							PM Peak TFlowFuzzy OD						
		A	B	C	D	E	F		A	B	C	D	E	F
	A	-	31%	21%	19%	9%	20%	A	-	-	-	-	-	-
	B	28%	-	20%	19%	9%	24%	B	-	-	-	-	-	-
2-3 PM	C	18%	33%	-	32%	0%	17%	C	8%	22%	-	51%	0%	20%
	D	24%	14%	16%	-	6%	40%	D	9%	8%	14%	-	15%	54%
	E	16%	33%	0%	19%	-	31%	E	17%	33%	0%	19%	-	31%
	F	20%	16%	10%	44%	10%	-	F	7%	6%	11%	65%	11%	-
		A	B	C	D	E	F		A	B	C	D	E	F
	A	-	31%	21%	17%	10%	21%	A	-	-	-	-	-	-
	B	28%	-	18%	20%	10%	24%	B	-	-	-	-	-	-
3-4 PM	C	18%	33%	-	32%	0%	17%	C	9%	22%	-	48%	0%	21%
	D	22%	14%	16%	-	5%	43%	D	9%	8%	13%	-	12%	62%
	E	17%	33%	0%	19%	-	31%	E	18%	33%	0%	18%	-	31%
	F	19%	15%	8%	47%	11%	-	F	7%	6%	10%	67%	9%	-
		A	B	C	D	E	F		A	B	C	D	E	F
	A	-	30%	19%	17%	11%	23%	A	-	-	-	-	-	-
	B	26%	-	23%	20%	10%	22%	B	-	-	-	-	-	-
4-5 PM	C	16%	31%	-	35%	0%	17%	C	10%	21%	-	49%	0%	20%
	D	20%	14%	15%	-	4%	47%	D	9%	7%	13%	-	11%	60%
	E	17%	31%	0%	17%	-	35%	E	17%	31%	0%	17%	-	35%
	F	19%	15%	8%	48%	11%	-	F	8%	6%	10%	66%	9%	-
		A	B	C	D	E	F		A	B	C	D	E	F
	A	-	30%	22%	19%	9%	20%	A	-	-	-	-	-	-
	B	21%	-	24%	21%	10%	24%	B	-	-	-	-	-	-
5-6 PM	C	16%	33%	-	37%	0%	14%	C	10%	26%	-	48%	0%	16%
	D	18%	14%	14%	-	3%	51%	D	12%	10%	10%	-	13%	55%
	E	15%	32%	0%	17%	-	37%	E	15%	32%	0%	16%	-	37%
	F	20%	14%	7%	49%	10%	-	F	10%	8%	8%	64%	11%	-
Time	MD Peak Bluetooth OD							MD Peak TFlowFuzzy OD						
		A	B	C	D	E	F		A	B	C	D	E	F
	A	-	33%	19%	19%	9%	20%	A	-	-	-	-	-	-
	B	31%	-	17%	21%	9%	24%	B	-	-	-	-	-	-
12-1 PM	C	19%	33%	-	29%	0%	17%	C	3%	18%	-	59%	0%	20%
	D	25%	14%	16%	-	6%	40%	D	10%	12%	11%	-	16%	52%
	E	14%	35%	0%	17%	-	31%	E	20%	28%	0%	17%	-	35%
	F	22%	16%	10%	42%	10%	-	F	7%	9%	8%	64%	12%	-
		A	B	C	D	E	F		A	B	C	D	E	F
	A	-	31%	19%	20%	9%	21%	A	-	-	-	-	-	-
	B	30%	-	18%	19%	10%	24%	B	-	-	-	-	-	-
1-2 PM	C	18%	34%	-	29%	0%	19%	C	6%	13%	-	58%	0%	23%
	D	25%	14%	16%	-	6%	40%	D	10%	12%	10%	-	16%	53%
	E	16%	33%	0%	19%	-	31%	E	17%	33%	0%	18%	-	32%
	F	21%	15%	10%	42%	10%	-	F	7%	9%	7%	65%	12%	-

Time	AM Peak Bluetooth OD							AM Peak TFlowFuzzy OD						
		A	B	C	D	E	F		A	B	C	D	E	F
	A	-	30%	31%	11%	6%	22%	A	-	-	-	-	-	-
	B	35%	-	9%	16%	4%	36%	B	-	-	-	-	-	-
6-7 AM	C	25%	26%	-	37%	0%	11%	C	7%	18%	-	45%	0%	30%
	D	19%	10%	17%	-	3%	51%	D	9%	10%	12%	-	10%	58%
	E	20%	29%	0%	12%	-	39%	E	21%	31%	0%	12%	-	36%
	F	20%	13%	6%	49%	12%	-	F	8%	9%	10%	65%	9%	-
		A	B	C	D	E	F		A	B	C	D	E	F
	A	-	29%	32%	12%	6%	21%	A	-	-	-	-	-	-
	B	32%	-	12%	17%	6%	33%	B	-	-	-	-	-	-
7-8 AM	C	25%	32%	-	29%	0%	13%	C	12%	23%	-	42%	0%	22%
	D	21%	10%	18%	-	2%	49%	D	10%	11%	12%	-	11%	56%
	E	19%	26%	0%	13%	-	43%	E	18%	29%	0%	13%	-	40%
	F	19%	14%	6%	52%	9%	-	F	7%	9%	12%	63%	9%	-
		A	B	C	D	E	F		A	B	C	D	E	F
	A	-	33%	27%	13%	6%	21%	A	-	-	-	-	-	-
	B	31%	-	19%	14%	8%	28%	B	-	-	-	-	-	-
8-9 AM	C	23%	36%	-	25%	0%	16%	C	7%	27%	-	40%	0%	25%
	D	22%	11%	18%	-	3%	47%	D	9%	10%	12%	-	10%	58%
	E	18%	26%	0%	16%	-	40%	E	22%	23%	0%	16%	-	39%
	F	20%	13%	6%	53%	9%	-	F	8%	9%	11%	63%	9%	-
		A	B	C	D	E	F		A	B	C	D	E	F
	A	-	37%	24%	12%	6%	20%	A	-	-	-	-	-	-
	B	29%	-	20%	13%	8%	29%	B	-	-	-	-	-	-
9-10 AM	C	19%	37%	-	25%	0%	18%	C	5%	19%	-	53%	0%	23%
	D	22%	12%	15%	-	4%	47%	D	10%	12%	11%	-	13%	55%
	E	16%	29%	0%	15%	-	40%	E	16%	30%	0%	14%	-	41%
	F	24%	13%	8%	46%	9%	-	F	7%	9%	8%	65%	10%	-

Notes: Zone A and B are internal zones, indicating the zone A or B original nodes aren't the same and summations of routes from zone A or B routes aren't equal to 100%. (A: I-5 at Flint Ave; B: I-5 at Rose Quarter; C: I-5 near Morrison Bridge; D: I-5 North Overlook; E: I-84; F: US 30 and I-405)

Signal Timing

Signal timing data was provided from ODOT via PBOT. Due to the length of the study period, multiple coordination patterns were coded to replicate the field operations. Signal timing was coded in VISSIM using the RBC controller. Detector data was provided for some of the intersections via as-builts. In other cases, detector data was assumed based on standards, signal timing sheets, and field observations. The signal timing sheets, as discussed with PBOT, were not exactly what are currently being used in the field. Through field verification and discussions with PBOT, minor changes from the signal timing sheets were required to calibrate the model.

Speed Calibration

Spot speed data was developed from the INRIX data provided by ODOT. The INRIX speed data is based on average weekdays (Tuesdays, Wednesdays, and Thursdays) in 2013. In order to account for congestion outside of the study area, reduced speed areas (RSAs) were used to create bottlenecks based on the INRIX speed data. The size and location of the RSAs were

adjusted until the bottlenecks triggered correctly and reproduced the congestion observed in the field. Desired speed decisions were also used to maintain the bottleneck speed and reduce the length of the RSAs. During the p.m. peak period, bottlenecks were needed on I-5 NB north of the I-405 interchange and on I-84 EB east of Grande Avenue. The calculated INRIX speeds by 15-minute increments are provided in an excel file to ODOT.[4] During the a.m. and mid-day peak periods, no bottlenecks were needed to mimic any congestion in the study area.

A comparison of modeled speeds versus INRIX spot speed data for northbound and southbound I-5 is provided in Table 4 through Table 8 - Northbound Midday Peak Period Speed Comparison Chart

12:00 PM	12:15 PM	12:30 PM	12:45 PM	1:00 PM	1:15 PM	1:30 PM	1:45 PM	
MD - Northbound Average Speeds - (VISSIM Data)								**Location**
47.4	46.5	47.5	47.6	48.4	46.6	46.7	47.8	I-5 NB 114+04454 Near 84
52.3	51.7	52.7	52.3	52.9	52.6	51.6	50.2	I-5 NB 114P04454 Near 84
49.5	49.0	50.9	47.2	52.7	50.8	47.8	43.5	I-5 NB 114+04455 Near Multnomah
44.2	44.2	44.6	43.2	45.5	44.0	43.1	43.3	I-5 NB 114P04455 Near Weidler
49.3	47.7	47.8	47.5	47.9	48.6	47.4	48.3	I-5 NB 114+4456 Bt Broadway/Weidler
48.0	45.8	45.3	45.2	44.6	45.5	45.2	46.5	I-5 NB 114P04456 Near Broadway
44.1	42.7	42.7	42.6	41.8	41.6	42.1	43.7	I-5 NB 114+04457 BT 405/Weidler
53.1	53.2	53.1	53.4	53.7	53.6	53.5	53.6	I-5 NB 114P04457 Near 405
50.0	49.9	48.6	48.9	49.2	47.7	47.7	47.9	I-5 NB 114+04458 Near Going
MD - Northbound Average Speeds - (INRIX Data)								**Location**
48.9	49.0	48.5	47.6	46.6	45.7	43.3	43.1	I-5 NB 114+04454 Near 84
46.7	46.6	46.1	45.1	43.8	43.2	41.0	40.5	I-5 NB 114P04454 Near 84
47.1	46.8	46.3	45.6	45.3	43.5	41.9	41.5	I-5 NB 114+04455 Near Multnomah
50.4	50.0	49.4	48.6	48.4	46.8	45.6	44.9	I-5 NB 114P04455 Near Weidler
50.1	49.9	49.1	47.9	47.6	46.2	44.8	43.9	I-5 NB 114+4456 Bt Broadway/Weidler
50.2	50.2	49.6	48.6	48.6	47.5	46.3	45.8	I-5 NB 114P04456 Near Broadway
51.7	51.6	51.3	50.5	50.9	49.5	49.0	49.0	I-5 NB 114+04457 BT 405/Weidler
55.1	54.8	54.8	54.5	54.5	53.7	53.5	53.3	I-5 NB 114P04457 Near 405
56.1	55.8	56.1	56.1	55.9	55.1	54.7	53.8	I-5 NB 114+04458 Near Going
MD - Northbound Speed Difference								**Location**
1.6	2.5	1.1	0.1	-1.8	-0.8	-3.4	-4.8	I-5 NB 114+04454 Near 84
-5.5	-5.2	-6.6	-7.2	-9.1	-9.4	-10.6	-9.6	I-5 NB 114P04454 Near 84
-2.4	-2.2	-4.6	-1.6	-7.4	-7.4	-5.8	-2.0	I-5 NB 114+04455 Near Multnomah
6.2	5.8	4.8	5.3	2.9	2.8	2.5	1.6	I-5 NB 114P04455 Near Weidler
0.8	2.2	1.3	0.4	-0.3	-2.4	-2.7	-4.4	I-5 NB 114+4456 Bt Broadway/Weidler
2.2	4.4	4.3	3.4	3.9	2.0	1.2	-0.8	I-5 NB 114P04456 Near Broadway
7.6	8.9	8.6	7.9	9.1	8.0	6.9	5.2	I-5 NB 114+04457 BT 405/Weidler
2.1	1.6	1.7	1.1	0.8	0.1	0.0	-0.3	I-5 NB 114P04457 Near 405
6.2	5.9	7.5	7.2	6.7	7.4	7.0	5.9	I-5 NB 114+04458 Near Going

Source: Data collection results (.mes) averaged over 10 simulations runs (1 through 10)

[4] Submitted electronically week of August 25, 2014 to Joseph Auth, Simon Eng, and Jon Makler

Table 9. Table 4 and Table 5 show the p.m. model meets the spot speed calibration target of less than 10 miles per hour for 85% of the locations. The a.m. and mid-day peak hour northbound and southbound spot speed charts are in Table 6 through Table 8 - Northbound Midday Peak Period Speed Comparison Chart

12:00 PM	12:15 PM	12:30 PM	12:45 PM	1:00 PM	1:15 PM	1:30 PM	1:45 PM	
MD - Northbound Average Speeds - (VISSIM Data)								**Location**
47.4	46.5	47.5	47.6	48.4	46.6	46.7	47.8	I-5 NB 114+04454 Near 84
52.3	51.7	52.7	52.3	52.9	52.6	51.6	50.2	I-5 NB 114P04454 Near 84
49.5	49.0	50.9	47.2	52.7	50.8	47.8	43.5	I-5 NB 114+04455 Near Multnomah
44.2	44.2	44.6	43.2	45.5	44.0	43.1	43.3	I-5 NB 114P04455 Near Weidler
49.3	47.7	47.8	47.5	47.9	48.6	47.4	48.3	I-5 NB 114+4456 Bt Broadway/Weidler
48.0	45.8	45.3	45.2	44.6	45.5	45.2	46.5	I-5 NB 114P04456 Near Broadway
44.1	42.7	42.7	42.6	41.8	41.6	42.1	43.7	I-5 NB 114+04457 BT 405/Weidler
53.1	53.2	53.1	53.4	53.7	53.6	53.5	53.6	I-5 NB 114P04457 Near 405
50.0	49.9	48.6	48.9	49.2	47.7	47.7	47.9	I-5 NB 114+04458 Near Going
MD - Northbound Average Speeds - (INRIX Data)								**Location**
48.9	49.0	48.5	47.6	46.6	45.7	43.3	43.1	I-5 NB 114+04454 Near 84
46.7	46.6	46.1	45.1	43.8	43.2	41.0	40.5	I-5 NB 114P04454 Near 84
47.1	46.8	46.3	45.6	45.3	43.5	41.9	41.5	I-5 NB 114+04455 Near Multnomah
50.4	50.0	49.4	48.6	48.4	46.8	45.6	44.9	I-5 NB 114P04455 Near Weidler
50.1	49.9	49.1	47.9	47.6	46.2	44.8	43.9	I-5 NB 114+4456 Bt Broadway/Weidler
50.2	50.2	49.6	48.6	48.6	47.5	46.3	45.8	I-5 NB 114P04456 Near Broadway
51.7	51.6	51.3	50.5	50.9	49.5	49.0	49.0	I-5 NB 114+04457 BT 405/Weidler
55.1	54.8	54.8	54.5	54.5	53.7	53.5	53.3	I-5 NB 114P04457 Near 405
56.1	55.8	56.1	56.1	55.9	55.1	54.7	53.8	I-5 NB 114+04458 Near Going
MD - Northbound Speed Difference								**Location**
1.6	2.5	1.1	0.1	-1.8	-0.8	-3.4	-4.8	I-5 NB 114+04454 Near 84
-5.5	-5.2	-6.6	-7.2	-9.1	-9.4	-10.6	-9.6	I-5 NB 114P04454 Near 84
-2.4	-2.2	-4.6	-1.6	-7.4	-7.4	-5.8	-2.0	I-5 NB 114+04455 Near Multnomah
6.2	5.8	4.8	5.3	2.9	2.8	2.5	1.6	I-5 NB 114P04455 Near Weidler
0.8	2.2	1.3	0.4	-0.3	-2.4	-2.7	-4.4	I-5 NB 114+4456 Bt Broadway/Weidler
2.2	4.4	4.3	3.4	3.9	2.0	1.2	-0.8	I-5 NB 114P04456 Near Broadway
7.6	8.9	8.6	7.9	9.1	8.0	6.9	5.2	I-5 NB 114+04457 BT 405/Weidler
2.1	1.6	1.7	1.1	0.8	0.1	0.0	-0.3	I-5 NB 114P04457 Near 405
6.2	5.9	7.5	7.2	6.7	7.4	7.0	5.9	I-5 NB 114+04458 Near Going

Source: Data collection results (.mes) averaged over 10 simulations runs (1 through 10)

Table 9 that explains the morning and mid-day models meet the spot speed calibration targets. It should also be noted that while the INRIX segments are fairly short, they are not direct comparisons of how we are collecting the data as we are using specific points in the middle of the INRIX segment to collect the speed data.

Table 4 – Northbound PM Peak Period Speed Comparison Chart

2:00 PM	2:15 PM	2:30 PM	2:45 PM	3:00 PM	3:15 PM	3:30 PM	3:45 PM	4:00 PM	4:15 PM	4:30 PM	4:45 PM	5:00 PM	5:15 PM	5:30 PM	5:45 PM	
PM - Northbound Average Speeds - (VISSIM Data)																**Location**
50.4	51.6	51.9	50.0	51.6	49.7	51.4	45.3	43.9	46.1	45.0	37.6	27.9	24.6	22.8	23.3	I-5 NB 114+04454 Near 84
53.7	54.2	54.2	53.3	54.0	52.7	53.6	51.4	50.6	51.3	50.8	43.2	29.9	24.8	25.0	24.8	I-5 NB 114P04454 Near 84
54.3	54.6	54.5	54.5	54.5	54.1	54.2	49.2	50.8	48.0	47.0	39.7	25.2	22.0	22.5	22.5	I-5 NB 114+04455 Near Multnomah
51.3	52.2	52.3	51.3	51.6	50.8	51.3	45.8	45.2	45.4	44.0	35.8	28.2	27.0	32.3	37.4	I-5 NB 114P04455 Near Weidler
52.9	53.1	53.4	52.8	52.8	52.3	52.5	49.7	50.0	50.1	48.0	37.0	27.7	27.3	31.4	37.7	I-5 NB 114+4456 Bt Broadway/Weidler
52.5	52.4	52.9	52.5	52.1	51.7	51.8	48.5	48.9	48.9	45.2	33.5	26.1	25.5	28.1	34.0	I-5 NB 114P04456 Near Broadway
52.1	52.7	52.7	53.3	53.0	52.5	52.7	50.2	49.4	48.1	41.6	30.5	25.0	25.9	26.1	31.5	I-5 NB 114+04457 BT 405/Weidler
55.0	55.0	55.1	54.7	54.9	54.8	54.7	54.1	53.1	35.9	19.3	16.0	16.1	16.3	16.8	17.3	I-5 NB 114P04457 Near 405
44.0	47.2	45.4	46.5	48.0	46.9	45.8	33.3	14.9	12.6	13.0	12.7	12.3	13.0	12.7	13.2	I-5 NB 114+04458 Near Going
PM - Northbound Average Speeds - (INRIX Data)																**Location**
42.8	42.7	42.5	44.2	47.2	48.8	47.9	45.7	44.4	42.9	39.4	36.9	35.0	34.0	32.7	34.1	I-5 NB 114+04454 Near 84
40.4	40.6	40.3	41.5	45.0	46.5	45.4	43.4	42.3	41.3	37.7	35.5	34.3	33.1	31.6	32.8	I-5 NB 114P04454 Near 84
42.0	41.8	41.1	42.0	44.5	45.6	44.4	42.5	42.0	40.3	37.5	35.1	34.1	33.2	32.0	33.2	I-5 NB 114+04455 Near Multnomah
45.4	44.3	43.9	44.2	46.1	47.0	45.7	43.2	42.4	40.5	37.0	34.8	33.9	33.7	32.1	32.7	I-5 NB 114P04455 Near Weidler
44.3	43.2	42.5	42.8	46.1	46.9	45.4	42.9	41.9	40.2	36.8	34.5	33.2	33.4	31.8	32.0	I-5 NB 114+4456 Bt Broadway/Weidler
45.8	44.9	44.2	44.2	46.0	46.0	44.3	41.9	41.2	39.2	35.2	33.4	32.8	32.8	31.5	31.8	I-5 NB 114P04456 Near Broadway
49.2	48.5	47.7	47.3	47.7	46.4	44.1	41.9	40.7	38.7	35.5	32.8	32.7	33.4	32.1	32.4	I-5 NB 114+04457 BT 405/Weidler
52.6	51.7	50.8	49.0	45.0	37.4	32.1	29.0	28.0	25.1	22.2	20.3	20.8	20.7	20.1	21.7	I-5 NB 114P04457 Near 405
52.9	51.2	50.3	45.7	38.5	26.9	22.4	20.9	19.1	17.2	15.6	14.5	14.1	13.1	13.1	14.8	I-5 NB 114+04458 Near Going
PM - Northbound Speed Difference																**Location**
-7.6	-8.9	-9.5	-5.8	-4.4	-0.9	-3.5	0.4	0.6	-3.2	-5.6	-0.7	7.1	9.5	9.9	10.8	I-5 NB 114+04454 Near 84
-13.3	-13.6	-13.9	-11.8	-9.1	-6.2	-8.2	-8.0	-8.3	-10.0	-13.1	-7.7	4.4	8.3	6.6	8.1	I-5 NB 114P04454 Near 84
-12.3	-12.9	-13.4	-12.5	-10.0	-8.5	-9.8	-6.7	-8.8	-7.7	-9.5	-4.5	8.9	11.3	9.5	10.7	I-5 NB 114+04455 Near Multnomah
-5.9	-7.9	-8.4	-7.0	-5.6	-3.8	-5.6	-2.6	-2.9	-4.9	-7.0	-1.0	5.7	6.7	-0.2	-4.7	I-5 NB 114P04455 Near Weidler
-8.6	-9.9	-11.0	-10.0	-6.7	-5.4	-7.1	-6.8	-8.1	-9.9	-11.3	-2.5	5.5	6.1	0.4	-5.6	I-5 NB 114+4456 Bt Broadway/Weidler
-6.7	-7.5	-8.8	-8.3	-6.2	-5.7	-7.5	-6.5	-7.8	-9.7	-10.0	-0.2	6.7	7.2	3.5	-2.2	I-5 NB 114P04456 Near Broadway
-2.9	-4.2	-5.1	-6.0	-5.3	-6.1	-8.6	-8.3	-8.6	-9.3	-6.2	2.3	7.7	7.4	6.1	0.9	I-5 NB 114+04457 BT 405/Weidler
-2.3	-3.3	-4.3	-5.7	-9.9	-17.4	-22.6	-25.1	-25.1	-10.8	2.9	4.3	4.7	4.4	3.3	4.4	I-5 NB 114P04457 Near 405
8.9	4.0	4.8	-0.8	-9.5	-20.0	-23.4	-12.4	4.2	4.6	2.6	1.8	1.8	0.1	0.3	1.6	I-5 NB 114+04458 Near Going

Source: Data collection results (.mes) averaged over 10 simulations runs (1 through 10)

Table 5 – Southbound PM Peak Period Speed Comparison Chart

2:00 PM	2:15 PM	2:30 PM	2:45 PM	3:00 PM	3:15 PM	3:30 PM	3:45 PM	4:00 PM	4:15 PM	4:30 PM	4:45 PM	5:00 PM	5:15 PM	5:30 PM	5:45 PM	
PM - Southbound Average Speeds - (VISSIM Data)																**Location**
54.0	54.0	53.9	54.0	53.6	48.7	38.1	40.5	40.0	44.5	46.7	50.6	52.2	47.6	26.9	20.1	I-5 SB 114-04457 Near Going
53.2	53.1	53.3	45.7	29.6	21.7	26.8	28.0	28.3	32.1	39.6	42.1	39.6	22.0	18.8	19.0	I-5 SB 114N04457 Near 405
52.9	52.2	36.9	15.5	15.1	15.0	15.7	15.2	15.6	15.3	15.4	15.1	14.0	14.3	14.6	14.0	I-5 SB 114-04456 Bt 405/Broadway
39.5	33.2	22.3	19.7	18.0	18.6	19.5	18.8	19.1	19.1	18.8	18.3	15.7	15.1	15.0	14.6	I-5 SB 114N04456 Near Broadway
44.1	39.4	32.9	32.4	27.0	29.8	33.3	30.2	32.8	31.2	30.7	29.0	22.4	19.7	19.2	19.4	I-5 SB 114-04455 Near Broadway
41.3	36.8	31.3	31.2	27.1	29.5	31.2	29.5	30.1	29.4	27.9	27.8	21.1	19.5	18.8	19.7	I-5 SB 114N04455 Near Moda Center
36.7	35.1	33.5	33.1	33.5	34.3	34.5	34.1	34.0	34.4	33.9	32.9	30.6	29.9	30.4	29.9	I-5 SB 114-04454 Near Multnomah
51.0	50.7	51.2	50.3	49.3	45.4	46.3	46.7	47.0	47.6	47.8	47.9	40.7	50.9	52.6	51.6	I-5 SB 114N04454 Near 84
55.7	55.4	55.6	55.5	55.4	55.0	55.1	54.9	54.7	55.1	47.8	43.8	41.4	39.8	40.3	40.5	I-5 SB 114-04452 Near Morrison
PM - Southbound Average Speeds - (INRIX Data)																**Location**
53.0	53.9	53.5	49.8	41.4	38.2	40.3	42.7	42.1	43.9	41.3	41.4	40.9	40.1	37.0	39.4	I-5 SB 114-04457 Near Going
41.1	41.1	40.9	26.7	18.3	18.2	22.2	21.7	22.5	25.0	23.0	25.0	25.9	25.1	21.8	25.5	I-5 SB 114N04457 Near 405
33.3	32.9	33.1	18.4	14.6	15.2	18.6	16.0	17.4	19.3	18.2	19.4	20.8	20.0	17.0	20.5	I-5 SB 114-04456 Bt 405/Broadway
33.9	32.7	33.2	20.4	17.3	17.7	20.3	18.1	19.4	21.1	19.6	20.3	21.3	20.7	17.7	21.0	I-5 SB 114N04456 Near Broadway
38.1	36.9	37.1	27.1	23.3	23.0	25.7	23.8	25.4	26.6	24.8	25.3	26.0	25.2	21.4	25.0	I-5 SB 114-04455 Near Broadway
41.6	40.5	40.5	30.7	26.9	26.1	28.6	26.7	28.3	29.2	27.1	27.5	28.3	27.3	22.5	26.4	I-5 SB 114N04455 Near Moda Center
44.4	43.5	43.0	36.5	32.6	32.1	33.5	32.5	33.2	33.1	31.0	30.5	30.6	29.5	25.0	28.2	I-5 SB 114-04454 Near Multnomah
50.5	50.3	49.9	47.0	46.0	45.6	46.4	46.1	47.0	45.7	44.0	43.0	40.9	39.7	34.7	36.9	I-5 SB 114N04454 Near 84
54.8	55.1	54.8	54.5	54.9	54.9	53.8	53.4	52.5	49.9	46.2	43.3	41.9	39.7	38.3	38.9	I-5 SB 114-04452 Near Morrison
PM - Southbound Speed Difference																**Location**
-1.0	-0.1	-0.4	-4.2	-12.2	-10.5	2.2	2.3	2.1	-0.6	-5.4	-9.2	-11.4	-7.4	10.1	19.3	I-5 SB 114-04457 Near Going
-12.2	-12.0	-12.4	-18.9	-11.3	-3.5	-4.6	-6.3	-5.8	-7.1	-16.5	-17.0	-13.7	3.1	3.0	6.4	I-5 SB 114N04457 Near 405
-19.6	-19.3	-3.8	2.9	-0.4	0.3	2.9	0.8	1.8	4.0	2.9	4.3	6.8	5.6	2.4	6.6	I-5 SB 114-04456 Bt 405/Broadway
-5.6	-0.5	10.9	0.8	-0.6	-0.9	0.8	-0.7	0.3	2.0	0.8	2.0	5.6	5.6	2.7	6.4	I-5 SB 114N04456 Near Broadway
-6.0	-2.4	4.2	-5.3	-3.7	-6.8	-7.6	-6.4	-7.3	-4.6	-5.9	-3.6	3.7	5.5	2.2	5.6	I-5 SB 114-04455 Near Broadway
0.3	3.7	9.2	-0.5	-0.1	-3.5	-2.6	-2.8	-1.8	-0.2	-0.7	-0.2	7.2	7.7	3.8	6.8	I-5 SB 114N04455 Near Moda Center
7.7	8.4	9.4	3.4	-1.0	-2.1	-1.0	-1.6	-0.8	-1.3	-2.9	-2.4	0.0	-0.5	-5.3	-1.7	I-5 SB 114-04454 Near Multnomah
-0.5	-0.4	-1.4	-3.2	-3.3	0.2	0.2	-0.6	0.0	-1.9	-3.8	-5.0	0.2	-11.2	-17.8	-14.6	I-5 SB 114N04454 Near 84
-0.9	-0.3	-0.8	-1.0	-0.6	-0.1	-1.3	-1.4	-2.2	-5.2	-1.6	-0.5	0.5	-0.1	-2.1	-1.6	I-5 SB 114-04452 Near Morrison

Source: Data collection results (.mes) averaged over 10 simulations runs (1 through 10)

Table 6 – Northbound AM Peak Period Speed Comparison Chart

6:00 AM	6:15 AM	6:30 AM	6:45 AM	7:00 AM	7:15 AM	7:30 AM	7:45 AM	8:00 AM	8:15 AM	8:30 AM	8:45 AM	9:00 AM	9:15 AM	9:30 AM	9:45 AM	
AM - Northbound Average Speeds - (VISSIM Data)																**Location**
54.2	52.3	47.5	44.4	45.7	41.6	37.1	33.7	32.1	36.1	38.5	42.5	47.0	47.4	47.8	49.2	I-5 NB 114+04454 Near 84
55.4	54.1	52.3	49.9	50.6	48.2	39.6	33.8	30.9	36.7	42.1	42.6	49.7	51.8	52.4	53.1	I-5 NB 114P04454 Near 84
55.1	52.4	45.5	37.7	34.7	33.6	27.8	26.7	25.3	28.3	32.2	33.8	41.7	49.3	50.2	49.2	I-5 NB 114+04455 Near Multnomah
52.7	48.2	44.1	41.2	40.4	41.2	39.6	38.8	39.2	42.0	41.8	42.1	42.2	45.4	46.7	46.1	I-5 NB 114P04455 Near Weidler
53.5	51.0	49.3	47.1	43.0	46.5	46.4	44.5	43.7	47.2	46.7	47.2	44.8	48.7	50.1	49.8	I-5 NB 114+4456 Bt Broadway/Weidler
52.3	48.9	46.1	42.5	40.9	42.9	44.1	41.0	40.9	43.7	43.0	44.7	41.9	46.6	48.2	47.8	I-5 NB 114P04456 Near Broadway
54.9	53.1	52.2	49.3	48.4	47.3	46.7	42.5	42.8	45.1	44.9	47.0	45.3	48.4	48.9	49.4	I-5 NB 114+04457 BT 405/Weidler
56.2	55.8	55.6	54.9	55.0	55.0	54.8	54.6	54.7	54.8	54.5	54.9	54.0	54.2	54.2	54.5	I-5 NB 114P04457 Near 405
55.6	54.7	53.0	52.0	51.0	50.8	50.1	50.0	50.4	49.7	49.8	50.4	50.8	51.2	52.0	52.0	I-5 NB 114+04458 Near Going
AM - Northbound Average Speeds - (INRIX Data)																**Location**
55.3	55.3	54.2	49.7	45.4	44.0	40.4	36.3	34.3	38.0	40.2	41.6	42.8	45.3	47.9	50.3	I-5 NB 114+04454 Near 84
52.4	52.4	50.9	46.1	42.2	42.1	39.5	36.7	35.2	37.6	39.4	40.6	41.4	42.7	45.5	47.4	I-5 NB 114P04454 Near 84
53.9	52.8	50.2	46.6	45.1	45.3	44.7	44.0	43.8	44.5	45.2	45.3	44.6	44.5	46.3	47.2	I-5 NB 114+04455 Near Multnomah
56.0	55.4	53.1	50.8	50.6	50.4	50.1	50.4	50.2	50.4	50.5	50.1	49.4	48.8	50.3	50.7	I-5 NB 114P04455 Near Weidler
56.6	56.0	53.8	51.6	51.5	51.3	51.1	51.5	51.2	51.2	51.2	51.0	49.5	48.4	50.0	51.2	I-5 NB 114+4456 Bt Broadway/Weidler
56.2	55.5	53.0	50.8	50.8	50.7	50.6	50.9	50.7	50.7	50.6	50.4	50.0	49.2	50.4	51.1	I-5 NB 114P04456 Near Broadway
55.8	55.3	53.1	51.3	51.4	51.6	51.3	51.3	51.4	51.2	51.2	50.9	51.3	50.7	51.5	52.0	I-5 NB 114+04457 BT 405/Weidler
57.0	56.9	56.3	55.6	55.6	55.8	55.7	55.5	55.7	55.6	55.4	55.2	55.4	55.1	55.3	55.7	I-5 NB 114P04457 Near 405
58.9	58.5	58.2	57.9	57.8	57.7	57.7	57.4	57.5	57.1	56.8	56.6	56.8	56.6	56.4	57.0	I-5 NB 114+04458 Near Going
AM - Northbound Speed Difference																**Location**
1.1	3.1	6.6	5.4	-0.3	2.4	3.4	2.6	2.3	1.9	1.6	-0.9	-4.2	-2.1	0.0	1.1	I-5 NB 114+04454 Near 84
-3.1	-1.6	-1.3	-3.8	-8.4	-6.1	-0.1	2.9	4.3	1.0	-2.7	-2.0	-8.4	-9.1	-6.9	-5.7	I-5 NB 114P04454 Near 84
-1.2	0.3	4.7	8.9	10.4	11.7	16.9	17.3	18.4	16.3	13.1	11.4	3.0	-4.7	-4.0	-2.0	I-5 NB 114+04455 Near Multnomah
3.3	7.3	9.1	9.5	10.2	9.2	10.5	11.5	11.0	8.4	8.7	8.0	7.2	3.4	3.6	4.7	I-5 NB 114P04455 Near Weidler
3.1	5.0	4.4	4.5	8.5	4.8	4.7	7.0	7.5	4.0	4.4	3.8	4.8	-0.3	-0.1	1.4	I-5 NB 114+4456 Bt Broadway/Weidler
3.9	6.6	6.9	8.2	9.9	7.8	6.5	9.9	9.8	7.0	7.7	5.7	8.1	2.6	2.2	3.3	I-5 NB 114P04456 Near Broadway
0.9	2.2	0.9	1.9	3.0	4.3	4.6	8.8	8.6	6.1	6.3	3.9	6.0	2.2	2.7	2.6	I-5 NB 114+04457 BT 405/Weidler
0.8	1.1	0.7	0.7	0.6	0.8	0.9	0.9	1.0	0.8	0.9	0.3	1.4	0.9	1.1	1.2	I-5 NB 114P04457 Near 405
3.3	3.8	5.1	5.9	6.8	7.0	7.6	7.4	7.1	7.3	7.0	6.2	6.1	5.4	4.4	4.9	I-5 NB 114+04458 Near Going

Source: Data collection results (.mes) averaged over 10 simulations runs (1 through 10)

Table 7 - Southbound AM Peak Period Speed Comparison Chart

6:00 AM	6:15 AM	6:30 AM	6:45 AM	7:00 AM	7:15 AM	7:30 AM	7:45 AM	8:00 AM	8:15 AM	8:30 AM	8:45 AM	9:00 AM	9:15 AM	9:30 AM	9:45 AM	
AM - Southbound Average Speeds - (VISSIM Data)																**Location**
54.2	52.1	51.2	50.7	49.9	49.7	46.0	43.8	36.7	34.5	31.3	30.6	30.1	39.9	43.9	41.5	I-5 SB 114-04457 Near Going
54.4	53.4	52.8	53.3	52.6	52.2	52.1	41.0	29.7	31.6	28.3	25.1	24.5	35.2	42.5	41.2	I-5 SB 114N04457 Near 405
56.1	55.6	55.1	55.2	55.1	54.5	35.2	17.1	16.0	16.6	16.2	16.3	16.5	15.7	18.3	23.1	I-5 SB 114-04456 Bt 405/Broadway
53.2	51.1	46.8	46.3	42.4	39.0	29.8	28.6	29.1	28.7	29.1	29.3	29.3	28.4	29.1	29.3	I-5 SB 114N04456 Near Broadway
53.0	52.0	49.5	49.6	48.4	47.0	42.8	40.9	41.1	41.1	42.4	42.4	42.7	39.0	41.4	42.0	I-5 SB 114-04455 Near Broadway
53.0	51.7	49.4	49.6	48.4	47.1	42.4	40.3	39.1	40.0	41.8	41.3	41.1	37.6	40.2	39.4	I-5 SB 114N04455 Near Moda Center
54.0	52.1	50.4	49.9	45.8	41.8	39.2	38.0	36.7	37.1	39.4	37.6	38.2	38.4	39.3	39.4	I-5 SB 114-04454 Near Multnomah
53.6	52.1	50.3	50.2	46.6	38.4	36.8	36.5	38.4	37.5	36.2	38.5	38.3	43.2	44.6	43.1	I-5 SB 114N04454 Near 84
56.5	56.2	55.8	55.9	55.3	54.3	54.4	54.2	54.6	54.5	54.1	54.6	54.7	55.4	55.1	55.0	I-5 SB 114-04452 Near Morrison
AM - Southbound Average Speeds - (INRIX Data)																**Location**
57.1	55.7	52.9	50.9	50.2	48.0	44.3	36.7	34.5	35.4	34.0	32.0	33.6	43.6	46.3	47.7	I-5 SB 114-04457 Near Going
55.3	55.7	54.4	54.2	54.0	52.6	50.5	43.6	40.7	40.7	40.2	34.4	29.9	40.5	44.4	45.8	I-5 SB 114N04457 Near 405
55.8	55.0	53.1	52.7	52.0	50.6	48.1	39.4	36.8	37.1	37.4	31.4	27.0	34.8	40.5	41.0	I-5 SB 114-04456 Bt 405/Broadway
57.4	55.9	53.7	53.0	52.0	50.7	48.2	40.2	37.8	37.7	38.5	33.9	30.5	35.8	41.1	41.6	I-5 SB 114N04456 Near Broadway
57.0	55.3	53.1	52.6	51.7	50.5	48.5	43.8	42.0	41.7	41.6	39.1	37.1	40.0	43.6	43.9	I-5 SB 114-04455 Near Broadway
57.0	55.4	53.2	52.6	51.8	50.4	48.8	45.5	44.1	43.6	43.7	42.3	41.8	43.2	45.5	45.7	I-5 SB 114N04455 Near Moda Center
56.7	55.2	53.2	52.8	52.1	50.8	49.5	47.0	46.0	45.2	44.8	44.2	44.6	45.6	47.1	47.4	I-5 SB 114-04454 Near Multnomah
57.3	56.4	54.5	54.5	54.0	53.3	52.1	50.1	49.4	48.2	48.0	48.0	49.5	49.6	50.6	51.3	I-5 SB 114N04454 Near 84
57.2	56.8	55.7	55.7	55.1	54.9	54.3	53.9	54.0	52.9	53.0	53.1	54.0	54.1	54.2	54.2	I-5 SB 114-04452 Near Morrison
AM - Southbound Speed Difference																**Location**
2.9	3.6	1.7	0.2	0.3	-1.7	-1.8	-7.1	-2.1	0.9	2.7	1.3	3.4	3.7	2.3	6.2	I-5 SB 114-04457 Near Going
0.9	2.4	1.6	0.9	1.4	0.3	-1.5	2.5	11.0	9.2	11.9	9.3	5.4	5.4	1.9	4.6	I-5 SB 114N04457 Near 405
-0.3	-0.5	-2.0	-2.5	-3.1	-3.8	12.9	22.4	20.9	20.5	21.2	15.1	10.4	19.1	22.2	17.9	I-5 SB 114-04456 Bt 405/Broadway
4.2	4.8	6.9	6.8	9.7	11.7	18.4	11.6	8.7	9.0	9.4	4.6	1.2	7.4	12.0	12.3	I-5 SB 114N04456 Near Broadway
4.0	3.3	3.7	3.0	3.3	3.5	5.7	2.9	0.9	0.6	-0.7	-3.2	-5.7	1.0	2.2	2.0	I-5 SB 114-04455 Near Broadway
4.0	3.7	3.8	3.1	3.5	3.4	6.4	5.2	5.0	3.6	1.9	1.0	0.7	5.6	5.3	6.2	I-5 SB 114N04455 Near Moda Center
2.7	3.1	2.8	2.9	6.2	9.1	10.3	9.0	9.3	8.1	5.5	6.5	6.4	7.2	7.7	8.0	I-5 SB 114-04454 Near Multnomah
3.7	4.3	4.1	4.4	7.4	14.9	15.3	13.6	11.0	10.7	11.8	9.5	11.2	6.3	6.0	8.2	I-5 SB 114N04454 Near 84
0.7	0.7	-0.1	-0.2	-0.2	0.6	-0.1	-0.4	-0.6	-1.6	-1.1	-1.5	-0.7	-1.4	-1.0	-0.8	I-5 SB 114-04452 Near Morrison

