The Overlake Access Ramp

at the Interchange of SR 520 and 148th Avenue NE

Interchange Justification Report

Prepared by:
HDR Engineering
February 2011

Interchange Justification Report

Interchange of SR 520 and 148th Avenue NE
The Overlake Access Ramp

This ***Interchange Justification Report***, prepared under my direct supervision, has been prepared in accordance with RCW 18.43 and appropriate Washington State Department of Transportation manuals.

☒ **IJR Engineer of Record**

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Date: 6/30, 2011

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Introduction

Purpose

The purpose of this interchange justification report (IJR) is to investigate the operational feasibility of constructing an interchange modification to the 148th Avenue NE interchange on State Route 520 (SR 520). This justification report is prepared based on guidelines identified by the Washington State Department of Transportation's (WSDOT's) Chapter 550 Interchange Justification Report of the Design Manual M 22-01.06. This report was prepared for submittal to WSDOT for approval.

Project Location

The proposed modification is referred to as "The Overlake Access Ramp." It provides for a "through" traffic movement at the existing 148th Avenue NE eastbound off-ramp via a grade separated intersection of the proposed slip ramp and the existing 148th Avenue NE arterial. The location of this interchange is shown in **Figure 1.** The proposed modification does not increase or decrease the total number of access points along SR 520.

Project Proposal

This project proposes an access revision to the SR 520 / 148th Avenue NE Interchange. Specifically, a through movement at the eastbound ramp terminal is proposed to be added. Although this movement could be physically accommodated by a simple signal and channelization modification at the ramp terminal, the operational performance of that modification would result in added congestion and delay at this interchange. Therefore, a grade separated intersection is proposed to accommodate the proposed through movement. This will result in improved traffic operations at all adjacent intersections through dispersion of existing trips as well as expected future growth as documented in this report. Specifically, this revision will improve ramp terminal operations and local intersection operations by creating a more direct connection between the off ramp and the local trip destinations.

In order to construct a new single lane grade separated slip ramp under 148th Avenue NE, the existing off-ramp terminal to southbound 148th Avenue NE will be relocated approximated 100 feet to the north (see Figure 28). This relocation will result in proper alignment of the eastbound on- and off-ramps and well as an increase in limited access to the south. The proposed new "Overlake Access Slip ramp" will go under 148th Avenue NE and will terminate with a proposed new roundabout for a ramp terminal intersection control type. This new ramp terminal intersection will be located at approximate location of 150th Avenue NE and NE 26th Street. In addition, this project proposal includes a new pedestrian bridge over SR 520 adjacent to 148th Avenue NE. This new pedestrian bridge will accommodate a multiuse non-motorized

trail and would connect the SR 520 Regional Shared Use trail on the north side of the interchange to a location south of the interchange.

Project Development

The Overlake Access Ramp project initially emerged in 2001 from the joint Bellevue and Redmond North and South Study. It received strong support from the cities of Bellevue and Redmond in the Overlake Neighborhood Plan Update. In 2008, this project was adopted to the Redmond Transportation Facilities Plan (project ID: RED-OV-096.1). Several studies have been done over the years in the area. These studies include the Bellevue Redmond Overlake Transportation Study (BROTS), the 150th Avenue Crossing Study, the Bel-Red Corridor Study, the Overlake Neighborhood Plan and the 152nd Avenue NE Corridor Study.

Study Area

The study area for the IJR includes SR 520 eastbound from 124th Avenue NE to NE 40th Street since this proposed modification to the 148th interchange will have no impact to westbound traffic volumes. The study area also includes the proposed ramp terminal and 148th Avenue NE between NE 24th Street and NE 29th Place. The study area was agreed on at the first IJR support team meeting in July 2010 and was documented in the "Methods and Assumptions Memo."

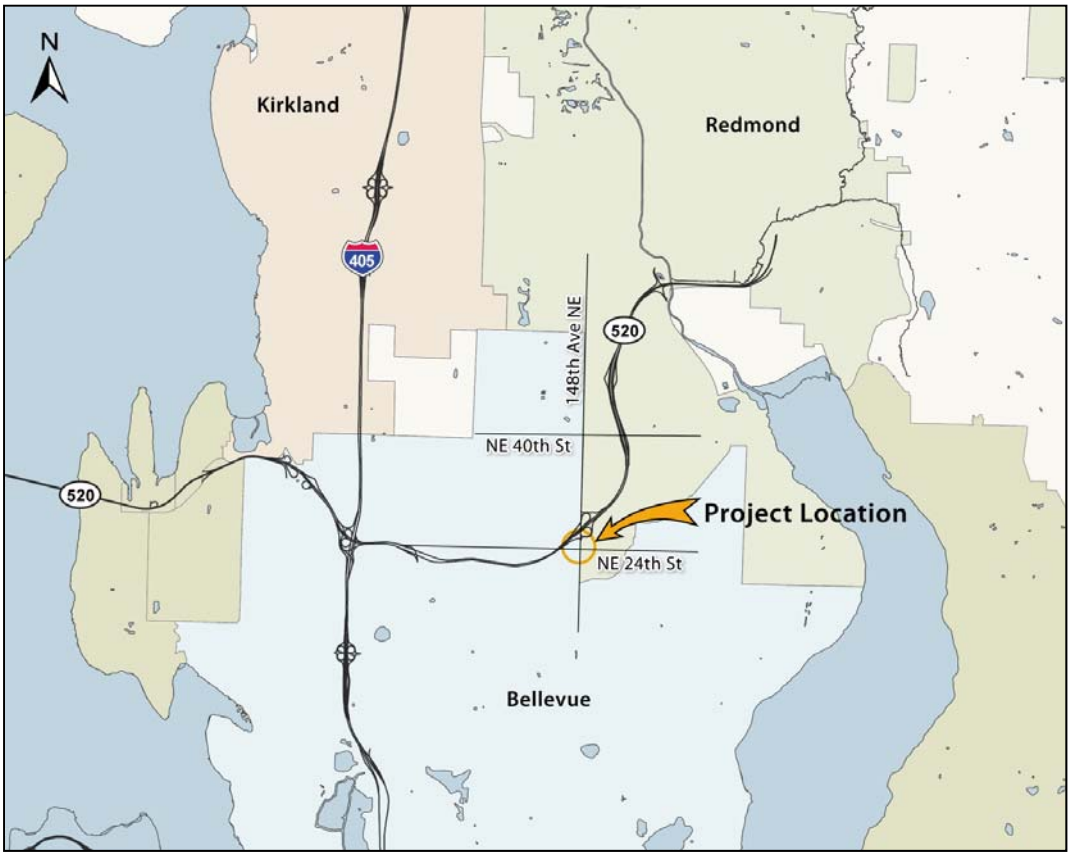

Figure 1: Vicinity Map

Policy Point 1: Need for the Access Point Revision

The SR 520/148th Avenue NE interchange is a full access partial clover leaf interchange providing access to the Overlake area spanning the jurisdictions of Redmond and Bellevue. According to the latest WSDOT published "2010 Ramps and Roadways", this interchange serves 52,000 daily vehicular trips accessing (to and from) SR 520. Looking holistically at the transportation infrastructure providing access to and from SR 520 within this transportation sub-area (Overlake Area), it is important to also consider the next interchange to the east – SR 520/NE 40th Street – which was included in the project study area. This interchange is approximately 1.0 mile east of the SR 520/148th Avenue NE interchange (measured center to center). The SR 520/NE 40th Street interchange serves 23,330 daily vehicular trips access (to and from) SR 520.