Source: Data collection results (.mes) averaged over 10 simulations runs (1 through 10)

Table 8 - Northbound Midday Peak Period Speed Comparison Chart

12:00 PM	12:15 PM	12:30 PM	12:45 PM	1:00 PM	1:15 PM	1:30 PM	1:45 PM	
MD - Northbound Average Speeds - (VISSIM Data)								**Location**
47.4	46.5	47.5	47.6	48.4	46.6	46.7	47.8	I-5 NB 114+04454 Near 84
52.3	51.7	52.7	52.3	52.9	52.6	51.6	50.2	I-5 NB 114P04454 Near 84
49.5	49.0	50.9	47.2	52.7	50.8	47.8	43.5	I-5 NB 114+04455 Near Multnomah
44.2	44.2	44.6	43.2	45.5	44.0	43.1	43.3	I-5 NB 114P04455 Near Weidler
49.3	47.7	47.8	47.5	47.9	48.6	47.4	48.3	I-5 NB 114+4456 Bt Broadway/Weidler
48.0	45.8	45.3	45.2	44.6	45.5	45.2	46.5	I-5 NB 114P04456 Near Broadway
44.1	42.7	42.7	42.6	41.8	41.6	42.1	43.7	I-5 NB 114+04457 BT 405/Weidler
53.1	53.2	53.1	53.4	53.7	53.6	53.5	53.6	I-5 NB 114P04457 Near 405
50.0	49.9	48.6	48.9	49.2	47.7	47.7	47.9	I-5 NB 114+04458 Near Going
MD - Northbound Average Speeds - (INRIX Data)								**Location**
48.9	49.0	48.5	47.6	46.6	45.7	43.3	43.1	I-5 NB 114+04454 Near 84
46.7	46.6	46.1	45.1	43.8	43.2	41.0	40.5	I-5 NB 114P04454 Near 84
47.1	46.8	46.3	45.6	45.3	43.5	41.9	41.5	I-5 NB 114+04455 Near Multnomah
50.4	50.0	49.4	48.6	48.4	46.8	45.6	44.9	I-5 NB 114P04455 Near Weidler
50.1	49.9	49.1	47.9	47.6	46.2	44.8	43.9	I-5 NB 114+4456 Bt Broadway/Weidler
50.2	50.2	49.6	48.6	48.6	47.5	46.3	45.8	I-5 NB 114P04456 Near Broadway
51.7	51.6	51.3	50.5	50.9	49.5	49.0	49.0	I-5 NB 114+04457 BT 405/Weidler
55.1	54.8	54.8	54.5	54.5	53.7	53.5	53.3	I-5 NB 114P04457 Near 405
56.1	55.8	56.1	56.1	55.9	55.1	54.7	53.8	I-5 NB 114+04458 Near Going
MD - Northbound Speed Difference								**Location**
1.6	2.5	1.1	0.1	-1.8	-0.8	-3.4	-4.8	I-5 NB 114+04454 Near 84
-5.5	-5.2	-6.6	-7.2	-9.1	-9.4	-10.6	-9.6	I-5 NB 114P04454 Near 84
-2.4	-2.2	-4.6	-1.6	-7.4	-7.4	-5.8	-2.0	I-5 NB 114+04455 Near Multnomah
6.2	5.8	4.8	5.3	2.9	2.8	2.5	1.6	I-5 NB 114P04455 Near Weidler
0.8	2.2	1.3	0.4	-0.3	-2.4	-2.7	-4.4	I-5 NB 114+4456 Bt Broadway/Weidler
2.2	4.4	4.3	3.4	3.9	2.0	1.2	-0.8	I-5 NB 114P04456 Near Broadway
7.6	8.9	8.6	7.9	9.1	8.0	6.9	5.2	I-5 NB 114+04457 BT 405/Weidler
2.1	1.6	1.7	1.1	0.8	0.1	0.0	-0.3	I-5 NB 114P04457 Near 405
6.2	5.9	7.5	7.2	6.7	7.4	7.0	5.9	I-5 NB 114+04458 Near Going

Source: Data collection results (.mes) averaged over 10 simulations runs (1 through 10)

Table 9 - Southbound Midday Peak Period Speed Comparison Chart

12:00 PM	12:15 PM	12:30 PM	12:45 PM	1:00 PM	1:15 PM	1:30 PM	1:45 PM	
MD - Southbound Average Speeds - (VISSIM Data)								**Location**
53.7	53.5	53.0	53.2	53.8	53.9	53.2	53.7	I-5 SB 114-04457 Near Going
52.7	52.9	52.1	52.4	52.2	52.6	52.6	48.1	I-5 SB 114N04457 Near 405
36.7	42.3	40.9	34.0	33.2	37.4	37.9	27.0	I-5 SB 114-04456 Bt 405/Broadway
23.8	26.6	26.1	24.6	28.5	29.3	25.9	21.2	I-5 SB 114N04456 Near Broadway
40.3	39.0	38.0	37.3	40.0	41.1	35.9	32.7	I-5 SB 114-04455 Near Broadway
37.4	34.3	36.2	35.0	38.7	37.1	32.0	31.1	I-5 SB 114N04455 Near Moda Center
34.8	34.0	34.2	34.5	35.1	33.8	33.0	32.7	I-5 SB 114-04454 Near Multnomah
47.6	44.9	48.8	47.3	50.1	49.9	49.8	48.1	I-5 SB 114N04454 Near 84
55.1	55.0	55.3	55.0	55.4	55.4	55.4	55.6	I-5 SB 114-04452 Near Morrison
MD - Southbound Average Speeds - (INRIX Data)								**Location**
53.7	54.1	54.2	53.2	53.1	53.2	52.8	52.3	I-5 SB 114-04457 Near Going
45.1	46.4	46.2	45.6	45.2	45.8	45.1	41.7	I-5 SB 114N04457 Near 405
39.2	40.4	40.5	39.2	39.5	39.4	39.0	33.7	I-5 SB 114-04456 Bt 405/Broadway
39.4	39.7	39.9	39.2	39.3	39.0	38.9	33.5	I-5 SB 114N04456 Near Broadway
42.3	42.8	43.0	42.2	42.2	42.0	41.9	37.8	I-5 SB 114-04455 Near Broadway
45.1	45.1	45.2	44.8	44.8	44.6	44.5	41.1	I-5 SB 114N04455 Near Moda Center
46.9	46.9	47.2	46.6	46.7	46.1	46.4	43.8	I-5 SB 114-04454 Near Multnomah
51.3	51.3	51.4	51.1	50.8	50.7	51.0	50.0	I-5 SB 114N04454 Near 84
55.3	55.6	55.5	55.2	55.0	55.2	55.1	54.5	I-5 SB 114-04452 Near Morrison
MD - Southbound Speed Difference								**Location**
0	1	1	0	-1	-1	0	-1	I-5 SB 114-04457 Near Going
-8	-7	-6	-7	-7	-7	-8	-6	I-5 SB 114N04457 Near 405
2	-2	0	5	6	2	1	7	I-5 SB 114-04456 Bt 405/Broadway
16	13	14	15	11	10	13	12	I-5 SB 114N04456 Near Broadway
2	4	5	5	2	1	6	5	I-5 SB 114-04455 Near Broadway
8	11	9	10	6	8	13	10	I-5 SB 114N04455 Near Moda Center
12	13	13	12	12	12	13	11	I-5 SB 114-04454 Near Multnomah
4	6	3	4	1	1	1	2	I-5 SB 114N04454 Near 84
0	1	0	0	0	0	0	-1	I-5 SB 114-04452 Near Morrison

Source: Data collection results (.mes) averaged over 10 simulations runs (1 through 10)

Traffic Volume Calibration

Traffic volumes were developed using data provided by ODOT and Portland State's Portal website. The data included turn movement counts, ramp volumes, and freeway volumes that were collected from 2009 through 2014 and varied from yearly averages to weekly and daily volumes. The variability of the data required the volumes to be balanced and smoothed in order to best represent a worse than average 2013 volume scenario.

Model volumes were collected at all entry and exit locations as well as for intersection turn movements and at all freeway locations between ramps in the study area. The entry and exit volumes and the freeway volumes were obtained using data collection points and turn movements were based on the nodal analysis. All modeled volumes were averaged over 10 simulation runs. Provided in Table 10 through

Table 21 Table 13 is a summary of the modeled traffic volumes compared to the 2013 freeway traffic demands and the corresponding GEH value for three peak periods.

As can be seen in Table 10 throughTable 13, the a.m., mid-day, and p.m. peak GEH values are less than 5 for more than 85% of the locations required and they also meet this requirement for the additional locations evaluated throughout the model. It is important to note that the volumes being compared to the model output represent traffic demand. As the model gets more congested in the later periods, it is expected that the demand will be higher than the throughput, which is occurring in the p.m. peak model, and there may be some volume that does not get onto the model, but as we know from field observations, the queues from this area extend the model too far to capture.

GEH is calculated using the following formula[5]:

$$GEH = \sqrt{\frac{2(m-c)^2}{m+c}}$$

Notes:
m = output traffic volume from the simulation model (vph)
c = input traffic volume (vph)

The GEH is scored using the following classification:[6]

GEH < 5.0	**Acceptable fit**
5.0 <= GEH <= 10.0	Caution: possible model error or bad data
GEH > 10.0	Unacceptable

[5] ODOT VISSIM Protocol, June 2011
[6] ODOT VISSIM Protocol, June 2011

Table 10 – PM Peak Period Northbound Freeway GEH Summary

2:00 PM	2:15 PM	2:30 PM	2:45 PM	3:00 PM	3:15 PM	3:30 PM	3:45 PM	4:00 PM	4:15 PM	4:30 PM	4:45 PM	5:00 PM	5:15 PM	5:30 PM	5:45 PM	
PM - Northbound Average Volumes - (VISSIM Data)																**Location**
538	490	490	564	508	597	515	700	729	688	727	737	647	570	597	595	I-5 NB 114+04454 Near 84
826	803	808	821	821	816	811	1,006	1,001	1,028	1,049	951	888	836	857	825	I-5 NB 114+04455 Near Multnomah
616	596	590	612	610	608	608	750	765	772	788	705	640	607	623	602	I-5 NB 114P04455 Near Weidler
810	774	768	788	780	791	784	910	969	978	974	881	821	816	833	819	I-5 NB 114+04457 BT 405/Weidler
455	428	424	452	413	425	420	479	536	504	484	473	459	453	463	470	I-5 NB 114P04457 Near 405
1,016	948	971	993	957	1,000	981	1,099	946	872	871	858	825	841	843	884	I-5 NB 114+04458 Near Going
PM - Northbound Average Volumes - (Input Data)																**Location**
539	488	501	557	505	600	512	710	731	688	728	776	762	621	646	657	I-5 NB 114+04454 Near 84
822	801	818	809	818	818	810	1,027	1,001	1,030	1,059	1,039	1,018	966	989	997	I-5 NB 114+04455 Near Multnomah
628	602	596	593	618	593	596	793	786	789	789	766	748	710	702	689	I-5 NB 114P04455 Near Weidler
810	781	772	774	816	772	751	996	1,003	1,009	997	981	949	899	917	873	I-5 NB 114+04457 BT 405/Weidler
470	422	432	432	448	412	384	541	565	551	524	541	515	519	479	489	I-5 NB 114P04457 Near 405
1,031	939	983	973	992	991	948	1,217	1,165	1,125	1,114	1,166	1,184	1,139	1,039	1,015	I-5 NB 114+04458 Near Going
PM - Northbound GEH																**Location**
0.0	0.1	0.5	0.3	0.1	0.1	0.1	0.4	0.1	0.0	0.1	1.4	4.3	2.1	2.0	2.5	I-5 NB 114+04454 Near 84
0.1	0.1	0.4	0.4	0.1	0.1	0.0	0.6	0.0	0.1	0.3	2.8	4.2	4.4	4.4	5.7	I-5 NB 114+04455 Near Multnomah
0.5	0.2	0.3	0.8	0.3	0.6	0.5	1.6	0.8	0.6	0.0	2.3	4.1	4.0	3.1	3.4	I-5 NB 114P04455 Near Weidler
0.0	0.3	0.1	0.5	1.3	0.7	1.2	2.8	1.1	1.0	0.7	3.3	4.3	2.8	2.8	1.9	I-5 NB 114+04457 BT 405/Weidler
0.7	0.2	0.4	0.9	1.7	0.6	1.8	2.7	1.2	2.0	1.8	3.0	2.5	3.0	0.8	0.9	I-5 NB 114P04457 Near 405
0.5	0.3	0.4	0.6	1.1	0.3	1.1	3.5	6.8	8.0	7.7	9.7	11.3	9.5	6.4	4.2	I-5 NB 114+04458 Near Going

Source: Data collection results (.mes) averaged over 10 simulations runs (1 through 10)

Table 11 – PM Peak Period Southbound Freeway GEH Summary

2:00 PM	2:15 PM	2:30 PM	2:45 PM	3:00 PM	3:15 PM	3:30 PM	3:45 PM	4:00 PM	4:15 PM	4:30 PM	4:45 PM	5:00 PM	5:15 PM	5:30 PM	5:45 PM	
PM - Southbound Average Volumes - (VISSIM Data)																**Location**
1,217	1,215	1,218	1,231	1,214	1,213	1,265	1,283	1,257	1,237	1,204	1,128	1,063	1,031	834	807	I-5 SB 114-04457 Near Going
555	563	565	548	494	483	542	535	530	508	492	465	431	387	344	356	I-5 SB 114N04457 Near 405
946	949	996	913	880	905	975	944	966	964	952	930	752	689	644	670	I-5 SB 114-04456 Bt 405/Broadway
755	764	766	742	697	713	758	729	740	741	726	708	551	509	470	484	I-5 SB 114N04456 Near Broadway
942	944	956	962	964	1,008	1,006	1,002	998	1,004	986	967	726	670	628	680	I-5 SB 114-04454 Near Multnomah
563	567	570	576	606	652	654	641	648	639	630	619	455	409	377	401	I-5 SB 114N04454 Near 84
PM - Southbound Average Volumes - (Input Data)																**Location**
1,228	1,215	1,215	1,235	1,206	1,246	1,319	1,250	1,239	1,229	1,183	1,129	1,052	1,043	1,056	1,065	I-5 SB 114-04457 Near Going
597	618	515	523	467	517	558	564	456	507	477	484	443	427	475	533	I-5 SB 114N04457 Near 405
994	1,003	1,012	1,021	949	942	1,026	998	995	966	980	991	952	923	906	969	I-5 SB 114-04456 Bt 405/Broadway
820	820	810	800	740	740	780	780	770	750	750	750	705	683	652	675	I-5 SB 114N04456 Near Broadway
995	1,014	1,054	1,035	1,001	993	1,053	1,077	1,058	1,031	1,007	990	955	923	861	878	I-5 SB 114-04454 Near Multnomah
569	604	636	645	612	612	740	692	683	621	656	650	564	564	513	510	I-5 SB 114N04454 Near 84
PM - Southbound GEH																**Location**
0.3	0.0	0.1	0.1	0.2	0.9	1.5	0.9	0.5	0.2	0.6	0.0	0.3	0.4	7.2	8.4	I-5 SB 114-04457 Near Going
1.8	2.2	2.2	1.1	1.2	1.5	0.7	1.3	3.3	0.1	0.7	0.9	0.5	2.0	6.5	8.4	I-5 SB 114N04457 Near 405
1.5	1.7	0.5	3.5	2.3	1.2	1.6	1.8	0.9	0.0	0.9	2.0	6.9	8.3	9.4	10.4	I-5 SB 114-04456 Bt 405/Broadway
2.3	2.0	1.6	2.1	1.6	1.0	0.8	1.9	1.1	0.3	0.9	1.6	6.2	7.1	7.7	7.9	I-5 SB 114N04456 Near Broadway
1.7	2.2	3.1	2.3	1.2	0.5	1.5	2.3	1.9	0.8	0.7	0.7	7.9	8.9	8.5	7.1	I-5 SB 114-04454 Near Multnomah
0.2	1.5	2.7	2.8	0.3	1.6	3.2	2.0	1.4	0.7	1.0	1.2	4.8	7.1	6.4	5.1	I-5 SB 114N04454 Near 84

Source: Data collection results (.mes) averaged over 10 simulations runs (1 through 10)

Table 12 – PM Peak Period Intersection GEH Summary

PM Peak Period					
Overall Intersection Results (2:00 PM to 3:00 PM)					
Intersection		**Delay (sec)**	**Input Volumes**	**Output Volumes**	**GEH**
Broadway	Flint	45	1,047	1,036	0.4
Broadway	Williams	22	2,397	2,404	0.1
Broadway	Vancouver	40	1,965	1,941	0.5
Weidler	Vancouver	18	2,664	2,620	0.9
Wheeler	Winning	33	1,011	975	1.2
Weidler	Williams	13	1,960	1,916	1.0
Broadway	Victoria	42	2,106	2,130	0.5
Weidler	Victoria	24	2,414	2,399	0.3
Overall Intersection Results (3:00 PM to 4:00 PM)					
Broadway	Flint	216	1,040	1,022	0.6
Broadway	Williams	25	2,567	2,512	1.1
Broadway	Vancouver	115	2,143	2,067	1.6
Weidler	Vancouver	32	3,011	2,873	2.5
Wheeler	Winning	48	1,262	1,251	0.3
Weidler	Williams	14	2,143	2,046	2.1
Broadway	Victoria	61	2,265	2,244	0.4
Weidler	Victoria	24	2,615	2,533	1.6
Overall Intersection Results (4:00 PM to 5:00 PM)					
Broadway	Flint	200	1,057	1,052	0.2
Broadway	Williams	22	2,303	2,355	1.1
Broadway	Vancouver	102	1,671	1,715	1.1
Weidler	Vancouver	69	2,786	2,856	1.3
Wheeler	Winning	29	1,296	1,315	0.5
Weidler	Williams	14	2,034	2,075	0.9
Broadway	Victoria	60	1,969	2,007	0.9
Weidler	Victoria	24	2,626	2,648	0.4
Overall Intersection Results (5:00 PM to 6:00 PM)					
Broadway	Flint	369	1,164	980	5.6
Broadway	Williams	26	2,433	2,217	4.5
Broadway	Vancouver	209	1,638	1,327	8.1
Weidler	Vancouver	181	2,728	2,203	10.6
Wheeler	Winning	222	1,226	988	7.2
Weidler	Williams	13	2,016	1,692	7.5
Broadway	Victoria	127	2,063	1,903	3.6
Weidler	Victoria	171	2,680	2,219	9.3

Source: Node results (.kna) averaged over 10 simulation runs (1 through 10)

Table 13 – PM Peak Period Model Entry/Exit GEH Summary

Data Collection Number	Data Collection Location	Inputs	Output	GEH	Inputs	Output	GEH	Inputs	Output	GEH	Inputs	Output	GEH
		2:00 - 3:00 p.m.			3:00 - 4:00 p.m.			4:00 - 5:00 p.m.			5:00 - 6:00 p.m.		
1001	SB I-5 N of Going	4,317	4,312	0.1	4,356	4,333	0.4	4,044	4,070	0.4	3,639	3,282	6.1
1010	I-5 SB S of Morrison	1,530	1,407	3.2	1,647	1,567	2.0	1,651	1,600	1.3	1,068	855	6.9
2001	I-5 NB S of Morrison Ramp	838	834	0.1	1,378	1,372	0.2	2,028	2,016	0.3	1,847	1,816	0.7
2010	I-84 EB E of Grand	4,972	4,858	1.6	4,352	4,311	0.6	4,670	4,493	2.6	5,136	4,761	5.3
2020	NB I-5 N of Going	2,609	2,594	0.3	2,860	2,717	2.7	3,626	2,770	15.1	3,360	2,591	14.1
7000	Flint On	141	141	0.0	164	164	0.0	162	162	0.0	174	174	0.0
7001	Flint Off	56	52	0.5	65	62	0.4	104	99	0.5	98	79	2.0
7004	Wheeler Off	117	115	0.2	126	133	0.6	133	144	0.9	195	134	4.8
7006	Victoria Off	85	87	0.2	88	85	0.3	76	76	0.0	84	65	2.2
7007	Victoria On	19	17	0.5	20	18	0.4	15	15	0.0	21	21	0.0
7009	Vancouver On	393	395	0.1	446	451	0.2	210	218	0.6	129	135	0.5
7010	Weidler On	1,354	1,361	0.2	1,490	1,474	0.4	1,725	1,742	0.4	1,710	1,435	6.9
7021	Broadway Off	991	986	0.1	975	968	0.2	953	958	0.1	1,066	905	5.1
7031	Winning On	249	249	0.0	345	345	0.0	447	447	0.0	384	380	0.2
7041	Weidler Off	2,134	2,107	0.6	2,334	2,245	1.9	2,222	2,260	0.8	2,247	1,876	8.2
7051	Broadway on	1,799	1,795	0.1	1,967	1,961	0.2	1,548	1,551	0.1	1,615	1,612	0.1
7081	Williams Off	636	632	0.2	755	740	0.5	609	626	0.7	799	709	3.3

Source: Data collection results (.mes) averaged over 10 simulations runs (1 through 10)

Table 14 – AM Peak Period Northbound Freeway GEH Summary

6:00 AM	6:15 AM	6:30 AM	6:45 AM	7:00 AM	7:15 AM	7:30 AM	7:45 AM	8:00 AM	8:15 AM	8:30 AM	8:45 AM	9:00 AM	9:15 AM	9:30 AM	9:45 AM	
AM - Northbound Average Volumes - (VISSIM Data)																**Location**
337	496	621	696	682	724	758	759	721	724	698	684	632	632	614	581	I-5 NB 114+04454 Near 84
787	939	1,057	1,112	1,100	1,112	1,115	1,099	1,069	1,072	1,073	1,049	1,033	992	981	995	I-5 NB 114+04455 Near Multnomah
589	705	793	839	834	832	841	827	794	793	799	785	795	764	748	755	I-5 NB 114P04455 Near Weidler
656	779	881	949	974	991	1,015	1,023	998	1,004	985	953	975	936	917	913	I-5 NB 114+04457 BT 405/Weidler
248	310	362	420	422	435	452	468	462	463	439	434	505	494	477	471	I-5 NB 114P04457 Near 405
492	602	731	821	846	853	905	909	885	883	874	854	904	891	876	842	I-5 NB 114+04458 Near Going
AM - Northbound Average Volumes - (Input Data)																**Location**
335	504	629	701	681	728	782	779	710	719	691	675	628	632	618	579	I-5 NB 114+04454 Near 84
789	990	1,130	1,153	1,090	1,146	1,148	1,170	1,106	1,085	1,047	1,055	1,003	989	983	996	I-5 NB 114+04455 Near Multnomah
585	754	870	870	852	867	856	844	807	798	794	789	764	762	753	772	I-5 NB 114P04455 Near Weidler
643	834	973	1,000	1,002	1,050	1,045	1,040	1,020	995	992	969	929	924	921	931	I-5 NB 114+04457 BT 405/Weidler
240	330	439	397	435	470	471	472	472	436	457	438	456	483	500	504	I-5 NB 114P04457 Near 405
480	631	815	806	861	890	929	912	895	860	889	862	853	884	893	873	I-5 NB 114+04458 Near Going
AM - Northbound GEH																**Location**
0.1	0.4	0.3	0.2	0.0	0.2	0.9	0.7	0.4	0.2	0.3	0.3	0.1	0.0	0.1	0.1	I-5 NB 114+04454 Near 84
0.1	1.7	2.2	1.2	0.3	1.0	1.0	2.1	1.1	0.4	0.8	0.2	0.9	0.1	0.0	0.0	I-5 NB 114+04455 Near Multnomah
0.2	1.8	2.7	1.0	0.6	1.2	0.5	0.6	0.5	0.2	0.2	0.1	1.1	0.1	0.2	0.6	I-5 NB 114P04455 Near Weidler
0.5	1.9	3.0	1.6	0.9	1.9	0.9	0.5	0.7	0.3	0.2	0.5	1.5	0.4	0.1	0.6	I-5 NB 114+04457 BT 405/Weidler
0.5	1.1	3.9	1.1	0.6	1.6	0.9	0.2	0.5	1.3	0.8	0.2	2.2	0.5	1.1	1.5	I-5 NB 114P04457 Near 405
0.5	1.2	3.0	0.5	0.5	1.2	0.8	0.1	0.4	0.8	0.5	0.3	1.7	0.2	0.6	1.1	I-5 NB 114+04458 Near Going

Source: Data collection results (.mes) averaged over 10 simulations runs (1 through 10)

Table 15 – AM Peak Period Southbound Freeway GEH Summary

6:00 AM	6:15 AM	6:30 AM	6:45 AM	7:00 AM	7:15 AM	7:30 AM	7:45 AM	8:00 AM	8:15 AM	8:30 AM	8:45 AM	9:00 AM	9:15 AM	9:30 AM	9:45 AM	
AM - Southbound Average Volumes - (VISSIM Data)																**Location**
1,103	1,279	1,340	1,296	1,367	1,372	1,395	1,377	1,271	1,347	1,312	1,334	1,319	1,368	1,380	1,395	I-5 SB 114-04457 Near Going
462	530	565	535	591	600	613	580	540	555	556	544	587	627	603	629	I-5 SB 114N04457 Near 405
660	783	889	896	946	994	1,019	950	986	992	978	998	1,004	969	974	986	I-5 SB 114-04456 Bt 405/Broadway
521	606	698	706	747	775	770	756	772	771	775	789	781	763	769	780	I-5 SB 114N04456 Near Broadway
583	689	791	829	918	964	991	997	1,000	985	981	1,007	971	950	947	947	I-5 SB 114-04454 Near Multnomah
401	468	536	569	638	673	698	699	688	669	666	689	650	596	594	600	I-5 SB 114N04454 Near 84
AM - Southbound Average Volumes - (Input Data)																**Location**
1,114	1,350	1,374	1,378	1,365	1,451	1,421	1,458	1,457	1,498	1,444	1,390	1,444	1,453	1,310	1,314	I-5 SB 114-04457 Near Going
443	564	584	579	572	636	609	641	620	645	614	561	624	653	593	629	I-5 SB 114N04457 Near 405
642	825	914	944	929	1,035	1,061	1,107	1,052	1,085	1,048	1,040	980	981	951	976	I-5 SB 114-04456 Bt 405/Broadway
510	642	732	730	748	837	840	840	836	850	827	801	765	774	762	767	I-5 SB 114N04456 Near Broadway
593	716	834	865	927	1,038	1,092	1,117	1,059	1,070	1,052	1,021	947	924	938	925	I-5 SB 114-04454 Near Multnomah
404	513	541	605	639	715	763	774	735	760	720	651	636	586	608	547	I-5 SB 114N04454 Near 84
AM - Southbound GEH																**Location**
0.3	2.0	0.9	2.3	0.0	2.1	0.7	2.1	5.0	4.0	3.5	1.5	3.4	2.3	1.9	2.2	I-5 SB 114-04457 Near Going
0.9	1.5	0.8	1.9	0.8	1.5	0.2	2.5	3.3	3.7	2.4	0.7	1.5	1.1	0.4	0.0	I-5 SB 114N04457 Near 405
0.7	1.5	0.8	1.6	0.6	1.3	1.3	4.9	2.1	2.9	2.2	1.3	0.8	0.4	0.7	0.3	I-5 SB 114-04456 Bt 405/Broadway
0.4	1.4	1.3	0.9	0.0	2.2	2.5	3.0	2.2	2.8	1.9	0.4	0.6	0.4	0.2	0.4	I-5 SB 114N04456 Near Broadway
0.4	1.0	1.5	1.2	0.3	2.3	3.1	3.7	1.8	2.6	2.2	0.4	0.7	0.8	0.3	0.7	I-5 SB 114-04454 Near Multnomah
0.2	2.0	0.2	1.5	0.0	1.6	2.4	2.8	1.8	3.4	2.0	1.5	0.5	0.4	0.6	2.2	I-5 SB 114N04454 Near 84

Source: Data collection results (.mes) averaged over 10 simulations runs (1 through 10)

Table 16 – AM Peak Period Intersection GEH Summary

AM Peak Period					
Overall Intersection Results (6:00 AM to 7:00 AM)					
Intersection		**Delay (sec)**	**Input Volumes**	**Output Volumes**	**GEH**
Broadway	Flint	36	1,028	996	1.0
Broadway	Williams	19	1,519	1,481	1.0
Broadway	Vancouver	28	1,532	1,484	1.2
Weidler	Vancouver	10	1,168	1,141	0.8
Wheeler	Winning	18	548	518	1.3
Weidler	Williams	4	661	658	0.1
Broadway	Victoria	27	1,393	1,406	0.3
Weidler	Victoria	21	1,476	1,467	0.2
Overall Intersection Results (7:00 AM to 8:00 AM)					
Broadway	Flint	99	1,213	1,166	1.4
Broadway	Williams	22	2,297	2,176	2.6
Broadway	Vancouver	60	2,205	2,074	2.8
Weidler	Vancouver	12	2,083	1,971	2.5
Wheeler	Winning	19	1,085	984	3.1
Weidler	Williams	6	1,143	1,087	1.7
Broadway	Victoria	49	2,125	2,063	1.4
Weidler	Victoria	44	2,042	1,996	1.0
Overall Intersection Results (8:00 AM to 9:00 AM)					
Broadway	Flint	245	1,347	1,257	2.5
Broadway	Williams	23	2,570	2,416	3.1
Broadway	Vancouver	111	2,469	2,294	3.6
Weidler	Vancouver	13	2,404	2,309	2.0
Wheeler	Winning	18	1,180	1,082	2.9
Weidler	Williams	6	1,364	1,323	1.1
Broadway	Victoria	178	2,324	2,258	1.4
Weidler	Victoria	23	2,161	2,210	1.0
Overall Intersection Results (9:00 AM to 10:00 AM)					
Broadway	Flint	205	1,199	1,252	1.5
Broadway	Williams	17	2,219	2,317	2.1
Broadway	Vancouver	92	2,107	2,195	1.9
Weidler	Vancouver	13	2,220	2,272	1.1
Wheeler	Winning	15	996	1,020	0.8
Weidler	Williams	7	1,328	1,334	0.2
Broadway	Victoria	240	1,912	2,058	3.3
Weidler	Victoria	32	1,878	1,948	1.6

Source: Node results (.kna) averaged over 10 simulation runs (1 through 10)

Table 17 – AM Peak Period Model Entry/Exit GEH Summary

Data Collection Number	Data Collection Location	Inputs	Output	GEH	Inputs	Output	GEH	Inputs	Output	GEH	Inputs	Output	GEH
		6:00 to 7:00			7:00 to 8:00			8:00 to 9:00			9:00 to 10:00		
1001	SB I-5 N of Going	4,966	4,805	2.3	5,221	5,059	2.3	5,133	4,686	6.4	4,966	4,904	0.9
1010	I-5 SB S of Morrison	1,100	1,044	1.7	1,570	1,513	1.4	1,564	1,465	2.5	1,157	1,192	1.0
2001	I-5 NB S of Morrison Ramp	1,135	1,129	0.2	1,674	1,671	0.1	1,449	1,448	0.0	1,190	1,189	0.0
2010	I-84 EB E of Grand	3,581	3,525	1.0	4,779	4,637	2.1	4,558	4,480	1.2	4,514	4,530	0.2
2020	NB I-5 N of Going	1,943	1,876	1.6	2,464	2,409	1.1	2,274	2,288	0.3	2,514	2,504	0.2
7000	Flint On	46	46	0.0	149	149	0.0	178	178	0.0	133	133	0.0
7001	Flint Off	129	131	0.2	83	83	0.0	64	61	0.4	61	61	0.0
7004	Wheeler Off	133	126	0.6	120	118	0.2	235	209	1.7	278	286	0.5
7006	Victoria Off	43	40	0.6	63	63	0.1	62	61	0.1	62	65	0.4
7007	Victoria On	9	7	0.6	13	13	0.0	12	12	0.0	12	11	0.4
7009	Vancouver On	117	118	0.1	321	324	0.2	409	415	0.3	322	324	0.1
7010	Weidler On	324	330	0.4	655	663	0.3	785	794	0.3	877	887	0.3
7021	Broadway Off	899	870	1.0	1,130	1,086	1.3	1,283	1,220	1.8	1,138	1,188	1.5
7031	Winning On	20	20	0.0	87	87	0.0	83	83	0.0	52	52	0.0
7041	Weidler Off	1,172	1,130	1.2	1,612	1,545	1.7	1,718	1,701	0.4	1,446	1,483	1.0
7051	Broadway on	1,081	1,074	0.2	1,682	1,673	0.2	1,869	1,831	0.9	1,467	1,508	1.1
7081	Williams Off	152	152	0.0	275	263	0.7	314	326	0.7	298	298	0.0

Source: Data collection results (.mes) averaged over 10 simulations runs (1 through 10)

Table 18 – Mid-day Peak Period Northbound Freeway GEH Summary

12:00 PM	12:15 PM	12:30 PM	12:45 PM	1:00 PM	1:15 PM	1:30 PM	1:45 PM	
MD - Northbound Average Volumes - (VISSIM Data)								**Location**
631	647	620	613	601	627	625	605	I-5 NB 114+04454 Near 84
980	983	983	1,006	958	992	985	972	I-5 NB 114+04455 Near Multnomah
773	766	773	786	765	792	782	775	I-5 NB 114P04455 Near Weidler
977	982	986	998	982	994	994	988	I-5 NB 114+04457 BT 405/Weidler
581	590	583	577	575	572	564	564	I-5 NB 114P04457 Near 405
994	1,015	1,041	1,017	1,026	1,054	1,061	1,041	I-5 NB 114+04458 Near Going
MD - Northbound Average Volumes - (Input Data)								**Location**
632	650	620	613	600	631	623	606	I-5 NB 114+04454 Near 84
981	985	986	1,007	955	997	991	995	I-5 NB 114+04455 Near Multnomah
767	776	786	782	763	788	793	786	I-5 NB 114P04455 Near Weidler
975	984	1,006	996	980	1,003	996	1,003	I-5 NB 114+04457 BT 405/Weidler
578	611	576	566	561	559	571	577	I-5 NB 114P04457 Near 405
985	1,042	1,035	1,006	1,015	1,045	1,067	1,052	I-5 NB 114+04458 Near Going
MD - Northbound GEH								**Location**
0.0	0.1	0.0	0.0	0.0	0.2	0.1	0.0	I-5 NB 114+04454 Near 84
0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.7	I-5 NB 114+04455 Near Multnomah
0.2	0.4	0.4	0.1	0.1	0.2	0.4	0.4	I-5 NB 114P04455 Near Weidler
0.1	0.1	0.6	0.1	0.1	0.3	0.1	0.5	I-5 NB 114+04457 BT 405/Weidler
0.1	0.9	0.3	0.4	0.6	0.6	0.3	0.5	I-5 NB 114P04457 Near 405
0.3	0.8	0.2	0.3	0.3	0.3	0.2	0.3	I-5 NB 114+04458 Near Going

Source: Data collection results (.mes) averaged over 10 simulations runs (1 through 10)

Table 19 – Mid-day Peak Period Southbound Freeway GEH Summary

12:00 PM	12:15 PM	12:30 PM	12:45 PM	1:00 PM	1:15 PM	1:30 PM	1:45 PM	
MD - Southbound Average Volumes - (VISSIM Data)								**Location**
1,209	1,204	1,206	1,191	1,162	1,150	1,201	1,168	I-5 SB 114-04457 Near Going
583	583	584	568	553	543	570	555	I-5 SB 114N04457 Near 405
929	912	925	920	881	896	924	889	I-5 SB 114-04456 Bt 405/Broadway
742	728	729	733	712	719	710	725	I-5 SB 114N04456 Near Broadway
908	908	903	918	896	879	866	894	I-5 SB 114-04454 Near Multnomah
545	542	541	550	518	508	483	516	I-5 SB 114N04454 Near 84
MD - Southbound Average Volumes - (Input Data)								**Location**
1,209	1,210	1,206	1,188	1,164	1,148	1,205	1,165	I-5 SB 114-04457 Near Going
597	584	570	572	562	576	539	546	I-5 SB 114N04457 Near 405
944	911	935	916	893	905	932	919	I-5 SB 114-04456 Bt 405/Broadway
742	740	741	729	717	729	745	725	I-5 SB 114N04456 Near Broadway
928	912	933	903	886	898	927	884	I-5 SB 114-04454 Near Multnomah
543	546	553	547	512	541	518	469	I-5 SB 114N04454 Near 84
MD - Southbound GEH								**Location**
0.0	0.2	0.0	0.1	0.1	0.1	0.1	0.1	I-5 SB 114-04457 Near Going
0.6	0.0	0.6	0.1	0.4	1.4	1.3	0.4	I-5 SB 114N04457 Near 405
0.5	0.1	0.3	0.1	0.4	0.3	0.3	1.0	I-5 SB 114-04456 Bt 405/Broadway
0.0	0.4	0.4	0.1	0.2	0.4	1.3	0.0	I-5 SB 114N04456 Near Broadway
0.7	0.1	1.0	0.5	0.3	0.6	2.0	0.3	I-5 SB 114-04454 Near Multnomah
0.1	0.2	0.5	0.1	0.3	1.4	1.5	2.1	I-5 SB 114N04454 Near 84

Source: Data collection results (.mes) averaged over 10 simulations runs (1 through 10)

Table 20 – Mid-day Peak Period Intersection GEH Summary

MD Peak Period					
Overall Intersection Results (12:00 PM to 1:00 PM)					
Intersection		**Delay (sec)**	**Input Volumes**	**Output Volumes**	**GEH**
Broadway	Flint	47	1,004	991	0.4
Broadway	Williams	17	2,448	2,433	0.3
Broadway	Vancouver	34	1,898	1,888	0.2
Weidler	Vancouver	14	2,067	2,073	0.1
Wheeler	Winning	16	907	898	0.3
Weidler	Williams	5	1,373	1,382	0.2
Broadway	Victoria	61	2,203	2,228	0.5
Weidler	Victoria	21	1,913	1,962	1.1
Overall Intersection Results (1:00 PM to 2:00 PM)					
Broadway	Flint	59	1,171	1,142	0.9
Broadway	Williams	18	2,605	2,593	0.2
Broadway	Vancouver	39	2,112	2,082	0.7
Weidler	Vancouver	13	2,113	2,112	0.0
Wheeler	Winning	15	868	869	0.0
Weidler	Williams	5	1,451	1,457	0.2
Broadway	Victoria	91	2,438	2,439	0.0
Weidler	Victoria	45	2,013	1,990	0.5

Source: Node results (.kna) averaged over 10 simulation runs (1 through 10)

Table 21 – Mid-day Peak Period Model Entry/Exit GEH Summary

Data Collection Number	Data Collection Location	Inputs	Output	GEH	Inputs	Output	GEH
		12:00 - 1:00 p.m.			1:00 to 2:00 p.m.		
1001	SB I-5 N of Going	4,318	4,321	0.0	4,204	4,202	0.0
1010	I-5 SB S of Morrison	1,085	1,058	0.8	940	948	0.3
2001	I-5 NB S of Morrison Ramp	1,308	1,308	0.0	1,156	1,155	0.0
2010	I-84 EB E of Grand	4,848	4,826	0.3	5,072	5,020	0.7
2020	NB I-5 N of Going	3,077	3,075	0.0	3,193	3,203	0.2
7000	Flint On	106	106	0.0	114	114	0.0
7001	Flint Off	56	52	0.6	48	47	0.2
7004	Wheeler Off	115	118	0.3	143	148	0.4
7006	Victoria Off	65	67	0.3	79	76	0.4
7007	Victoria On	17	17	0.0	8	8	0.0
7009	Vancouver On	325	330	0.3	340	345	0.3
7010	Weidler On	826	834	0.3	831	840	0.3
7021	Broadway Off	948	951	0.1	1,123	1,090	1.0
7031	Winning On	145	145	0.0	161	161	0.0
7041	Weidler Off	1,475	1,499	0.6	1,446	1,434	0.3
7051	Broadway on	1,748	1,741	0.2	1,863	1,856	0.2
7081	Williams Off	540	547	0.3	489	497	0.4

Source: Data collection results (.mes) averaged over 10 simulations runs (1 through 10)

Calibration Adjustments

Calibration adjustments included changes to the driver parameters and lane change distances. These changes were based on field observed vehicle operations. For example, connector lane change distances were adjusted to achieve appropriate lane utilization observed in the field and to mimic critical merging and weaving behaviors in congested areas. Driver behavior parameters were adjusted to replicate the less aggressive driver behaviors seen in Oregon. Oregon drivers typically drive with larger gaps between vehicles and operate with more of a "zipper effect".

Three sets of driver behavior parameters were used in the I-5 Broadway-Weidler VISSIM model:

- Urban
- Freeway
- Heavy Merge

Car following parameters for freeway (Wiedemann 99) were adjusted however the arterials (Wiedemann 74) was note, adjustments to the car following for freeway are shown below in Table 22. The table provides a comparison between the default values in VISSIM and those used for calibration. Lane change parameters are provided in Table 23 for Urban, Freeway and Heavy Merge driver behaviors. The changes fall within the ODOT's VISSIM Protocol's recommendations. The changes were made to reflect a more typical less aggressive Oregon driver. As seen in the field, they typically driver further spaced apart and give bigger gaps between vehicles to let other vehicles merge in. All driver behaviors are consistent between models with the exception of the southbound off-ramp to Morrison westbound, the look back distance was increased slightly in the a.m. model as the higher volume warranted this.

Table 22 – Wiedemann 99 Car Following Parameters

Parameter		Unit	Default	Calibrated Model	
				Freeway	Heavy Merge
CC0: Standstill Distance		ft	4.92	5.18	5.51
CC1: Headway Time		s	0.90	1.50	1.00
CC2: 'Following' Variation		ft	13.12	13.12	13.12
Look ahead distance	Min	ft	0.00	0.00	0.00
	Max	ft	820.21	850.00	1000.00
	Observed vehicles	-	4	4	4
Look back distance	Min	ft	0.00	0.00	0.00
	Max	ft	492.13	492.13	700.00
Temporary Lack of attention	Duration	s	0.00	0.00	0.00
	Probability	%	0.00	0.00	0.00
Smooth closeup behavior		-	☐	☑	☑
Standstill distance for static obstacles		-	☐	☐	☐

Table 23 - Driving Behavior Lane Change Parameters

Parameter		Unit	Default		Calibrated Model		
			Urban	Freeway	Urban	Freeway	Heavy Merge
Maximum Deceleration	Free Lane Selection / Own	ft/s^2	-13.12	-13.12	-13.12	-13.12	-12.99
	Trailing Vehicle	ft/s^2	-9.84	-9.84	-9.84	-9.84	-12.99
-1 ft/s^2 per distance	Free Lane Selection / Own	ft	100	200	100	200	250
	Trailing Vehicle	ft	100	200	100	200	250
Accepted Deceleration	Free Lane Selection / Own	ft/s^2	-3.28	-3.28	-3.28	-3.28	-3.28
	Trailing Vehicle	ft/s^2	-3.28	-1.64	-3.28	-1.64	-2.99
Waiting Time before Diffusion		s	60.00	60.00	90.00	90.00	90.00
Min. headway (front/rear)		ft	1.64	1.64	1.71	2.00	1.71
Safety distance reduction factor		-	0.60	0.60	0.50	0.50	0.80
Maximum deceleration for cooperative braking		ft/s^2	-9.84	-9.84	-10.01	-12.01	-12.99
Advanced merging		-	☐	☐	☐	☐	☐
Cooperative lane change		-	☐	☐	☑	☑	☑
Maximum speed difference		mph	-	-	20	25	30
Maximum collision time		s	-	-	15	16	12

Appendix A

Field Visit Memorandum

Appendix B

Bluetooth Survey Memorandum

APPENDIX C: EXISTING CONDITIONS DATA SUMMARY

Memo

Date:	Tuesday, August 12, 2014
Project:	I-5 Broadway Weidler
To:	Chi Mai, ODOT Jon Makler, ODOT
From:	Miranda Wells, HDR Andy Johnson, HDR
Subject:	Existing Conditions Data Summary

Introduction

The following data was collected as part of Phase 1 of the Broadway-Weidler project.

Table 1: Model Data Sources for use in the VISSIM modeling.

Data	Use	Source
Traffic volumes	Input/calibration	ODOT/Portal
Origin-Destination	Input	Bluetooth – ODOT
Signal Timing Data	Input	ODOT
Ramp Meter Data	Input	ODOT
Transit Data	Input	TriMet Website
Speed Data	Calibration/Input	INRIX – ODOT/Portal

This technical memorandum summarizes the methods used to process the data for VISSIM model inputs and calibration and provides a summary of the data used. Please note this document is aimed for a technical, internal audience.

These data are used as inputs into the VISSIM models that are being developed as part of this project. There were three study periods chosen for which data need to be processed:

- Morning Peak – 5:30 a.m. to 10:00 a.m.
- Mid-day – 11:30 a.m. to 2:00 p.m.
- Afternoon Peak – 1:30 a.m. to 6:00 p.m.

The first half an hour of the modeling will be used for “seeding” purposes and data collection from the model will only occur for the times after that first half an hour.

Traffic Volumes

The following traffic volume data was provided by ODOT as well as obtained from PSU’s Portal Website:

- Mainline Volumes – PSU Portal: January 1st through December 31st 2013
- Ramp Volumes – ODOT: May 12th through May 14th 2014

- Arterial Volumes – PBOT: ATR data for 2007 through 2010, Turning Movement Counts for 2009 and 2010. ODOT: 2014
- Heavy Vehicles – ODOT: Short duration classification counts, December 2011

Freeway Mainline Volume

Mainline volumes were exported for the entire year of 2013 from PSU's Portal website. Data were collected and processed in 15-minute increments for two locations near ramps within the study area: Broadway Street Northbound and Broadway Street Southbound. These locations were chosen because they are outside of the major bottleneck areas and they are capturing demand in the study area on not just the throughput. Weekday traffic volumes used in the VISSIM model are based on data collected on Tuesdays, Wednesdays, and Thursdays, excluding major holidays. Traffic volumes at other locations on the mainline were calculated by adding and subtracting ramp volumes. The freeway mainline volumes are summarized in the excel file provided in the attachments.

Ramp Volume

Tube counts were collected in 2014 for the ramps in the study area and were provided by ODOT in 15-minute increments for all study area ramps. When count data over multiple days were provided, the data from each day for each 15-minute period were averaged together to get a multi-day volume average.

Arterial Volume

Arterial turning movement counts were provided for the p.m. peak period from 4:00 p.m. to 6:00 p.m. for the majority of the study area intersections. Because the study period is longer than the typical p.m. peak hour, the additional p.m. peak times were calculated using PBOT's ATR data. Given that the count data was collected over multiple years, volume balancing was required between intersections. The calculations used for the additional time periods and the balanced arterial volumes are included in the excel file provided in the attachments.

Much like the p.m. period, traffic volume data was provided for only a portion of the a.m. study period for the majority of the intersections. The same method used in the p.m. period was applied to the a.m. period. Mid-day counts were collected as part of this project so no calculations were required to get the additional time periods; however, some balancing was required.

In addition to intersection turning movement counts, bicycle and pedestrian volumes were also provided. Similar to the traffic volume data, bicycle counts were not provided for the entire study period. Bike counts were also not provided for all intersections. To obtain all bicycle counts, PBOT's count website was used.[1] The two hours of data provided during the a.m. and p.m. periods will be applied to the additional two hours of data that is not provided during the modeling period. Pedestrian volumes will be handled in the same way.

[1]http://www.portlandmaps.com/detail.cfm?action=Traffic&intersection_id=45168&x=7646952.895&y=688627.422&site_name=N%20BROADWAY%20%20and%20N%20WILLIAMS%20AVE&city=PORTLAND&ResultCount=2

Heavy Vehicles

The short duration (24-hour) classification counts provided by ODOT were used to develop heavy vehicle percentages and fleet distributions for both medium and heavy trucks. Classification counts within the study area were provided at the following locations:

- I-5, MP 300.37 – Marquam Bridge ATR
- I-5, MP 302.25 – I-5 south of Weidler Street
- I-84, MP 0.49 – West Banfield ATR
- I-405, MP 3.05 – Fremont Bridge ATR

Heavy vehicle fleet distributions were calculated using the classification count on I-5 south of Weidler Street, as this location provides a good representation of the types of trucks within our study area. Medium and heavy truck 2D/3D model distributions used in VISSIM are shown in Table 2. The fleet distribution for cars is based on the North American default distribution provided in VISSIM.

Table 2 – Heavy Vehicle Fleet Distributions

Medium Trucks				
#	**AASHTO Vehicle Class**	**AM**	**MID**	**PM**
4	Buses	0.183	0.108	0.192
5	2 Axle, 6 Tire, Single Unit Trucks	0.817	0.892	0.808
	Total	**1.000**	**1.000**	**1.000**
Heavy Trucks				
#	**AASHTO Vehicle Class**	**AM**	**MID**	**PM**
6	3 Axle Single Unit Trucks	0.117	0.157	0.125
7	4 or more Axle Single Unit Trucks	0.011	0.012	0.006
8	Four or Fewer Axle Single-Trailer Trucks	0.102	0.091	0.104
9	Five-Axle Single-Trailer Trucks	0.529	0.579	0.580
10	Six or more Axle Single-Trailer Trucks	0.142	0.095	0.127
11	Five or fewer Axle Multi-Trailer Trucks	0.022	0.012	0.012
12	Six-Axle Multi-Trailer Trucks	0.012	0.005	0.006
13	Seven or more Axle Multi-Trailer Trucks	0.065	0.048	0.040
	Total	**1.000**	**1.000**	**1.000**

In addition to the heavy vehicle fleet distributions, the short duration classification counts were used to determine medium and heavy truck percentages. Heavy vehicle percentages were identified for each study time period for I-5, I-84 and I-405. For the on-ramps within the study area that do not have classification data available, it is assumed that the heavy vehicle percentages are the same as for the adjacent mainline. For arterials, where detailed vehicle classification data are not available, ODOT provided values for medium and heavy trucks. Vehicle compositions are summarized in Table 3.

Table 3 – Study Area Vehicle Compositions				
Location	Vehicle Class	AM	MID	PM
		Vehicle Composition %		
I-5 Northbound	Cars	88	86	89
	Medium Trucks	4	5	4
	Heavy Trucks	8	9	7
I-5 Southbound	Cars	86	86	92
	Medium Trucks	6	4	3
	Heavy Trucks	8	10	5
I-405 Northbound	Cars	91	89	94
	Medium Trucks	3	4	3
	Heavy Trucks	6	7	3
I-84 Westbound	Cars	96	94	97
	Medium Trucks	2	3	2
	Heavy Trucks	2	3	1
I-84 Eastbound	Cars	94	94	96
	Medium Trucks	3	3	2
	Heavy Trucks	3	3	2
Arterials	Cars	95	95	97
	Medium Trucks	4	4	2
	Heavy Trucks	1	1	1

The short duration classification counts and heavy vehicle compositions are summarized in the excel file provided in the Attachments.

Origin-Destination

A bluetooth origin-destination (OD) summary was provided by ODOT for a portion of the study area, but because it was not for the entire study area, it could not be used as an input into the model. The OD data was used as a back check to the OD developed using Tflowfuzzy[2]. In order to develop the OD matrix to be used in VISSIM, invalid movements were identified and assigned in VISUM prior to running Tflowfuzzy. Hourly OD matrices were developed and coded into VISSIM. A summary of the OD patterns for the study periods is provided in the attachments.

Signal Timing

Signal timing data was provided from ODOT via PBOT. Due to the length of the study period, multiple coordination patterns were coded to replicate the field operations. Signal timing was coded in VISSIM using the RBC controller. A summary of the splits, cycle lengths, and offsets are provided in the attachments. Detector data was provided for some of the intersections via

[2] TFlowFuzzy is a PTV product that is used to develop origin destination using data like turn movement counts and ramp meter volumes.

as-builts. In other cases,, the data were interpolated based on standards and signal timing sheets.

Ramp Meter

Ramp meter data was provided by ODOT as saturation flow rates in15-minutes increments. Because the flow rates were similar between 15-minute periods and given the limitation of the number of different timing patterns available in VISSIM, the flow rates were averaged by hour. The hourly saturation flow rates for each ramp are summarized in Table 4.

Table 4 – Hourly Saturation Flow Rates for Ramp Meters in the Study Area

Ramp Meter			6 to 7 AM	7 to 8 AM	8 to 9 AM	2 to 3 PM	3 to 4 PM	3 to 5 PM	5 to 6 PM
I-5	NB	EB Morrison				429	514	514	514
		WB Morrison				1,000	791	665	665
		Broadway				1,029	1,029	878	800
	SB	Going	900	900	975				
		Greeley	900	900	975				
		Wheeler	1,091	1,091	1,118	867	1,200	1,200	1,200
I-84	EB	Morrison				571	600	610	610
		Grand				1,000	1,143	915	875

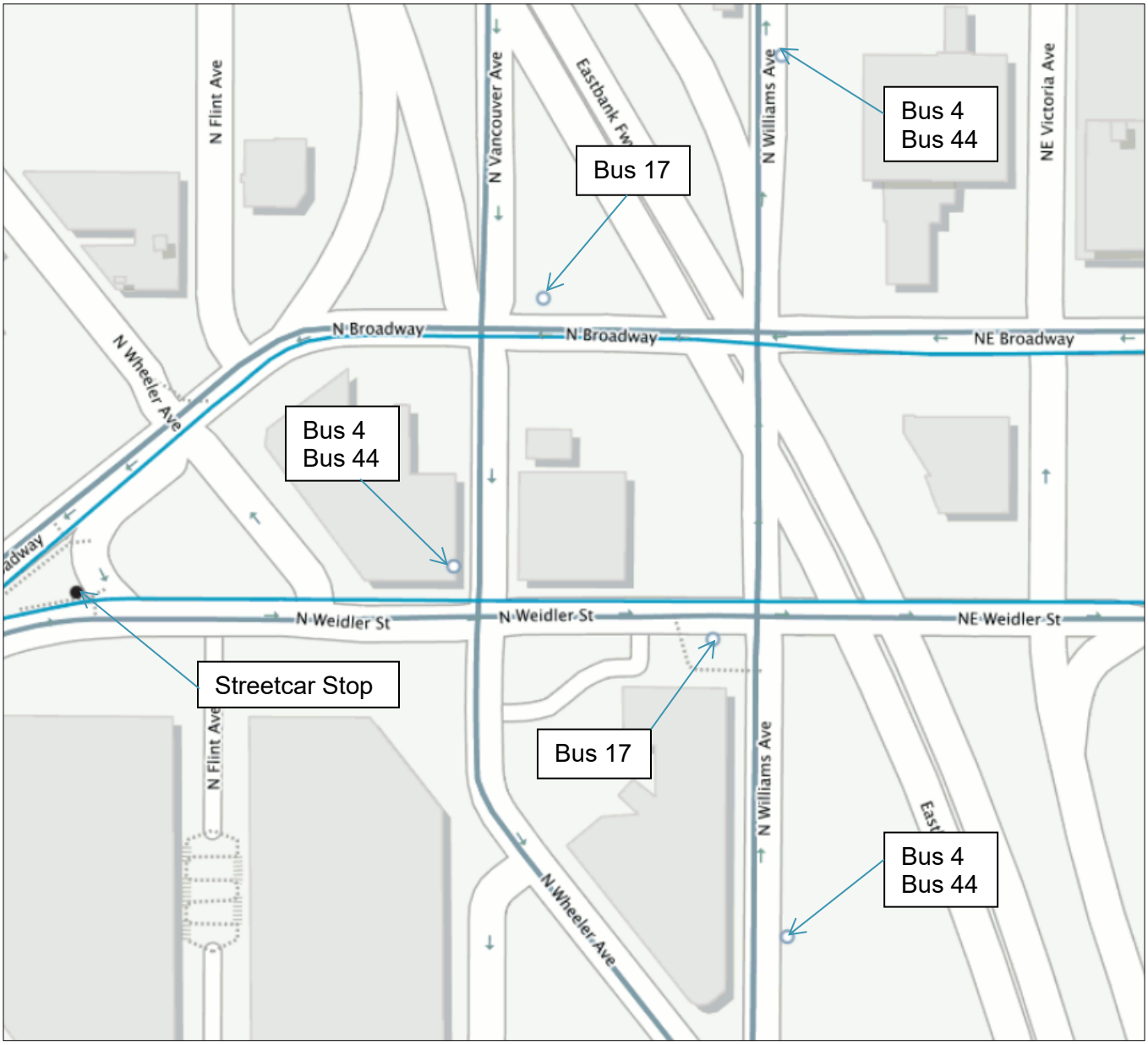
Transit

Transit data was obtained from TriMet's website for bus and streetcar operations. Headways were determined based on the scheduled stops, and average dwell times were based on data provided by TriMet which equated to 25 seconds per stop. Within the study area there are four bus lines (4, 17, 44, and 85) and a streetcar that traverses on the roadway on Broadway and Weidler. For each bus line and the streetcar the following stops are located within the study area (as shown in Figure 1):

- Bus 4: N Williams/Wheeler, N Williams/NE Broadway, and N Vancouver/Weidler
- Bus 17: NE Broadway/Vancouver and N Weidler/Williams
- Bus 44: N Williams/Wheeler and N Williams/NE Broadway
- Bus 85: No stops in the study area but travels through the study area
- Streetcar: No stops in the study area but travels through the study area

Transit maps, stop locations, stop data, and headways are provided in the attachments.

Figure 1 – Transit Stop Locations within the Study Area

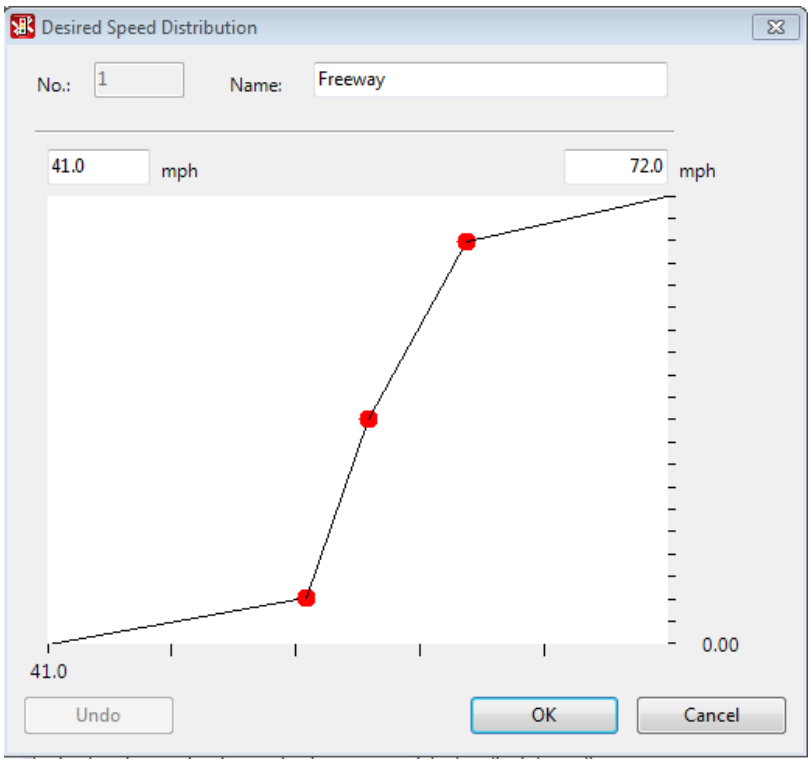


Speeds

Mainline freeway speed data was obtained through INRIX. The speed data is used for calibration as well as developing the freeway speed distribution profile in VISSIM. The calibration speed data will be summarized in the summary of calibration results. To develop the freeway speed profile inputs, data points were collected between 1:00 a.m. and 3:00 a.m. to capture free flow speeds within the study area. INIRIX also provides a historical value, a historical combined with calculated, and calculated data point based on the size of the sample

set during each time period. Only time periods with a calculated value were used. The INRIX data set was used to develop percentile speeds that were used for the freeway speed distribution in VISSIM as shown in Figure 2.

Figure 2 – Freeway Speed Distribution Profile in VISSIM

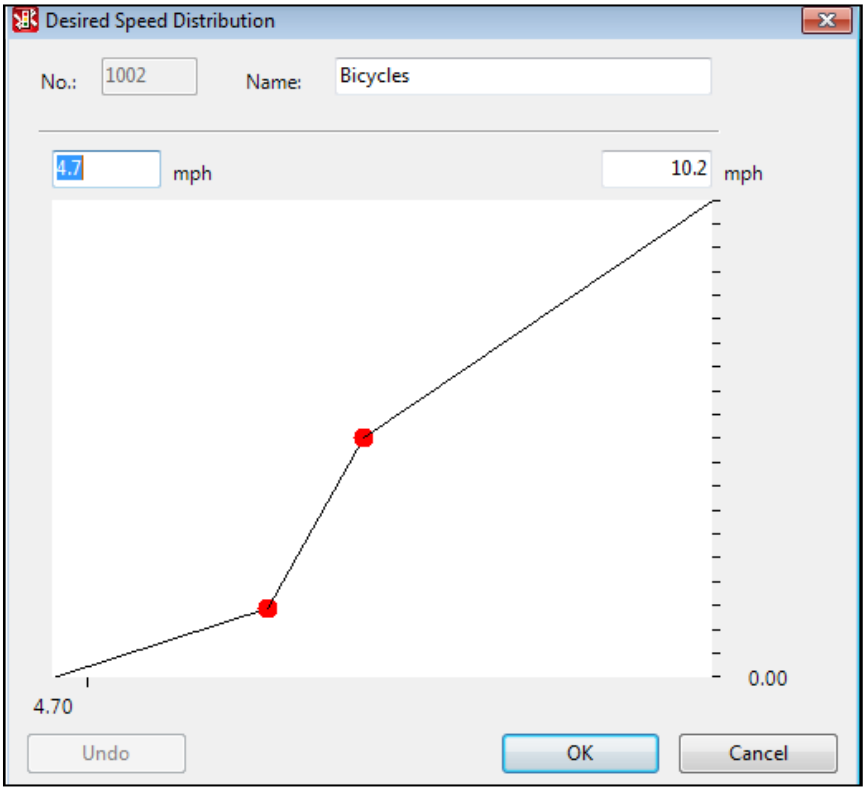


Arterial speeds were based on speed limits posted in the field. All roadways were 30 miles per hour (mph) with the exception of Flint Road which was 25 mph. Per the VISSIM protocol, these were used to develop linear speed distributions with deviation of plus and minus 5 mph from the posted speed.

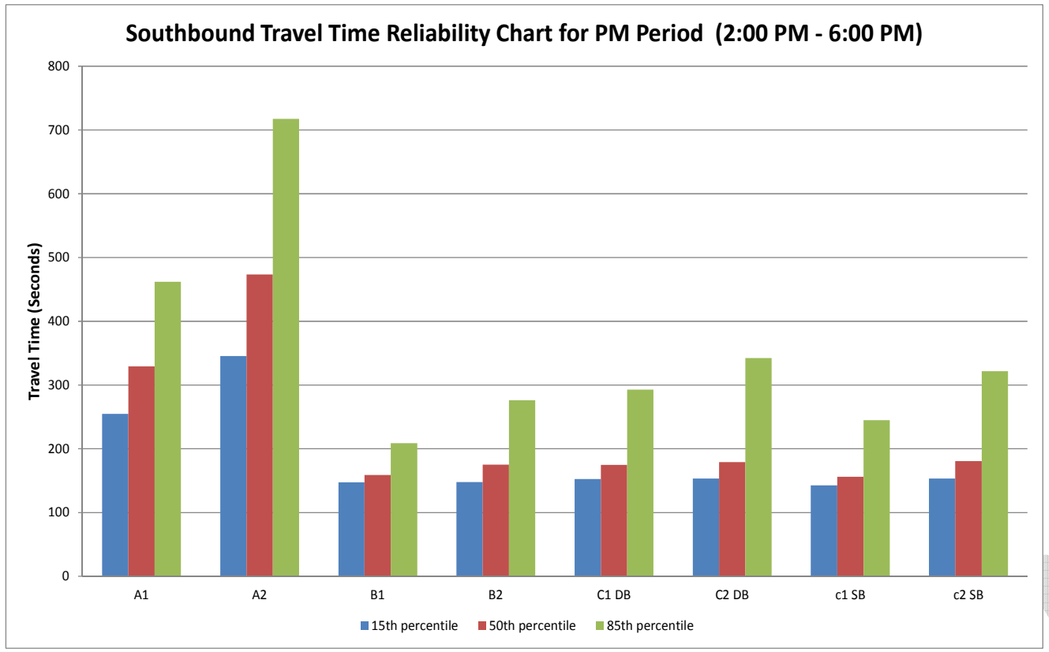
Pedestrian speeds were assumed to be between 3.5 feet per second (fps) to 5.0 fps with a linear distribution. This matched with known typical values and was checked against research done in Portland, Oregon.[3] For bicycles, local research in Portland, Oregon was used to set 15th percentile and average speeds (15th = 9.5 fps and 50th = 10.7 fps).[4] To obtain minimum and maximum values, AASHTO standards[5] were evaluated to determine a minimum of 7.0 fps and a maximum of 15 fps as shown in Figure 3 (note values in figure are in mph).

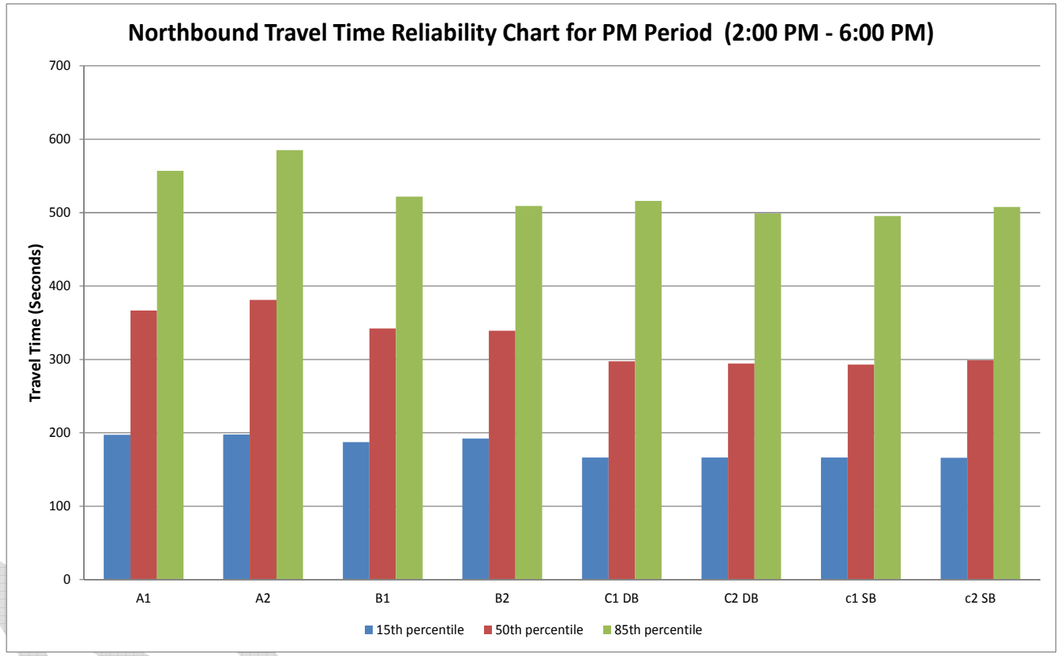
[3]http://www.westernite.org/datacollectionfund/2005/psu_ped_summary.pdf
[4]http://web.cecs.pdx.edu/~maf/Conference_Proceedings/A%20Statistical%20Analysis%20of%20Bicycle%20Rider%20Performance.pdf
[5]Average speeds of 12.7, 12.0 and 9.1 ft/s for advanced, basic/beginner and child cyclist are specified, respectively from AASHTO, *Guide for the Development of Bicycle Facilities*. 4th ed. 1999, Washington, D.C.: American Association of State Highway and Transportation Officials, U.S. Department of Transportation.

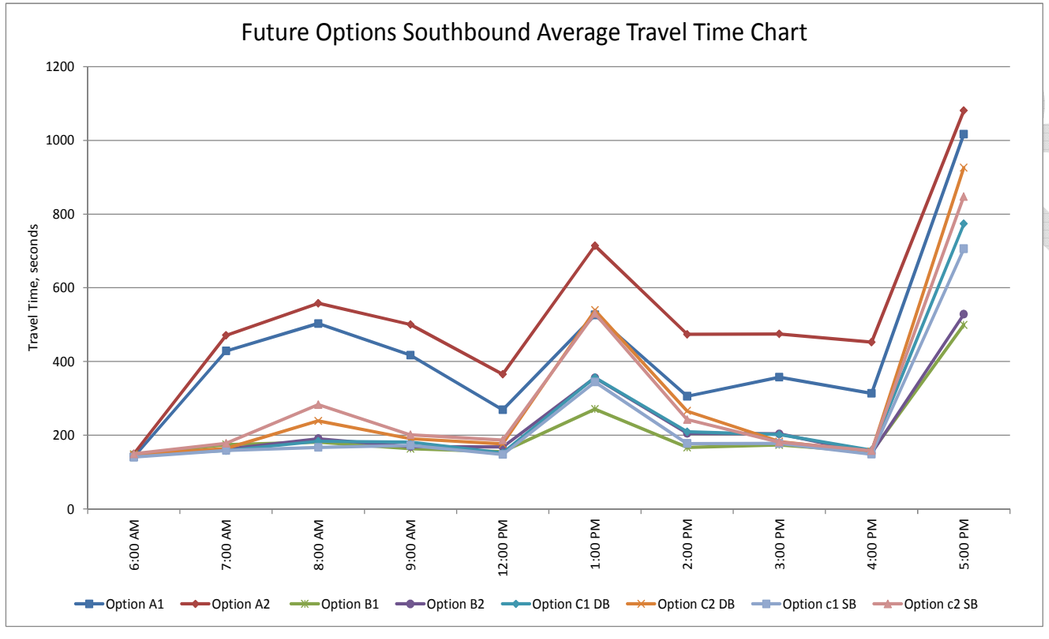
Figure 3 – Bicycle Speed Distribution Profile in VISSIM

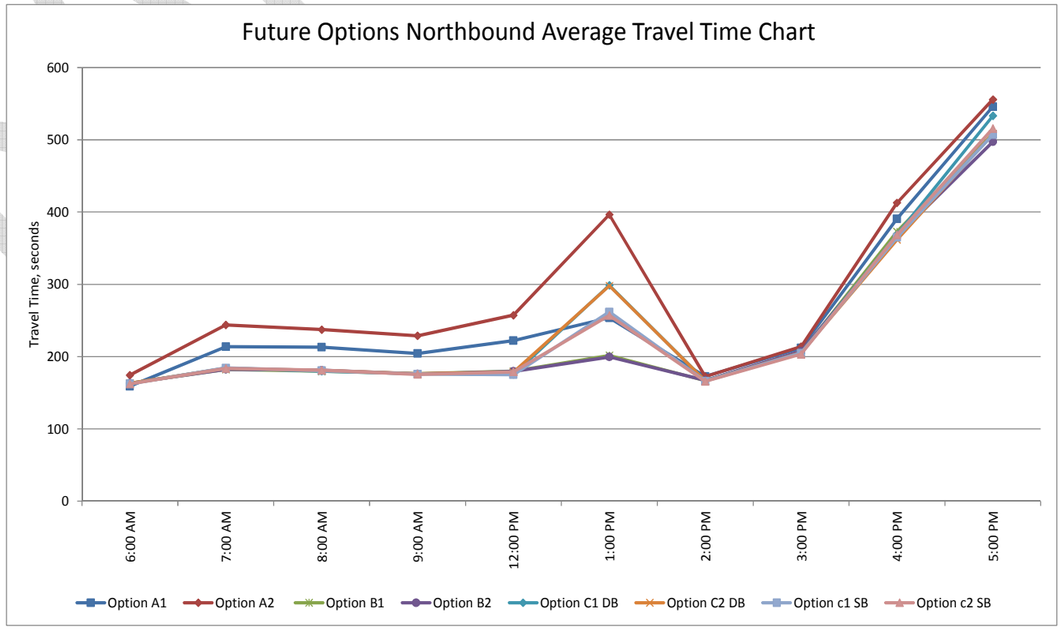


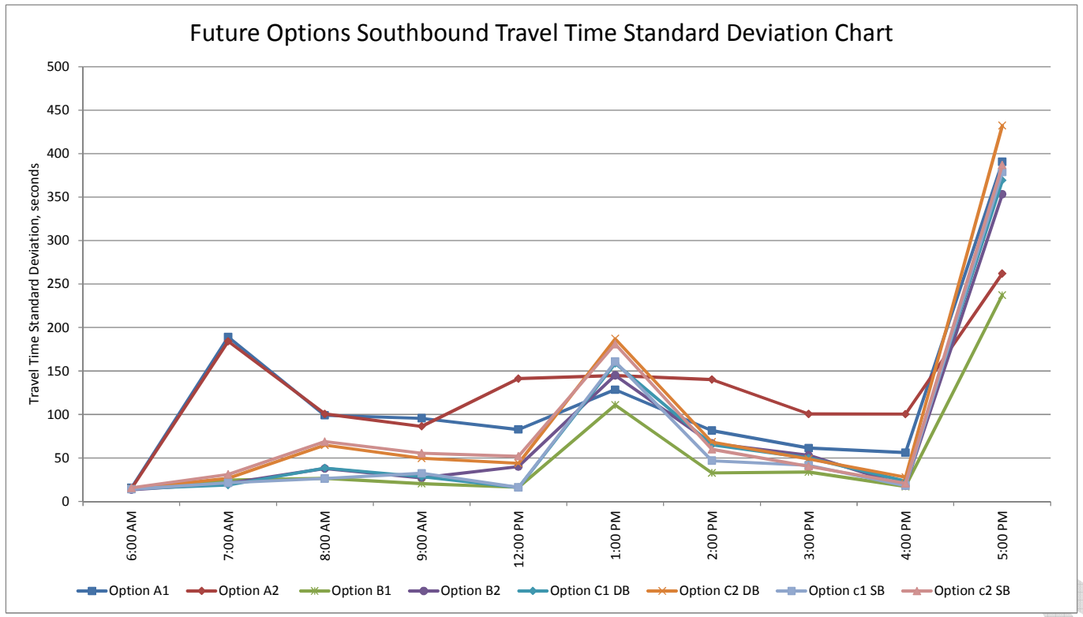
APPENDIX D: TRAVEL TIME CONSISTENCY ANALYSIS

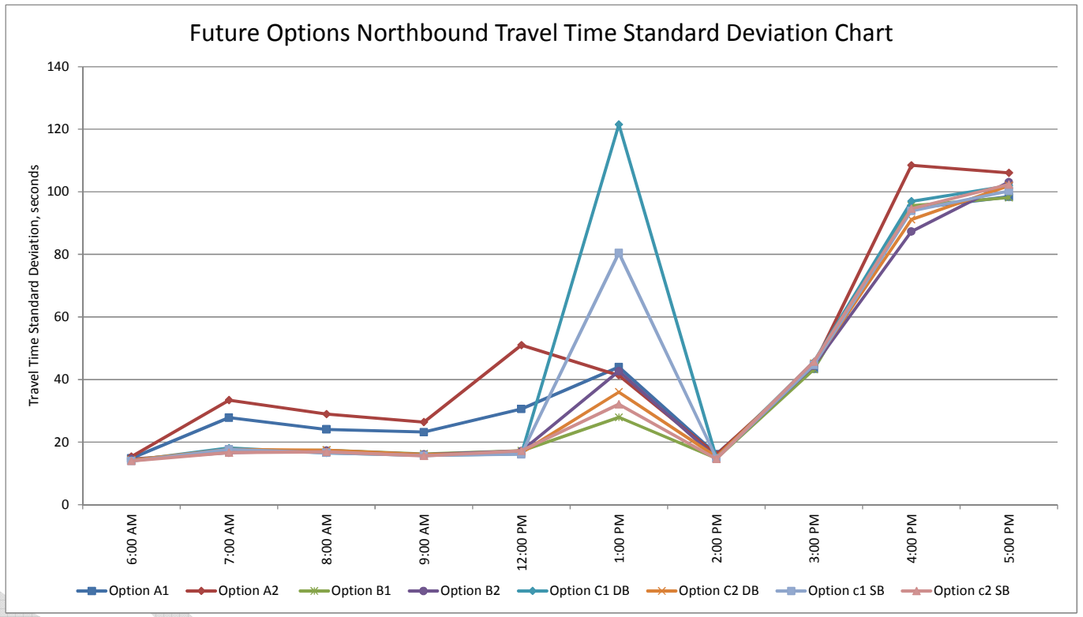

Southbound Travel Time Reliability Chart for PM Period (2:00 PM - 6:00 PM)
Travel Time (Seconds)
800
700
600
500
400
300
200
100
0
A1
A2
B1
B2
C1 DB
C2 DB
c1 SB
c2 SB
15th percentile
50th percentile
85th percentile

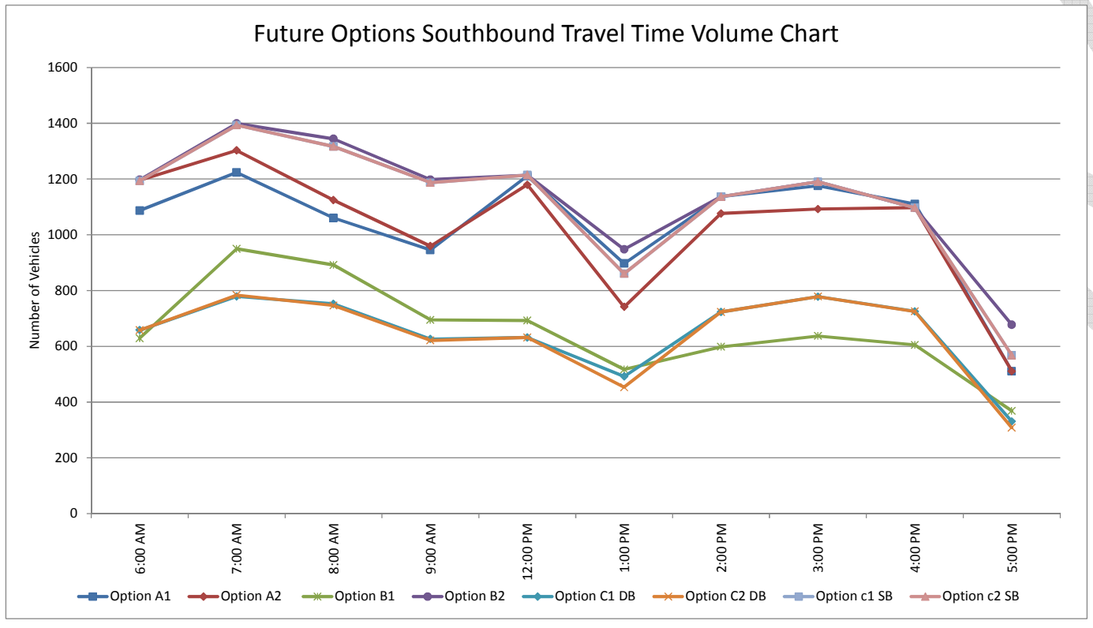

Northbound Travel Time Reliability Chart for PM Period (2:00 PM - 6:00 PM)
Travel Time (Seconds)
700
600
500
400
300
200
100
0
A1
A2
B1
B2
C1 DB
C2 DB
c1 SB
c2 SB
15th percentile
50th percentile
85th percentile

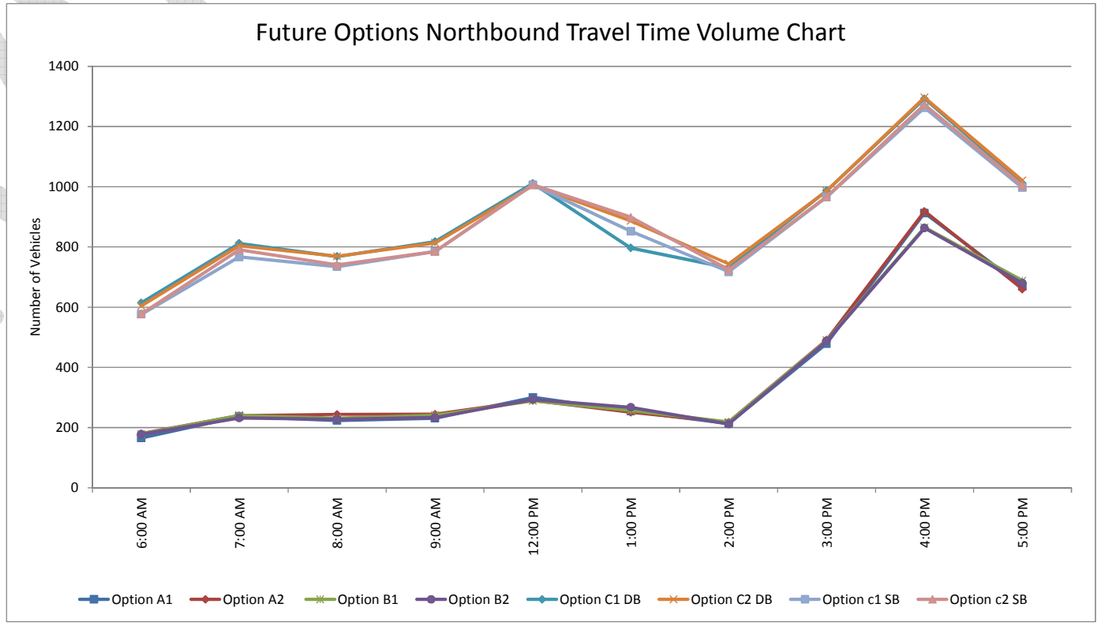

Future Options Southbound Average Travel Time Chart
Travel Time, seconds
1200
1000
800
600
400
200
0
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Option A1
Option A2
Option B1
Option B2
Option C1 DB
Option C2 DB
Option c1 SB
Option c2 SB