As presented in the existing traffic conditions section of this report, four out of the five off-ramps serving these two interchanges are currently failing from an LOS perspective during the morning peak. Due to these high traffic demands, off-ramp queues can regularly extend nearly to the mainline of SR 520, and occasionally even backing up onto the mainline.

WSDOT Signal Operations staff has worked closely over the years with both Bellevue's and Redmond's operations staff to optimize signal timing at these ramp terminals in an effort to reduce queues and maximize throughput capacity.

In addition, both jurisdictions have made a number of local street improvements in these areas to address increasing demands. Additional local street improvements are programmed for the future and these improvements have been considered under future modeling scenarios.

As documented later in this report, future travel demands will increase in the study area due to increasing levels of residential and commercial activity in the Overlake Village Area. The Microsoft campus, located a half mile north and east of the 148th Avenue NE interchange, currently provides office space for 40,000 employees at their Redmond campus and this is expected to grow in the future. In addition, there are current plans to redevelop the Overlake Village area and this will place further demands on the existing transportation infrastructure. Continued and increased operational degradation of this interchange as well as the next interchange to the east (SR 520/40th Street NE) is predicted to occur in spite of programmed local street improvements and a significant increase in mode split by transit, HOV, and non-motorized trips in future.

This proposed access revision will provide a direct measurable benefit to SR 520 mainline as well as all three existing eastbound off-ramps (SR 520 EB to SB 148th Avenue NE, SR 520 EB to NB 148th Avenue NE, and SR 520 EB to 40th Street NE) within the study area that are currently failing or predicted to fail in the future from an LOS perspective as documented later in this report.

Existing Roadway System

The existing roadway network is shown in **Figure 2**. SR 520 is a six-lane east-west freeway extending from Interstate 5 in the city of Seattle to the city of Redmond. This critical transportation corridor connects Eastside communities including Bellevue, Kirkland, Redmond, Medina, Hunts Point, Clyde Hill, Yarrow Point, and Seattle within King County. As part of this regional multimodal corridor, SR 520 has a non-motorized bike trail along north side of the freeway east of I-405.

The 148th Avenue NE roadway is a five-lane north-south major arterial that situates on the boundary of the cities of Bellevue and Redmond. It serves a major thoroughfare from/to SR 520 and a major corridor for north-south commuter traffic. NE 24th Street is a five-lane east-west major arterial between the city of Bellevue and the city of Redmond. It is a multimodal corridor in the study area that connects the Overlake Urban Center (Redmond) with the city of Bellevue.

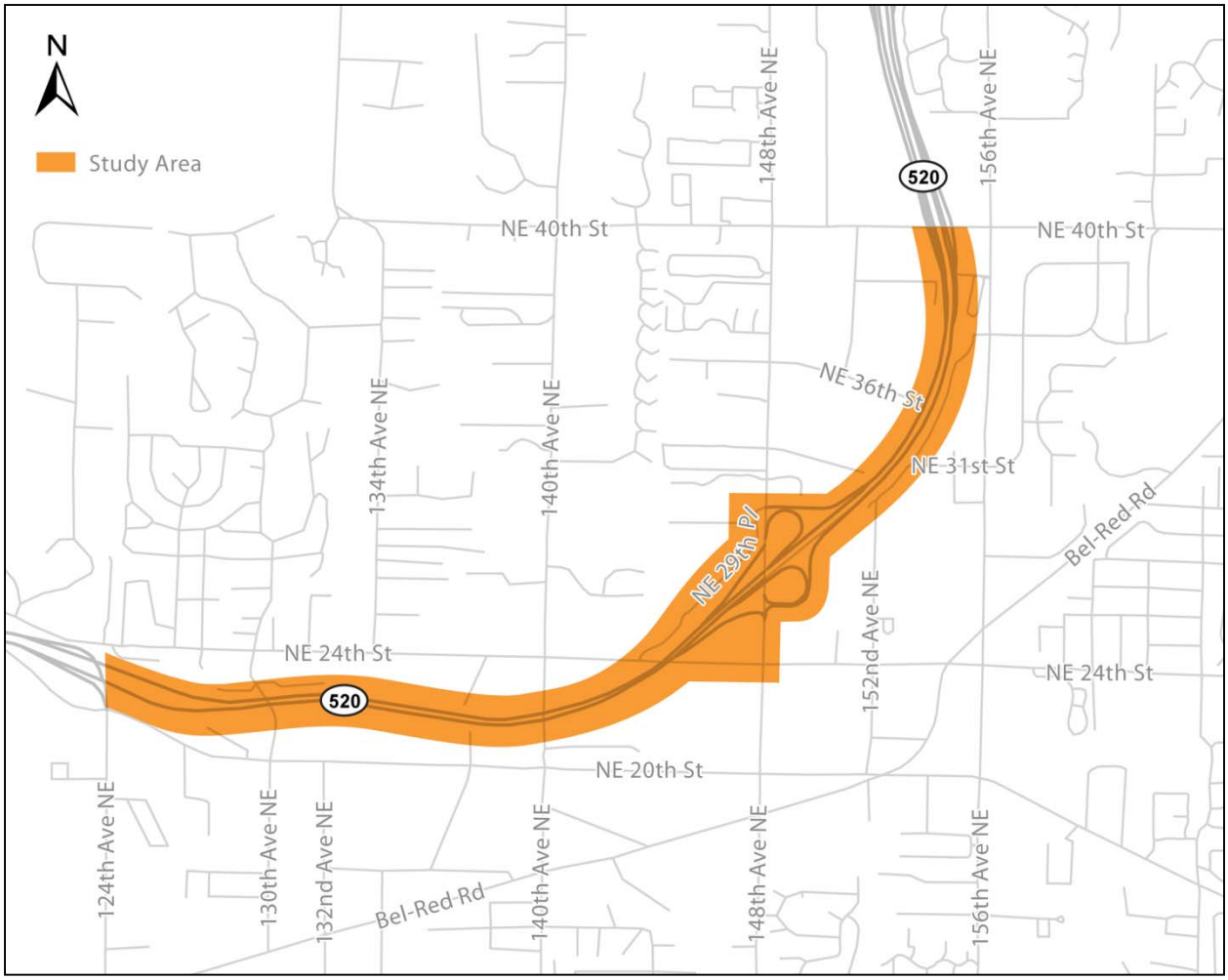

Figure 2: Study Area Map

Existing intersection geometry and number of lanes along roadway in the study area are presented in **Figure 3**.