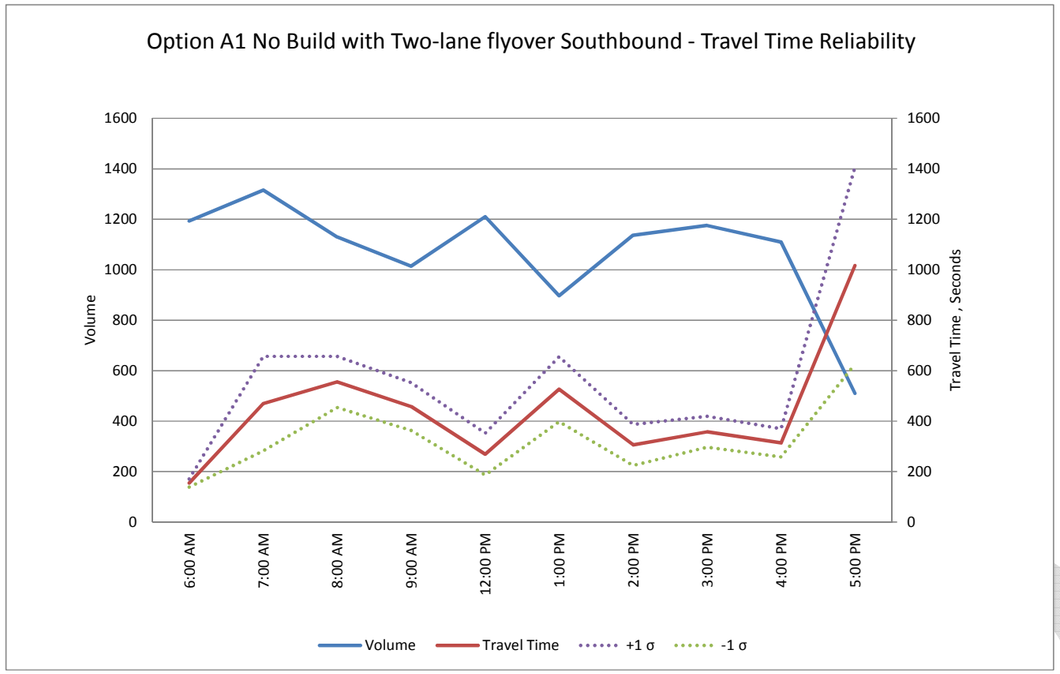

Future Options Northbound Average Travel Time Chart
Travel Time, seconds
600
500
400
300
200
100
0
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Option A1
Option A2
Option B1
Option B2
Option C1 DB
Option C2 DB
Option c1 SB
Option c2 SB

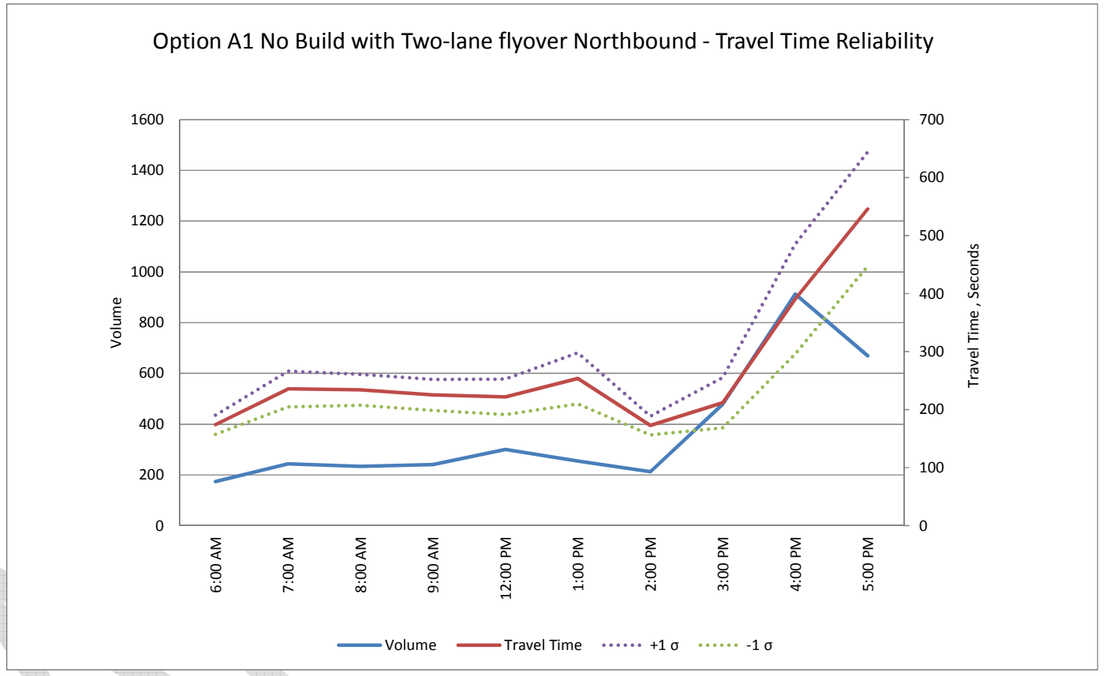

Future Options Southbound Travel Time Standard Deviation Chart
Travel Time Standard Deviation, seconds
500
450
400
350
300
250
200
150
100
50
0
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Option A1
Option A2
Option B1
Option B2
Option C1 DB
Option C2 DB
Option c1 SB
Option c2 SB

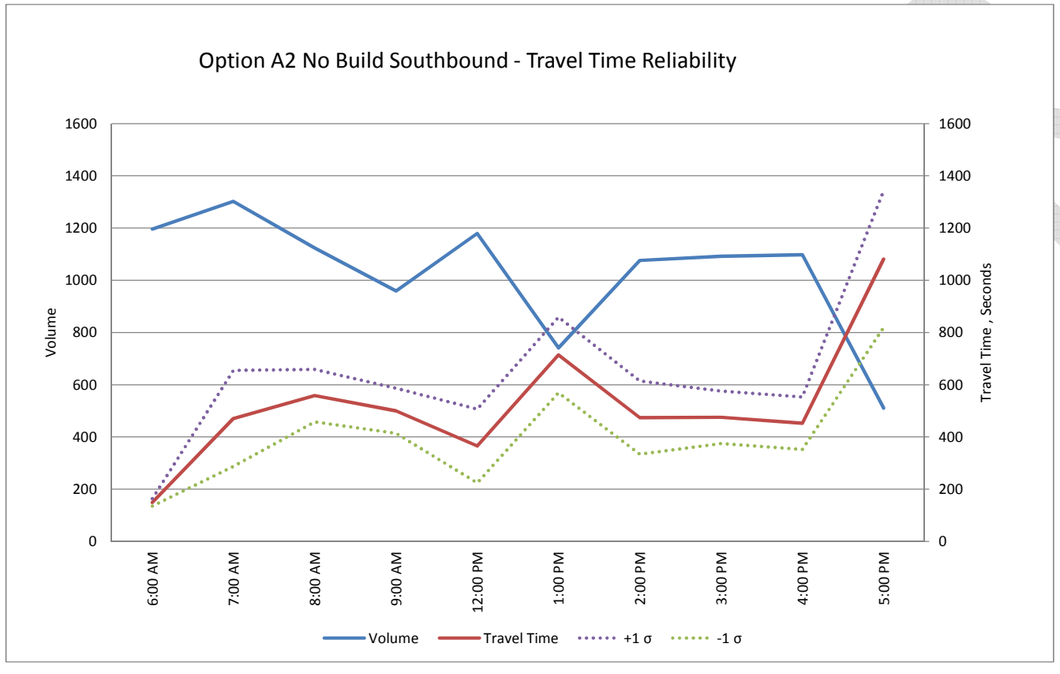

Future Options Northbound Travel Time Standard Deviation Chart
Travel Time Standard Deviation, seconds
140
120
100
80
60
40
20
0
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Option A1
Option A2
Option B1
Option B2
Option C1 DB
Option C2 DB
Option c1 SB
Option c2 SB

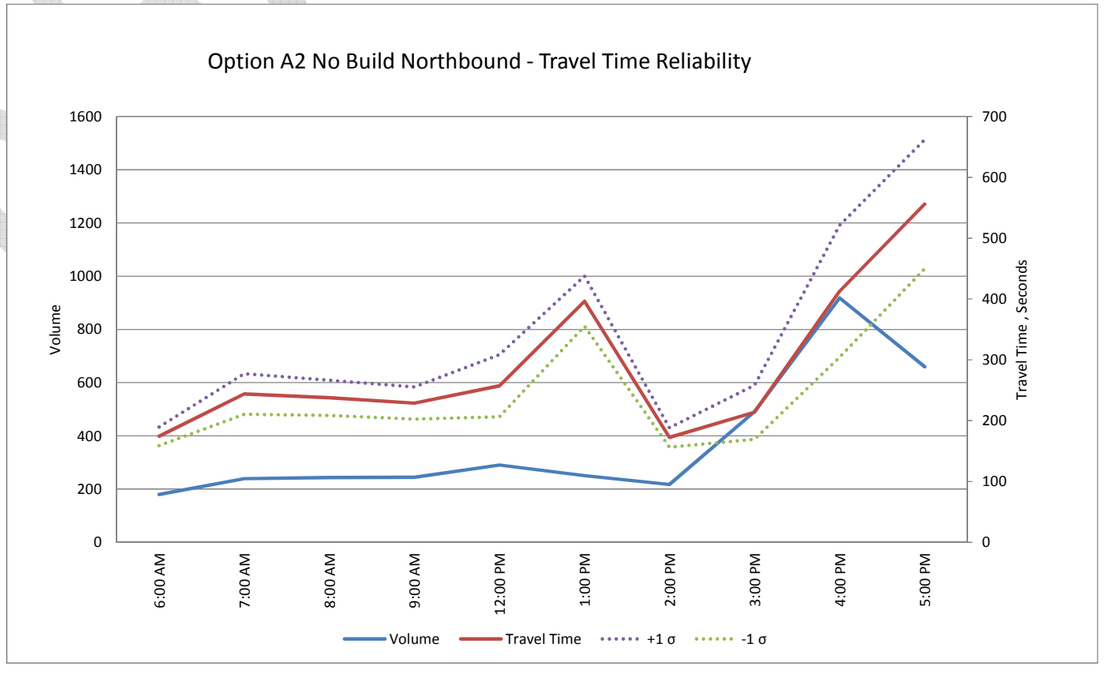

Future Options Southbound Travel Time Volume Chart
Number of Vehicles
1600
1400
1200
1000
800
600
400
200
0
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Option A1
Option A2
Option B1
Option B2
Option C1 DB
Option C2 DB
Option c1 SB
Option c2 SB

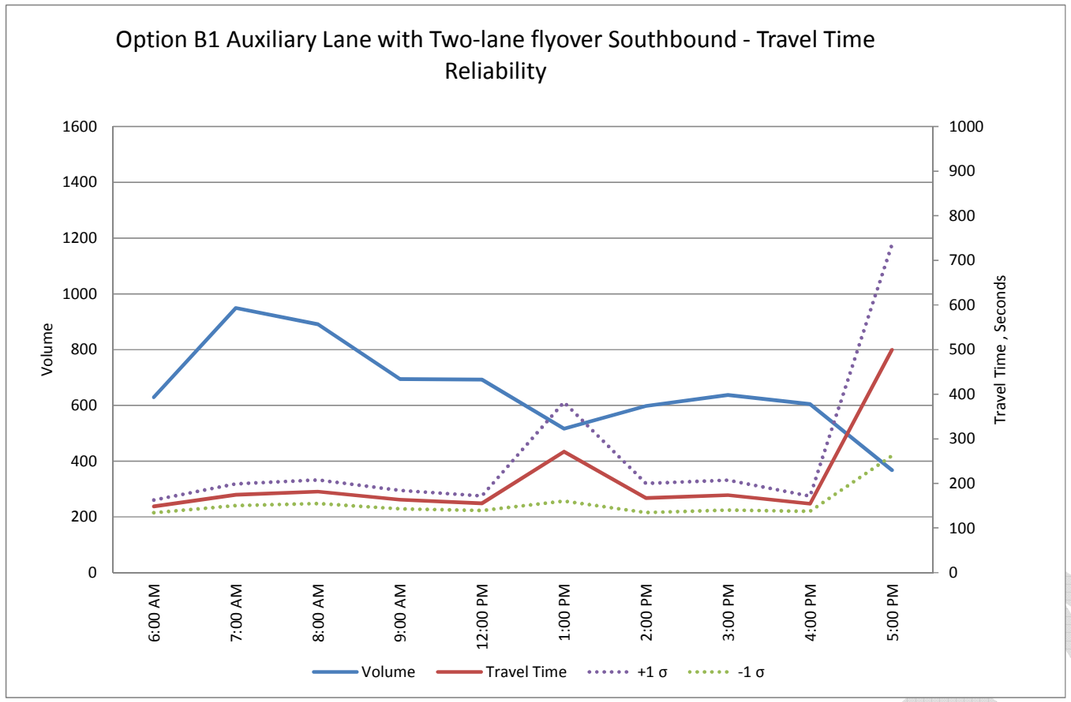

Future Options Northbound Travel Time Volume Chart
Number of Vehicles
1400
1200
1000
800
600
400
200
0
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Option A1
Option A2
Option B1
Option B2
Option C1 DB
Option C2 DB
Option c1 SB
Option c2 SB

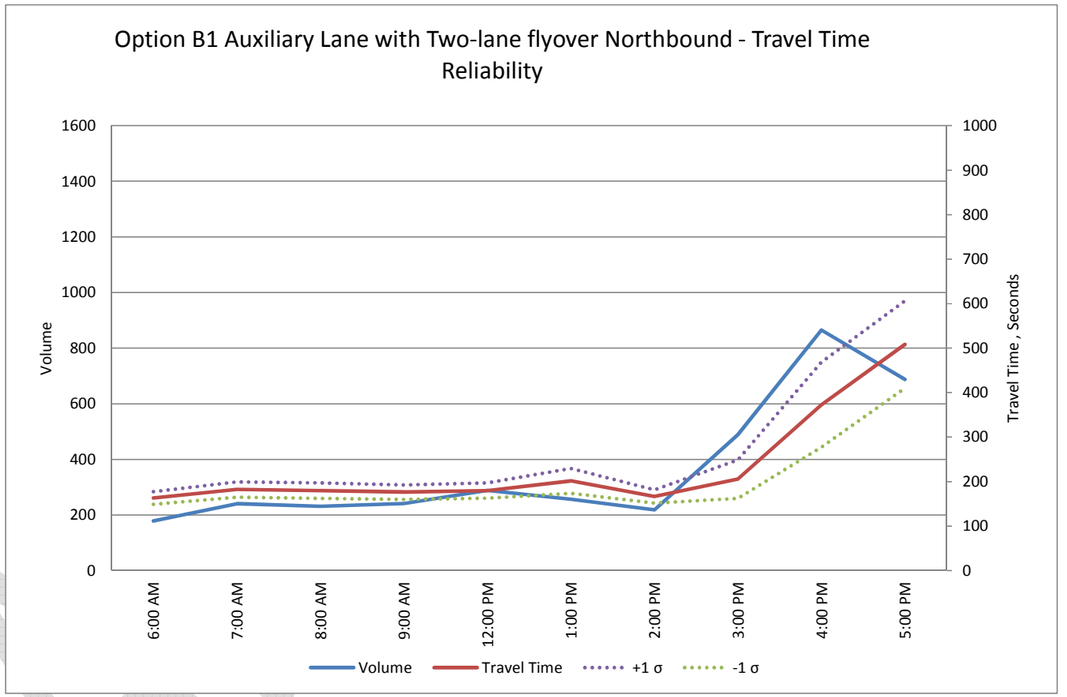

Option A1 No Build with Two-lane flyover Southbound - Travel Time Reliability
Volume
Travel Time , Seconds
0
200
400
600
800
1000
1200
1400
1600
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Volume
Travel Time
+1 σ
-1 σ

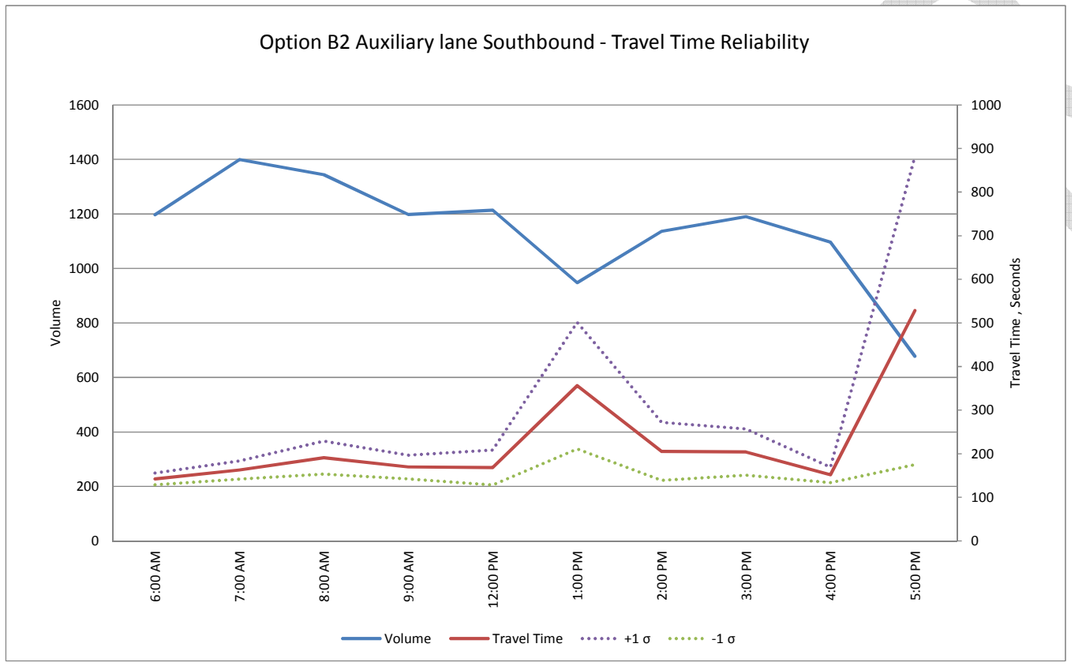

Option A1 No Build with Two-lane flyover Northbound - Travel Time Reliability
Volume
Travel Time , Seconds
0
200
400
600
800
1000
1200
1400
1600
0
100
200
300
400
500
600
700
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Volume
Travel Time
+1 σ
-1 σ

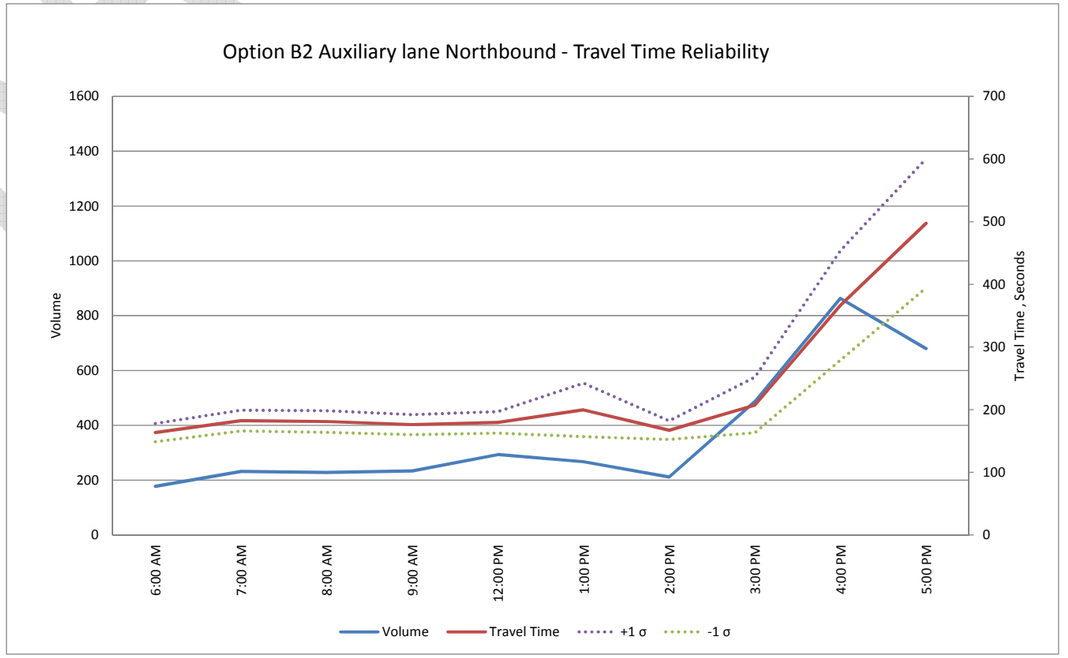

Option A2 No Build Southbound - Travel Time Reliability
Volume
Travel Time , Seconds
0
200
400
600
800
1000
1200
1400
1600
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Volume
Travel Time
+1 σ
-1 σ

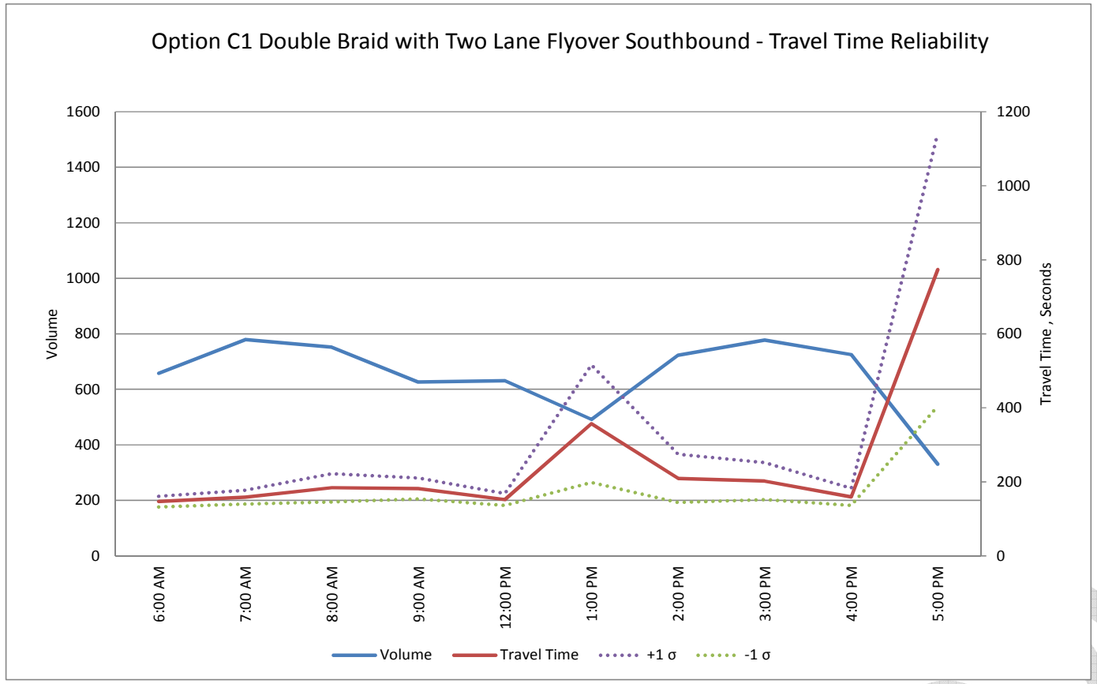

Option A2 No Build Northbound - Travel Time Reliability
Volume
Travel Time , Seconds
0
200
400
600
800
1000
1200
1400
1600
0
100
200
300
400
500
600
700
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Volume
Travel Time
+1 σ
-1 σ

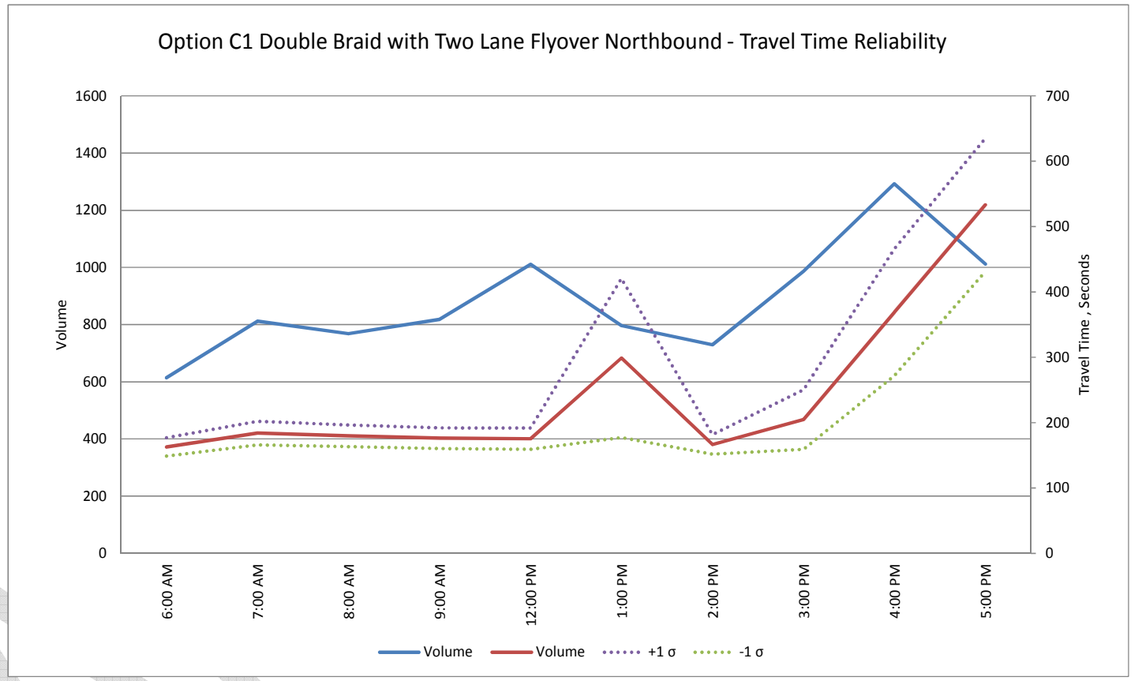

Option B1 Auxiliary Lane with Two-lane flyover Southbound - Travel Time Reliability
Volume
Travel Time , Seconds
1600
1400
1200
1000
800
600
400
200
0
1000
900
800
700
600
500
400
300
200
100
0
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Volume
Travel Time
+1 σ
-1 σ

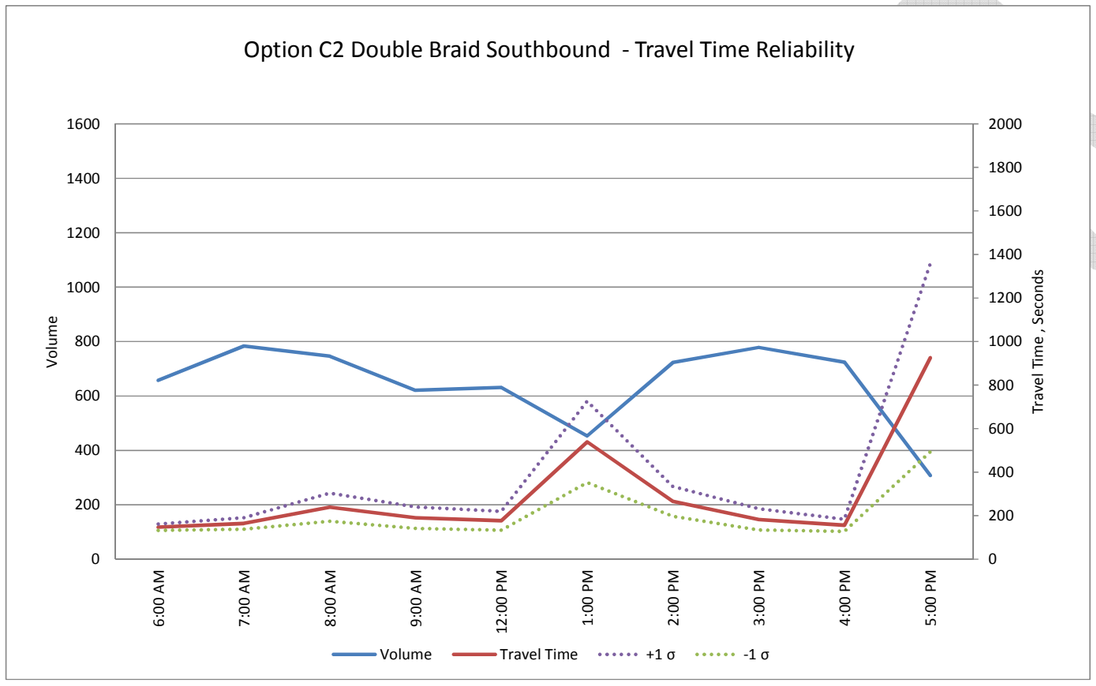

Option B1 Auxiliary Lane with Two-lane flyover Northbound - Travel Time Reliability
Volume
Travel Time , Seconds
1600
1400
1200
1000
800
600
400
200
0
1000
900
800
700
600
500
400
300
200
100
0
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Volume
Travel Time
+1 σ
-1 σ

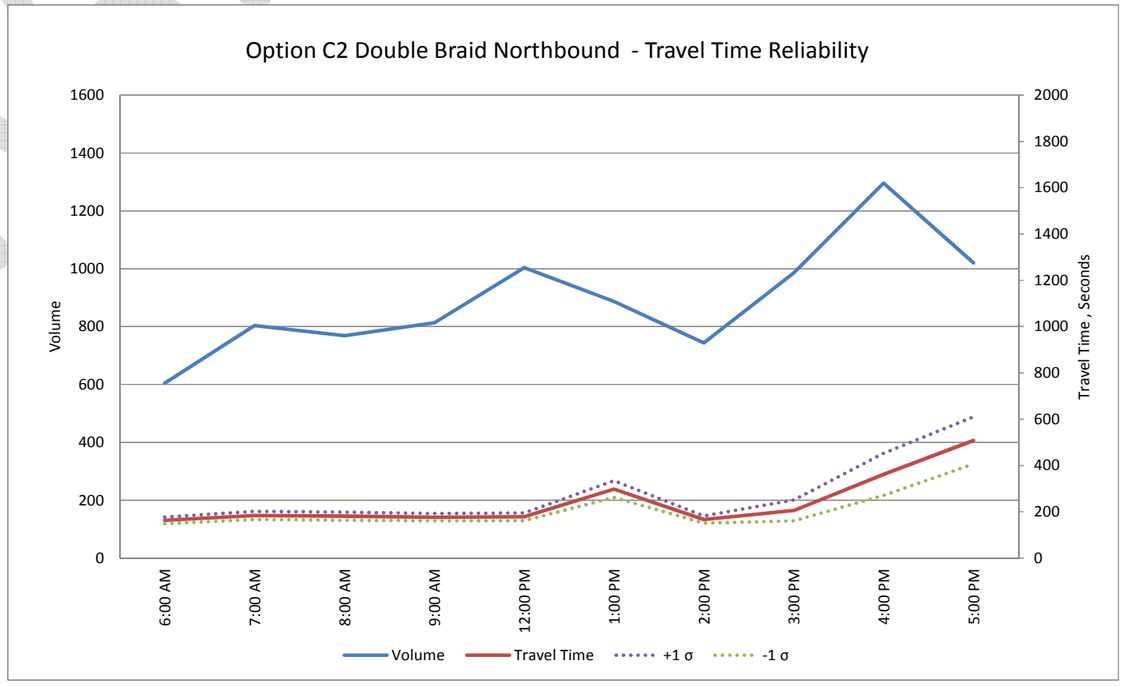

Option B2 Auxiliary lane Southbound - Travel Time Reliability
Volume
Travel Time , Seconds
1600
1400
1200
1000
800
600
400
200
0
1000
900
800
700
600
500
400
300
200
100
0
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Volume
Travel Time
+1 σ
-1 σ

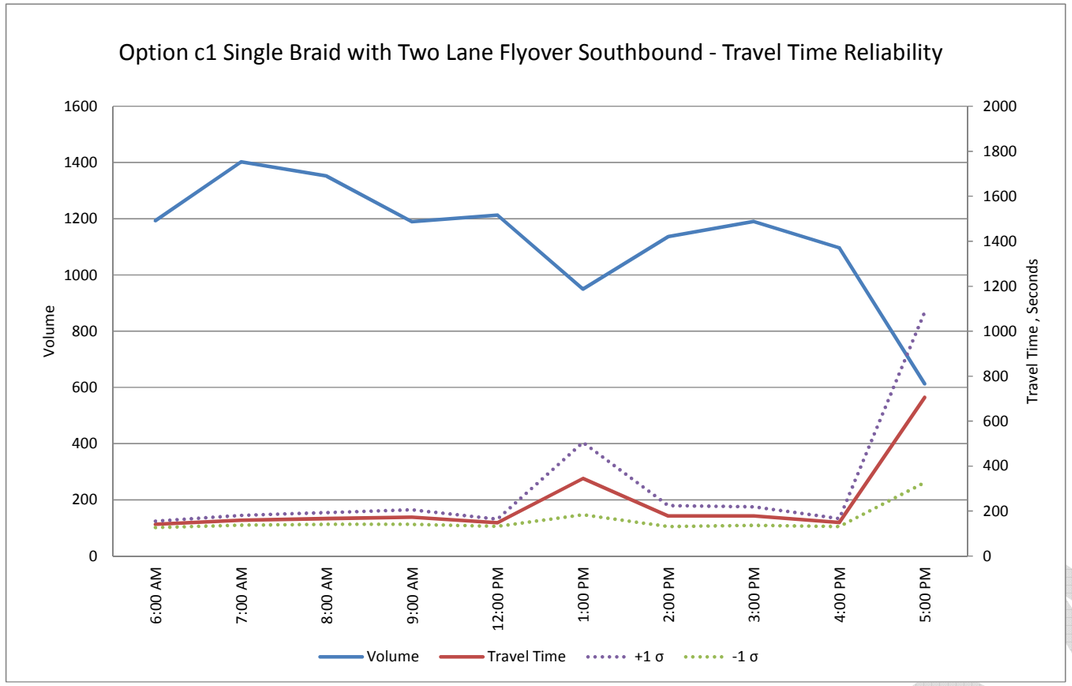

Option B2 Auxiliary lane Northbound - Travel Time Reliability
Volume
Travel Time , Seconds
1600
1400
1200
1000
800
600
400
200
0
700
600
500
400
300
200
100
0
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Volume
Travel Time
+1 σ
-1 σ

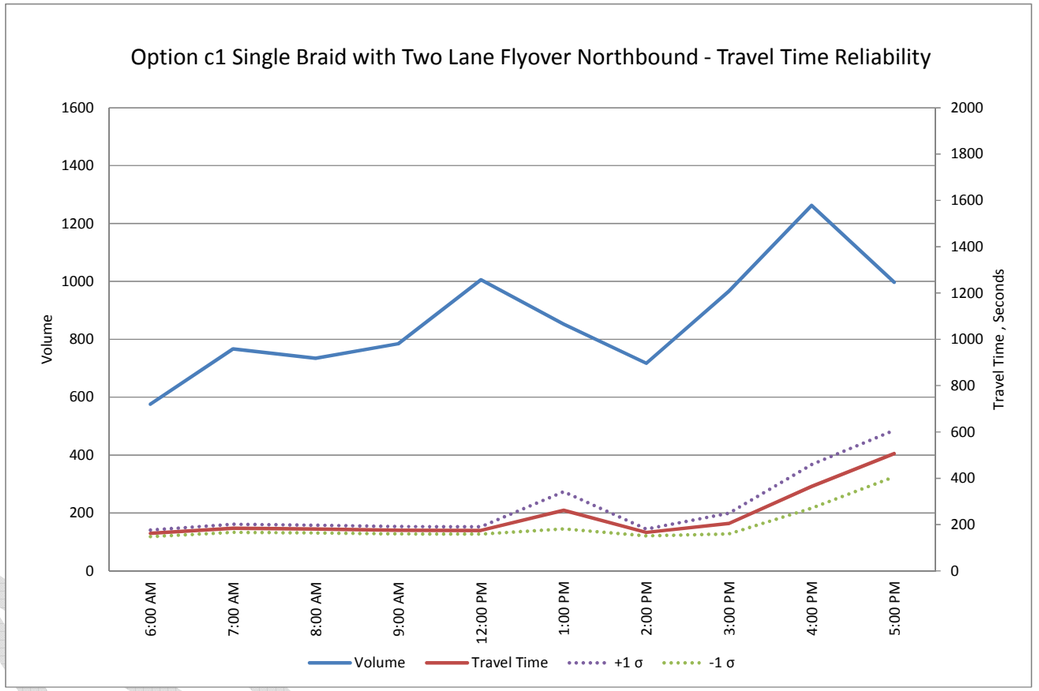

Option C1 Double Braid with Two Lane Flyover Southbound - Travel Time Reliability
Volume
Travel Time , Seconds
1600
1400
1200
1000
800
600
400
200
0
1200
1000
800
600
400
200
0
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Volume
Travel Time
+1 σ
-1 σ

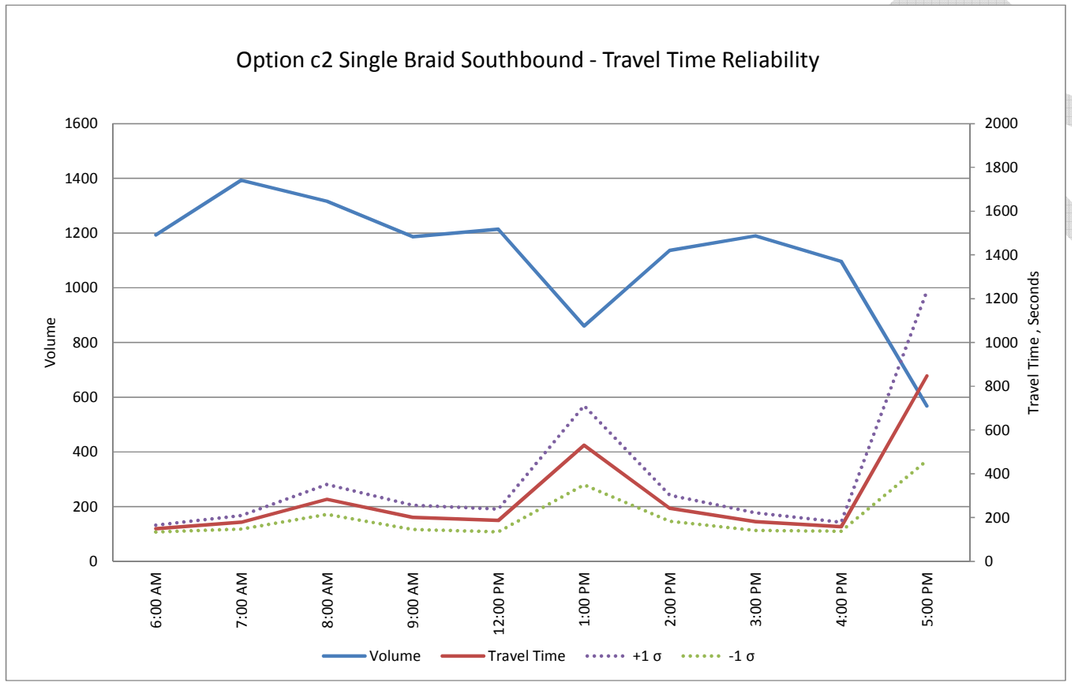

Option C1 Double Braid with Two Lane Flyover Northbound - Travel Time Reliability
Volume
Travel Time , Seconds
1600
1400
1200
1000
800
600
400
200
0
700
600
500
400
300
200
100
0
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Volume
Volume
+1 σ
-1 σ

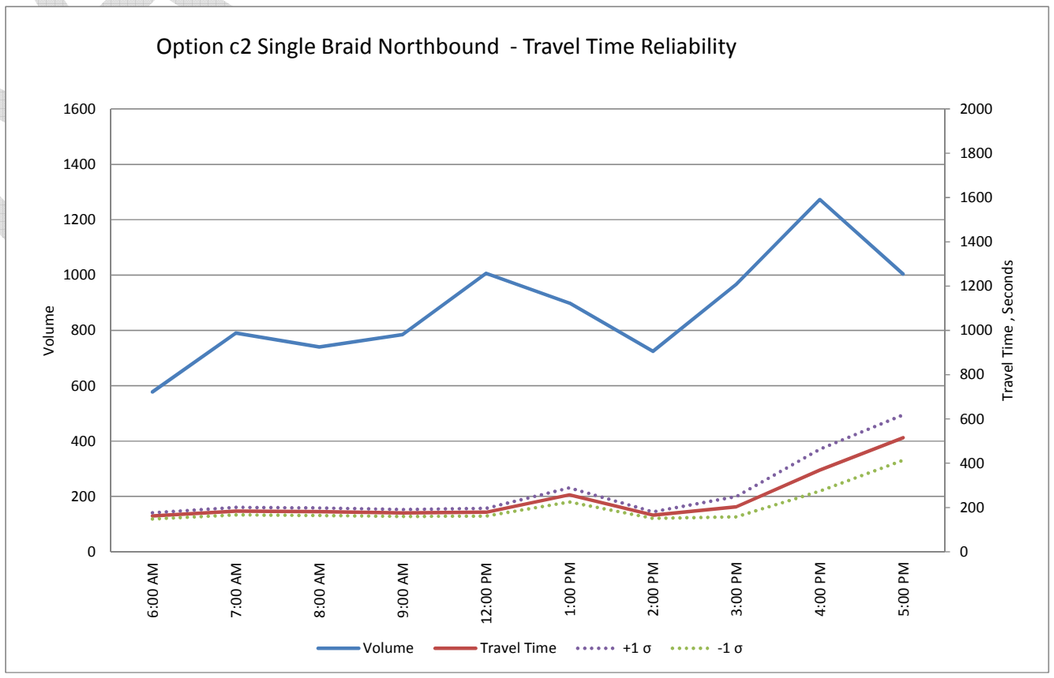

Option C2 Double Braid Southbound - Travel Time Reliability
Volume
Travel Time , Seconds
1600
1400
1200
1000
800
600
400
200
0
2000
1800
1600
1400
1200
1000
800
600
400
200
0
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Volume
Travel Time
+1 σ
-1 σ


Option C2 Double Braid Northbound - Travel Time Reliability
Volume
Travel Time , Seconds
1600
1400
1200
1000
800
600
400
200
0
2000
1800
1600
1400
1200
1000
800
600
400
200
0
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Volume
Travel Time
+1 σ
-1 σ


Option c1 Single Braid with Two Lane Flyover Southbound - Travel Time Reliability
Volume
Travel Time , Seconds
0
200
400
600
800
1000
1200
1400
1600
1800
2000
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Volume
Travel Time
+1 σ
-1 σ


Option c1 Single Braid with Two Lane Flyover Northbound - Travel Time Reliability
Volume
Travel Time , Seconds
0
200
400
600
800
1000
1200
1400
1600
1800
2000
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Volume
Travel Time
+1 σ
-1 σ


Option c2 Single Braid Southbound - Travel Time Reliability
Volume
Travel Time , Seconds
0
200
400
600
800
1000
1200
1400
1600
1800
2000
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Volume
Travel Time
+1 σ
-1 σ


Option c2 Single Braid Northbound - Travel Time Reliability
Volume
Travel Time , Seconds
0
200
400
600
800
1000
1200
1400
1600
1800
2000
6:00 AM
7:00 AM
8:00 AM
9:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
Volume
Travel Time
+1 σ
-1 σ

APPENDIX E: LANE-BY-LANE ANALYSIS

I-5 Broadway/Weidler 2035 Future Options Northbound Spot Speed Chart

	6:00 AM	6:15 AM	6:30 AM	6:45 AM	7:00 AM	7:15 AM	7:30 AM	7:45 AM	8:00 AM	8:15 AM	8:30 AM	8:45 AM	9:00 AM	9:15 AM	9:30 AM	9:45 AM	12:00 PM	12:15 PM	12:30 PM	12:45 PM	1:00 PM	1:15 PM	1:30 PM	1:45 PM	2:00 PM	2:15 PM	2:30 PM	2:45 PM	3:00 PM	3:15 PM	3:30 PM	3:45 PM	4:00 PM	4:15 PM	4:30 PM	4:45 PM	5:00 PM	5:15 PM	5:30 PM	5:45 PM
NB Location	**Percentage Difference in Northbound Average Speeds between Option A1(No-build with two lane flyover) and Option A2(No-build)**																																							
I-5 NB Near 84	0%	0%	1%	-1%	0%	3%	-1%	4%	3%	3%	4%	-3%	9%	5%	5%	5%	3%	-1%	22%	22%	36%	18%	7%	1%	0%	0%	0%	0%	0%	0%	-2%	-1%	0%	0%	-3%	-2%	5%	2%	0%	7%
I-5 NB Near 84	0%	1%	0%	0%	0%	3%	4%	3%	9%	5%	0%	1%	20%	-4%	-2%	4%	-1%	15%	24%	31%	36%	20%	8%	-3%	0%	0%	0%	0%	0%	0%	-2%	0%	0%	0%	-1%	9%	15%	-1%	2%	6%
I-5 NB Near Multnomah	2%	2%	-3%	0%	1%	1%	0%	4%	1%	3%	0%	-5%	7%	-2%	2%	3%	-5%	12%	9%	3%	4%	15%	2%	1%	0%	-1%	0%	0%	0%	0%	-3%	-1%	2%	-2%	0%	9%	8%	1%	-1%	3%
I-5 NB Near Weidler	0%	1%	1%	-1%	3%	3%	4%	0%	1%	0%	1%	0%	-2%	1%	0%	0%	1%	6%	8%	8%	12%	15%	18%	17%	0%	-1%	0%	0%	0%	0%	0%	0%	0%	2%	2%	3%	2%	5%	-5%	-9%
I-5 NB Bt Broadway/Weidler	-1%	1%	-1%	0%	3%	6%	7%	0%	-1%	-2%	1%	-3%	2%	-1%	0%	-4%	2%	17%	12%	14%	19%	27%	29%	22%	0%	0%	0%	0%	0%	0%	0%	0%	1%	2%	2%	3%	3%	7%	-5%	-7%
I-5 NB Near Broadway	1%	-1%	2%	-1%	4%	8%	9%	3%	-1%	-2%	-2%	-2%	-2%	-4%	1%	-7%	5%	17%	12%	19%	18%	28%	33%	26%	0%	0%	0%	0%	-1%	0%	-1%	0%	1%	4%	3%	4%	4%	6%	-5%	-10%
I-5 NB BT 405/Weidler	1%	5%	1%	3%	6%	5%	8%	3%	3%	8%	2%	-1%	1%	-1%	0%	-4%	5%	8%	18%	15%	13%	19%	21%	17%	1%	-1%	-1%	0%	1%	1%	0%	0%	2%	-1%	3%	5%	10%	8%	5%	-10%
I-5 NB Near 405	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	5%	28%	17%	3%	1%	1%	-6%
I-5 NB Near Going	0%	-1%	0%	0%	0%	-2%	0%	1%	1%	-1%	4%	0%	1%	-2%	-1%	-2%	3%	1%	3%	-1%	2%	2%	4%	4%	2%	-2%	1%	1%	3%	0%	21%	1%	7%	-1%	2%	2%	3%	-1%	0%	1%
NB Location	**Percentage Difference in Northbound Average Speeds between Option B1(Auxiliary lanes with two lane flyover) and Option B2(Auxiliary lanes)**																																							
I-5 NB Near 84	0%	-2%	-3%	0%	0%	0%	-1%	0%	0%	0%	1%	2%	1%	0%	2%	1%	-1%	1%	0%	1%	-1%	0%	3%	6%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%
I-5 NB Near 84	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	14%	29%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-2%	3%
I-5 NB Near Multnomah	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-2%	-2%	-4%	5%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-6%	0%	12%
I-5 NB Near Weidler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-5%	-5%	-1%	-5%
I-5 NB Bt Broadway/Weidler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-3%	-5%	-7%	-5%	-6%
I-5 NB Near Broadway	0%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-5%	-5%	-5%	-6%	-4%
I-5 NB BT 405/Weidler	0%	1%	0%	0%	0%	0%	-2%	1%	0%	-1%	-1%	0%	-2%	-1%	0%	-1%	0%	0%	1%	0%	1%	0%	-2%	1%	0%	1%	0%	0%	0%	0%	0%	0%	0%	1%	-3%	-2%	-7%	-7%	-4%	-3%
I-5 NB Near 405	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	0%	1%	16%	2%	-22%	28%	16%	16%	-12%
I-5 NB Near Going	0%	-1%	0%	0%	0%	-1%	0%	1%	1%	-2%	-1%	0%	-1%	0%	1%	1%	1%	0%	3%	3%	2%	-1%	0%	-2%	-1%	1%	0%	0%	-2%	-1%	-4%	3%	0%	1%	0%	-4%	0%	-1%	-3%	-2%
NB Location	**Percentage Difference in Northbound Average Speeds between Option C1(Double Braid with two lane flyover)and Option C2(Double Braid)**																																							
I-5 NB Near 84	1%	-1%	1%	-2%	2%	1%	1%	1%	1%	0%	0%	1%	0%	0%	-2%	-1%	0%	1%	-3%	0%	1%	-2%	-4%	-4%	1%	0%	1%	0%	-3%	0%	0%	-1%	0%	1%	0%	-1%	-1%	0%	0%	-1%
I-5 NB Near 84	0%	0%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-2%	-4%	19%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-1%
I-5 NB Near Multnomah	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	1%	-2%	-7%	17%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-2%
I-5 NB Near Weidler	0%	0%	0%	1%	0%	0%	0%	0%	0%	-1%	0%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	0%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-2%	-7%
I-5 NB Bt Broadway/Weidler	0%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	1%	0%	0%	0%	1%	0%	0%	0%	0%	0%	-1%	0%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-3%	-5%
I-5 NB Near Broadway	0%	0%	0%	0%	1%	-1%	0%	0%	0%	1%	0%	-1%	0%	1%	1%	0%	0%	0%	0%	0%	-1%	0%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-4%	-4%	-3%	1%
I-5 NB BT 405/Weidler	0%	-1%	-3%	2%	0%	-2%	-2%	-1%	0%	1%	1%	1%	0%	2%	0%	0%	3%	1%	-3%	1%	-1%	1%	1%	0%	1%	0%	0%	0%	0%	0%	-1%	0%	-1%	-1%	0%	-3%	-9%	-10%	-5%	-10%
I-5 NB Near 405	0%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	1%	1%	-1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	-1%	1%	-3%	9%	-3%	-5%	0%	1%
I-5 NB Near Going	0%	0%	1%	0%	2%	0%	-1%	0%	2%	-2%	2%	-3%	-1%	1%	3%	-1%	-1%	-2%	-1%	-2%	1%	3%	4%	-1%	-1%	1%	-4%	-1%	-1%	4%	4%	-3%	1%	6%	-2%	0%	2%	5%	-1%	-3%
NB Location	**Percentage Difference in Northbound Average Speeds between Option c1(Single Braid with two lane flyover) and Option c2(Single Braid)**																																							
I-5 NB Near 84	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	-1%	1%	1%	0%	-1%	9%	7%	11%	17%	12%	5%	7%	-8%	0%	0%	0%	0%	-2%	-1%	-2%	1%	0%	1%	1%	2%	3%	1%	2%	2%
I-5 NB Near 84	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%	0%	-6%	-20%	-25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-2%
I-5 NB Near Multnomah	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	-3%	1%	-20%	-33%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-2%	-5%
I-5 NB Near Weidler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	0%	-1%	-1%	0%	0%	0%	-2%	-4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-3%	-6%	-5%
I-5 NB Bt Broadway/Weidler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	-1%	-2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-5%	-6%	-5%
I-5 NB Near Broadway	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	0%	0%	0%	-1%	-1%	0%	0%	0%	-2%	-2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-3%	-1%	-5%	-4%
I-5 NB BT 405/Weidler	-1%	-1%	1%	-1%	1%	0%	1%	0%	-1%	1%	0%	1%	0%	1%	1%	1%	-1%	0%	0%	0%	1%	0%	2%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	0%	0%	2%	-5%	-4%	-3%	-3%	-7%
I-5 NB Near 405	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%	0%	1%	1%	4%	-19%	12%	-2%	17%	30%	16%
I-5 NB Near Going	0%	-1%	2%	0%	0%	2%	2%	-1%	-1%	1%	0%	1%	-1%	1%	0%	-3%	-1%	2%	1%	-2%	5%	-1%	0%	4%	1%	-1%	-1%	-3%	-3%	0%	3%	-3%	-5%	1%	4%	0%	1%	1%	-3%	3%

Legend
Different>=50%
25%<= Different<50%
10%<= Different<25%
0%<= Different<10%
-10%<= Different<0%
-25%<= Different<-10%
-50%<= Different<-25%
Different<50%

I-5 Broadway/Weidler 2035 Future Options Southbound Spot Speed Chart

	6:00 AM	6:15 AM	6:30 AM	6:45 AM	7:00 AM	7:15 AM	7:30 AM	7:45 AM	8:00 AM	8:15 AM	8:30 AM	8:45 AM	9:00 AM	9:15 AM	9:30 AM	9:45 AM	12:00 PM	12:15 PM	12:30 PM	12:45 PM	1:00 PM	1:15 PM	1:30 PM	1:45 PM	2:00 PM	2:15 PM	2:30 PM	2:45 PM	3:00 PM	3:15 PM	3:30 PM	3:45 PM	4:00 PM	4:15 PM	4:30 PM	4:45 PM	5:00 PM	5:15 PM	5:30 PM	5:45 PM
SB Location	**Percentage Difference in Northbound Average Speeds between Option A1(No-build with two lane flyover) and Option A2(No-build)**																																							
I-5 SB Near Going	-1%	0%	1%	1%	-1%	0%	4%	-1%	0%	1%	2%	2%	-3%	3%	9%	25%	-2%	-1%	13%	31%	53%	57%	42%	23%	1%	5%	31%	70%	51%	34%	17%	20%	14%	22%	39%	54%	68%	95%	16%	-5%
I-5 SB Near 405	0%	0%	0%	0%	0%	-3%	5%	2%	-3%	0%	-2%	1%	-4%	3%	10%	20%	0%	5%	32%	32%	18%	17%	16%	11%	7%	47%	77%	35%	16%	32%	6%	21%	25%	35%	50%	60%	88%	33%	2%	-7%
I-5 SB Bt 405/Broadway	0%	0%	0%	0%	0%	-6%	-3%	3%	-2%	3%	1%	2%	1%	0%	6%	0%	4%	34%	21%	6%	6%	9%	6%	-1%	29%	6%	8%	4%	9%	4%	6%	5%	4%	10%	5%	6%	12%	-2%	-6%	-14%
I-5 SB Near Broadway	-2%	-3%	1%	0%	-6%	4%	4%	-1%	-2%	1%	1%	4%	-2%	4%	6%	1%	3%	15%	5%	10%	9%	12%	13%	5%	15%	12%	13%	6%	19%	6%	9%	2%	9%	13%	11%	13%	19%	-4%	-8%	-18%
I-5 SB Near Broadway	0%	0%	0%	0%	5%	17%	4%	1%	1%	1%	12%	9%	7%	14%	23%	14%	8%	30%	23%	47%	34%	37%	34%	19%	30%	45%	49%	24%	44%	20%	23%	18%	25%	37%	38%	39%	55%	1%	-6%	-1%
I-5 SB Near Moda Center	1%	1%	1%	1%	10%	25%	1%	-4%	-1%	5%	11%	11%	11%	26%	37%	22%	16%	41%	45%	68%	50%	57%	33%	13%	33%	58%	56%	34%	50%	28%	36%	28%	36%	44%	47%	53%	54%	-13%	-9%	-12%
I-5 SB Near Multnomah	5%	8%	7%	5%	19%	24%	-23%	-28%	-22%	-8%	-7%	-4%	-15%	16%	22%	32%	28%	39%	46%	52%	51%	41%	-6%	-37%	47%	48%	33%	38%	27%	38%	37%	34%	34%	31%	36%	33%	-9%	-48%	-50%	-46%
I-5 SB Near 84	-1%	1%	1%	-1%	7%	9%	-1%	-3%	-5%	4%	7%	2%	-9%	-17%	-6%	3%	-1%	2%	6%	9%	9%	2%	1%	1%	1%	3%	0%	2%	-1%	8%	5%	9%	3%	-1%	-3%	-7%	20%	1%	-2%	0%
I-5 SB Near Morrison	0%	0%	0%	0%	0%	1%	0%	0%	-1%	1%	0%	0%	0%	-1%	0%	0%	0%	1%	1%	0%	1%	1%	2%	1%	0%	0%	0%	0%	0%	1%	0%	1%	0%	0%	0%	-2%	4%	4%	1%	5%
SB Location	**Percentage Difference in Northbound Average Speeds between Option B1(Auxiliary lanes with two lane flyover) and Option B2(Auxiliary lanes)**																																						
I-5 SB Near Going	0%	-1%	-5%	1%	3%	-4%	-6%	-5%	0%	-6%	8%	-4%	2%	0%	7%	0%	0%	0%	0%	1%	5%	8%	39%	55%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	0%	0%	3%	42%	11%
I-5 SB Near 405	0%	0%	0%	0%	0%	0%	-1%	0%	1%	0%	0%	1%	5%	2%	0%	1%	0%	0%	0%	3%	9%	31%	78%	46%	0%	0%	1%	2%	10%	17%	10%	1%	0%	0%	0%	0%	1%	15%	44%	-22%
I-5 SB Bt 405/Broadway	0%	0%	-1%	1%	0%	6%	1%	4%	6%	16%	17%	15%	15%	7%	6%	0%	1%	0%	0%	9%	38%	99%	116%	22%	3%	15%	72%	85%	72%	67%	51%	31%	13%	1%	1%	2%	5%	61%	18%	-26%
I-5 SB Near Broadway	0%	0%	0%	0%	1%	1%	1%	1%	3%	12%	13%	12%	6%	2%	5%	3%	1%	2%	5%	17%	19%	19%	-15%	-52%	7%	38%	82%	76%	32%	3%	4%	3%	1%	0%	1%	1%	15%	-8%	-46%	3%
I-5 SB Near Broadway	0%	0%	1%	0%	0%	1%	1%	3%	9%	18%	20%	14%	12%	4%	7%	5%	1%	9%	35%	53%	54%	25%	-22%	-44%	17%	60%	73%	59%	40%	13%	9%	7%	2%	3%	1%	4%	36%	-1%	-50%	-1%
I-5 SB Near Moda Center	0%	0%	0%	0%	0%	0%	1%	14%	20%	24%	25%	24%	17%	11%	11%	6%	3%	19%	51%	69%	59%	28%	-17%	-29%	27%	64%	55%	46%	32%	16%	13%	13%	6%	4%	3%	8%	41%	10%	-36%	-17%
I-5 SB Near Multnomah	0%	0%	0%	0%	0%	-4%	6%	-11%	-13%	-2%	-2%	1%	3%	1%	1%	1%	-1%	1%	0%	-1%	-1%	-5%	-7%	-6%	-1%	-2%	-4%	-4%	-4%	-3%	-3%	0%	0%	-1%	0%	-1%	-3%	-5%	-5%	-3%
I-5 SB Near 84	0%	0%	0%	0%	0%	-4%	6%	-11%	-13%	-2%	-2%	1%	3%	1%	1%	1%	-1%	1%	0%	-1%	-1%	-5%	-7%	-6%	-1%	-2%	-4%	-4%	-4%	-3%	-3%	0%	0%	-1%	0%	-1%	-3%	-5%	-5%	-3%
I-5 SB Near Morrison	0%	0%	0%	0%	0%	-1%	0%	-1%	-2%	0%	-1%	0%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	-1%	0%	0%	-1%	0%	1%	0%	0%	0%	0%	-2%	-2%	-4%	4%
SB Location	**Percentage Difference in Northbound Average Speeds between Option C1(Double Braid with two lane flyover)and Option C2(Double Braid)**																																						
I-5 SB Near Going	-1%	2%	0%	0%	-6%	-5%	-3%	-7%	26%	9%	17%	-8%	4%	-8%	0%	-6%	0%	0%	0%	0%	0%	3%	23%	29%	0%	0%	0%	-2%	2%	9%	1%	-1%	-3%	-2%	-1%	0%	0%	8%	55%	-2%
I-5 SB Near 405	0%	0%	1%	0%	1%	1%	0%	-1%	2%	3%	11%	9%	-10%	-13%	-13%	-14%	0%	0%	0%	1%	3%	30%	34%	-4%	0%	4%	24%	12%	-2%	0%	0%	0%	0%	0%	0%	0%	4%	52%	21%	11%
I-5 SB Bt 405/Broadway	0%	0%	0%	0%	1%	2%	2%	8%	15%	28%	28%	14%	-2%	-14%	-18%	-24%	0%	0%	1%	29%	60%	83%	15%	-2%	14%	67%	36%	16%	7%	-14%	-16%	-11%	-3%	-4%	-1%	-2%	13%	64%	5%	3%
I-5 SB Near Broadway	1%	0%	0%	0%	1%	1%	2%	7%	31%	23%	17%	1%	-8%	-17%	-9%	-10%	0%	0%	6%	47%	80%	56%	12%	13%	32%	69%	19%	5%	3%	-17%	-10%	-10%	-6%	-3%	0%	-2%	40%	36%	-1%	3%
I-5 SB Near Broadway	1%	-1%	-1%	-2%	3%	1%	6%	18%	64%	49%	23%	-11%	-2%	-15%	-11%	-23%	1%	5%	49%	74%	97%	21%	17%	27%	78%	91%	24%	29%	6%	-14%	-13%	-12%	-8%	-10%	-7%	2%	79%	27%	-8%	-10%
I-5 SB Near Moda Center	1%	0%	1%	-1%	3%	2%	1%	4%	9%	7%	4%	1%	3%	0%	-7%	-9%	0%	0%	7%	10%	8%	2%	1%	2%	5%	6%	1%	1%	1%	-2%	-2%	-2%	-1%	-2%	-1%	0%	4%	-1%	2%	1%
I-5 SB Near Multnomah	1%	0%	1%	0%	1%	1%	0%	1%	1%	2%	2%	1%	1%	1%	1%	-2%	0%	0%	1%	1%	1%	1%	-1%	1%	0%	0%	0%	1%	1%	0%	-1%	0%	0%	-1%	0%	-1%	0%	0%	0%	1%
I-5 SB Near 84	0%	0%	1%	0%	0%	1%	0%	0%	1%	2%	2%	1%	1%	0%	0%	-2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	-1%	1%	1%	0%	-1%	0%	0%	-1%	-1%	-1%	0%	0%	1%	1%
I-5 SB Near Morrison	1%	0%	1%	0%	1%	1%	0%	0%	1%	1%	2%	1%	1%	-1%	0%	-2%	0%	0%	1%	0%	0%	0%	-1%	1%	1%	0%	-2%	1%	1%	0%	-1%	0%	-1%	-1%	-1%	-2%	1%	-1%	-1%	3%
SB Location	**Percentage Difference in Northbound Average Speeds between Option c1(Single Braid with two lane flyover) and Option c2(Single Braid)**																																						
I-5 SB Near Going	2%	-1%	1%	1%	-2%	3%	4%	-5%	1%	12%	11%	11%	10%	0%	-4%	-8%	-2%	0%	3%	0%	1%	11%	32%	36%	0%	0%	0%	3%	-2%	-3%	3%	2%	3%	-1%	5%	3%	-1%	14%	75%	1%
I-5 SB Near 405	0%	0%	0%	0%	0%	0%	0%	-1%	6%	21%	26%	28%	11%	1%	1%	0%	1%	-1%	1%	0%	6%	43%	55%	10%	0%	2%	11%	6%	-3%	-1%	0%	0%	0%	0%	0%	0%	1%	61%	25%	8%
I-5 SB Bt 405/Broadway	0%	0%	0%	0%	1%	-2%	1%	10%	42%	67%	56%	57%	40%	19%	2%	4%	0%	-1%	0%	36%	74%	115%	52%	0%	9%	71%	69%	40%	12%	-5%	-5%	-2%	1%	0%	0%	0%	-2%	17%	124%	9%	5%
I-5 SB Near Broadway	0%	0%	0%	0%	0%	0%	4%	14%	45%	40%	33%	22%	31%	9%	1%	-1%	0%	1%	13%	74%	99%	86%	10%	1%	29%	71%	36%	18%	3%	-9%	-1%	-4%	0%	0%	0%	2%	52%	69%	13%	9%
I-5 SB Near Broadway	1%	1%	0%	2%	4%	6%	11%	20%	50%	42%	35%	32%	35%	20%	6%	-1%	3%	14%	41%	72%	76%	52%	38%	41%	50%	68%	42%	44%	25%	3%	1%	2%	-1%	3%	2%	7%	49%	47%	31%	39%
I-5 SB Near Moda Center	0%	0%	0%	0%	1%	1%	1%	-1%	2%	3%	1%	2%	5%	1%	1%	0%	0%	1%	2%	2%	3%	1%	0%	0%	0%	1%	1%	1%	0%	-1%	-1%	0%	0%	0%	0%	0%	0%	-1%	-1%	0%
I-5 SB Near Multnomah	0%	0%	0%	0%	0%	0%	0%	-7%	-2%	2%	2%	2%	7%	0%	1%	-1%	0%	0%	1%	1%	0%	0%	0%	0%	0%	0%	0%	1%	0%	-1%	0%	0%	0%	0%	-1%	1%	0%	-2%	-1%	0%
I-5 SB Near 84	1%	1%	0%	0%	1%	-4%	-9%	-8%	-11%	-5%	7%	10%	17%	3%	1%	0%	-1%	-1%	1%	2%	2%	-1%	0%	0%	-1%	0%	-1%	0%	-1%	0%	-1%	0%	0%	-1%	0%	-1%	-1%	-1%	-2%	0%
I-5 SB Near Morrison	0%	0%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	1%	2%	1%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	1%	0%	0%	-1%	0%	0%	0%	-1%	1%	-1%	-1%	-4%	0%

Legend

Different>=50%
25%<= Different<50%
10%<= Different<25%
0%<= Different<10%
-10%<= Different<0%
-25%<= Different<-10%
-50%<= Different<-25%
Different<50%

I-5 Broadway/Weidler 2035 Future Options Northbound Spot Speed Chart

	6:00 AM	6:15 AM	6:30 AM	6:45 AM	7:00 AM	7:15 AM	7:30 AM	7:45 AM	8:00 AM	8:15 AM	8:30 AM	8:45 AM	9:00 AM	9:15 AM	9:30 AM	9:45 AM	12:00 PM	12:15 PM	12:30 PM	12:45 PM	1:00 PM	1:15 PM	1:30 PM	1:45 PM	2:00 PM	2:15 PM	2:30 PM	2:45 PM	3:00 PM	3:15 PM	3:30 PM	3:45 PM	4:00 PM	4:15 PM	4:30 PM	4:45 PM	5:00 PM	5:15 PM	5:30 PM	5:45 PM
NB Location	**Percentage Difference in Northbound Average Speeds between Option A1(No-build with two lane flyover) and Option B1(No-build)**																																							
I-5 NB Near 84	4%	6%	6%	3%	-3%	-10%	-17%	-15%	-12%	-9%	-8%	-11%	-1%	3%	7%	11%	10%	0%	4%	-1%	5%	-4%	-12%	-19%	7%	9%	5%	6%	8%	7%	8%	10%	-4%	-6%	-10%	-11%	-10%	-24%	-26%	-26%
I-5 NB Near 84	-4%	-5%	-5%	-5%	-20%	-41%	-42%	-45%	-42%	-38%	-40%	-35%	-30%	-31%	-24%	-16%	-9%	-17%	-36%	-34%	-33%	-40%	-44%	-47%	-5%	-5%	-5%	-5%	-7%	-7%	-9%	-9%	-14%	-21%	-27%	-22%	-31%	-48%	-47%	-48%
I-5 NB Near Multnomah	-7%	-12%	-15%	-12%	-40%	-54%	-53%	-53%	-53%	-52%	-53%	-52%	-53%	-57%	-51%	-49%	-23%	-42%	-57%	-55%	-55%	-39%	-42%	-33%	-10%	-5%	-5%	-4%	-10%	-7%	-12%	-17%	-23%	-34%	-39%	-37%	-47%	-53%	-54%	-51%
I-5 NB Near Weidler	-13%	-15%	-16%	-17%	-22%	-26%	-25%	-26%	-26%	-26%	-26%	-27%	-28%	-30%	-29%	-28%	-22%	-28%	-29%	-28%	-26%	-24%	-23%	-22%	-12%	-9%	-9%	-10%	-14%	-13%	-13%	-14%	-20%	-22%	-23%	-24%	-22%	-19%	-22%	-19%
I-5 NB Bt Broadway/Weidler	-8%	-8%	-9%	-8%	-11%	-15%	-12%	-13%	-15%	-15%	-14%	-16%	-17%	-24%	-22%	-21%	-12%	-17%	-22%	-16%	-16%	-14%	-12%	-14%	-6%	-6%	-6%	-7%	-8%	-7%	-8%	-8%	-11%	-11%	-10%	-11%	-11%	-8%	-12%	-10%
I-5 NB Near Broadway	-10%	-12%	-11%	-14%	-14%	-16%	-14%	-15%	-20%	-19%	-19%	-18%	-24%	-28%	-28%	-26%	-14%	-22%	-24%	-18%	-18%	-18%	-14%	-17%	-7%	-6%	-7%	-6%	-8%	-8%	-9%	-8%	-12%	-12%	-12%	-11%	-13%	-11%	-13%	-12%
I-5 NB BT 405/Weidler	-5%	-4%	-6%	-7%	-8%	-13%	-9%	-14%	-13%	-8%	-11%	-10%	-16%	-14%	-21%	-19%	-12%	-17%	-10%	-13%	-13%	-13%	-10%	-15%	-6%	-6%	-6%	-5%	-7%	-7%	-7%	-5%	-10%	-12%	-7%	-11%	-9%	-7%	-6%	-10%
I-5 NB Near 405	0%	0%	0%	0%	0%	0%	1%	0%	-1%	0%	0%	0%	-1%	0%	-1%	0%	0%	0%	2%	1%	1%	1%	0%	0%	0%	-1%	0%	-1%	0%	0%	0%	0%	0%	0%	24%	5%	-24%	-2%	8%	15%
I-5 NB Near Going	0%	0%	-1%	0%	-1%	-1%	0%	1%	-2%	1%	1%	3%	-1%	0%	-2%	-1%	2%	1%	3%	0%	3%	1%	2%	0%	1%	-3%	-1%	-3%	1%	-4%	11%	0%	4%	-1%	1%	3%	-1%	-1%	4%	3%
NB Location	**Percentage Difference in Northbound Average Speeds between Option B1(Auxiliary lanes with two lane flyover) and Option C1 (Double Braid with two lane flyover)**																																						
I-5 NB Near 84	-1%	0%	-4%	3%	-1%	0%	0%	0%	1%	1%	2%	2%	1%	2%	3%	2%	-2%	-2%	-2%	-2%	-4%	0%	3%	7%	-2%	-3%	0%	0%	1%	-1%	0%	1%	1%	2%	0%	1%	1%	1%	0%	1%
I-5 NB Near 84	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	6%	16%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-4%	-1%
I-5 NB Near Multnomah	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-2%	-8%	8%	-2%	0%	0%	0%	0%	0%	0%	0%	1%	1%	0%	0%	0%	-1%	-5%	-1%	6%
I-5 NB Near Weidler	0%	0%	0%	-1%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-1%	-2%	-3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-5%	-6%	-1%	2%
I-5 NB Bt Broadway/Weidler	0%	0%	0%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	0%	0%	-1%	-2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-3%	-5%	-7%	-1%	2%
I-5 NB Near Broadway	-1%	0%	0%	0%	-1%	1%	0%	0%	1%	0%	0%	0%	0%	-1%	-1%	0%	0%	0%	0%	-1%	0%	0%	-1%	-2%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	0%	-4%	1%	-2%	0%	4%
I-5 NB BT 405/Weidler	0%	2%	4%	0%	1%	2%	2%	1%	1%	0%	-1%	-1%	-1%	-1%	2%	0%	-2%	0%	1%	-1%	1%	0%	-2%	-1%	0%	0%	0%	0%	1%	0%	1%	-1%	1%	2%	-4%	0%	4%	9%	7%	14%
I-5 NB Near 405	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	1%	-1%	1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	-5%	-24%	21%	6%	10%	4%
I-5 NB Near Going	-1%	-1%	0%	2%	-2%	1%	3%	-1%	0%	1%	-2%	0%	1%	-2%	-2%	0%	1%	0%	0%	1%	-1%	-1%	-4%	-3%	0%	1%	2%	3%	2%	2%	-3%	3%	0%	-2%	2%	-2%	-2%	-1%	-2%	3%
NB Location	**Percentage Difference in Northbound Average Speeds between Option B1(Auxiliary lanes) and Option c1 (Single Braid with two lane flyover)**																																						
I-5 NB Near 84	-1%	-2%	-3%	-1%	1%	2%	2%	2%	3%	1%	3%	4%	1%	1%	1%	-1%	-10%	-6%	-13%	-13%	-13%	-5%	-6%	7%	-2%	-4%	0%	-1%	0%	0%	-1%	-1%	1%	2%	0%	1%	-1%	0%	-1%	0%
I-5 NB Near 84	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	7%	28%	47%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-4%	-2%
I-5 NB Near Multnomah	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	-1%	0%	-9%	25%	45%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-6%	-2%	3%
I-5 NB Near Weidler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%	1%	0%	-1%	0%	2%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	-1%	-5%	-4%	-1%	-1%
I-5 NB Bt Broadway/Weidler	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	0%	0%	0%	0%	0%	0%	1%	1%	0%	0%	1%	2%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	1%	0%	-3%	-5%	-4%	-3%	1%
I-5 NB Near Broadway	-1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%	-1%	0%	1%	3%	2%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	1%	0%	-5%	-1%	-2%	1%	1%
I-5 NB BT 405/Weidler	0%	1%	0%	2%	0%	0%	-3%	1%	3%	0%	-1%	0%	0%	0%	2%	0%	0%	0%	0%	-2%	0%	1%	-1%	1%	0%	0%	0%	0%	0%	1%	0%	-1%	1%	1%	-4%	0%	0%	-4%	-2%	3%
I-5 NB Near 405	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	-1%	-10%	-28%	7%	-6%	1%	-2%
I-5 NB Near Going	-1%	0%	-1%	1%	-1%	0%	0%	0%	2%	-2%	0%	2%	0%	-1%	0%	3%	1%	-1%	0%	3%	-3%	-2%	0%	-3%	-3%	0%	1%	4%	1%	3%	2%	2%	-1%	-1%	2%	-4%	0%	-1%	-1%	-1%
NB Location	**Percentage Difference in Northbound Average Speeds between Option C1 (Double Braid with two lane flyover) and Option c1(Single Braid with two lane flyover)**																																						
I-5 NB Near 84	0%	-2%	1%	-4%	3%	1%	2%	2%	2%	0%	0%	2%	1%	-1%	-2%	-3%	-8%	-4%	-11%	-11%	-10%	-5%	-9%	0%	0%	-1%	0%	0%	-1%	1%	0%	-2%	0%	0%	1%	-1%	-1%	-1%	-1%	-1%
I-5 NB Near 84	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	6%	21%	26%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-1%	
I-5 NB Near Multnomah	0%	0%	0%	0%	0%	0%	0%	1%	1%	0%	0%	0%	0%	0%	0%	0%	1%	1%	0%	0%	1%	-2%	16%	47%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	-1%	-1%	-2%
I-5 NB Near Weidler	0%	0%	0%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%	1%	0%	0%	1%	4%	6%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	-1%	-4%
I-5 NB Bt Broadway/Weidler	0%	0%	0%	1%	1%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%	0%	0%	1%	0%	0%	1%	3%	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	3%	-1%	-1%
I-5 NB Near Broadway	0%	0%	0%	1%	1%	-1%	-1%	1%	0%	0%	0%	0%	0%	1%	1%	1%	1%	0%	1%	0%	0%	0%	5%	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-2%	1%	0%	-3%
I-5 NB BT 405/Weidler	0%	-1%	-3%	2%	-1%	-1%	-4%	0%	1%	-1%	1%	1%	0%	1%	0%	0%	2%	1%	-1%	-1%	-2%	1%	1%	2%	0%	0%	0%	0%	0%	1%	0%	0%	0%	-1%	0%	0%	-4%	-12%	-9%	-10%
I-5 NB Near 405	0%	0%	0%	0%	1%	-1%	0%	0%	0%	0%	0%	1%	-1%	1%	-1%	0%	0%	0%	1%	0%	0%	0%	1%	0%	-1%	0%	0%	0%	0%	-1%	0%	-1%	-1%	-1%	-5%	-6%	-11%	-11%	-8%	-6%
I-5 NB Near Going	0%	1%	-1%	-1%	1%	-1%	-3%	1%	1%	-3%	2%	1%	-1%	1%	3%	2%	0%	-1%	0%	2%	-2%	-1%	4%	0%	-2%	0%	-1%	1%	-1%	1%	6%	-1%	-1%	1%	0%	-2%	2%	0%	1%	-4%

Legend
Different>=50%
25%<= Different<50%
10%<= Different<25%
0%<= Different<10%
-10%<= Different<0%
-25%<= Different<-10%
-50%<= Different<-25%
Different<50%