Data Collection and Traffic Volumes

Traffic Volumes contained in this report were obtained from WSDOT and the City of Redmond. Intersection turning movement counts (TMCs) were conducted at two intersections of 148th Avenue NE / NE 24th Street and 148th Avenue NE / NE 29th Place on June 10, 2010. The ramp and freeway traffic volumes were requested from WSDOT Northwest Region Freeway Operations. Existing AM and PM peak hour turning movement volumes at intersections and ramp terminals along 148th Avenue NE and NE 40th Street are shown in **Figure 4** and **Figure 5**.

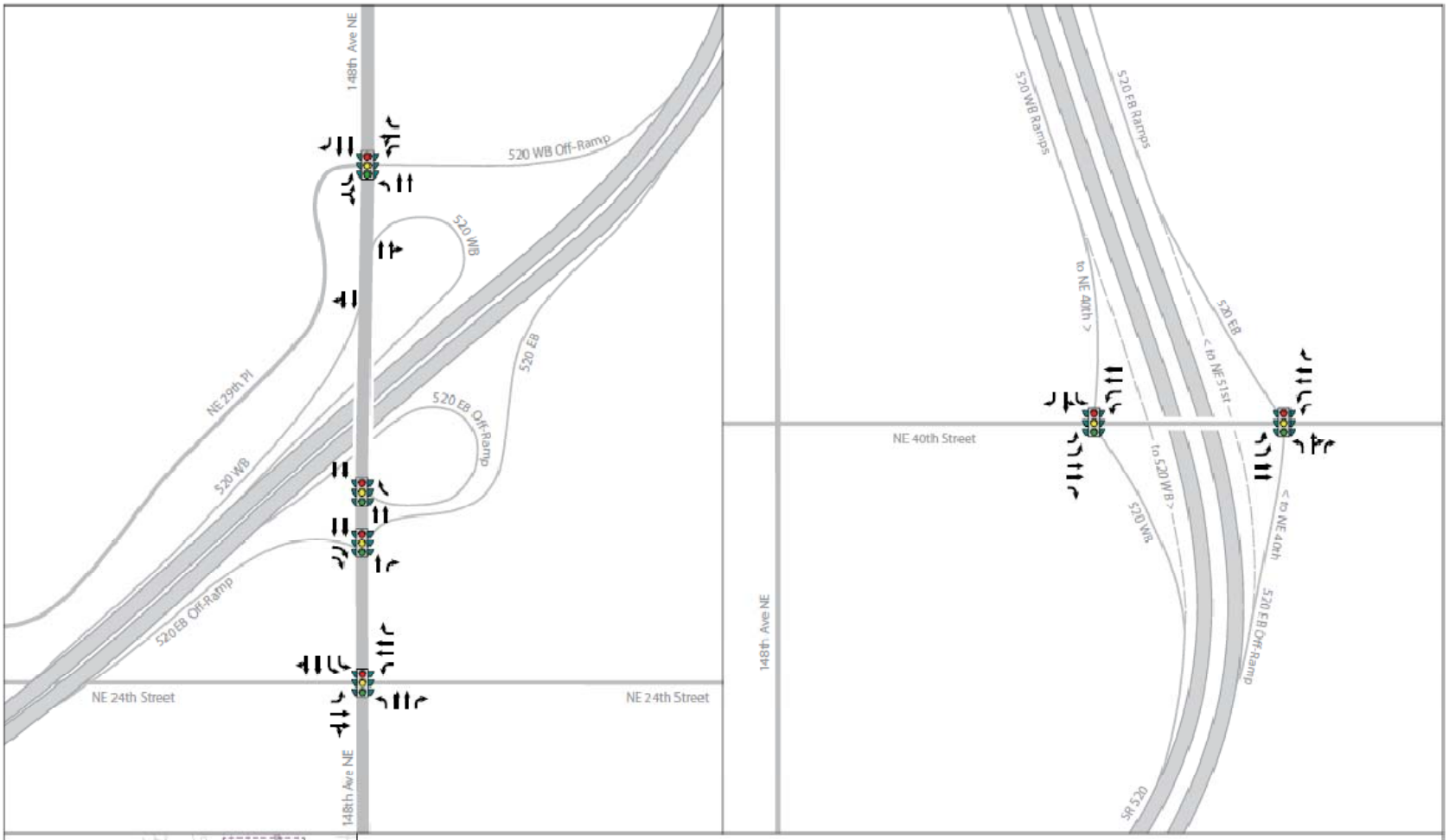

Figure 3

Existing Channelization and Traffic Control

SR 520 Overlake Access Ramp – Interchange Justification Report

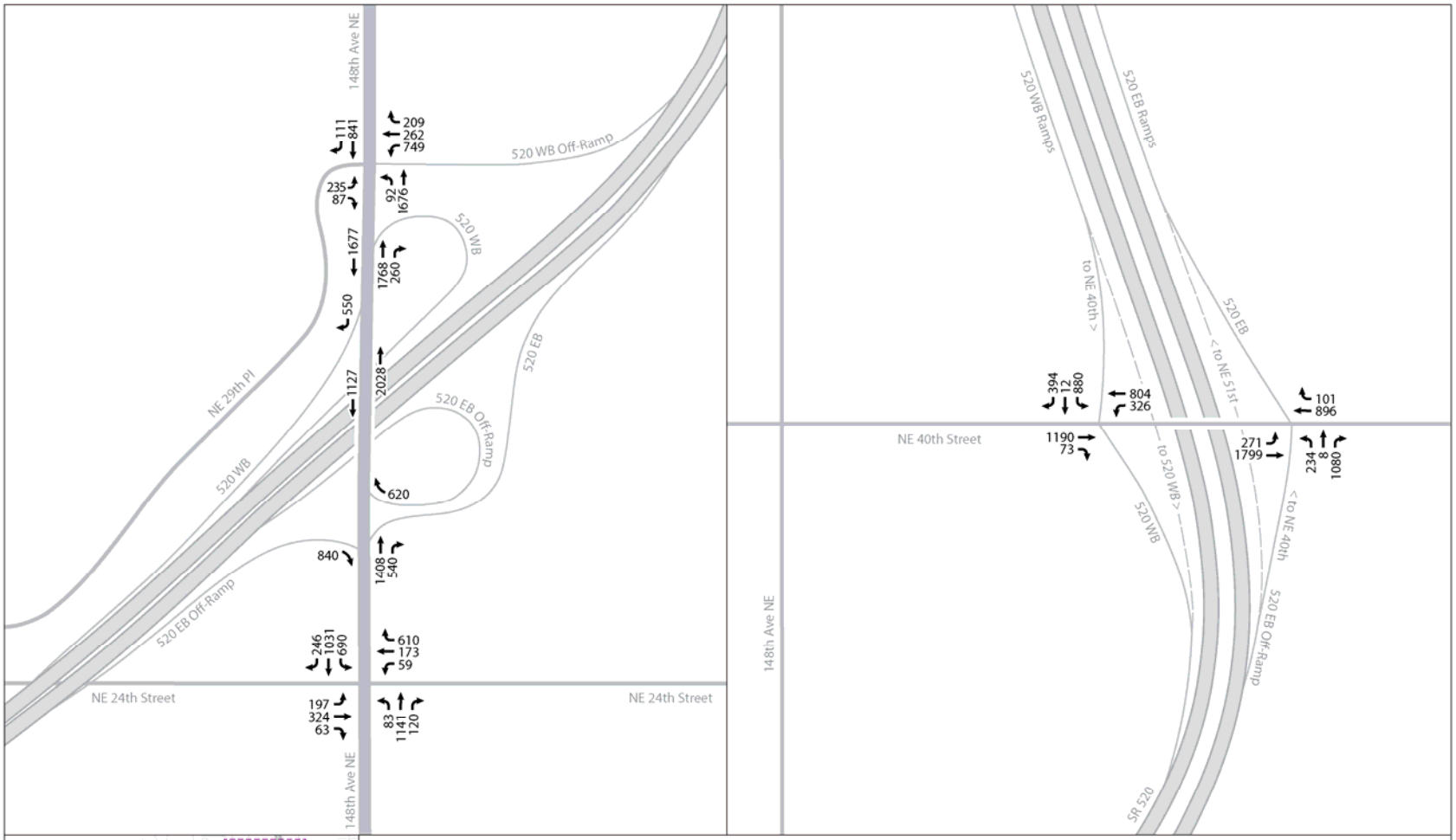

Figure 4

Existing AM Peak Hour Traffic Volumes
148th Ave NE / NE 40th Street

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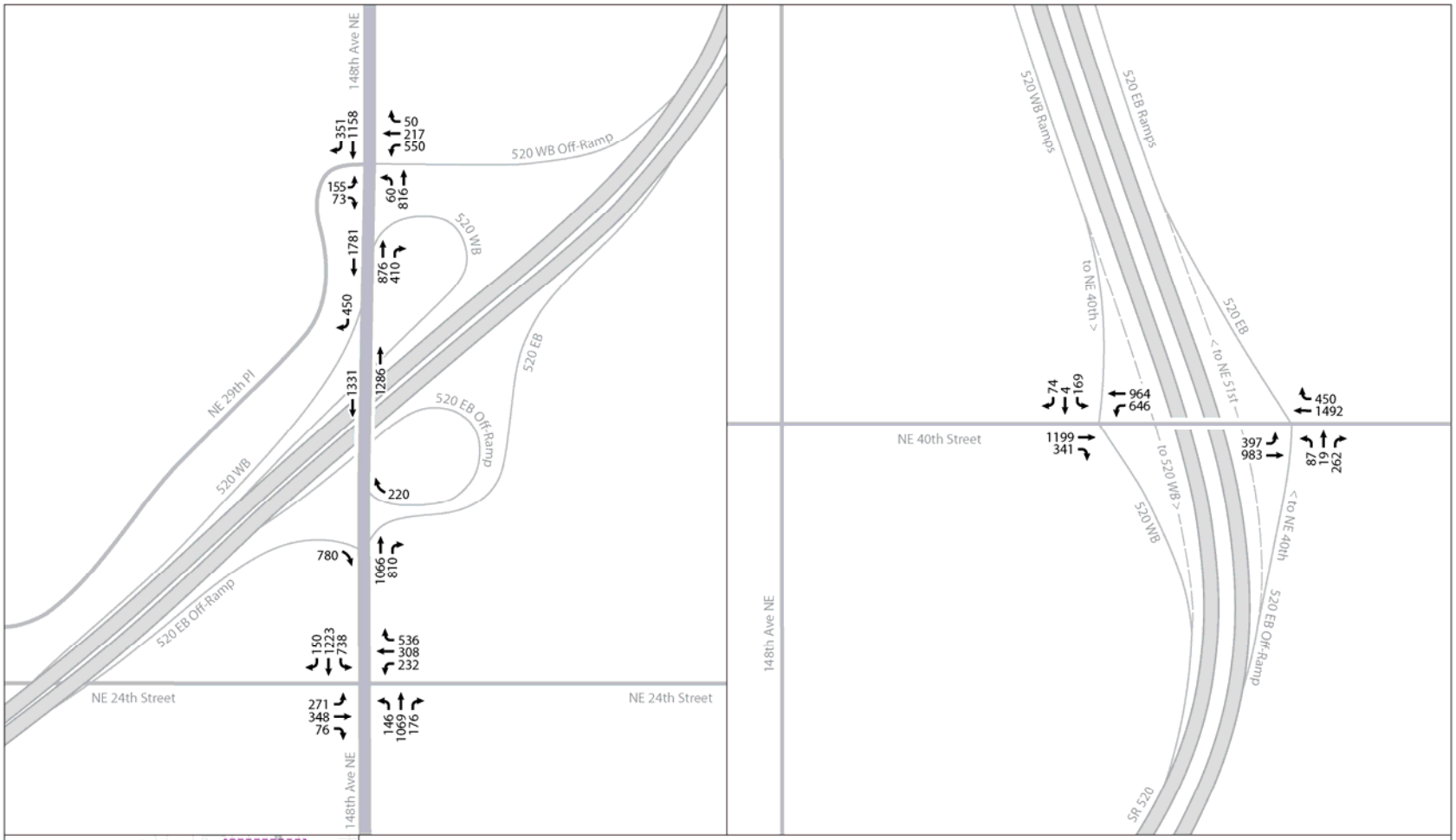

Figure 5

Existing PM Peak Hour Traffic Volumes
148th Ave NE / NE 40th Street

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Future Roadway and Transit Network

Major future changes or improvements within the study area are shown below in **Table 1** without the proposed Overlake Access Ramp. These proposed changes include SR 520 Eastside HOV Lane Restripe, 124th Avenue NE interchange improvement, eastbound SR 520 auxiliary lane between 124th Avenue NE and 148th Avenue NE, capacity improvement at the intersection of 148th Avenue NE and NE 24th Street, 152nd Avenue NE rechannelization, East Link Light Rail, King County Metro Bus Rapid Transit (Redmond-Bellevue), and two pedestrian bridge overpasses of SR 520 at 152nd Avenue NE and south of NE 40th Street. Detailed roadway and transit improvements outside of the study area, as well as non-motorized improvements, are discussed as part of the future travel demand model in the next section.