I-5 Broadway/Weidler 2035 Future Options Southbound Spot Speed Chart

	6:00 AM	6:15 AM	6:30 AM	6:45 AM	7:00 AM	7:15 AM	7:30 AM	7:45 AM	8:00 AM	8:15 AM	8:30 AM	8:45 AM	9:00 AM	9:15 AM	9:30 AM	9:45 AM	12:00 PM	12:15 PM	12:30 PM	12:45 PM	1:00 PM	1:15 PM	1:30 PM	1:45 PM	2:00 PM	2:15 PM	2:30 PM	2:45 PM	3:00 PM	3:15 PM	3:30 PM	3:45 PM	4:00 PM	4:15 PM	4:30 PM	4:45 PM	5:00 PM	5:15 PM	5:30 PM	5:45 PM
SB Location	**Percentage Difference in Southbound Average Speeds between Option A1(No-build with two lane flyover) and Option B1(No-build)**																																						
I-5 SB Near Going	-1%	-2%	5%	-3%	1%	1%	-12%	-35%	-37%	-23%	-26%	-20%	-35%	-39%	-28%	-12%	0%	0%	0%	-13%	-21%	-18%	-32%	-45%	0%	0%	-3%	-10%	-20%	-10%	-18%	-15%	-19%	-12%	-12%	-6%	-2%	-20%	-53%	-34%
I-5 SB Near 405	0%	0%	0%	0%	0%	-16%	-47%	-61%	-61%	-59%	-59%	-60%	-61%	-55%	-50%	-47%	0%	0%	-14%	-40%	-49%	-51%	-52%	-41%	0%	-4%	-27%	-45%	-53%	-42%	-48%	-44%	-39%	-30%	-24%	-23%	-21%	-46%	-45%	-10%
I-5 SB Bt 405/Broadway	1%	1%	1%	0%	-25%	-67%	-73%	-72%	-71%	-70%	-70%	-69%	-71%	-70%	-69%	-70%	-4%	-41%	-62%	-69%	-69%	-68%	-61%	-29%	-39%	-68%	-67%	-66%	-62%	-61%	-63%	-66%	-66%	-64%	-65%	-66%	-67%	-67%	-28%	-15%
I-5 SB Near Broadway	-14%	-17%	-16%	-16%	-47%	-62%	-65%	-65%	-64%	-62%	-60%	-60%	-63%	-61%	-61%	-61%	-35%	-58%	-60%	-60%	-60%	-59%	-42%	-9%	-57%	-59%	-56%	-52%	-49%	-56%	-59%	-60%	-58%	-59%	-59%	-60%	-63%	-62%	-49%	-60%
I-5 SB Near Broadway	-7%	-8%	-9%	-7%	-12%	-19%	-38%	-41%	-35%	-26%	-13%	-16%	-19%	-12%	-13%	-13%	-9%	-11%	-10%	-11%	-11%	1%	42%	48%	-9%	-5%	1%	21%	26%	4%	-7%	-10%	-10%	-10%	-11%	-10%	-23%	-31%	-20%	-49%
I-5 SB Near Moda Center	-5%	-6%	-6%	-6%	-8%	-19%	-42%	-47%	-40%	-27%	-14%	-18%	-18%	-8%	-10%	-9%	-7%	-8%	-7%	-7%	-6%	11%	38%	20%	-8%	-3%	6%	25%	31%	15%	-1%	-8%	-8%	-8%	-9%	-8%	-25%	-41%	-35%	-44%
I-5 SB Near Multnomah	-2%	-2%	-2%	-3%	-9%	-24%	-54%	-53%	-47%	-42%	-41%	-34%	-46%	-26%	-20%	-15%	-10%	-12%	-9%	-8%	-5%	-12%	-40%	-63%	-8%	-8%	-16%	-6%	-16%	-3%	-7%	-9%	-13%	-15%	-14%	-16%	-47%	-71%	-72%	-70%
I-5 SB Near 84	-5%	-6%	-5%	-6%	-17%	-39%	-47%	-43%	-41%	-39%	-42%	-32%	-47%	-43%	-31%	-28%	-11%	-9%	-9%	-8%	-5%	-2%	-5%	-3%	-7%	-4%	-6%	-4%	-8%	-5%	-9%	-10%	-12%	-15%	-15%	-17%	-8%	-2%	-2%	-3%
I-5 SB Near Morrison	0%	-1%	0%	0%	1%	0%	0%	0%	0%	0%	0%	1%	-2%	-3%	-2%	-2%	-1%	0%	0%	-1%	0%	-1%	0%	0%	1%	1%	1%	1%	0%	2%	2%	1%	1%	1%	3%	2%	3%	5%	1%	-1%
SB Location	**Percentage Difference in Southbound Average Speeds between Option B1(Auxiliary lanes with two lane flyover) and Option C1 (Double Braid with two lane flyover)**																																						
I-5 SB Near Going	4%	0%	-4%	2%	-5%	4%	-5%	12%	-10%	-13%	-3%	13%	-2%	14%	-5%	-3%	1%	-1%	0%	1%	-1%	0%	4%	44%	0%	0%	0%	2%	1%	-3%	1%	1%	1%	0%	1%	0%	0%	9%	56%	43%
I-5 SB Near 405	0%	0%	-1%	0%	-1%	0%	0%	0%	0%	0%	0%	0%	19%	26%	18%	16%	-1%	1%	-1%	0%	0%	2%	26%	62%	0%	0%	1%	3%	13%	2%	0%	0%	0%	0%	0%	0%	3%	26%	56%	-5%
I-5 SB Bt 405/Broadway	-1%	-1%	-1%	-1%	-1%	-2%	-2%	-1%	-3%	-2%	0%	20%	32%	32%	33%	30%	-1%	-3%	-2%	-2%	-1%	17%	61%	15%	-3%	-2%	32%	51%	50%	20%	13%	10%	1%	0%	-3%	0%	10%	69%	19%	-9%
I-5 SB Near Broadway	-1%	-1%	-1%	-1%	-2%	-2%	-2%	-1%	-2%	-1%	4%	27%	38%	33%	11%	11%	-1%	-1%	-1%	0%	5%	38%	44%	-11%	-1%	4%	44%	53%	27%	18%	11%	10%	5%	2%	-1%	3%	16%	82%	87%	159%
I-5 SB Near Broadway	3%	4%	4%	4%	4%	5%	5%	5%	14%	11%	32%	74%	65%	57%	34%	42%	13%	19%	15%	26%	44%	127%	71%	18%	13%	44%	98%	84%	70%	51%	30%	21%	15%	17%	12%	12%	29%	106%	124%	225%
I-5 SB Near Moda Center	-2%	-1%	-2%	-1%	-2%	-1%	-2%	-1%	1%	1%	-1%	2%	-2%	-1%	9%	9%	-2%	-2%	-3%	-1%	-2%	-16%	-45%	-55%	-5%	-8%	-16%	-26%	-29%	-16%	-6%	-1%	-2%	-2%	-2%	-2%	-14%	-43%	-53%	-43%
I-5 SB Near Multnomah	-2%	-2%	-2%	-1%	-8%	-18%	-18%	-21%	-21%	-11%	-13%	-16%	-9%	-4%	-4%	-2%	-3%	-3%	-4%	-6%	-5%	-8%	-8%	-8%	-2%	-3%	-4%	-6%	-6%	-6%	-5%	-3%	-1%	-2%	-1%	-2%	-4%	-5%	-5%	-4%
I-5 SB Near 84	-2%	-2%	-3%	-1%	-8%	-17%	-18%	-21%	-21%	-11%	-13%	-16%	-9%	-4%	-4%	-2%	-3%	-3%	-4%	-6%	-5%	-8%	-9%	-9%	-2%	-3%	-4%	-6%	-7%	-6%	-5%	-2%	-1%	-2%	-1%	-2%	-4%	-5%	-5%	-5%
I-5 SB Near Morrison	-1%	0%	0%	0%	-2%	-3%	-1%	-2%	-2%	0%	-1%	-1%	-1%	1%	1%	2%	0%	0%	-1%	0%	1%	1%	1%	0%	0%	1%	3%	1%	1%	0%	1%	1%	1%	1%	1%	3%	1%	1%	-1%	3%
SB Location	**Percentage Difference in Southbound Average Speeds between Option B1(Auxiliary lanes) and Option c1 (Single Braid with two lane flyover)**																																						
I-5 SB Near Going	0%	1%	-4%	1%	-5%	-1%	-13%	-3%	-4%	-14%	1%	2%	0%	0%	8%	5%	2%	0%	0%	1%	-2%	1%	2%	38%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	29%	51%
I-5 SB Near 405	0%	0%	0%	0%	0%	1%	-1%	0%	0%	-1%	0%	0%	4%	4%	1%	1%	0%	1%	-1%	0%	0%	2%	19%	44%	0%	0%	0%	0%	12%	1%	0%	0%	0%	0%	0%	0%	2%	12%	63%	1%
I-5 SB Bt 405/Broadway	0%	-1%	-1%	0%	-1%	2%	-2%	0%	0%	1%	0%	-1%	7%	6%	5%	-1%	-2%	-2%	-1%	-2%	-1%	8%	54%	23%	-1%	1%	14%	33%	52%	17%	4%	0%	-2%	0%	-2%	0%	5%	42%	37%	0%
I-5 SB Near Broadway	-1%	0%	0%	0%	0%	1%	0%	1%	0%	1%	0%	5%	6%	6%	1%	2%	-1%	0%	-1%	0%	1%	30%	59%	12%	-1%	3%	30%	52%	26%	11%	3%	5%	1%	1%	0%	0%	7%	74%	89%	205%
I-5 SB Near Broadway	3%	3%	4%	2%	6%	5%	7%	6%	7%	8%	8%	10%	6%	9%	10%	8%	8%	11%	8%	8%	15%	21%	-15%	-40%	8%	13%	21%	10%	2%	10%	10%	9%	8%	6%	6%	6%	5%	-15%	-33%	12%
I-5 SB Near Moda Center	-2%	-2%	-1%	-2%	-2%	-2%	-4%	-1%	-2%	-2%	-7%	-7%	-9%	-6%	-3%	-3%	-4%	-5%	-5%	-4%	-7%	-23%	-50%	-59%	-6%	-10%	-22%	-31%	-33%	-21%	-9%	-4%	-3%	-3%	-3%	-3%	-16%	-48%	-56%	-48%
I-5 SB Near Multnomah	2%	1%	2%	2%	-2%	-11%	-12%	-8%	-13%	-5%	-7%	-9%	-3%	1%	0%	2%	2%	2%	0%	-1%	0%	-3%	-5%	-4%	2%	0%	-1%	-2%	-2%	-2%	-1%	0%	2%	1%	2%	1%	-1%	-1%	-1%	-1%
I-5 SB Near 84	3%	3%	3%	3%	13%	12%	16%	21%	10%	18%	9%	4%	5%	5%	5%	5%	3%	5%	3%	3%	3%	-1%	-3%	-3%	4%	2%	2%	0%	3%	0%	1%	3%	5%	4%	5%	5%	2%	1%	2%	1%
I-5 SB Near Morrison	0%	0%	0%	0%	0%	0%	-1%	-1%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	-1%	1%	1%	1%	0%	0%	0%	1%	1%	0%	1%	0%	1%	0%	0%	0%	1%	0%	2%	1%	4%	5%
SB Location	**Percentage Difference in Southbound Average Speeds between Option C1 (Double Braid with two lane flyover) and Option c1(Single Braid with two lane flyover)**																																						
I-5 SB Near Going	-3%	2%	0%	-1%	-1%	-4%	-9%	-14%	7%	-2%	5%	-10%	2%	-13%	14%	8%	2%	1%	0%	0%	-1%	1%	-2%	-4%	0%	0%	0%	-2%	-1%	3%	-1%	-1%	-1%	0%	-1%	0%	0%	-5%	-17%	6%
I-5 SB Near 405	0%	0%	1%	0%	1%	1%	0%	0%	0%	-1%	0%	0%	-12%	-17%	-14%	-13%	0%	0%	0%	0%	0%	0%	-5%	-11%	0%	0%	-1%	-3%	-1%	-1%	0%	0%	0%	0%	0%	0%	-1%	-11%	4%	7%
I-5 SB Bt 405/Broadway	0%	0%	1%	0%	0%	4%	0%	1%	3%	4%	0%	-17%	-19%	-20%	-21%	-24%	-1%	1%	1%	1%	-1%	-8%	-5%	7%	1%	3%	-14%	-12%	1%	-2%	-8%	-9%	-3%	0%	1%	0%	-4%	-16%	14%	11%
I-5 SB Near Broadway	1%	1%	1%	0%	2%	3%	2%	2%	2%	3%	-4%	-17%	-23%	-21%	-9%	-9%	0%	0%	1%	-1%	-4%	-6%	10%	26%	0%	-1%	-10%	-1%	0%	-6%	-7%	-5%	-4%	-1%	1%	-3%	-8%	-4%	1%	18%
I-5 SB Near Broadway	-1%	-1%	0%	-2%	1%	0%	2%	0%	-6%	-3%	-18%	-37%	-36%	-31%	-18%	-24%	-4%	-7%	-6%	-14%	-20%	-47%	-50%	-49%	-4%	-21%	-39%	-40%	-40%	-27%	-15%	-10%	-6%	-9%	-5%	-5%	-19%	-58%	-70%	-66%
I-5 SB Near Moda Center	0%	-1%	0%	-1%	0%	-1%	-2%	-1%	-3%	-4%	-5%	-8%	-7%	-5%	-11%	-11%	-1%	-3%	-2%	-4%	-5%	-9%	-10%	-8%	0%	-3%	-7%	-6%	-5%	-6%	-2%	-2%	-1%	-2%	-2%	-1%	-3%	-8%	-6%	-8%
I-5 SB Near Multnomah	4%	3%	5%	3%	6%	8%	7%	17%	9%	7%	7%	8%	6%	6%	5%	4%	5%	5%	4%	5%	4%	5%	3%	4%	4%	3%	2%	4%	4%	4%	4%	3%	3%	3%	3%	3%	3%	5%	4%	3%
I-5 SB Near 84	5%	5%	5%	4%	23%	36%	42%	53%	39%	32%	25%	25%	14%	10%	10%	7%	6%	8%	8%	9%	8%	8%	6%	6%	6%	5%	5%	6%	10%	6%	7%	5%	6%	6%	5%	7%	6%	6%	7%	6%
I-5 SB Near Morrison	1%	0%	1%	0%	2%	3%	0%	1%	2%	1%	2%	1%	1%	0%	0%	-1%	0%	1%	0%	1%	0%	0%	-1%	0%	0%	0%	-2%	-1%	0%	-1%	0%	-1%	0%	-1%	-1%	-3%	1%	0%	5%	2%

Legend

- Different>=50%
- 25%<= Different<50%
- 10%<= Different<25%
- 0%<= Different<10%
- -10%<= Different<0%
- -25%<= Different<-10%
- -50%<= Different<-25%
- Different<50%

I-5 Broadway/Weidler 2035 Future Options Northbound Spot Speed Chart

NB Location	6:00 AM	6:15 AM	6:30 AM	6:45 AM	7:00 AM	7:15 AM	7:30 AM	7:45 AM	8:00 AM	8:15 AM	8:30 AM	8:45 AM	9:00 AM	9:15 AM	9:30 AM	9:45 AM	12:00 PM	12:15 PM	12:30 PM	12:45 PM	1:00 PM	1:15 PM	1:30 PM	1:45 PM	2:00 PM	2:15 PM	2:30 PM	2:45 PM	3:00 PM	3:15 PM	3:30 PM	3:45 PM	4:00 PM	4:15 PM	4:30 PM	4:45 PM	5:00 PM	5:15 PM	5:30 PM	5:45 PM
Option A1: No-build with two lane flyover (Northbound Average Speeds)																																								
I-5 NB Near 84	49	48	48	48	35	31	28	29	31	32	32	32	36	38	39	40	42	36	37	35	38	35	32	28	47	48	48	47	42	41	41	41	33	32	30	30	30	26	25	25
I-5 NB Near 84	54	53	53	53	44	32	32	30	32	34	33	36	38	38	42	46	50	45	35	36	37	31	29	25	53	53	53	53	51	51	50	50	47	43	40	43	37	28	27	27
I-5 NB Near Multnomah	51	49	47	49	33	25	25	26	26	26	26	26	26	23	27	28	42	32	24	24	23	25	22	22	50	53	53	53	50	52	49	46	43	36	34	35	29	24	24	25
I-5 NB Near Weidler	47	46	46	45	42	39	40	40	40	40	40	40	39	37	38	38	42	39	38	39	39	41	41	41	48	50	50	49	47	48	47	47	43	42	42	41	40	41	39	39
I-5 NB Bt Broadway/Weidler	50	50	49	50	48	46	47	47	46	46	46	45	44	41	42	42	48	45	42	45	45	46	47	46	51	52	52	51	51	51	51	50	49	48	49	47	46	45	43	44
I-5 NB Near Broadway	48	47	47	46	45	44	45	45	43	43	43	43	40	37	38	38	46	41	40	43	43	44	46	44	50	51	51	51	50	49	49	49	47	47	47	45	44	43	41	42
I-5 NB BT 405/Weidler	50	50	50	50	47	45	46	45	45	47	45	46	43	44	42	42	45	42	45	43	45	45	47	45	51	52	51	52	51	51	51	51	48	48	48	45	43	41	42	40
I-5 NB Near 405	56	55	55	55	55	55	55	55	54	55	55	55	54	54	54	54	54	53	54	53	54	54	54	54	55	55	55	55	55	55	55	55	54	47	36	21	17	20	24	25
I-5 NB Near Going	52	52	52	52	47	47	46	47	46	47	47	47	47	47	47	46	46	43	43	44	42	42	42	44	41	40	41	40	40	38	27	15	14	13	13	13	13	13	13	14
Option A2: No-build (Northbound Average Speeds)																																								
I-5 NB Near 84	49	48	48	49	35	30	29	28	30	31	31	33	33	36	38	38	40	37	30	29	28	29	29	28	47	48	48	47	42	41	42	41	33	32	31	31	29	25	25	24
I-5 NB Near 84	53	52	53	53	44	32	30	29	29	33	33	35	32	39	43	44	51	40	28	28	27	26	27	26	53	53	53	53	51	51	51	50	47	43	40	39	33	28	27	25
I-5 NB Near Multnomah	50	48	49	49	32	25	25	25	26	25	26	28	24	24	26	27	45	29	22	24	22	22	22	22	50	53	53	53	50	52	50	46	42	37	34	32	27	24	24	24
I-5 NB Near Weidler	47	46	45	45	41	38	38	40	39	40	40	40	39	37	38	38	42	37	35	36	35	35	35	35	48	50	50	49	47	48	47	47	43	41	41	40	39	39	41	43
I-5 NB Bt Broadway/Weidler	51	50	50	50	47	43	44	46	47	47	46	47	44	41	42	44	47	38	37	39	38	37	37	38	51	52	52	52	51	51	51	50	48	47	48	46	45	43	46	47
I-5 NB Near Broadway	47	47	47	46	43	41	41	43	43	43	44	44	41	39	38	41	44	35	36	36	37	34	34	35	50	51	51	51	50	49	50	49	47	45	46	43	42	40	44	46
I-5 NB BT 405/Weidler	50	48	50	48	45	43	43	44	44	44	44	46	43	44	42	43	43	39	38	38	40	38	39	39	51	52	51	52	50	50	51	51	48	48	47	42	39	38	40	44
I-5 NB Near 405	56	55	55	55	55	54	55	55	55	55	54	55	54	54	54	54	54	53	53	53	53	54	54	53	55	55	55	55	55	55	55	55	54	44	28	18	17	20	24	26
I-5 NB Near Going	52	53	52	51	47	47	46	46	45	47	45	47	46	48	47	47	45	43	42	44	41	41	41	42	40	41	41	40	39	38	23	15	13	13	13	13	12	13	13	13
Option B1: Auxiliary lanes with two lane flyover (Northbound Average Speeds)																																								
I-5 NB Near 84	47	45	46	46	35	34	34	34	35	35	35	36	36	37	37	36	38	36	35	35	36	37	36	35	44	44	46	45	39	39	38	37	35	34	33	34	34	34	34	34
I-5 NB Near 84	56	55	56	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	52	53	47	56	55	56	56	55	55	55	55	55	55	55	55	55	54	52	52	52
I-5 NB Near Multnomah	55	55	55	55	55	55	54	55	55	55	55	55	55	55	55	55	55	55	55	54	51	41	38	33	56	56	56	55	56	55	55	55	55	55	55	55	54	52	52	51
I-5 NB Near Weidler	55	54	54	54	54	54	54	54	54	54	54	54	54	54	54	53	54	54	53	53	53	53	53	52	55	55	55	55	55	55	54	55	54	54	54	53	52	51	50	49
I-5 NB Bt Broadway/Weidler	55	54	55	54	54	54	54	54	54	54	54	54	54	54	54	53	54	54	54	54	54	54	54	54	55	55	55	55	55	55	55	55	54	54	54	53	52	49	49	49
I-5 NB Near Broadway	53	53	53	53	53	52	52	53	53	53	53	53	52	52	53	52	53	53	53	52	53	53	53	53	54	55	55	54	54	54	54	54	54	54	54	51	51	48	48	47
I-5 NB BT 405/Weidler	53	53	53	53	52	51	51	52	52	51	51	51	51	51	52	51	51	50	50	50	51	52	52	53	54	55	55	54	54	55	54	54	54	54	52	50	47	44	45	44
I-5 NB Near 405	55	55	55	55	55	54	54	54	55	54	54	55	54	54	54	54	54	53	53	53	53	54	54	54	55	55	55	55	55	55	55	55	54	47	29	20	23	21	22	22
I-5 NB Near Going	52	52	52	52	48	47	46	46	47	46	46	46	47	47	48	47	45	43	42	43	41	41	42	44	41	42	42	42	40	40	25	15	14	13	13	13	13	13	12	13
Option B2: Auxiliary Lanes (Northbound Average Speeds)																																								
I-5 NB Near 84	47	46	47	47	35	34	34	34	35	35	35	35	36	36	36	36	38	36	35	35	36	36	35	33	44	44	46	45	39	39	38	37	35	34	33	34	34	34	34	34
I-5 NB Near 84	56	55	56	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	50	46	37	56	55	56	55	55	55	55	55	55	55	55	55	55	53	53	51
I-5 NB Near Multnomah	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	52	42	37	30	56	56	56	55	56	55	55	55	55	55	55	55	55	55	52	45
I-5 NB Near Weidler	55	54	54	54	54	53	53	54	54	54	54	54	54	54	54	54	54	54	53	53	53	53	52	52	55	55	55	55	55	55	55	55	54	54	54	54	54	54	51	51
I-5 NB Bt Broadway/Weidler	55	54	55	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	53	54	54	54	54	54	55	55	55	55	55	55	55	55	54	54	54	54	55	53	52	52
I-5 NB Near Broadway	53	53	53	53	53	52	52	52	53	53	53	53	53	52	52	52	53	53	52	52	53	53	53	53	54	55	55	54	54	54	54	54	54	54	54	53	53	51	51	49
I-5 NB BT 405/Weidler	53	52	53	53	51	51	51	51	52	52	51	51	52	51	52	52	51	50	49	50	51	52	53	52	55	54	54	55	54	54	54	54	53	53	52	51	47	47	46	
I-5 NB Near 405	56	55	55	55	55	54	54	54	55	55	55	54	54	54	54	54	53	53	53	53	53	54	54	54	55	55	55	55	55	55	55	55	54	41	29	26	18	18	19	24
I-5 NB Near Going	53	53	52	51	48	48	46	46	46	47	47	46	47	47	47	46	45	43	41	42	40	42	42	44	41	41	42	41	40	40	26	14	14	13	13	13	13	13	13	13
Option C1: Double Braid with two lane flyover (Northbound Average Speeds)																																								
I-5 NB Near 84	48	45	47	45	36	34	34	34	35	35	34	35	36	36	36	35	39	37	36	36	38	36	35	33	44	46	46	45	39	39	38	37	34	33	34	33	34	34	34	34
I-5 NB Near 84	56	55	56	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	52	50	41	55	55	56	55	55	55	55	55	55	55	55	55	55	55	54	53
I-5 NB Near Multnomah	56	55	55	55	55	55	54	55	55	55	55	55	55	55	55	55	55	55	55	55	52	44	36	33	55	56	56	55	55	55	55	55	55	55	55	55	55	54	52	48
I-5 NB Near Weidler	55	54	54	55	54	53	54	54	54	54	54	54	54	54	54	53	54	54	53	53	53	53	54	54	55	55	55	55	55	55	55	54	54	54	54	54	54	54	51	47
I-5 NB Bt Broadway/Weidler	55	54	55	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	53	54	54	54	54	54	55	55	55	55	55	55	55	55	54	54	54	54	54	55	53	52
I-5 NB Near Broadway	53	53	53	53	53	52	53	52	53	53	53	52	52	52	52	52	53	53	52	52	53	53	53	53	54	55	55	54	54	54	54	54	53	53	53	53	50	49	47	45
I-5 NB BT 405/Weidler	53	52	51	54	51	50	50	51	52	51	51	51	51	52	51	52	52	51	50	50	51	52	53	54	54	55	54	54	54	55	54	54	53	53	54	50	46	41	42	39
I-5 NB Near 405	56	55	55	55	55	54	54	55	55	55	55	54	54	54	54	54	54	53	53	53	53	54	54	54	55	55	55	55	55	55	55	55	54	47	31	26	19	19	21	21
I-5 NB Near Going	53	53	52	51	49	47	45	47	47	46	47	46	47	48	49	47	45	43	42	43	41	42	43	45	41	41	41	40	39	39	25	14	14	13	13	13	13	13	12	13
Option C2: Double Braid (Northbound Average Speeds)																																								
I-5 NB Near 84	47	46	47	46	35	34	34	34	35	35	34	35	36	36	37	36	39	37	37	36	37	37	36	34	44	46	45	45	40	39	39	37	34	33	33	33	34	34	34	34
I-5 NB Near 84	56	55	56	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	53	52	34	55	55	56	55	55	55	55	55	55	55	55	55	55	55	54	54	
I-5 NB Near Multnomah	55	55	55	55	55	55	54	54	55	55	55	54	55	55	55	55	55	55	55	55	52	45	38	29	55	55	56	55	55	55	55	55	55	55	55	55	55	54	53	49
I-5 NB Near Weidler	55	54	54	54	54	54	54	54	54	54	54	54	54	54	54	53	54	53	53	53	53	53	53	53	55	55	55	55	55	55	54	54	54	54	54	54	54	54	52	51
I-5 NB Bt Broadway/Weidler	55	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	55	55	55	55	55	55	55	55	54	54	54	54	54	53	51	50
I-5 NB Near Broadway	53	53	53	53	53	53	52	52	53	52	53	53	52	52	52	52	53	53	52	52	53	53	53	54	54	54	54	54	54	54	54	54	54	53	54	53	52	51	49	45
I-5 NB BT 405/Weidler	53	52	53	53	51	51	51	51	52	50	51	51	51	51	51	52	51	50	51	51	51	51	52	53	54	55	54	54	54	54	54	54	53	54	54	52	50	45	44	43
I-5 NB Near 405	56	55	55	55	55	54	54	54	55	55	54	54	54	54	54	54	54	53	53	53	53	54	54	54	55	55	55	55	55	55	55	55	54	46	32	24	19	21	21	20
I-5 NB Near Going	53	52	52	51	48	47	45	47	46	47	46	47	47	48	48	47	45	43	43	44	41	40	42	46	41	41	43	41	39	38	24	15	14	12	13	13	13	12	13	13
Option c1: Single Braid with two lane flyover (Northbound Average Speeds)																																								
I-5 NB Near 84	48	46	47	47	35	34	33	33	34	34	34	34	36	36	37	37	42	39	40	40	42	39	38	33	44	46	46	45	39	39	39	38	34	33	33	34	34	34	34	34
I-5 NB Near 84	56	55	56	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	49	41	32	55	55	56	55	55	55	55	55	55	55	55	55	54	54	54	
I-5 NB Near Multnomah	56	55	55	55	55	54	54	54	55	55	55	55	55	55	55	55	55	54	55	54	51	45	31	23	56	56	56	55	56	55	55	55	55	55	55	55	55	55	53	49
I-5 NB Near Weidler	55	54	54	54	54	53	54	53	54	54	54	54	54	54	54	53	54	53	53	53	53	53	52	51	55	55	55	55	55	55	54	54	54	54	54	54	54	53	51	49
I-5 NB Bt Broadway/Weidler	55	54	54	54	54	54	54	54	54	54	54	54	54	54	54	53	54	54	53	54	54	54	53	53	55	55	55	55	55	55	55	55	54	54	54	54	54	52	51	48
I-5 NB Near Broadway	53	53	53	53	53	52	53	52	53	53	53	52	52	52	52	52	53	52	52	52	53	53	52	52	54	55	54	54	54	54	54	54	53	53	53	53	51	49	47	47
I-5 NB BT 405/Weidler	53	52	53	53	52	51	52	51	51	51	51	51	51	51	51	51	51	50	50	51	51	51	52	53	55	55	55	54	54	54	54	54	53	53	54	50	48	46	46	43
I-5 NB Near 405	56	55	55	55	54	55	54	54	55	55	54	54	54	54	54	54	54	53	53	53	53	54	53	54	55	55	55	55	55	55	55	55	54	48	32	28	21	22	22	22
I-5 NB Near Going	53	52	53	51	48	47	46	46	46	47	46	45	47	48	48	46	45	43	42	42	42	42	42	45	42	41	42	40	39	39	24	15	14	13	13	13	13	13	12	13
Option c2: Single Braid (Northbound Average Speeds)																																								
I-5 NB Near 84	48	46	47	47	35	34	33	33	34	34	34	34	35	36	37	37	39	36	36	35	37	37	36	36	44	46	46	45	40	39	39	37	34	33	33	33	33	34	33	34
I-5 NB Near 84	56	55	56	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	52	51	43	55	55	56	55	55	55	55	55	55	55	55	55	55	54	55	54	54
I-5 NB Near Multnomah	55	55	55	55	55	55	54	54	55	55	55	55	55	55	55	55	55	55	55	54	53	44	38	34	56	56	56	56	55	56	55	55	55	55	55	55	55	54	52	
I-5 NB Near Weidler	55	54	55	54	54	54	53	53	54	54	54	54	54	54	54	53	54	54	53	53	53	53	53	53	55	55	55	55	55	55	55	54	54	54	54	54	54	54	52	
I-5 NB Bt Broadway/Weidler	55	54	55	54	54	54	54	54	54	54	54	54	54	54	54	53	54	54	54	54	54	54	54	54	55	55	55	55	55	55	55	55	54	54	54	54	54	54	51	
I-5 NB Near Broadway	53	53	53	53	53	52	53	52	53	53	53	52	52	52	52	52	53	53	52	52	53	53	53	53	54	55	55	55	54	54	54	54	53	53	53	53	50	50	49	
I-5 NB BT 405/Weidler	53	53	53	53	51	51	51	51	52	51	51	50	51	51	51	51	51	50	50	51	51	51	51	53	55	55	55	55	54	54	54	54	53	53	53	53	49	47	47	46
I-5 NB Near 405	56	55	55	55	55	54	54	55	55	55	54	54	54	54	54	54	54	53	53	53	53	54	54	54	55	55	55	55	55	55	55	55	54	46	40	25	22	19	17	19
I-5 NB Near Going	53	52	52	51	48	46	45	47	46	47	46	45	47	47	48	47	45	42	41	43	40	42	42	44	41	42	42	41	41	39	23	15	15	13	12	13	12	13	13	13

Legend	
< 20	19
20-30	25
30-40	35
40-50	45
>50	51.0

I-5 Broadway/Weidler 2035 Future Options Southbound Spot Speed Chart

SB Location	6:00 AM	6:15 AM	6:30 AM	6:45 AM	7:00 AM	7:15 AM	7:30 AM	7:45 AM	8:00 AM	8:15 AM	8:30 AM	8:45 AM	9:00 AM	9:15 AM	9:30 AM	9:45 AM	12:00 PM	12:15 PM	12:30 PM	12:45 PM	1:00 PM	1:15 PM	1:30 PM	1:45 PM	2:00 PM	2:15 PM	2:30 PM	2:45 PM	3:00 PM	3:15 PM	3:30 PM	3:45 PM	4:00 PM	4:15 PM	4:30 PM	4:45 PM	5:00 PM	5:15 PM	5:30 PM	5:45 PM
Option A1: No-build with two lane flyover (Southbound Average Speeds)																																							
I-5 SB Near Going	51	50	50	49	42	41	34	25	22	24	25	26	24	25	30	36	51	49	50	43	39	40	32	25	52	52	50	45	38	38	36	37	34	38	40	45	51	43	22	18
I-5 SB Near 405	53	53	53	53	52	44	28	20	20	21	22	21	20	23	26	28	52	52	44	31	27	26	24	22	53	51	38	29	25	30	28	29	33	37	41	41	42	27	18	18
I-5 SB Bt 405/Broadway	55	55	55	55	40	17	14	15	15	16	15	15	15	16	16	16	50	30	19	16	16	16	15	14	31	17	16	16	17	17	17	17	17	18	17	17	17	14	13	13
I-5 SB Near Broadway	47	45	46	46	28	20	19	19	19	20	21	21	20	21	21	21	35	22	21	21	21	21	20	17	23	22	22	22	22	22	22	22	22	22	22	22	19	14	13	13
I-5 SB Near Broadway	50	49	49	50	47	42	33	31	33	38	44	42	41	45	46	46	48	46	47	46	46	45	38	28	47	47	45	46	47	47	47	47	47	47	47	47	37	20	17	18
I-5 SB Near Moda Center	51	50	51	51	49	43	30	28	32	38	43	40	40	47	47	48	49	48	48	48	48	46	37	27	47	47	44	46	47	48	48	48	48	48	48	48	34	17	16	16
I-5 SB Near Multnomah	54	54	54	54	47	35	21	21	23	29	28	31	27	40	43	46	49	48	49	49	50	45	30	19	50	49	44	49	43	50	48	49	48	46	47	45	28	16	15	16
I-5 SB Near 84	52	51	52	52	42	28	24	25	26	30	28	31	27	30	37	39	49	49	49	48	51	50	48	50	50	52	50	50	48	49	47	48	48	46	46	45	49	52	53	52
I-5 SB Near Morrison	56	55	55	56	55	54	53	53	53	54	53	54	54	54	54	54	55	55	55	55	55	55	56	56	55	56	56	55	55	55	55	55	55	55	47	43	42	42	41	42
Option A2: No-build (Southbound Average Speeds)																																							
I-5 SB Near Going	52	50	50	48	42	41	33	25	22	23	25	26	25	24	27	29	52	49	44	33	25	25	23	21	52	50	38	26	25	28	31	31	30	31	29	29	30	22	19	19
I-5 SB Near 405	53	53	53	53	52	45	26	20	21	21	22	21	21	23	23	23	52	50	33	24	23	22	21	19	49	34	22	21	21	23	26	24	26	28	27	26	22	21	18	19
I-5 SB Bt 405/Broadway	55	54	55	55	40	19	15	14	15	15	15	15	15	16	15	16	48	23	16	15	15	15	14	14	24	16	15	15	15	17	16	16	17	16	16	16	15	14	14	15
I-5 SB Near Broadway	48	46	45	46	30	20	18	19	19	20	20	20	20	20	20	21	34	19	20	19	20	19	17	17	20	19	19	20	18	21	20	21	20	19	20	19	16	15	15	16
I-5 SB Near Broadway	50	49	49	50	44	36	31	31	33	38	39	38	38	40	37	40	44	35	38	31	34	33	28	24	36	32	30	37	32	39	38	40	38	34	34	34	24	19	18	19
I-5 SB Near Moda Center	51	49	50	50	44	34	30	29	32	37	38	36	36	37	35	39	42	34	33	29	32	29	27	23	35	30	28	35	31	38	36	38	35	33	32	32	22	19	17	18
I-5 SB Near Multnomah	52	50	50	51	39	28	27	29	29	31	31	32	32	34	35	35	38	34	33	32	33	32	32	30	34	33	33	35	34	36	35	36	36	35	34	34	31	30	30	30
I-5 SB Near 84	53	51	52	52	40	26	24	26	27	29	26	31	30	36	39	38	49	49	46	44	46	49	48	49	50	50	50	49	48	45	45	44	47	46	48	48	41	52	54	52
I-5 SB Near Morrison	56	55	55	56	54	53	53	53	54	53	53	54	54	54	54	54	55	55	54	55	55	55	55	56	55	55	56	55	55	55	55	54	55	55	47	44	40	40	41	40
Option B1: Auxiliary lanes with two lane flyover (Southbound Average Speeds)																																							
I-5 SB Near Going	52	51	48	50	41	40	38	39	35	31	34	33	37	41	41	41	51	49	50	50	49	48	48	45	52	52	52	50	48	42	44	44	42	43	45	47	52	54	48	27
I-5 SB Near 405	53	53	53	53	52	52	52	52	52	52	52	52	52	52	52	52	52	52	51	52	52	52	50	37	53	53	53	52	53	52	53	53	53	53	53	53	53	51	34	20
I-5 SB Bt 405/Broadway	54	54	54	55	53	52	52	52	51	52	51	50	53	52	53	52	52	51	52	52	52	51	39	20	51	51	49	47	43	44	47	51	51	50	50	51	50	42	18	15
I-5 SB Near Broadway	55	54	55	55	53	53	53	53	53	53	51	52	53	54	53	54	53	53	53	53	53	51	34	19	53	52	49	45	43	49	53	54	54	53	53	53	51	37	26	42
I-5 SB Near Broadway	54	54	54	54	53	53	53	52	52	52	50	50	50	51	53	53	52	51	52	52	52	45	27	19	51	49	45	38	37	45	51	52	53	52	52	52	48	28	22	36
I-5 SB Near Moda Center	54	54	54	54	53	53	52	52	52	52	50	49	49	51	52	53	52	52	52	52	51	41	27	22	51	49	42	37	36	42	49	52	53	52	52	53	46	29	24	29
I-5 SB Near Multnomah	55	55	55	55	51	46	45	44	44	50	48	46	51	54	53	54	54	54	54	53	53	52	51	51	54	54	53	52	51	51	52	54	54	54	54	54	54	53	54	54
I-5 SB Near 84	55	55	55	55	51	46	45	44	44	50	48	46	51	54	53	54	54	54	54	53	53	52	51	51	54	54	53	52	51	51	52	54	54	54	54	54	54	53	54	54
I-5 SB Near Morrison	56	56	56	56	54	53	54	53	53	54	54	54	55	55	55	55	55	55	55	56	56	56	56	56	55	55	55	55	55	54	54	54	54	54	46	42	41	40	41	42
Option B2: Auxiliary Lanes (Southbound Average Speeds)																																							
I-5 SB Near Going	52	51	50	50	40	42	41	41	35	33	32	34	36	41	39	41	51	49	50	50	47	45	34	29	52	52	52	50	47	42	44	44	42	43	45	47	52	52	34	24
I-5 SB Near 405	53	53	53	53	52	52	52	52	52	52	52	52	50	51	52	52	52	52	51	50	48	40	28	25	53	53	53	51	48	45	48	52	53	53	53	53	53	45	23	25
I-5 SB Bt 405/Broadway	54	54	54	54	53	49	52	50	48	44	43	43	46	49	50	52	52	51	51	48	38	25	18	16	50	45	29	25	25	27	31	39	45	49	49	50	47	26	15	20
I-5 SB Near Broadway	54	54	54	55	53	52	53	52	51	47	45	46	50	53	51	52	53	52	51	46	45	43	40	39	50	38	27	26	32	48	51	52	53	53	53	53	44	41	48	41
I-5 SB Near Broadway	54	54	54	54	53	52	52	51	48	44	42	44	45	49	49	50	52	47	38	34	34	36	34	34	44	31	26	24	26	40	47	49	51	51	52	50	35	29	43	36
I-5 SB Near Moda Center	54	54	54	54	53	52	51	46	43	42	40	40	42	46	47	50	51	43	34	31	32	32	32	31	40	30	27	25	27	36	43	46	50	50	51	49	33	26	38	35
I-5 SB Near Multnomah	55	55	55	55	51	48	43	49	50	51	49	46	50	53	53	53	55	54	54	53	54	54	55	55	55	55	55	54	54	53	54	54	55	55	54	54	55	56	56	56
I-5 SB Near 84	55	55	55	55	51	48	43	49	50	51	49	46	50	53	53	53	55	54	54	53	54	54	55	55	55	55	55	54	54	53	54	54	55	55	54	54	55	56	56	56
I-5 SB Near Morrison	56	56	56	56	54	54	54	54	54	54	54	54	54	55	55	55	56	55	55	55	56	56	56	56	55	55	55	55	54	54	54	54	54	54	46	42	41	41	42	41
Option C1: Double Braid with two lane flyover (Southbound Average Speeds)																																							
I-5 SB Near Going	50	51	50	49	43	39	40	35	39	35	36	29	37	36	44	42	50	49	50	50	50	49	46	32	52	52	52	49	47	44	44	44	42	43	45	47	51	49	31	19
I-5 SB Near 405	53	53	54	53	53	52	52	52	52	52	52	52	44	41	44	45	52	51	52	52	52	51	40	23	53	53	52	51	46	51	53	53	53	53	53	54	52	41	21	21
I-5 SB Bt 405/Broadway	55	54	55	55	54	53	53	53	52	53	51	42	40	40	40	40	53	53	52	53	52	52	43	24	17	52	52	37	31	29	37	42	46	50	50	51	51	46	25	15	16
I-5 SB Near Broadway	55	55	55	55	54	54	54	54	54	54	49	41	39	40	48	48	54	53	54	53	51	37	24	22	54	50	34	29	34	42	48	49	51	52	54	52	44	20	14	16
I-5 SB Near Broadway	52	52	52	52	51	50	50	50	46	47	38	29	30	33	39	37	46	43	45	41	36	20	16	16	46	34	23	21	22	30	39	43	46	45	47	47	37	14	10	11
I-5 SB Near Moda Center	55	54	55	55	54	53	53	53	52	52	50	49	50	51	48	48	54	53	53	52	52	49	48	49	54	53	50	50	50	50	52	53	54	53	53	54	53	51	52	51
I-5 SB Near Multnomah	57	56	56	56	56	56	55	56	55	56	56	55	56	56	56	55	56	56	56	56	56	56	55	56	56	55	55	55	55	55	55	55	55	55	55	56	56	56	56	56
I-5 SB Near 84	56	56	56	56	56	56	55	56	55	56	56	55	56	56	56	55	56	56	56	56	56	56	56	56	56	55	55	55	55	55	55	55	55	55	55	56	56	56	57	57
I-5 SB Near Morrison	56	56	56	56	55	55	54	54	54	54	54	54	55	55	55	54	55	55	55	55	55	56	55	56	55	55	54	54	54	53	53	54	54	54	45	40	40	39	41	41
Option C2: Double Braid (Southbound Average Speeds)																																							
I-5 SB Near Going	51	50	50	49	46	41	42	37	31	32	30	32	36	39	44	45	50	49	50	50	50	47	37	24	52	52	52	50	46	40	44	44	43	44	46	47	52	45	20	19
I-5 SB Near 405	53	53	53	53	52	52	52	52	51	50	47	48	49	47	50	52	52	51	52	51	50	39	30	24	53	51	42	45	47	51	53	53	53	53	53	53	50	27	18	19
I-5 SB Bt 405/Broadway	55	54	55	55	53	52	52	49	45	41	40	37	40	46	49	53	53	53	52	41	33	24	21	18	46	31	27	27	27	43	49	52	52	52	52	52	40	15	14	16
I-5 SB Near Broadway	55	55	55	55	54	54	53	50	41	44	42	41	42	48	53	54	54	53	51	36	28	24	21	19	41	30	29	28	33	51	53	54	54	54	54	53	32	15	14	16
I-5 SB Near Broadway	52	52	52	53	49	50	47	42	28	31	31	32	31	39	44	49	46	41	30	24	18	16	13	13	26	18	18	16	21	35	45	49	50	49	50	46	21	11	11	12
I-5 SB Near Moda Center	54	54	55	55	52	52	52	51	47	48	48	48	49	51	52	53	54	52	50	47	48	48	48	48	51	50	50	50	50	51	53	54	54	54	54	54	51	51	50	50
I-5 SB Near Multnomah	56	56	56	56	55	55	55	55	54	55	54	55	55	56	55	56	56	56	56	55	55	55	55	55	55	55	55	54	55	55	55	55	55	55	55	55	56	56	56	56
I-5 SB Near 84	56	56	56	56	55	55	55	55	55	55	55	55	55	56	56	56	56	56	56	56	56	56	56	56	55	55	55	55	55	55	55	55	55	55	55	55	56	56	56	56
I-5 SB Near Morrison	56	56	55	56	54	55	54	54	53	54	53	54	54	55	55	55	55	55	55	55	56	56	56	55	55	55	55	54	53	53	54	54	54	54	46	41	40	40	42	40
Option c1: Single Braid with two lane flyover (Southbound Average Speeds)																																							
I-5 SB Near Going	52	50	50	50	44	41	44	40	37	36	34	32	37	41	38	39	49	49	50	50	50	48	47	33	52	52	52	50	48	42	44	44	42	43	45	47	52	52	37	18
I-5 SB Near 405	53	53	53	54	52	52	52	52	52	52	52	52	50	50	51	52	52	52	52	52	52	51	42	26	53	53	53	52	47	52	53	53	53	53	53	52	46	21	19
I-5 SB Bt 405/Broadway	55	54	54	55	53	51	53	52	51	51	51	50	49	50	50	53	53	52	52	53	52	47	25	16	52	51	43	35	28	38	45	51	52	50	51	51	47	30	13	15
I-5 SB Near Broadway	55	55	54	55	53	52	53	52	53	52	51	49	50	51	53	53	54	53	53	53	53	39	21	17	53	51	38	30	34	45	51	51	53	53	53	53	48	21	14	14
I-5 SB Near Broadway	53	52	52	53	50	50	49	49	48	48	46	45	47	47	48	49	48	46	48	48	45	37	31	31	48	44	37	35	36	41	46	48	49	49	49	49	45	33	32	32
I-5 SB Near Moda Center	55	55	55	55	54	54	54	53	53	54	53	53	54	54	54	54	54	54	54	54	54	54	54	54	54	55	54	54	53	53	54	54	54	54	54	54	55	55	55	55
I-5 SB Near Multnomah	54	54	54	54	52	52	52	48	50	52	52	51	53	53	53	53	53	53	54	53	53	53	53	53	54	54	54	53	53	52	53	53	53	53	53	54	54	54	55	55
I-5 SB Near 84	54	53	53	54	45	41	39	36	40	42	44	44	49	51	51	51	53	52	52	51	52	52	52	53	52	53	52	52	50	52	51	52	52	52	52	52	53	53	53	53
I-5 SB Near Morrison	56	56	55	56	54	53	54	53	53	54	53	54	55	55	55	55	55	55	56	55	55	56	56	56	55	55	55	55	55	54	54	53	54	54	54	46	42	40	40	39	40
Option c2: Single Braid (Southbound Average Speeds)																																							
I-5 SB Near Going	51	51	49	49	45	39	43	42	36	32	31	29	34	41	40	42	50	49	49	49	50	43	35	24	52	52	52	49	48	43	43	43	41	43	43	46	52	45	21	18
I-5 SB Near 405	53	53	53	53	52	52	52	52	49	43	42	41	45	49	51	52	52	52	51	52	49	36	27	23	53	52	48	49	48	53	53	53	53	53	53	53	52	28	17	18
I-5 SB Bt 405/Broadway	55	54	55	55	53	52	53	48	36	30	32	32	35	42	49	51	53	53	52	39	30	22	17	16	48	30	26	25	25	40	47	52	51	50	51	51	52	41	13	12	14
I-5 SB Near Broadway	55	55	55	55	53	52	51	46	36	37	38	40	38	47	52	54	54	53	47	31	27	21	19	17	41	30	28	25	33	49	52	54	53	53	53	53	31	13	12	13
I-5 SB Near Broadway	52	52	52	52	48	47	44	41	32	34	34	34	35	39	45	49	47	41	34	28	25	24	23	22	32	26	26	24	29	40	46	47	49	48	48	46	30	22	25	23
I-5 SB Near Moda Center	55	55	55	55	54	53	53	53	53	52	53	52	51	53	54	54	54	54	54	53	53	53	54	53	54	54	54	54	53	54	54	54	54	54	55	54	55	55	55	55
I-5 SB Near Multnomah	54	54	54	54	52	52	52	51	52	51	51	50	49	53	53	53	54	53	53	52	53	53	53	53	54	54	53	53	52	53	53	53	54	53	54	53	54	55	55	55
I-5 SB Near 84	54	53	53	53	45	43	43	39	45	44	42	40	42	49	51	52	53	52	52	50	51	52	53	53	53	53	53	52	51	51	52	52	52	52	52	53	54	54	54	54
I-5 SB Near Morrison	56	55	55	55	54	54	54	54	54	54	53	53	54	55	55	55	55	55	55	56	56	56	56	56	55	55	55	54	54	54	54	54	54	54	46	41	40	40	41	40

Legend	
< 20	19
20-30	25
30-40	35
40-50	45
>50	51.0

APPENDIX F: EMERGENCY BRAKING ANALYSIS

EMERGENCY BRAKING BY SEGMENT

	SB Going On-Ramp to Broadway Off-Ramp							NB Broadway On-Ramp to Going Off-Ramp						
	<= 20 mph	20-30 mph	30-40 mph	40-50 mph	50-60 mph	>60 mph	Total	<= 20 mph	20-30 mph	30-40 mph	40-50 mph	50-60 mph	>60 mph	Total
Option A2: No-build	56,933	7,755	2,315	860	153	4	68,016	14,454	1,761	1,250	1,078	323	16	18,883
Option A1: No-build with two lane flyover	44,654	6,895	2,612	1,172	197	6	55,529	13,936	1,710	1,241	1,050	330	16	18,282
Option B1: Auxiliary lanes with two lane fl	7,450	1,757	1,795	1,621	455	18	13,078	14,385	1,548	1,179	1,290	487	22	18,911
Option B2: Auxiliary Lanes	11,801	2,428	2,015	1,570	389	16	18,203	14,206	1,581	1,186	1,279	484	20	18,756
Option C1: Double Braid with two lane flyc	13,109	2,399	1,947	1,521	415	16	19,391	14,679	1,613	1,185	1,271	459	22	19,228
Option C2: Double Braid	18,917	3,054	2,114	1,506	394	15	25,985	14,253	1,579	1,172	1,279	482	21	18,786
Option c1: Single Braid with two lane flyov	12,204	2,167	1,827	1,545	428	17	18,170	13,643	1,713	1,573	1,803	701	36	19,471
Option c2: Single Braid	20,607	3,305	2,122	1,485	371	14	27,890	13,130	1,650	1,596	1,827	712	35	18,949
Option A1: No-build with two lane flyover	-22%	-11%	13%	36%	29%	30%	-18%	-4%	-3%	-1%	-3%	2%	-4%	-3%
Option B1: Auxiliary lanes with two lane fl	-87%	-77%	-22%	88%	198%	328%	-81%	0%	-12%	-6%	20%	51%	36%	0%
Option B2: Auxiliary Lanes	-79%	-69%	-13%	83%	155%	260%	-73%	-2%	-10%	-5%	19%	50%	23%	-1%
Option C1: Double Braid with two lane flyc	-77%	-69%	-16%	77%	171%	281%	-71%	2%	-8%	-5%	18%	42%	32%	2%
Option C2: Double Braid	-67%	-61%	-9%	75%	158%	242%	-62%	-1%	-10%	-6%	19%	49%	27%	-1%
Option c1: Single Braid with two lane flyov	-79%	-72%	-21%	80%	180%	298%	-73%	-6%	-3%	26%	67%	117%	120%	3%
Option c2: Single Braid	-64%	-57%	-8%	73%	143%	214%	-59%	-9%	-6%	28%	69%	120%	114%	0%

	SB Broadway Off-Ramp to Morrison Off-Ramp							NB Morrison On-Ramp to Broadway On-Ramp						
	<= 20 mph	20-30 mph	30-40 mph	40-50 mph	50-60 mph	>60 mph	Total	<= 20 mph	20-30 mph	30-40 mph	40-50 mph	50-60 mph	>60 mph	Total
Option A2: No-build	9,327	2,126	1,210	553	74	1	13,289	6,394	2,055	1,418	814	170	3	10,852
Option A1: No-build with two lane flyover	9,603	1,450	1,000	641	124	2	12,818	5,421	1,847	1,423	918	185	3	9,799
Option B1: Auxiliary lanes with two lane fl	13,291	1,122	1,046	1,011	289	11	16,759	2,661	595	648	710	246	13	4,873
Option B2: Auxiliary Lanes	11,738	1,469	1,538	1,279	282	10	16,306	2,506	554	607	714	273	16	4,670
Option C1: Double Braid with two lane flyc	5,751	593	448	337	79	4	7,209	3,490	619	629	701	291	12	5,742
Option C2: Double Braid	8,182	758	500	314	71	3	9,826	2,492	541	618	778	314	13	4,756
Option c1: Single Braid with two lane flyov	4,830	722	849	629	154	6	7,183	2,983	588	584	635	251	13	5,053
Option c2: Single Braid	7,734	937	901	613	132	5	10,315	2,546	528	575	645	256	13	4,562
Option A1: No-build with two lane flyover	3%	-32%	-17%	16%	69%	77%	-4%	-15%	-10%	0%	13%	9%	3%	-10%
Option B1: Auxiliary lanes with two lane fl	42%	-47%	-14%	83%	293%	738%	26%	-58%	-71%	-54%	-13%	45%	306%	-55%
Option B2: Auxiliary Lanes	26%	-31%	27%	131%	284%	669%	23%	-61%	-73%	-57%	-12%	61%	394%	-57%
Option C1: Double Braid with two lane flyc	-38%	-72%	-63%	-39%	7%	185%	-46%	-45%	-70%	-56%	-14%	72%	288%	-47%
Option C2: Double Braid	-12%	-64%	-59%	-43%	-3%	100%	-26%	-61%	-74%	-56%	-4%	85%	309%	-56%
Option c1: Single Braid with two lane flyov	-48%	-66%	-30%	14%	109%	323%	-46%	-53%	-71%	-59%	-22%	48%	303%	-53%
Option c2: Single Braid	-17%	-56%	-26%	11%	79%	285%	-22%	-60%	-74%	-59%	-21%	51%	291%	-58%

EMERGENCY BRAKING TOTAL															
	<= 20 mph	20-30 mph	30-40 mph	40-50 mph	50-60 mph	>60 mph	Total	<= 20 mph	20-30 mph	30-40 mph	40-50 mph	50-60 mph	>60 mph	Total
Option A2: No-build	66,260	9,881	3,525	1,413	226	6	81,305	20,848	3,816	2,668	1,892	493	20	29,735
Option A1: No-build with two lane flyover	54,257	8,344	3,612	1,813	321	8	68,348	19,357	3,557	2,664	1,968	515	19	28,080
Option B1: Auxiliary lanes with two lane fl	20,740	2,880	2,841	2,632	744	29	29,837	17,046	2,143	1,826	2,000	734	35	23,784
Option B2: Auxiliary Lanes	23,539	3,897	3,553	2,849	672	26	34,509	16,712	2,135	1,792	1,993	758	36	23,426
Option C1: Double Braid with two lane flyc	18,860	2,992	2,395	1,858	494	20	26,600	18,169	2,232	1,813	1,972	750	34	24,970
Option C2: Double Braid	27,099	3,813	2,615	1,819	465	17	35,810	16,745	2,120	1,790	2,057	796	34	23,542
Option c1: Single Braid with two lane flyov	17,034	2,889	2,675	2,173	581	23	25,352	16,626	2,301	2,157	2,438	953	49	24,524
Option c2: Single Braid	28,341	4,242	3,022	2,098	503	19	38,206	15,675	2,178	2,171	2,472	968	47	23,511
Option A1: No-build with two lane flyover	-18%	-16%	2%	28%	42%	41%	-16%	-7%	-7%	0%	4%	5%	-3%	-6%
Option B1: Auxiliary lanes with two lane fl	-69%	-71%	-19%	86%	228%	423%	-63%	-18%	-44%	-32%	6%	49%	80%	-20%
Option B2: Auxiliary Lanes	-64%	-61%	1%	102%	197%	355%	-58%	-20%	-44%	-33%	5%	54%	84%	-21%
Option C1: Double Braid with two lane flyc	-72%	-70%	-32%	32%	118%	259%	-67%	-13%	-41%	-32%	4%	52%	74%	-16%
Option C2: Double Braid	-59%	-61%	-26%	29%	106%	209%	-56%	-20%	-44%	-33%	9%	62%	73%	-21%
Option c1: Single Braid with two lane flyov	-74%	-71%	-24%	54%	157%	304%	-69%	-20%	-40%	-19%	29%	93%	150%	-18%
Option c2: Single Braid	-57%	-57%	-14%	48%	122%	230%	-53%	-25%	-43%	-19%	31%	96%	143%	-21%

NUMBER OF EMERGENCY BRAKING EVENTS						
	SB Going On-Ramp to	SB Broadway Off-Ramp to	SB Total	NB Broadway On-ramp to Going	NB Morrison to Broadway On-	NB Total
Option A2: No-build	68,016	13,289	81,305	18,883	10,852	29,735
Option A1: No-build with two lane flyover	55,529	12,818	68,348	18,282	9,799	28,080
Option B1: Auxiliary lanes with two lane flyover	13,078	16,759	29,837	18,911	4,873	23,784
Option B2: Auxiliary Lanes	18,203	16,306	34,509	18,756	4,670	23,426
Option C1: Double Braid with two lane flyover	19,391	7,209	26,600	19,228	5,742	24,970
Option C2: Double Braid	25,985	9,826	35,810	18,786	4,756	23,542
Option c1: Single Braid with two lane flyover	18,170	7,183	25,352	19,471	5,053	24,524
Option c2: Single Braid	27,890	10,315	38,206	18,949	4,562	23,511

	Southbound			Northbound		
	Going On-Ramp to Broadway Off-Ramp	Broadway Off-Ramp to Morrison Off-Ramp	Total	NB Broadway On-ramp to Going Off-ramp	NB Morrison to Broadway On-ramp	Total
Option A1 vs. A2	5% - 20%	<5%	5% - 20%	<5%	5% - 20%	5% - 20%
Option B1 vs. A2	>60%	<5%	>60%	<5%	>60%	40% - 60%
Option B2 vs. A2	>60%	<5%	>60%	<5%	>60%	40% - 60%
Option C1 DB vs. A2	>60%	>60%	>60%	<5%	>60%	5% - 20%
Option C2 DB vs. A2	>60%	40% - 60%	>60%	<5%	>60%	40% - 60%
Option c1 SB vs. A2	>60%	>60%	>60%	<5%	>60%	5% - 20%
Option c2 SB vs. A2	>60%	40% - 60%	>60%	<5%	>60%	40% - 60%

	Southbound		Northbound	
	Total	Broadway to Morrison	Total	Morrison to Broadway
Option B1 vs. A1	>60%	<-5%	5% - 20%	>60%
Option B1 vs. A2	>60%	<-5%	40% - 60%	>60%
Option c1 SB vs. B1	5% - 20%	>60%	-5% - 5%	-5% - 5%
Option c2 SB vs. B2	<-5%	40% - 60%	-5% - 5%	-5% - 5%
Option c1 SB vs. C1 DB	-5% - 5%	-5% - 5%	-5% - 5%	5% - 20%
Option c2 SB vs. C2 DB	<-5%	-5% - 5%	-5% - 5%	-5% - 5%

Legend
<-5%
-5% - 5%
5% - 20%
20% - 40%
40% - 60%
>60%

REFERENCE						
BUILD OPTIONS EMERGENCY BRAKING REDUCTION PERCENTAGE						
Option A2	-	-	-	-	-	-
Option A1 vs. A2	-18%	-4%	-16%	-3%	-10%	-6%
Option B1 vs. A2	-81%	26%	-63%	0%	-55%	-20%
Option B2 vs. A2	-73%	23%	-58%	-1%	-57%	-21%
Option C1 DB vs. A2	-71%	-46%	-67%	2%	-47%	-16%
Option C2 DB vs. A2	-62%	-26%	-56%	-1%	-56%	-21%
Option c1 SB vs. A2	-73%	-46%	-69%	3%	-53%	-18%
Option c2 SB vs. A2	-59%	-22%	-53%	0%	-58%	-21%
Option B1 vs. A1	-76%	31%	-56%	3%	-50%	-15%
Option c1 SB vs. B1	39%	-57%	-15%	3%	4%	3%
Option c2 SB vs. B2	53%	-37%	11%	1%	-2%	0%
Option c1 SB vs. C1 DB	-6%	0%	-5%	1%	-12%	-2%
Option c2 SB vs. C2 DB	7%	5%	7%	1%	-4%	0%

	Southbound			Northbound		
	Going to Broadwa	Broadway to Morr	Total	Broadway to Goin	Morrison to Broac	Total
Option A1: No-build with two lane flyover	2	1	2	1	2	2
Option B1: Auxiliary lanes with two lane flyover	5	0	5	1	5	4
Option B2: Auxiliary Lanes	5	0	5	1	5	4
Option C1: Double Braid with two lane flyover	5	5	5	1	5	2
Option C2: Double Braid	5	4	5	1	5	4
Option c1: Single Braid with two lane flyover	5	5	5	1	5	2
Option c2: Single Braid	5	4	5	1	5	4
Option B1 vs. A1	5	0	5	1	5	2
Option c1 SB vs. B1	0	5	2	1	1	1
Option c2 SB vs. B2	0	4	0	1	1	1
Option c1 SB vs. C1 DB	2	1	1	1	2	1
Option c2 SB vs. C2 DB	0	1	0	1	1	1

	Southbound			Northbound		
	Going to Broadwa	Broadway to Morr	Total	Broadway to Goin	Morrison to Broac	Total
Option A1: No-build with two lane flyover	2	1	2	1	2	2
Option B1: Auxiliary lanes with two lane flyover	5	1	5	1	5	4
Option B2: Auxiliary Lanes	5	1	5	1	5	4
Option C1: Double Braid with two lane flyover	5	5	5	1	5	2
Option C2: Double Braid	5	4	5	1	5	4
Option c1: Single Braid with two lane flyover	5	5	5	1	5	2
Option c2: Single Braid	5	4	5	1	5	4
Option B1 vs. A1	5	1	5	1	5	2
Option c1 SB vs. B1	1	5	2	1	1	1
Option c2 SB vs. B2	1	4	1	1	1	1
Option c1 SB vs. C1 DB	2	1	1	1	2	1
Option c2 SB vs. C2 DB	1	1	1	1	1	1

APPENDIX G: INTERSECTION ANALYSIS

Level of Service									
Intersection		Option A2	Option A1	Option B1	Option B2	Option C1	Option C2	Option c1	Option c2
6:00-7:00 AM									
Broadway	Flint	A	A	A	A	A	A	A	A
Broadway	Williams	B	B	B	B	B	B	B	B
Broadway	Vancouver	C	C	C	C	C	C	C	C
Weidler	Vancouver	B	B	B	B	B	B	B	B
Wheeler	Winning	A	A	A	A	A	A	A	A
Weidler	Williams	A	A	A	A	A	A	B	B
Broadway	Victoria	E	E	C	C	C	C	C	C
Weidler	Victoria	C	C	B	B	B	B	B	B
Winning	Vancouver			A	A	A	A	A	A
7:00-8:00 AM									
Broadway	Flint	A	A	A	A	A	A	A	A
Broadway	Williams	C	C	C	B	B	C	C	C
Broadway	Vancouver	F	F	D	D	D	D	E	E
Weidler	Vancouver	B	B	B	C	B	B	D	D
Wheeler	Winning	B	B	A	A	A	A	A	A
Weidler	Williams	A	A	B	B	B	B	D	D
Broadway	Victoria	F	F	D	D	D	D	E	E
Weidler	Victoria	F	F	D	D	D	D	D	D
Winning	Vancouver			A	A	A	A	A	A
8:00-9:00 AM									
Broadway	Flint	A	A	A	A	A	A	A	A
Broadway	Williams	C	C	C	C	C	B	C	C
Broadway	Vancouver	F	F	E	F	E	F	F	F
Weidler	Vancouver	B	B	C	F	B	B	F	F
Wheeler	Winning	B	B	A	A	A	A	A	A
Weidler	Williams	A	A	B	D	B	B	E	E
Broadway	Victoria	F	F	D	F	E	D	F	F
Weidler	Victoria	B	B	D	D	D	D	E	D
Winning	Vancouver			A	A	A	A	A	A
9:00-10:00 AM									
Broadway	Flint	A	A	A	A	A	A	A	A
Broadway	Williams	C	C	B	C	C	B	C	C
Broadway	Vancouver	F	F	E	F	E	F	F	F
Weidler	Vancouver	B	B	C	F	C	C	F	F
Wheeler	Winning	A	A	A	A	A	A	A	A
Weidler	Williams	A	A	A	B	A	A	D	D
Broadway	Victoria	F	F	D	E	D	D	F	F
Weidler	Victoria	E	E	D	D	C	C	D	D
Winning	Vancouver			A	A	A	A	A	A

Note: All Intersection Results are referenced to the original Intersection Spreadsheet for each design Option

Level of Service									
Intersection		Option A2	Option A1	Option B1	Option B2	Option C1	Option C2	Option c1	Option c2
12:00-1:00 PM									
Broadway	Flint	A	A	A	A	A	A	A	A
Broadway	Williams	B	C	C	C	C	C	C	C
Broadway	Vancouver	E	E	C	D	C	C	C	C
Weidler	Vancouver	B	B	C	D	C	C	C	C
Wheeler	Winning	B	A	A	A	A	A	A	A
Weidler	Williams	A	A	A	B	A	A	A	A
Broadway	Victoria	E	F	F	E	F	F	F	F
Weidler	Victoria	D	D	C	C	C	C	B	C
Winning	Vancouver			A	A	A	A	A	A
1:00-2:00 PM									
Broadway	Flint	A	A	A	A	A	A	A	A
Broadway	Williams	B	C	C	D	D	C	C	C
Broadway	Vancouver	F	F	D	F	E	F	E	F
Weidler	Vancouver	B	B	F	F	E	D	D	E
Wheeler	Winning	B	B	A	A	A	A	A	A
Weidler	Williams	A	A	B	D	B	B	B	B
Broadway	Victoria	E	F	F	F	F	F	F	F
Weidler	Victoria	E	F	F	F	F	F	F	F
Winning	Vancouver			B	B	B	B	B	B
2:00-3:00 PM									
Broadway	Flint	A	A	A	A	A	A	A	A
Broadway	Williams	C	C	C	C	C	C	C	C
Broadway	Vancouver	F	F	D	E	D	E	D	E
Weidler	Vancouver	D	E	F	F	F	F	F	F
Wheeler	Winning	D	D	A	A	A	A	A	A
Weidler	Williams	B	B	B	C	B	B	B	B
Broadway	Victoria	F	F	D	D	D	D	D	D
Weidler	Victoria	C	C	C	C	C	C	B	C
Winning	Vancouver			A	A	A	A	A	A
3:00-4:00 PM									
Broadway	Flint	A	A	A	A	A	A	A	A
Broadway	Williams	C	C	C	C	C	C	C	C
Broadway	Vancouver	F	F	F	F	F	F	F	F
Weidler	Vancouver	F	F	F	F	F	F	F	F
Wheeler	Winning	C	C	A	A	A	A	A	A
Weidler	Williams	B	B	B	C	B	B	B	B
Broadway	Victoria	F	F	F	F	F	F	F	F
Weidler	Victoria	C	C	C	C	C	C	B	C
Winning	Vancouver			B	B	B	B	B	B
4:00-5:00 PM									
Broadway	Flint	A	A	A	A	A	A	A	A
Broadway	Williams	C	C	C	C	C	C	C	C
Broadway	Vancouver	F	F	F	F	F	F	F	F
Weidler	Vancouver	F	F	F	F	F	F	F	F
Wheeler	Winning	C	C	A	A	A	A	A	A
Weidler	Williams	B	B	B	B	B	B	B	B
Broadway	Victoria	F	F	F	F	F	F	F	F
Weidler	Victoria	C	C	D	D	D	D	C	D
Winning	Vancouver			B	B	B	B	B	B
5:00-6:00 PM									
Broadway	Flint	A	A	A	A	A	A	A	A
Broadway	Williams	C	C	C	C	C	C	C	C
Broadway	Vancouver	F	F	F	F	F	F	F	F
Weidler	Vancouver	F	F	F	F	F	F	F	F
Wheeler	Winning	F	F	A	A	A	A	A	A
Weidler	Williams	B	B	C	D	B	B	B	B
Broadway	Victoria	F	F	F	F	F	F	F	F
Weidler	Victoria	F	F	F	F	F	F	F	F
Winning	Vancouver			C	C	B	B	B	B

Delay (seconds)									
Intersection		Option A2	Option A1	Option B1	Option B2	Option C1	Option C2	Option c1	Option c2
6:00-7:00 AM									
Broadway	Flint	1	1	1	1	1	1	1	1
Broadway	Williams	20	20	17	17	17	17	17	17
Broadway	Vancouver	24	24	25	24	25	25	24	24
Weidler	Vancouver	11	11	15	15	15	15	15	15
Wheeler	Winning	6	6	1	1	1	1	1	1
Weidler	Williams	4	4	10	10	10	10	10	10
Broadway	Victoria	75	75	30	29	30	31	31	30
Weidler	Victoria	22	22	17	17	17	17	16	16
Winning	Vancouver			3	3	3	3	3	3
7:00-8:00 AM									
Broadway	Flint	1	1	1	1	1	1	1	1
Broadway	Williams	23	25	20	19	20	20	24	25
Broadway	Vancouver	107	105	42	43	41	41	59	60
Weidler	Vancouver	14	14	19	21	18	18	50	53
Wheeler	Winning	14	14	2	2	2	2	2	2
Weidler	Williams	4	4	14	17	13	13	36	36
Broadway	Victoria	124	247	46	42	48	53	67	70
Weidler	Victoria	87	84	52	51	47	48	44	45
Winning	Vancouver			3	3	3	3	4	3
8:00-9:00 AM									
Broadway	Flint	2	2	2	2	2	2	2	2
Broadway	Williams	24	25	21	24	20	20	33	32
Broadway	Vancouver	196	192	67	139	70	98	232	236
Weidler	Vancouver	14	14	20	179	20	20	295	336
Wheeler	Winning	12	12	3	3	3	3	3	3
Weidler	Williams	5	5	13	40	12	12	66	65
Broadway	Victoria	397	845	53	95	56	53	478	428
Weidler	Victoria	19	19	50	49	52	52	70	54
Winning	Vancouver			4	5	4	4	5	5
9:00-10:00 AM									
Broadway	Flint	1	1	1	1	1	1	1	1
Broadway	Williams	23	23	19	21	20	20	30	30
Broadway	Vancouver	181	168	64	107	71	82	203	199
Weidler	Vancouver	14	14	21	161	21	20	332	351
Wheeler	Winning	7	7	3	4	3	3	4	4
Weidler	Williams	6	6	9	17	9	9	41	40
Broadway	Victoria	538	873	39	60	38	38	681	592
Weidler	Victoria	74	63	41	40	29	29	38	37
Winning	Vancouver			6	7	6	6	8	8

Difference in Delay (seconds)									
Intersection		Option A2	Option A1	Option B1	Option B2	Option C1	Option C2	Option c1	Option c2
6:00-7:00 AM									
Broadway	Flint		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Broadway	Williams		0.0	3.3	3.1	3.2	3.0	2.6	2.6
Broadway	Vancouver		0.0	-0.5	0.0	-0.7	-0.7	-0.1	-0.1
Weidler	Vancouver		0.0	-4.0	-4.0	-3.8	-3.9	-3.7	-4.0
Wheeler	Winning		0.0	5.2	5.3	5.3	5.2	5.2	5.3
Weidler	Williams		0.0	-6.3	-6.4	-6.4	-6.4	-6.8	-6.9
Broadway	Victoria		0.0	45.6	45.9	44.9	43.9	44.8	45.2
Weidler	Victoria		0.0	4.2	4.2	5.0	5.0	5.6	5.3
Winning	Vancouver		n/a	n/a	n/a	n/a	n/a	n/a	n/a
7:00-8:00 AM									
Broadway	Flint		0.0	0.1	0.1	0.0	0.0	0.1	0.1
Broadway	Williams		-2.2	2.3	3.4	2.8	2.2	-1.6	-2.0
Broadway	Vancouver		1.7	65.1	63.6	65.7	65.5	47.7	46.6
Weidler	Vancouver		-0.2	-5.2	-7.6	-4.7	-4.7	-36.1	-39.0
Wheeler	Winning		-0.6	11.8	11.9	11.9	11.9	11.7	11.6
Weidler	Williams		0.0	-10.1	-13.4	-9.2	-9.1	-31.8	-31.7
Broadway	Victoria		-122.8	78.1	82.2	76.9	71.4	57.5	54.8
Weidler	Victoria		2.9	35.1	35.4	39.2	38.8	43.1	41.6
Winning	Vancouver		n/a	n/a	n/a	n/a	n/a	n/a	n/a
8:00-9:00 AM									
Broadway	Flint		0.2	0.2	0.2	0.1	0.1	0.2	0.2
Broadway	Williams		-1.2	2.7	-0.2	3.1	3.5	-9.6	-8.2
Broadway	Vancouver		4.5	129.2	56.8	126.1	98.2	-35.5	-39.6
Weidler	Vancouver		-0.1	-5.8	-164.7	-5.6	-5.8	-280.6	-321.6
Wheeler	Winning		0.3	9.4	8.8	9.4	9.3	8.9	8.7
Weidler	Williams		0.1	-8.4	-34.7	-7.6	-7.6	-61.6	-59.8
Broadway	Victoria		-447.6	344.6	301.7	341.5	344.6	-80.8	-31.2
Weidler	Victoria		0.2	-31.1	-30.3	-32.9	-32.8	-51.1	-34.5
Winning	Vancouver		n/a	n/a	n/a	n/a	n/a	n/a	n/a
9:00-10:00 AM									
Broadway	Flint		0.1	0.2	0.1	0.1	0.1	0.2	0.2
Broadway	Williams		-0.2	4.0	2.3	2.8	3.2	-7.4	-6.7
Broadway	Vancouver		13.4	117.5	73.8	110.5	99.0	-21.5	-18.3
Weidler	Vancouver		-0.1	-7.2	-146.9	-6.5	-6.4	-318.1	-337.1
Wheeler	Winning		0.0	3.6	3.2	3.7	3.4	2.7	2.6
Weidler	Williams		0.1	-3.4	-10.9	-3.3	-3.4	-35.7	-34.6
Broadway	Victoria		-335.1	499.1	478.9	500.1	500.7	-142.7	-53.5
Weidler	Victoria		10.6	32.8	34.3	44.5	44.5	35.9	37.2
Winning	Vancouver		n/a	n/a	n/a	n/a	n/a	n/a	n/a

Delay (seconds)									
Intersection		Option A2	Option A1	Option B1	Option B2	Option C1	Option C2	Option c1	Option c2
12:00-1:00 PM									
Broadway	Flint	1	1	1	1	1	1	1	1
Broadway	Williams	17	22	24	24	24	24	23	24
Broadway	Vancouver	78	59	32	41	29	33	30	32
Weidler	Vancouver	17	17	25	42	24	24	25	24
Wheeler	Winning	10	10	2	2	2	2	2	2
Weidler	Williams	4	4	9	13	9	9	10	9
Broadway	Victoria	58	398	82	80	100	88	83	83
Weidler	Victoria	39	37	34	28	23	21	20	23
Winning	Vancouver			6	6	6	6	6	6
1:00-2:00 PM									
Broadway	Flint	1	1	1	1	1	1	1	1
Broadway	Williams	19	23	33	36	35	35	33	33
Broadway	Vancouver	199	129	46	181	62	113	61	100
Weidler	Vancouver	15	15	83	555	55	53	52	56
Wheeler	Winning	15	11	2	3	2	2	2	2
Weidler	Williams	4	4	18	38	13	13	13	13
Broadway	Victoria	79	1202	336	353	427	369	391	330
Weidler	Victoria	66	85	185	182	183	193	151	168
Winning	Vancouver			11	11	11	11	11	10

Difference in Delay (seconds)									
Intersection		Option A2	Option A1	Option B1	Option B2	Option C1	Option C2	Option c1	Option c2
6:00-7:00 AM									
12:00-1:00 PM									
Broadway	Flint		0.1	0.1	0.1	0.0	0.0	0.1	0.1
Broadway	Williams		-4.7	-6.2	-6.1	-6.3	-6.2	-6.0	-6.2
Broadway	Vancouver		19.6	46.7	37.2	49.2	45.4	48.6	46.6
Weidler	Vancouver		0.1	-8.0	-25.1	-7.3	-6.9	-7.7	-7.4
Wheeler	Winning		0.4	8.1	7.9	8.3	8.3	8.2	8.0
Weidler	Williams		0.0	-5.7	-9.8	-5.4	-5.1	-5.8	-5.8
Broadway	Victoria		-340.1	-23.9	-21.6	-41.5	-30.0	-25.2	-25.1
Weidler	Victoria		1.9	4.9	10.5	15.4	17.5	18.9	15.5
Winning	Vancouver		n/a	n/a	n/a	n/a	n/a	n/a	n/a
1:00-2:00 PM									
Broadway	Flint		0.1	-0.1	0.0	0.0	0.0	0.0	0.0
Broadway	Williams		-3.9	-14.4	-17.7	-16.8	-16.2	-14.5	-14.3
Broadway	Vancouver		69.6	152.9	18.0	136.2	85.4	137.2	98.8
Weidler	Vancouver		-0.3	-68.2	-540.4	-40.1	-37.6	-37.3	-41.2
Wheeler	Winning		3.5	12.4	12.1	12.6	12.4	12.5	12.5
Weidler	Williams		-0.1	-13.8	-34.5	-9.0	-8.8	-8.7	-9.5
Broadway	Victoria		-1122.7	-256.8	-273.7	-347.3	-289.7	-311.5	-250.4
Weidler	Victoria		-19.4	-119.8	-116.5	-117.3	-127.2	-85.5	-102.0
Winning	Vancouver		n/a	n/a	n/a	n/a	n/a	n/a	n/a

Delay (seconds)									
Intersection		Option A2	Option A1	Option B1	Option B2	Option C1	Option C2	Option c1	Option c2
2:00-3:00 PM									
Broadway	Flint	1	1	1	1	1	1	1	1
Broadway	Williams	26	26	24	26	25	25	25	25
Broadway	Vancouver	120	84	42	78	53	77	46	75
Weidler	Vancouver	53	59	198	243	201	200	207	202
Wheeler	Winning	51	50	3	3	3	2	2	2
Weidler	Williams	11	11	13	24	12	12	13	13
Broadway	Victoria	158	142	42	47	44	44	42	42
Weidler	Victoria	27	27	23	23	21	21	20	21
Winning	Vancouver			9	9	9	9	9	9
3:00-4:00 PM									
Broadway	Flint	2	2	2	2	2	2	2	2
Broadway	Williams	33	34	26	28	29	29	28	27
Broadway	Vancouver	225	185	216	582	211	209	220	235
Weidler	Vancouver	233	241	208	236	225	219	208	207
Wheeler	Winning	22	20	4	4	4	4	4	4
Weidler	Williams	14	14	15	21	15	15	16	16
Broadway	Victoria	669	739	151	172	162	158	159	152
Weidler	Victoria	30	31	22	28	22	22	20	20
Winning	Vancouver			13	13	13	12	12	13
4:00-5:00 PM									
Broadway	Flint	2	2	2	2	2	2	2	2
Broadway	Williams	28	30	28	28	29	29	29	28
Broadway	Vancouver	221	172	188	220	167	170	196	196
Weidler	Vancouver	263	269	231	228	238	235	231	229
Wheeler	Winning	30	28	5	5	5	5	5	5
Weidler	Williams	13	13	13	14	13	13	14	14
Broadway	Victoria	902	889	245	296	252	233	243	226
Weidler	Victoria	28	28	54	54	39	41	35	35
Winning	Vancouver			17	16	16	17	17	17
5:00-6:00 PM									
Broadway	Flint	2	2	2	2	2	2	2	2
Broadway	Williams	30	27	30	31	29	29	28	28
Broadway	Vancouver	432	296	318	583	314	396	301	374
Weidler	Vancouver	264	240	394	467	243	264	234	234
Wheeler	Winning	184	105	6	6	5	5	5	5
Weidler	Williams	13	13	33	40	14	18	16	15
Broadway	Victoria	1115	1042	324	347	318	268	304	269
Weidler	Victoria	136	124	108	116	108	106	100	99
Winning	Vancouver			23	26	18	18	19	17

Difference in Delay (seconds)									
Intersection		Option A2	Option A1	Option B1	Option B2	Option C1	Option C2	Option c1	Option c2
6:00-7:00 AM									
2:00-3:00 PM									
Broadway	Flint		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Broadway	Williams		-0.2	1.7	0.0	1.2	1.4	1.4	1.4
Broadway	Vancouver		36.0	78.7	42.1	66.9	43.6	74.5	44.7
Weidler	Vancouver		-6.4	-145.5	-190.2	-148.4	-146.7	-153.8	-149.1
Wheeler	Winning		0.9	48.6	48.8	48.7	49.1	48.8	48.9
Weidler	Williams		-0.6	-2.4	-13.1	-1.5	-1.4	-2.4	-2.4
Broadway	Victoria		15.7	115.6	110.5	113.8	114.1	115.8	115.8
Weidler	Victoria		-0.1	3.5	3.4	6.3	6.2	7.1	5.9
Winning	Vancouver		n/a	n/a	n/a	n/a	n/a	n/a	n/a
3:00-4:00 PM									
Broadway	Flint		0.0	0.1	0.0	0.0	0.0	0.0	0.1
Broadway	Williams		-0.8	6.7	4.8	3.8	3.9	5.0	6.1
Broadway	Vancouver		40.1	8.9	-357.2	14.0	16.1	5.4	-9.8
Weidler	Vancouver		-7.7	25.2	-3.1	8.8	14.5	25.3	26.4
Wheeler	Winning		2.1	18.2	18.1	18.2	18.3	18.4	18.1
Weidler	Williams		-0.1	-1.8	-7.6	-1.3	-1.3	-2.2	-2.0
Broadway	Victoria		-70.1	518.2	497.2	507.7	511.0	509.9	517.3
Weidler	Victoria		-0.8	7.7	2.5	8.3	8.0	10.3	9.7
Winning	Vancouver		n/a	n/a	n/a	n/a	n/a	n/a	n/a
4:00-5:00 PM									
Broadway	Flint		0.0	0.1	0.1	0.0	0.0	0.1	0.1
Broadway	Williams		-1.5	0.5	0.0	-0.9	-0.9	-0.5	0.1
Broadway	Vancouver		49.0	33.1	1.1	54.7	51.8	25.4	25.5
Weidler	Vancouver		-6.0	32.3	34.5	24.9	27.7	31.5	34.2
Wheeler	Winning		1.2	24.9	24.7	25.0	25.0	24.9	24.9
Weidler	Williams		-0.1	0.1	-0.2	0.5	0.5	-0.8	-0.4
Broadway	Victoria		12.9	656.7	605.5	649.4	668.1	658.1	675.9
Weidler	Victoria		0.0	-26.1	-26.2	-11.1	-12.9	-6.7	-7.4
Winning	Vancouver		n/a	n/a	n/a	n/a	n/a	n/a	n/a
5:00-6:00 PM									
Broadway	Flint		0.0	0.0	0.0	0.1	0.1	0.1	0.2
Broadway	Williams		3.1	0.7	-1.0	1.8	1.0	1.9	2.6
Broadway	Vancouver		136.0	113.5	-151.4	117.1	35.2	130.3	57.5
Weidler	Vancouver		23.7	-130.3	-203.8	21.0	-0.4	29.6	30.1
Wheeler	Winning		78.8	178.0	177.9	178.8	179.0	178.8	179.1
Weidler	Williams		-0.1	-20.0	-27.5	-1.4	-5.1	-2.8	-2.6
Broadway	Victoria		72.3	790.9	767.3	796.6	846.2	810.7	845.7
Weidler	Victoria		11.3	27.7	19.1	27.6	29.7	35.5	36.3
Winning	Vancouver		n/a	n/a	n/a	n/a	n/a	n/a	n/a