Table 1: Proposed Roadway and Transit Improvements by Horizon Years

Year	SR 520 Eastside HOV Lane Restripe	124th Avenue NE Interchange	Eastbound SR 520 auxiliary	Intersection of 148th Avenue NE and NE 24th Street	152nd Avenue NE Rechannelization	East Link Light Rail	King County Metro Bus Rapid Transit	Pedestrian Bridges over SR 520
2015	Yes	No	No	No	No	No	Yes	Yes
2035	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes

Travel Demand Forecast

Travel Demand Forecasting Methodology

In order to determine the future needs of the study area, travel demand modeling analysis is required to evaluate future year No-Build (without Overlake Access Ramp) and Build (with Overlake Access Ramp) scenarios. For this study, future traffic volumes for Year 2015 (year of opening) and Year 2035 (design year) were generated using the calibrated BKR Travel Demand Models (City of Redmond version) and Puget Sound regional EMME travel demand forecast models. Zonal and network details in the city of Redmond area of Bellevue-Kirkland-Redmond (BKR) model were updated in conjunction with the City of Redmond EMME model.

Kirkland-Redmond (BKR) EMME Travel Demand Forecasting Models (MP6-R10 and MP30-R5.5) were updated for both 2015 and 2035 future scenario analysis. The updates include Redmond area land use interpolation for 2015 and 2035, Redmond Transportation Facilities Plan (TFP) for 2015 and Redmond Transportation Master Plan (TMP) for 2035.

The Year of Opening and the Design Year networks were checked to ensure that the future projects are represented in the City of Redmond EMME model. Validation of the base year model was performed at the screen line level for AM peak hour and PM peak hour time periods. After the validation was completed for the base year model, the procedure uses the base year model and the future 2030 model and interpolates the land use to get the opening year (2015) model and extrapolates them to get the design year (2035) model.

Future intersection volumes for all scenarios were post processed based on the methodology recommended by NCHRP Report 255 (Highway Traffic Data for Urbanized Area Project Planning and Design). The forecasted intersection volumes were balanced using a bi-proportional OD matrix balancing technique in link level as well as turning movement level with freeway ramp volumes as control totals.

Travel Forecast Model Assumptions

The City of Redmond travel demand forecasting model has a refined Traffic Analysis Zone (TAZ) structure that includes more local roads in the Redmond area. In addition, the Redmond model has the most updated network and the land use data for the Redmond area. However, the BKR model has the most updated network for Bellevue and Kirkland as well the freeway facilities on the eastside. Therefore, when the BKR model is updated or combined in conjunction with the City of Redmond model, the resulting model is able to provide the most reasonable forecasts for freeways, ramps, and arterials as well as for the local surface streets in the study area.

The projects listed below are assumed to be completed by the year 2015. These committed projects are included in all future forecast scenarios.

2015 Travel Demand Modeling Assumptions

City, WSDOT, and HDR staff met to discuss the regional modeling assumptions and local jurisdictional model assumptions to be included in the future 2015 and 2035 Redmond model to more accurately represent the regional and local committed land use and transportation system plans. Following are the modeling assumptions agreed to by meeting attendees:

Regional Modeling Assumptions:

1. 2015 Puget Sound Regional Council (PSRC) land use forecasts as external zone trip productions and attractions were interpolated from the 2010 and 2020 PSRC Travel Demand Models.
2. I-405 Implementation Plan: I-405 braided ramp to SR 520 interchange at 124th Avenue NE.

3. Bus Rapid Transit (BRT): Lynnwood Tukwila BRT on I-405 with direct high occupancy vehicle (HOV) access to/from arterial or park-and-ride lots.
4. SR 520 6-lanes with Tolls: consistent with WSDOT SR 520 toll assumptions of AM $2.57, Mid-Day $1.77, and PM $3.21 (charged in each travel direction), and the new slip off-ramp at 148th Street.
5. Parking Costs: increased at an inflation rate of 1.5% annually – the same assumption as in the Sound Transit model.
6. Central Link LRT: From Seattle's Northgate neighborhood to SeaTac Airport.
7. Sounder Commuter Rail Lines: Planned north-south expansions were included for Everett, Seattle Downtown, and Lakewood.
8. Coded 2014-2015 Sound Transit proposals under development:
    - Route 510: Extend minimum of 30-minute frequency at all times.
    - Route 511: Extend minimum of 30-minute frequency at all times.
    - Route 513: Add up to 14 round trips between Eastmont and downtown Seattle.
    - Route 550: Add peak period trips to better coordinate with Link light rail schedule in downtown Seattle transit tunnel.
    - Route 554: Extend minimum of 30-minute frequency at all times.
    - Route 556: Improve peak-hour, peak direction frequency to every 15-minutes and add midday service every 30-minutes on weekdays.
    - Route 560: Improve frequency between Burien and Bellevue to every 15-minutes on weekdays.
    - Route 566: Add trips in the afternoon peak period from Redmond Transit Center to Kent Station.
    - Route 574: Improve weekday service to 15-minute frequency.
    - Route 577: Improve peak-hour, peak-direction frequency.
    - Route 590-594: Improve midday service to every 15-minutes between Tacoma and Seattle.

Redmond Area Assumptions:

1. Redmond-Bellevue Bus Rapid Transit is a King County Metro project, which will replace Routes 230 and 253 where the two overlap.
2. RED-TMP-004: NE 36th/31st Street Multimodal Bridge Over-passing SR 520.
3. RED-TFP-118: Construct new 185th Avenue NE arterial from 80th Street to Union Hill Road.
4. RED-TMP-001: Construct new 161st Avenue NE from Bear Creek Parkway Extension to Redmond Way.
5. RED-TMP-002: Construct new 164th Avenue NE from NE 76th Street to Cleveland Street.

6. RED-TMP-079: Convert Redmond Way from 160th Avenue NE to Avondale Way to one through lane in each direction and a center turn lane with the west end having two westbound lanes starting at 161st Avenue NE and the east end having two eastbound lanes starting at 168th Avenue NE.
7. Two pedestrian bridges over-passing SR 520 at 152nd and south of NE 40th Street.
8. SR 520/148th Avenue NE Overlake Access Ramp for 2015 and 2035 Build Scenario, but not for 2015 or 2035 Base Scenario.
9. SR 520 widening to three general purpose (GP) lanes and one HOV lane for 2+ occupants from West Lake Sammamish Parkway NE to SR 202.
10. Overlake Urban Village development base and build-out land uses.

Bellevue Area Assumptions:

1. Interpolated 2015 Bel-Red Area Redevelopment preferred land use and network alternative;
2. Interpolated 2015 Bellevue downtown land use forecasts from 2030 BKR model;
3. Interpolated 2015 Wilburton Neighborhood Plan;
4. Interpolated 2015 Eastgate and Factoria transportation plans; and
5. Interpolated 2015 Overlake Hospital Build-out Plan.

The description below provides a list of the projects assumed to be completed by 2035.

2035 Travel Demand Modeling Assumptions

In addition to the above mentioned 2015 model assumptions, which should all be included in the 2035 travel demand model, the assumptions noted below are also included.

Regional Modeling Assumptions

1. 2035 Puget Sound Regional Council (PSRC) land use forecasts as external zone trip productions and attractions were interpolated from the 2030 and 2040 PSRC Travel Demand Model.
2. East Link LRT: Seattle-Bellevue-Overlake-Redmond with 11 Eastside stations (South Bellevue Park-and-Ride, Bellefield/Wilburton, two in downtown Bellevue, Overlake Hospital Medical Center, two in Bellevue's redeveloping Bel-Red corridor, two in Redmond's Overlake neighborhood near the Microsoft corporate campus, one in southeast Redmond and one in downtown Redmond).
3. I-405 Implementation Plan: new half-interchange at NE 10th Street as recommended in the 2020 Bellevue Downtown Implementation Plan, one added GP lane north of and south of downtown Bellevue, and HOT (high occupancy toll) lanes.

4. I-90 with R8A completed: reversible express lanes converted to Link LRT with three GP lanes and one HOV lane for 2+ occupants in each direction. Toll: AM $2.57; mid-day $1.77, and PM $3.21, charged in each travel direction.
5. Park-and-Ride Facilities: eight new park-and-ride lots as planned in Sound Transit Plan.

Redmond Area Assumptions:

1. Downtown one-way couplet converted to two-way streets.
2. Overlake Urban Village development base and build-out land uses.

Bellevue Area Assumptions:

1. Bel-Red Area Redevelopment preferred land use and network alternative
2. 2030 Bellevue downtown land use forecasts
3. Wilburton Neighborhood Plan
4. Eastgate and Factoria transportation plans
5. Overlake Hospital Build-out Plan
6. 124th Street Full Interchange with SR 520
7. Five existing bus routes serving Bellevue would be modified as feeder bus routes to serve Link LRT stations.

Base Year (2006) Travel Demand Model Validation

The base year (2006) Redmond model was calibrated by using vehicle traffic screenlines as shown in **Figure 6** and **Figure 7**. The screenline validation results indicate the following findings:

1. All screenlines for AM peak hour stay within the margin error of +/- 10% of the actual traffic counts, meeting FHWA standards.
2. The study area screenline summary shows that total model volumes exceed total traffic counts by +3%. The total E-W screenline by +4% and N-S screenline by +1%.
3. All screenlines except for the 9-NS Screenline for PM Peak hour stay within the margin error of +/- 10%, meeting FHWA standards; the 9-NS Screenline is -11% under-estimating the actual traffic count.
4. The study area screenline summary shows that total PM peak hour model volumes equal total traffic counts with 0% errors, while E-W screenline total model volumes exceed traffic counts by +4% and N-S screenline total model volumes underestimate traffic counts by -4%.

The combined Redmond/BKR/PSRC model is well validated in the study area for the base year AM and PM peak hour condition. Both base year AM and PM screenlines meet the FHWA travel demand model validation criteria.

These validation results build confidence among the model users to develop the future Year of Opening (2015) and Design Year (2035) travel demand forecasting models for the 148th/SR 520 Off-Ramp IJR Study.