Option A2 No Build Intersection Results v4.xlsm

AM Peak Period						
Overall Intersection Results (6:00 AM to 7:00 AM)						
Intersection		**Sig**	**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint		1	A	1257	1241
Broadway	Williams	X	20	B	2055	2024
Broadway	Vancouver	X	24	C	2067	2035
Weidler	Vancouver	X	11	B	1390	1374
Wheeler	Winning	X	6	A	599	576
Weidler	Williams	X	4	A	897	900
Broadway	Victoria	X	75	E	1808	1830
Weidler	Victoria	X	22	C	1591	1603
Overall Intersection Results (7:00 AM to 8:00 AM)						
Broadway	Flint		1	A	1318	1220
Broadway	Williams	X	23	C	2567	2450
Broadway	Vancouver	X	107	F	2882	2413
Weidler	Vancouver	X	14	B	2288	2111
Wheeler	Winning	X	14	B	1216	1114
Weidler	Williams	X	4	A	1283	1155
Broadway	Victoria	X	124	F	2335	2281
Weidler	Victoria	X	87	F	2233	2591
Overall Intersection Results (8:00 AM to 9:00 AM)						
Broadway	Flint		2	A	1387	1218
Broadway	Williams	X	24	C	2765	2492
Broadway	Vancouver	X	196	F	2913	2505
Weidler	Vancouver	X	14	B	2594	2366
Wheeler	Winning	X	12	B	1305	1159
Weidler	Williams	X	5	A	1494	1378
Broadway	Victoria	X	397	F	2469	2294
Weidler	Victoria	X	19	B	2341	2245
Overall Intersection Results (9:00 AM to 10:00 AM)						
Broadway	Flint		1	A	1265	1266
Broadway	Williams	X	23	C	2404	2532
Broadway	Vancouver	X	181	F	2580	3083
Weidler	Vancouver	X	14	B	2445	2427
Wheeler	Winning	X	7	A	1166	1177
Weidler	Williams	X	6	A	1448	1385
Broadway	Victoria	X	538	F	2032	2219
Weidler	Victoria	X	74	E	1979	1959

Midday Peak Period						
Overall Intersection Results (12:00 PM to 1:00 PM)						
Intersection		**Sig**	**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint		1	A	1082	1030
Broadway	Williams	X	17	B	2633	2590
Broadway	Vancouver	X	78	E	2318	2187
Weidler	Vancouver	X	17	B	2293	2208
Wheeler	Winning	X	10	B	1081	1039
Weidler	Williams	X	4	A	1493	1431
Broadway	Victoria	X	58	E	2760	2319
Weidler	Victoria	X	39	D	2682	1921
Overall Intersection Results (1:00 PM to 2:00 PM)						
Broadway	Flint		1	A	1250	1157
Broadway	Williams	X	19	B	2805	2736
Broadway	Vancouver	X	199	F	2528	2327
Weidler	Vancouver	X	15	B	2350	2249
Wheeler	Winning	X	15	B	1048	1039
Weidler	Williams	X	4	A	1577	1489
Broadway	Victoria	X	79	E	2948	2520
Weidler	Victoria	X	66	E	2996	1963

PM Peak Period						
Overall Intersection Results (2:00 PM to 3:00 PM)						
Intersection		**Sig**	**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint		1	A	1442	1327
Broadway	Williams	X	26	C	2900	2740
Broadway	Vancouver	X	120	F	2715	2462
Weidler	Vancouver	X	53	D	2964	2702
Wheeler	Winning	X	51	D	1176	1087
Weidler	Williams	X	11	B	2151	1956
Broadway	Victoria	X	158	F	2586	2492
Weidler	Victoria	X	27	C	2682	2558
Overall Intersection Results (3:00 PM to 4:00 PM)						
Broadway	Flint		2	A	1285	1176
Broadway	Williams	X	33	C	2991	2554
Broadway	Vancouver	X	225	F	2882	2500
Weidler	Vancouver	X	233	F	3412	2727
Wheeler	Winning	X	22	C	1442	1254
Weidler	Williams	X	14	B	2435	1950
Broadway	Victoria	X	669	F	2645	2300
Weidler	Victoria	X	30	C	2996	2591
Overall Intersection Results (4:00 PM to 5:00 PM)						
Broadway	Flint		2	A	1302	1259
Broadway	Williams	X	28	C	2716	2536
Broadway	Vancouver	X	221	F	2436	2421
Weidler	Vancouver	X	263	F	3186	2708
Wheeler	Winning	X	30	C	1476	1406
Weidler	Williams	X	13	B	2324	1893
Broadway	Victoria	X	902	F	2359	2240
Weidler	Victoria	X	28	C	3009	2634
Overall Intersection Results (5:00 PM to 6:00 PM)						
Broadway	Flint		2	A	1409	1086
Broadway	Williams	X	30	C	2849	2252
Broadway	Vancouver	X	432	F	2488	2173
Weidler	Vancouver	X	264	F	3128	2127
Wheeler	Winning	X	184	F	1406	950
Weidler	Williams	X	13	B	2308	1663
Broadway	Victoria	X	1115	F	2453	1959
Weidler	Victoria	X	136	F	3069	2361

Option A1 No Build Intersection Results v4.xlsm

AM Peak Period						
Overall Intersection Results (6:00 AM to 7:00 AM)						
Intersection		**Sig**	**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint		1	A	1257	1241
Broadway	Williams	X	20	B	2055	2024
Broadway	Vancouver	X	24	C	2067	2035
Weidler	Vancouver	X	11	B	1390	1374
Wheeler	Winning	X	6	A	599	576
Weidler	Williams	X	4	A	897	900
Broadway	Victoria	X	75	E	1808	1830
Weidler	Victoria	X	22	C	1591	1603
Overall Intersection Results (7:00 AM to 8:00 AM)						
Broadway	Flint		1	A	1318	1231
Broadway	Williams	X	25	C	2567	2366
Broadway	Vancouver	X	105	F	2882	2439
Weidler	Vancouver	X	14	B	2288	2126
Wheeler	Winning	X	14	B	1216	1123
Weidler	Williams	X	4	A	1283	1162
Broadway	Victoria	X	247	F	2335	2196
Weidler	Victoria	X	84	F	2233	2613
Overall Intersection Results (8:00 AM to 9:00 AM)						
Broadway	Flint		2	A	1387	1219
Broadway	Williams	X	25	C	2765	2419
Broadway	Vancouver	X	192	F	2913	2511
Weidler	Vancouver	X	14	B	2594	2374
Wheeler	Winning	X	12	B	1305	1166
Weidler	Williams	X	5	A	1494	1379
Broadway	Victoria	X	845	F	2469	2222
Weidler	Victoria	X	19	B	2341	2256
Overall Intersection Results (9:00 AM to 10:00 AM)						
Broadway	Flint		1	A	1265	1275
Broadway	Williams	X	23	C	2404	2580
Broadway	Vancouver	X	168	F	2580	3113
Weidler	Vancouver	X	14	B	2445	2433
Wheeler	Winning	X	7	A	1166	1176
Weidler	Williams	X	6	A	1448	1392
Broadway	Victoria	X	873	F	2032	2271
Weidler	Victoria	X	63	E	1979	1973

Midday Peak Period						
Overall Intersection Results (12:00 PM to 1:00 PM)						
Intersection		**Sig**	**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint		1	A	1082	1020
Broadway	Williams	X	22	C	2633	2336
Broadway	Vancouver	X	59	E	2318	2178
Weidler	Vancouver	X	17	B	2293	2209
Wheeler	Winning	X	10	A	1081	1023
Weidler	Williams	X	4	A	1493	1449
Broadway	Victoria	X	398	F	2760	2057
Weidler	Victoria	X	37	D	2682	1956
Overall Intersection Results (1:00 PM to 2:00 PM)						
Broadway	Flint		1	A	1250	1029
Broadway	Williams	X	23	C	2805	2197
Broadway	Vancouver	X	129	F	2528	2129
Weidler	Vancouver	X	15	B	2350	2184
Wheeler	Winning	X	11	B	1048	923
Weidler	Williams	X	4	A	1577	1540
Broadway	Victoria	X	1202	F	2948	1976
Weidler	Victoria	X	85	F	2996	1978

PM Peak Period						
Overall Intersection Results (2:00 PM to 3:00 PM)						
Intersection		**Sig**	**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint		1	A	1442	1353
Broadway	Williams	X	26	C	2900	2756
Broadway	Vancouver	X	84	F	2715	2530
Weidler	Vancouver	X	59	E	2964	2734
Wheeler	Winning	X	50	D	1176	1091
Weidler	Williams	X	11	B	2151	1984
Broadway	Victoria	X	142	F	2586	2508
Weidler	Victoria	X	27	C	2682	2583
Overall Intersection Results (3:00 PM to 4:00 PM)						
Broadway	Flint		2	A	1285	1160
Broadway	Williams	X	34	C	2991	2477
Broadway	Vancouver	X	185	F	2882	2487
Weidler	Vancouver	X	241	F	3412	2711
Wheeler	Winning	X	20	C	1442	1220
Weidler	Williams	X	14	B	2435	1967
Broadway	Victoria	X	739	F	2645	2228
Weidler	Victoria	X	31	C	2996	2613
Overall Intersection Results (4:00 PM to 5:00 PM)						
Broadway	Flint		2	A	1302	1298
Broadway	Williams	X	30	C	2716	2579
Broadway	Vancouver	X	172	F	2436	2545
Weidler	Vancouver	X	269	F	3186	2769
Wheeler	Winning	X	28	C	1476	1448
Weidler	Williams	X	13	B	2324	1915
Broadway	Victoria	X	889	F	2359	2276
Weidler	Victoria	X	28	C	3009	2656
Overall Intersection Results (5:00 PM to 6:00 PM)						
Broadway	Flint		2	A	1409	1157
Broadway	Williams	X	27	C	2849	2374
Broadway	Vancouver	X	296	F	2488	2378
Weidler	Vancouver	X	240	F	3128	2341
Wheeler	Winning	X	105	F	1406	1067
Weidler	Williams	X	13	B	2308	1781
Broadway	Victoria	X	1042	F	2453	2062
Weidler	Victoria	X	124	F	3069	2517

Option B1 Intersection Results v4.xlsm

AM Peak Period					
Overall Intersection Results (6:00 AM to 7:00 AM)					
Intersection		**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint	1	A	1257	1241
Broadway	Williams	17	B	2055	2029
Broadway	Vancouver	25	C	1801	1771
Weidler	Vancouver	15	B	1188	1173
Wheeler	Winning	1	A	160	140
Weidler	Williams	10	A	894	898
Broadway	Victoria	30	C	1808	1790
Weidler	Victoria	17	B	1591	1562
Winning	Vancouver	3	A	160	141
Overall Intersection Results (7:00 AM to 8:00 AM)					
Broadway	Flint	1	A	1318	1294
Broadway	Williams	20	C	2567	2505
Broadway	Vancouver	42	D	2493	2116
Weidler	Vancouver	19	B	1973	1909
Wheeler	Winning	2	A	204	168
Weidler	Williams	14	B	1277	1238
Broadway	Victoria	46	D	2335	2279
Weidler	Victoria	52	D	2233	2689
Winning	Vancouver	3	A	204	244
Overall Intersection Results (8:00 AM to 9:00 AM)					
Broadway	Flint	2	A	1387	1354
Broadway	Williams	21	C	2765	2735
Broadway	Vancouver	67	E	2416	2310
Weidler	Vancouver	20	C	2238	2170
Wheeler	Winning	3	A	315	265
Weidler	Williams	13	B	1482	1454
Broadway	Victoria	53	D	2469	2443
Weidler	Victoria	50	D	2341	2271
Winning	Vancouver	4	A	315	266
Overall Intersection Results (9:00 AM to 10:00 AM)					
Broadway	Flint	1	A	1265	1248
Broadway	Williams	19	B	2404	2420
Broadway	Vancouver	64	E	2201	2127
Weidler	Vancouver	21	C	2167	2114
Wheeler	Winning	3	A	357	316
Weidler	Williams	9	A	2202	2193
Broadway	Victoria	39	D	2032	2062
Weidler	Victoria	41	D	1979	1981
Winning	Vancouver	6	A	357	315

Midday Peak Period					
Overall Intersection Results (12:00 PM to 1:00 PM)					
Intersection		**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint	1	A	1082	1054
Broadway	Williams	24	C	2633	2564
Broadway	Vancouver	32	C	1946	1893
Weidler	Vancouver	25	C	2101	2068
Wheeler	Winning	2	A	179	159
Weidler	Williams	9	A	2311	2292
Broadway	Victoria	82	F	2323	2266
Weidler	Victoria	34	C	2017	1950
Winning	Vancouver	6	A	179	159
Overall Intersection Results (1:00 PM to 2:00 PM)					
Broadway	Flint	1	A	1250	1127
Broadway	Williams	33	C	2805	2500
Broadway	Vancouver	46	D	3270	3051
Weidler	Vancouver	83	F	1045	978
Wheeler	Winning	2	A	197	172
Weidler	Williams	18	B	2358	2262
Broadway	Victoria	336	F	2568	2257
Weidler	Victoria	185	F	2119	1898
Winning	Vancouver	11	B	197	172

PM Peak Period					
Overall Intersection Results (2:00 PM to 3:00 PM)					
Intersection		**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint	1	A	1442	1429
Broadway	Williams	24	C	2900	2832
Broadway	Vancouver	42	D	2372	2322
Weidler	Vancouver	198	F	2894	2465
Wheeler	Winning	3	A	195	177
Weidler	Williams	13	B	3059	2646
Broadway	Victoria	42	D	2586	2584
Weidler	Victoria	23	C	2682	2456
Winning	Vancouver	9	A	195	178
Overall Intersection Results (3:00 PM to 4:00 PM)					
Broadway	Flint	2	A	1285	1299
Broadway	Williams	26	C	2991	2804
Broadway	Vancouver	216	F	2493	2231
Weidler	Vancouver	208	F	3395	2748
Wheeler	Winning	4	A	279	244
Weidler	Williams	15	B	3526	2898
Broadway	Victoria	151	F	2645	2543
Weidler	Victoria	22	C	2996	2689
Winning	Vancouver	13	B	279	244
Overall Intersection Results (4:00 PM to 5:00 PM)					
Broadway	Flint	2	A	1302	1292
Broadway	Williams	28	C	2716	2652
Broadway	Vancouver	188	F	2224	2192
Weidler	Vancouver	231	F	3443	2738
Wheeler	Winning	5	A	287	270
Weidler	Williams	13	B	3398	2725
Broadway	Victoria	245	F	2359	2387
Weidler	Victoria	54	D	3009	2620
Winning	Vancouver	17	B	287	271
Overall Intersection Results (5:00 PM to 6:00 PM)					
Broadway	Flint	2	A	1409	1221
Broadway	Williams	30	C	2849	2476
Broadway	Vancouver	318	F	2276	1728
Weidler	Vancouver	394	F	3316	1722
Wheeler	Winning	6	A	346	221
Weidler	Williams	33	C	3217	1743
Broadway	Victoria	324	F	2453	2307
Weidler	Victoria	108	F	3069	2098
Winning	Vancouver	23	C	346	220

Option B2 Intersection Results v4.xlsm

AM Peak Period					
Overall Intersection Results (6:00 AM to 7:00 AM)					
Intersection		**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint	1	A	1257	1240
Broadway	Williams	17	B	2055	2029
Broadway	Vancouver	24	C	1801	1770
Weidler	Vancouver	15	B	1188	1174
Wheeler	Winning	1	A	160	140
Weidler	Williams	10	A	894	899
Broadway	Victoria	29	C	1808	1788
Weidler	Victoria	17	B	1591	1562
Winning	Vancouver	3	A	160	141
Overall Intersection Results (7:00 AM to 8:00 AM)					
Broadway	Flint	1	A	1318	1295
Broadway	Williams	19	B	2567	2509
Broadway	Vancouver	43	D	2493	2106
Weidler	Vancouver	21	C	1973	1868
Wheeler	Winning	2	A	204	164
Weidler	Williams	17	B	1277	1212
Broadway	Victoria	42	D	2335	2285
Weidler	Victoria	51	D	2233	2605
Winning	Vancouver	3	A	204	240
Overall Intersection Results (8:00 AM to 9:00 AM)					
Broadway	Flint	2	A	1387	1326
Broadway	Williams	24	C	2765	2660
Broadway	Vancouver	139	F	2416	2212
Weidler	Vancouver	179	F	2238	1938
Wheeler	Winning	3	A	315	249
Weidler	Williams	40	D	1482	1304
Broadway	Victoria	95	F	2469	2410
Weidler	Victoria	49	D	2341	2164
Winning	Vancouver	5	A	315	250
Overall Intersection Results (9:00 AM to 10:00 AM)					
Broadway	Flint	1	A	1265	1264
Broadway	Williams	21	C	2404	2449
Broadway	Vancouver	107	F	2201	2190
Weidler	Vancouver	161	F	2167	2186
Wheeler	Winning	4	A	357	324
Weidler	Williams	17	B	2202	2286
Broadway	Victoria	60	E	2032	2091
Weidler	Victoria	40	D	1979	2017
Winning	Vancouver	7	A	357	324

Midday Peak Period					
Overall Intersection Results (12:00 PM to 1:00 PM)					
Intersection		**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint	1	A	1082	1047
Broadway	Williams	24	C	2633	2549
Broadway	Vancouver	41	D	1946	1838
Weidler	Vancouver	42	D	2101	1956
Wheeler	Winning	2	A	179	151
Weidler	Williams	13	B	2311	2178
Broadway	Victoria	80	E	2323	2264
Weidler	Victoria	28	C	2017	1908
Winning	Vancouver	6	A	179	151
Overall Intersection Results (1:00 PM to 2:00 PM)					
Broadway	Flint	1	A	1250	1065
Broadway	Williams	36	D	2805	2436
Broadway	Vancouver	181	F	3270	2687
Weidler	Vancouver	555	F	1045	863
Wheeler	Winning	3	A	197	154
Weidler	Williams	38	D	2358	1949
Broadway	Victoria	353	F	2568	2225
Weidler	Victoria	182	F	2119	1662
Winning	Vancouver	11	B	197	154

PM Peak Period					
Overall Intersection Results (2:00 PM to 3:00 PM)					
Intersection		**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint	1	A	1442	1397
Broadway	Williams	26	C	2900	2776
Broadway	Vancouver	78	E	2372	2174
Weidler	Vancouver	243	F	2894	2157
Wheeler	Winning	3	A	195	162
Weidler	Williams	24	C	3059	2338
Broadway	Victoria	47	D	2586	2567
Weidler	Victoria	23	C	2682	2291
Winning	Vancouver	9	A	195	162
Overall Intersection Results (3:00 PM to 4:00 PM)					
Broadway	Flint	2	A	1285	1306
Broadway	Williams	28	C	2991	2786
Broadway	Vancouver	582	F	2493	2150
Weidler	Vancouver	236	F	3395	2579
Wheeler	Winning	4	A	279	240
Weidler	Williams	21	C	3526	2748
Broadway	Victoria	172	F	2645	2550
Weidler	Victoria	28	C	2996	2605
Winning	Vancouver	13	B	279	240
Overall Intersection Results (4:00 PM to 5:00 PM)					
Broadway	Flint	2	A	1302	1296
Broadway	Williams	28	C	2716	2637
Broadway	Vancouver	220	F	2224	2205
Weidler	Vancouver	228	F	3443	2753
Wheeler	Winning	5	A	287	274
Weidler	Williams	14	B	3398	2739
Broadway	Victoria	296	F	2359	2368
Weidler	Victoria	54	D	3009	2628
Winning	Vancouver	16	B	287	273
Overall Intersection Results (5:00 PM to 6:00 PM)					
Broadway	Flint	2	A	1409	1193
Broadway	Williams	31	C	2849	2456
Broadway	Vancouver	583	F	2276	1649
Weidler	Vancouver	467	F	3316	1581
Wheeler	Winning	6	A	346	211
Weidler	Williams	40	D	3217	1601
Broadway	Victoria	347	F	2453	2315
Weidler	Victoria	116	F	3069	1993
Winning	Vancouver	26	C	346	211

Option C1 Intersection Results v4.xlsm

AM Peak Period

Overall Intersection Results (6:00 AM to 7:00 AM)

Intersection		Delay (sec)	LOS	Input Volumes	Output Volumes
Broadway	Flint	1	A	1,257	1,329
Broadway	Williams	17	B	2,055	2,042
Broadway	Vancouver	25	C	1,801	1,860
Weidler	Vancouver	15	B	1,188	1,143
Wheeler	Winning	1	A	160	140
Weidler	Williams	10	A	894	913
Broadway	Victoria	30	C	1,808	1,785
Weidler	Victoria	17	B	1,591	1,562
Winning	Vancouver	3	A	160	140

Overall Intersection Results (7:00 AM to 8:00 AM)

Broadway	Flint	1	A	1,318	1,531
Broadway	Williams	20	B	2,567	2,594
Broadway	Vancouver	41	D	2,493	2,355
Weidler	Vancouver	18	B	1,973	1,829
Wheeler	Winning	2	A	204	169
Weidler	Williams	13	B	1,277	1,316
Broadway	Victoria	48	D	2,335	2,302
Weidler	Victoria	47	D	2,233	2,702
Winning	Vancouver	3	A	204	245

Overall Intersection Results (8:00 AM to 9:00 AM)

Broadway	Flint	2	A	1,387	1,567
Broadway	Williams	20	C	2,765	2,802
Broadway	Vancouver	70	E	2,416	2,522
Weidler	Vancouver	20	B	2,238	2,093
Wheeler	Winning	3	A	315	273
Weidler	Williams	12	B	1,482	1,501
Broadway	Victoria	56	E	2,469	2,453
Weidler	Victoria	52	D	2,341	2,300
Winning	Vancouver	4	A	315	274

Overall Intersection Results (9:00 AM to 10:00 AM)

Broadway	Flint	1	A	1,265	1,410
Broadway	Williams	20	C	2,404	2,465
Broadway	Vancouver	71	E	2,201	2,294
Weidler	Vancouver	21	C	2,167	2,033
Wheeler	Winning	3	A	357	327
Weidler	Williams	9	A	2,202	1,981
Broadway	Victoria	38	D	2,032	2,070
Weidler	Victoria	29	C	1,979	1,988
Winning	Vancouver	6	A	357	326

Midday Peak Period

Overall Intersection Results (12:00 PM to 1:00 PM)

Intersection		Delay (sec)	LOS	Input Volumes	Output Volumes
Broadway	Flint	1	A	1,082	1,233
Broadway	Williams	24	C	2,633	2,619
Broadway	Vancouver	29	C	1,946	2,072
Weidler	Vancouver	24	C	2,101	2,002
Wheeler	Winning	2	A	179	155
Weidler	Williams	9	A	2,311	2,117
Broadway	Victoria	100	F	2,323	2,255
Weidler	Victoria	23	C	2,017	1,986
Winning	Vancouver	6	A	179	155

Overall Intersection Results (1:00 PM to 2:00 PM)

Broadway	Flint	1	A	1,250	1,232
Broadway	Williams	35	D	2,805	2,523
Broadway	Vancouver	62	E	3,270	3,088
Weidler	Vancouver	55	E	1,045	952
Wheeler	Winning	2	A	197	168
Weidler	Williams	13	B	2,358	2,113
Broadway	Victoria	427	F	2,568	2,224
Weidler	Victoria	183	F	2,119	1,824
Winning	Vancouver	11	B	197	168

PM Peak Period

Overall Intersection Results (2:00 PM to 3:00 PM)

Intersection		Delay (sec)	LOS	Input Volumes	Output Volumes
Broadway	Flint	1	A	1,442	1,534
Broadway	Williams	25	C	2,900	2,859
Broadway	Vancouver	53	D	2,372	2,418
Weidler	Vancouver	201	F	2,894	2,405
Wheeler	Winning	3	A	195	175
Weidler	Williams	12	B	3,059	2,513
Broadway	Victoria	44	D	2,586	2,585
Weidler	Victoria	21	C	2,682	2,463
Winning	Vancouver	9	A	195	175

Overall Intersection Results (3:00 PM to 4:00 PM)

Broadway	Flint	2	A	1,285	1,420
Broadway	Williams	29	C	2,991	2,826
Broadway	Vancouver	211	F	2,493	2,379
Weidler	Vancouver	225	F	3,395	2,675
Wheeler	Winning	4	A	279	244
Weidler	Williams	15	B	3,526	2,738
Broadway	Victoria	162	F	2,645	2,545
Weidler	Victoria	22	C	2,996	2,702
Winning	Vancouver	13	B	279	245

Overall Intersection Results (4:00 PM to 5:00 PM)

Broadway	Flint	2	A	1,302	1,389
Broadway	Williams	29	C	2,716	2,715
Broadway	Vancouver	167	F	2,224	2,327
Weidler	Vancouver	238	F	3,443	2,722
Wheeler	Winning	5	A	287	273
Weidler	Williams	13	B	3,398	2,652
Broadway	Victoria	252	F	2,359	2,396
Weidler	Victoria	39	D	3,009	2,682
Winning	Vancouver	16	B	287	274

Overall Intersection Results (5:00 PM to 6:00 PM)

Broadway	Flint	2	A	1,409	1,322
Broadway	Williams	29	C	2,849	2,616
Broadway	Vancouver	314	F	2,276	1,889
Weidler	Vancouver	243	F	3,316	2,322
Wheeler	Winning	5	A	346	242
Weidler	Williams	14	B	3,217	2,275
Broadway	Victoria	318	F	2,453	2,301
Weidler	Victoria	108	F	3,069	2,426
Winning	Vancouver	18	B	346	241

Option C2 Intersection Results v4.xlsm

AM Peak Period					
Overall Intersection Results (6:00 AM to 7:00 AM)					
Intersection		**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint	1	A	1257	1329
Broadway	Williams	17	B	2055	2042
Broadway	Vancouver	25	C	1801	1858
Weidler	Vancouver	15	B	1188	1142
Wheeler	Winning	1	A	160	140
Weidler	Williams	10	A	894	912
Broadway	Victoria	31	C	1808	1785
Weidler	Victoria	17	B	1591	1563
Winning	Vancouver	3	A	160	140
Overall Intersection Results (7:00 AM to 8:00 AM)					
Broadway	Flint	1	A	1318	1533
Broadway	Williams	20	C	2567	2599
Broadway	Vancouver	41	D	2493	2358
Weidler	Vancouver	18	B	1973	1831
Wheeler	Winning	2	A	204	170
Weidler	Williams	13	B	1277	1317
Broadway	Victoria	53	D	2335	2303
Weidler	Victoria	48	D	2233	2719
Winning	Vancouver	3	A	204	243
Overall Intersection Results (8:00 AM to 9:00 AM)					
Broadway	Flint	2	A	1387	1561
Broadway	Williams	20	B	2765	2800
Broadway	Vancouver	98	F	2416	2498
Weidler	Vancouver	20	B	2238	2076
Wheeler	Winning	3	A	315	271
Weidler	Williams	12	B	1482	1485
Broadway	Victoria	53	D	2469	2453
Weidler	Victoria	52	D	2341	2288
Winning	Vancouver	4	A	315	273
Overall Intersection Results (9:00 AM to 10:00 AM)					
Broadway	Flint	1	A	1265	1414
Broadway	Williams	20	B	2404	2464
Broadway	Vancouver	82	F	2201	2307
Weidler	Vancouver	20	C	2167	2042
Wheeler	Winning	3	A	357	327
Weidler	Williams	9	A	2202	1991
Broadway	Victoria	38	D	2032	2068
Weidler	Victoria	29	C	1979	1996
Winning	Vancouver	6	A	357	325

Midday Peak Period					
Overall Intersection Results (12:00 PM to 1:00 PM)					
Intersection		**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint	1	A	1082	1235
Broadway	Williams	24	C	2633	2612
Broadway	Vancouver	33	C	1946	2062
Weidler	Vancouver	24	C	2101	1991
Wheeler	Winning	2	A	179	154
Weidler	Williams	9	A	2311	2108
Broadway	Victoria	88	F	2323	2247
Weidler	Victoria	21	C	2017	1971
Winning	Vancouver	6	A	179	154
Overall Intersection Results (1:00 PM to 2:00 PM)					
Broadway	Flint	1	A	1250	1221
Broadway	Williams	35	C	2805	2553
Broadway	Vancouver	113	F	3270	3041
Weidler	Vancouver	53	D	1045	915
Wheeler	Winning	2	A	197	166
Weidler	Williams	13	B	2358	2075
Broadway	Victoria	369	F	2568	2254
Weidler	Victoria	193	F	2119	1822
Winning	Vancouver	11	B	197	166

PM Peak Period					
Overall Intersection Results (2:00 PM to 3:00 PM)					
Intersection		**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint	1	A	1442	1529
Broadway	Williams	25	C	2900	2861
Broadway	Vancouver	77	E	2372	2397
Weidler	Vancouver	200	F	2894	2394
Wheeler	Winning	2	A	195	174
Weidler	Williams	12	B	3059	2503
Broadway	Victoria	44	D	2586	2585
Weidler	Victoria	21	C	2682	2453
Winning	Vancouver	9	A	195	175
Overall Intersection Results (3:00 PM to 4:00 PM)					
Broadway	Flint	2	A	1285	1418
Broadway	Williams	29	C	2991	2836
Broadway	Vancouver	209	F	2493	2378
Weidler	Vancouver	219	F	3395	2706
Wheeler	Winning	4	A	279	244
Weidler	Williams	15	B	3526	2770
Broadway	Victoria	158	F	2645	2549
Weidler	Victoria	22	C	2996	2719
Winning	Vancouver	12	B	279	243
Overall Intersection Results (4:00 PM to 5:00 PM)					
Broadway	Flint	2	A	1302	1383
Broadway	Williams	29	C	2716	2706
Broadway	Vancouver	170	F	2224	2318
Weidler	Vancouver	235	F	3443	2733
Wheeler	Winning	5	A	287	273
Weidler	Williams	13	B	3398	2668
Broadway	Victoria	233	F	2359	2393
Weidler	Victoria	41	D	3009	2681
Winning	Vancouver	17	B	287	273
Overall Intersection Results (5:00 PM to 6:00 PM)					
Broadway	Flint	2	A	1409	1298
Broadway	Williams	29	C	2849	2623
Broadway	Vancouver	396	F	2276	1799
Weidler	Vancouver	264	F	3316	2184
Wheeler	Winning	5	A	346	220
Weidler	Williams	18	B	3217	2159
Broadway	Victoria	268	F	2453	2330
Weidler	Victoria	106	F	3069	2353
Winning	Vancouver	18	B	346	220

Option c1 SB Intersection Results v4.xlsm

AM Peak Period					
Overall Intersection Results (6:00 AM to 7:00 AM)					
Intersection		**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint	1	A	1257	1238
Broadway	Williams	17	B	2055	2020
Broadway	Vancouver	24	C	1801	1768
Weidler	Vancouver	15	B	1188	1143
Wheeler	Winning	1	A	160	139
Weidler	Williams	10	B	894	873
Broadway	Victoria	31	C	1808	1788
Weidler	Victoria	16	B	1591	1549
Winning	Vancouver	3	A	160	140
Overall Intersection Results (7:00 AM to 8:00 AM)					
Broadway	Flint	1	A	1318	1277
Broadway	Williams	24	C	2567	2449
Broadway	Vancouver	59	E	2493	2047
Weidler	Vancouver	50	D	1973	1674
Wheeler	Winning	2	A	204	152
Weidler	Williams	36	D	1277	1090
Broadway	Victoria	67	E	2335	2256
Weidler	Victoria	44	D	2233	2694
Winning	Vancouver	4	A	204	245
Overall Intersection Results (8:00 AM to 9:00 AM)					
Broadway	Flint	2	A	1387	1227
Broadway	Williams	33	C	2765	2356
Broadway	Vancouver	232	F	2416	2076
Weidler	Vancouver	295	F	2238	1858
Wheeler	Winning	3	A	315	225
Weidler	Williams	66	E	1482	1237
Broadway	Victoria	478	F	2469	2123
Weidler	Victoria	70	E	2341	2173
Winning	Vancouver	5	A	315	226
Overall Intersection Results (9:00 AM to 10:00 AM)					
Broadway	Flint	1	A	1265	1249
Broadway	Williams	30	C	2404	2382
Broadway	Vancouver	203	F	2201	2185
Weidler	Vancouver	332	F	2167	2044
Wheeler	Winning	4	A	357	316
Weidler	Williams	41	D	2202	2146
Broadway	Victoria	681	F	2032	2069
Weidler	Victoria	38	D	1979	1973
Winning	Vancouver	8	A	357	316

Midday Peak Period					
Overall Intersection Results (12:00 PM to 1:00 PM)					
Intersection		**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint	1	A	1082	1063
Broadway	Williams	23	C	2633	2562
Broadway	Vancouver	30	C	1946	1902
Weidler	Vancouver	25	C	2101	2071
Wheeler	Winning	2	A	179	159
Weidler	Williams	10	A	2311	2295
Broadway	Victoria	83	F	2323	2261
Weidler	Victoria	20	B	2017	1973
Winning	Vancouver	6	A	179	159
Overall Intersection Results (1:00 PM to 2:00 PM)					
Broadway	Flint	1	A	1250	1119
Broadway	Williams	33	C	2805	2515
Broadway	Vancouver	61	E	3270	3060
Weidler	Vancouver	52	D	1045	957
Wheeler	Winning	2	A	197	172
Weidler	Williams	13	B	2358	2298
Broadway	Victoria	391	F	2568	2264
Weidler	Victoria	151	F	2119	1916
Winning	Vancouver	11	B	197	172

PM Peak Period					
Overall Intersection Results (2:00 PM to 3:00 PM)					
Intersection		**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint	1	A	1442	1423
Broadway	Williams	25	C	2900	2826
Broadway	Vancouver	46	D	2372	2314
Weidler	Vancouver	207	F	2894	2441
Wheeler	Winning	2	A	195	177
Weidler	Williams	13	B	3059	2623
Broadway	Victoria	42	D	2586	2584
Weidler	Victoria	20	B	2682	2432
Winning	Vancouver	9	A	195	177
Overall Intersection Results (3:00 PM to 4:00 PM)					
Broadway	Flint	2	A	1285	1302
Broadway	Williams	28	C	2991	2809
Broadway	Vancouver	220	F	2493	2235
Weidler	Vancouver	208	F	3395	2750
Wheeler	Winning	4	A	279	245
Weidler	Williams	16	B	3526	2900
Broadway	Victoria	159	F	2645	2547
Weidler	Victoria	20	B	2996	2694
Winning	Vancouver	12	B	279	245
Overall Intersection Results (4:00 PM to 5:00 PM)					
Broadway	Flint	2	A	1302	1296
Broadway	Williams	29	C	2716	2660
Broadway	Vancouver	196	F	2224	2197
Weidler	Vancouver	231	F	3443	2738
Wheeler	Winning	5	A	287	270
Weidler	Williams	14	B	3398	2724
Broadway	Victoria	243	F	2359	2392
Weidler	Victoria	35	C	3009	2661
Winning	Vancouver	17	B	287	271
Overall Intersection Results (5:00 PM to 6:00 PM)					
Broadway	Flint	2	A	1409	1245
Broadway	Williams	28	C	2849	2590
Broadway	Vancouver	301	F	2276	1850
Weidler	Vancouver	234	F	3316	2437
Wheeler	Winning	5	A	346	247
Weidler	Williams	16	B	3217	2443
Broadway	Victoria	304	F	2453	2317
Weidler	Victoria	100	F	3069	2420
Winning	Vancouver	19	B	346	245

Option c2 SB Intersection Results v4.xlsm

AM Peak Period					
Overall Intersection Results (6:00 AM to 7:00 AM)					
Intersection		**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint	1	A	1,257	1,241
Broadway	Williams	17	B	2,055	2,030
Broadway	Vancouver	24	C	1,801	1,772
Weidler	Vancouver	15	B	1,188	1,174
Wheeler	Winning	1	A	160	140
Weidler	Williams	10	B	894	899
Broadway	Victoria	30	C	1,808	1,790
Weidler	Victoria	16	B	1,591	1,564
Winning	Vancouver	3	A	160	141
Overall Intersection Results (7:00 AM to 8:00 AM)					
Broadway	Flint	1	A	1,318	1,273
Broadway	Williams	25	C	2,567	2,461
Broadway	Vancouver	60	E	2,493	2,041
Weidler	Vancouver	53	D	1,973	1,733
Wheeler	Winning	2	A	204	156
Weidler	Williams	36	D	1,277	1,129
Broadway	Victoria	70	E	2,335	2,259
Weidler	Victoria	45	D	2,233	2,702
Winning	Vancouver	3	A	204	244
Overall Intersection Results (8:00 AM to 9:00 AM)					
Broadway	Flint	2	A	1,387	1,249
Broadway	Williams	32	C	2,765	2,429
Broadway	Vancouver	236	F	2,416	2,111
Weidler	Vancouver	336	F	2,238	1,865
Wheeler	Winning	3	A	315	226
Weidler	Williams	65	E	1,482	1,247
Broadway	Victoria	428	F	2,469	2,188
Weidler	Victoria	54	D	2,341	2,167
Winning	Vancouver	5	A	315	227
Overall Intersection Results (9:00 AM to 10:00 AM)					
Broadway	Flint	1	A	1,265	1,263
Broadway	Williams	30	C	2,404	2,418
Broadway	Vancouver	199	F	2,201	2,182
Weidler	Vancouver	351	F	2,167	2,027
Wheeler	Winning	4	A	357	314
Weidler	Williams	40	D	2,202	2,138
Broadway	Victoria	592	F	2,032	2,100
Weidler	Victoria	37	D	1,979	1,949
Winning	Vancouver	8	A	357	315

Midday Peak Period						
Overall Intersection Results (12:00 PM to 1:00 PM)						
Intersection		**Sig**	**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint		1	A	1,082	1,056
Broadway	Williams	X	24	C	2,633	2,561
Broadway	Vancouver	X	32	C	1,946	1,887
Weidler	Vancouver	X	24	C	2,101	2,064
Wheeler	Winning	X	2	A	179	159
Weidler	Williams	X	9	A	2,311	2,288
Broadway	Victoria	X	83	F	2,323	2,265
Weidler	Victoria	X	23	C	2,017	1,958
Winning	Vancouver		6	A	179	159
Overall Intersection Results (1:00 PM to 2:00 PM)						
Broadway	Flint		1	A	1,250	1,103
Broadway	Williams	X	33	C	2,805	2,518
Broadway	Vancouver	X	100	F	3,270	3,002
Weidler	Vancouver	X	56	E	1,045	922
Wheeler	Winning	X	2	A	197	170
Weidler	Williams	X	13	B	2,358	2,255
Broadway	Victoria	X	330	F	2,568	2,277
Weidler	Victoria	X	168	F	2,119	1,859
Winning	Vancouver		10	B	197	170

PM Peak Period					
Overall Intersection Results (2:00 PM to 3:00 PM)					
Intersection		**Delay (sec)**	**LOS**	**Input Volumes**	**Output Volumes**
Broadway	Flint	1	A	1,442	1,412
Broadway	Williams	25	C	2,900	2,827
Broadway	Vancouver	75	E	2,372	2,276
Weidler	Vancouver	202	F	2,894	2,430
Wheeler	Winning	2	A	195	174
Weidler	Williams	13	B	3,059	2,613
Broadway	Victoria	42	D	2,586	2,583
Weidler	Victoria	21	C	2,682	2,423
Winning	Vancouver	9	A	195	175
Overall Intersection Results (3:00 PM to 4:00 PM)					
Broadway	Flint	2	A	1,285	1,306
Broadway	Williams	27	C	2,991	2,812
Broadway	Vancouver	235	F	2,493	2,234
Weidler	Vancouver	207	F	3,395	2,747
Wheeler	Winning	4	A	279	244
Weidler	Williams	16	B	3,526	2,898
Broadway	Victoria	152	F	2,645	2,550
Weidler	Victoria	20	C	2,996	2,702
Winning	Vancouver	13	B	279	244
Overall Intersection Results (4:00 PM to 5:00 PM)					
Broadway	Flint	2	A	1,302	1,299
Broadway	Williams	28	C	2,716	2,662
Broadway	Vancouver	196	F	2,224	2,203
Weidler	Vancouver	229	F	3,443	2,751
Wheeler	Winning	5	A	287	272
Weidler	Williams	14	B	3,398	2,736
Broadway	Victoria	226	F	2,359	2,398
Weidler	Victoria	35	D	3,009	2,665
Winning	Vancouver	17	B	287	273
Overall Intersection Results (5:00 PM to 6:00 PM)					
Broadway	Flint	2	A	1,409	1,211
Broadway	Williams	28	C	2,849	2,596
Broadway	Vancouver	374	F	2,276	1,754
Weidler	Vancouver	234	F	3,316	2,378
Wheeler	Winning	5	A	346	227
Weidler	Williams	15	B	3,217	2,404
Broadway	Victoria	269	F	2,453	2,330
Weidler	Victoria	99	F	3,069	2,375
Winning	Vancouver	17	B	346	226