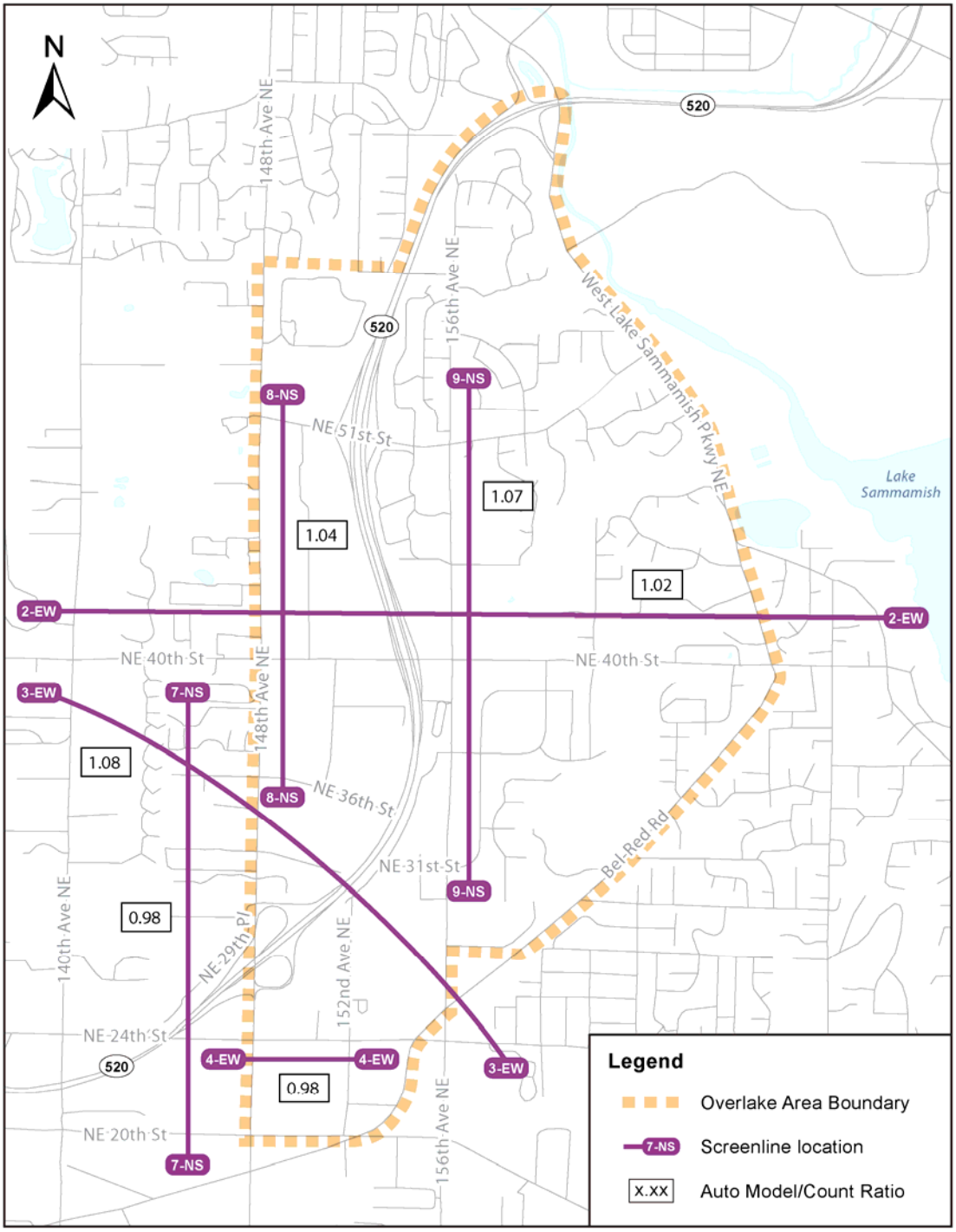

Figure 6: 2006 Redmond Travel Demand Model AM Peak Hour Screenline Validation

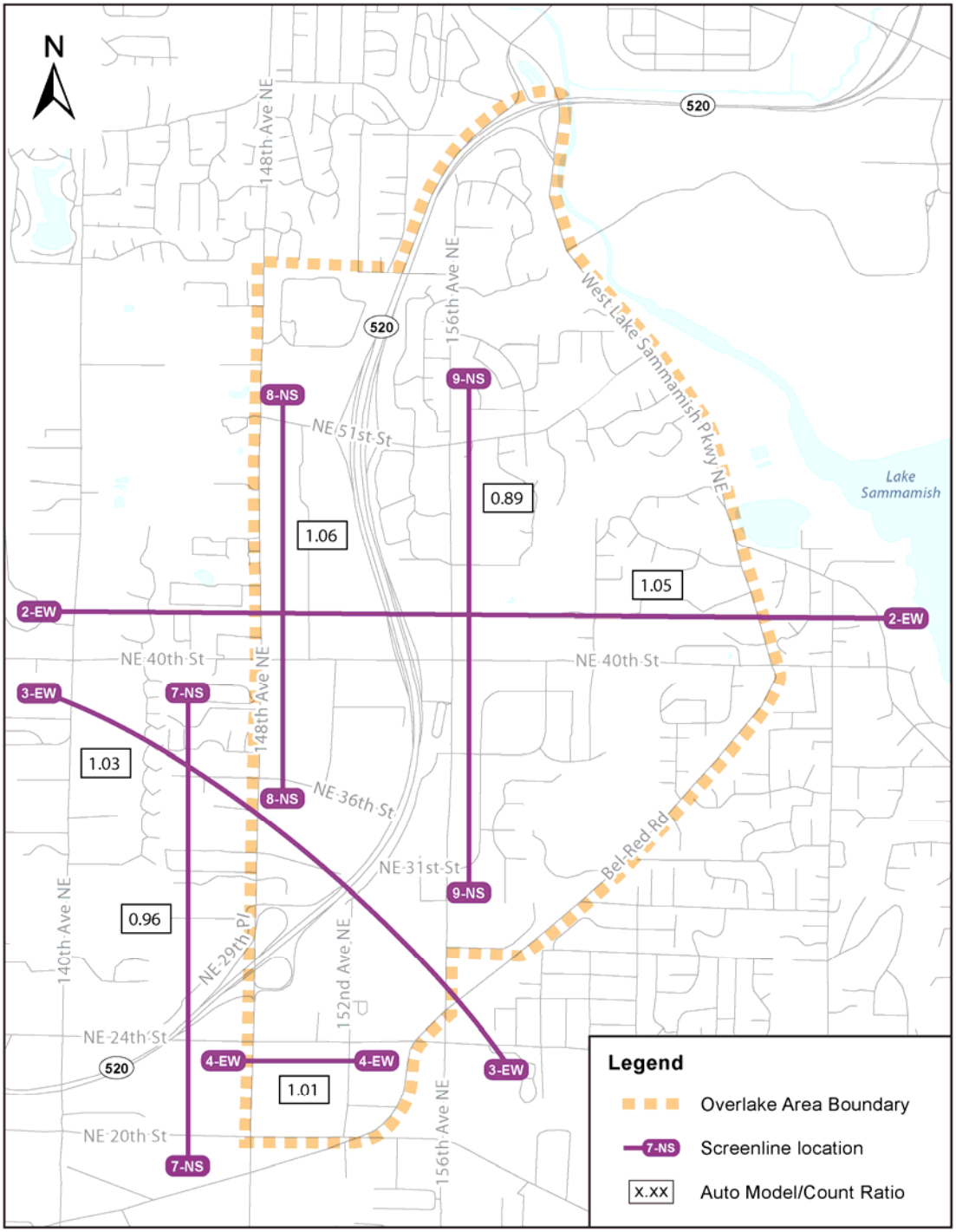

Figure 7: 2006 Redmond Travel Demand Model PM Peak Hour Screenline Validation

Policy Point 2: Reasonable Alternatives

Many transportation improvement alternatives for this sub-area and interchange have been studied and evaluated over the last decade by both the City of Redmond and City of Bellevue through a number of transportation studies in the Overlake Sub-area. These studies include:

- Bellevue and Redmond North and South Study in 2001
- Bellevue Redmond Overlake Transportation Study (BROTS)
- 150th Avenue Crossing Study
- Bel-Red Corridor Study
- Overlake Neighborhood Plan
- 152nd Avenue NE Corridor Study

These studies have resulted in many local street and intersection improvement options that have either been constructed, such as the new NE 36th Street overcrossing, or are planned/programmed future projects that were assumed to be constructed in the future model assumptions. Local street improvements have included intersection capacity and geometry improvements both to the north and south of the 148th Avenue NE interchange along 148th Avenue NE including the intersection of both NE 24th Avenue and NE 29th Avenue.

New interchanges (access points) in this vicinity were not considered in order to address future traffic demands due to interchange spacing limitations and corresponding safety concerns that would be associated with adding new access points to SR 520 in this area.

Policy Point 3: Operational and Collision Analyses

Traffic Operations Analysis

The existing traffic operational conditions within the study area were evaluated using Level of Service (LOS) analysis. Based on the methodologies provided in the 2000 Highway Capacity Manual (HCM), LOS A represents free-flow conditions (motorists experience little or no delay and traffic levels are well below roadway capacity), LOS F represents forced-flow conditions (motorists experience very long delays and traffic levels exceed roadway capacity), and LOS B to E represent decreasing desirable conditions. Synchro (version 7.0) was used to determine LOS for the intersections within the study area. Highway Capacity Software (HCS+ 5.4) was used to determine LOS for the freeway segments and ramp junctions within the study area.

LOS criteria for signalized intersections are shown in **Table 2**. Roundabout analysis also utilizes the same LOS criteria as signalized intersections. LOS criteria for weaving segments are shown in **Table 3** and LOS criteria for freeway merge and diverge areas are shown in **Table 4**.

Table 2: LOS Criteria for Signalized Intersections

Level of Service	Control Delay Range (second)
A	<=10
B	>10 and <=20
C	>20 and <=35
D	>35 and <=55
E	>55 and <=80
F	>80

Source: 2000 Highway Capacity Manual, Transportation Research Board

Table 3: LOS Criteria for Weaving Segments

Level of Service	Density (pc/mi/ln)
A	<=10
B	>10 and <=20
C	>20 and <=28
D	>28 and <=35
E	>35 and <=43
F	>43

Source: 2000 Highway Capacity Manual, Transportation Research Board

Table 4: LOS Criteria for Merge and Diverge Areas

Level of Service	Density (pc/mi/ln)
A	<=10
B	>10 and <=20
C	>20 and <=28
D	>28 and <=35
E	>35
F	Demand Exceeds Capacity

Source: 2000 Highway Capacity Manual, Transportation Research Board

Table 5 presents the summary of the existing conditions analysis for signalized intersections. **Table 6** presents the summary of the existing conditions analysis for freeway weaving segment and merge and diverge areas. **Figure 8** and **Figure 9** present existing AM and PM peak hour LOS and ninety-fifth percentile queue lengths for individual intersection approaches along 148th Avenue NE and NE 40th Street. During both existing AM and PM peak hours, the 148th Avenue NE corridor within the study area is very congested. Volume to capacity ratios showed that the

traffic volumes are exceeding capacity by approximately 10% - 15% and queues at critical intersections spill back to adjacent intersections. During existing AM peak hour, NE 40th Street is very congested and both ramp terminal intersections have excessively long queues. Detailed existing geometry data, signal timing, and analysis results for signalized intersections are included in **Appendix A**. Detailed existing geometry data and analysis results for freeway diverge areas and the weaving section are included in **Appendix B**.

Table 5: Existing Operational Analysis Results - Signalized Intersections

Intersection			AM Peak Hour		PM Peak Hour	
			Delay[1]	LOS	Delay	LOS
1	148th Avenue NE	NE 24th Street	55.5	E	69.4	E
2	SR 520 EB Off-Ramp	SB 148th Avenue NE	53.7	D	19.7	B
3	SR 520 EB Off-Ramp (Loop)	NB 148th Avenue NE	41.4	D	19.0	B
4	SR 520 WB Off-Ramp / NE 29th Place	148th Avenue NE	88.4	F	37.3	D
5	SR 520 EB Off-Ramp	NE 40th Street	82.6	F	24.3	C
6	SR 520 WB Off-Ramp	NE 40th Street	90.3	F	22.1	C

Note:
1. Delay, or control delay per vehicle (unit: seconds/vehicle), is a measure of all the delay contributable to traffic control measures, such as signals or stop signs.

Source: HDR, Inc.

Table 6: Existing Operational Analysis Results – Freeway Weaving/Merge/Diverge

Location		Type	AM Peak Hour		PM Peak Hour	
			Density[2]	LOS	Density	LOS
1	SR 520 EB Off-Ramp Junction to SB 148th Avenue NE	Diverge Area	32.1	D	28.9	D
2	SR 520 EB Off-Ramp Junction to NB 148th Avenue NE	Diverge Area	26.6	C	22.7	C
3	SR 520 EB Mainline Between 148th Avenue NE On-Ramp and NE 40th Street Off-Ramp	Weaving Segment (Type A)[1]	36.7	E	34.4	D

Note:
1. Type A weaving segment requires that weaving vehicles in both directions (from on-ramp to mainline or from mainline to off-ramp) must make one lane change to successfully complete a weaving maneuver.
2. Density is the average density for all vehicles in the weaving segment (unit: pc/mi/ln)

Source: HDR, Inc.

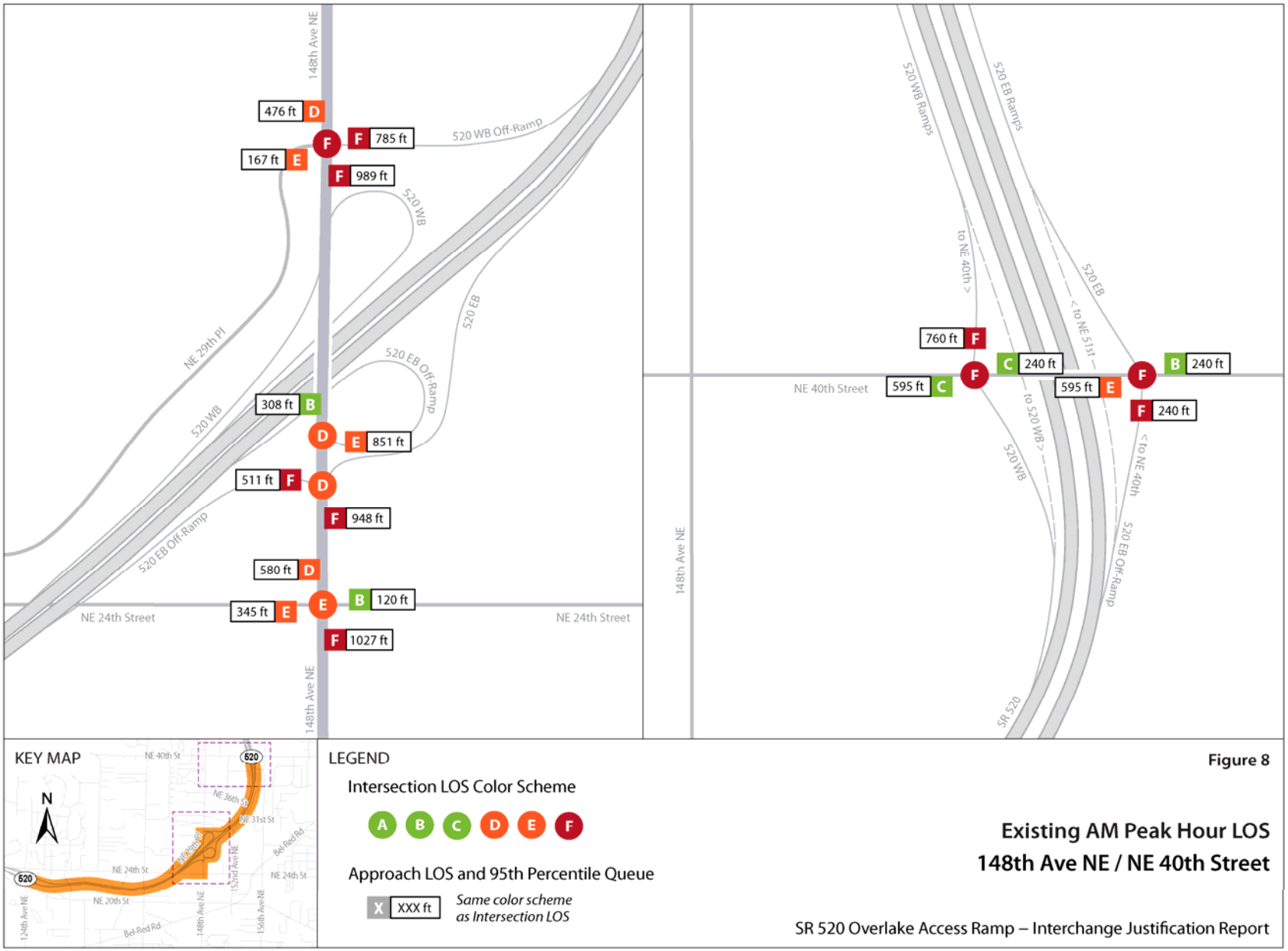

Figure 8

Existing AM Peak Hour LOS
148th Ave NE / NE 40th Street

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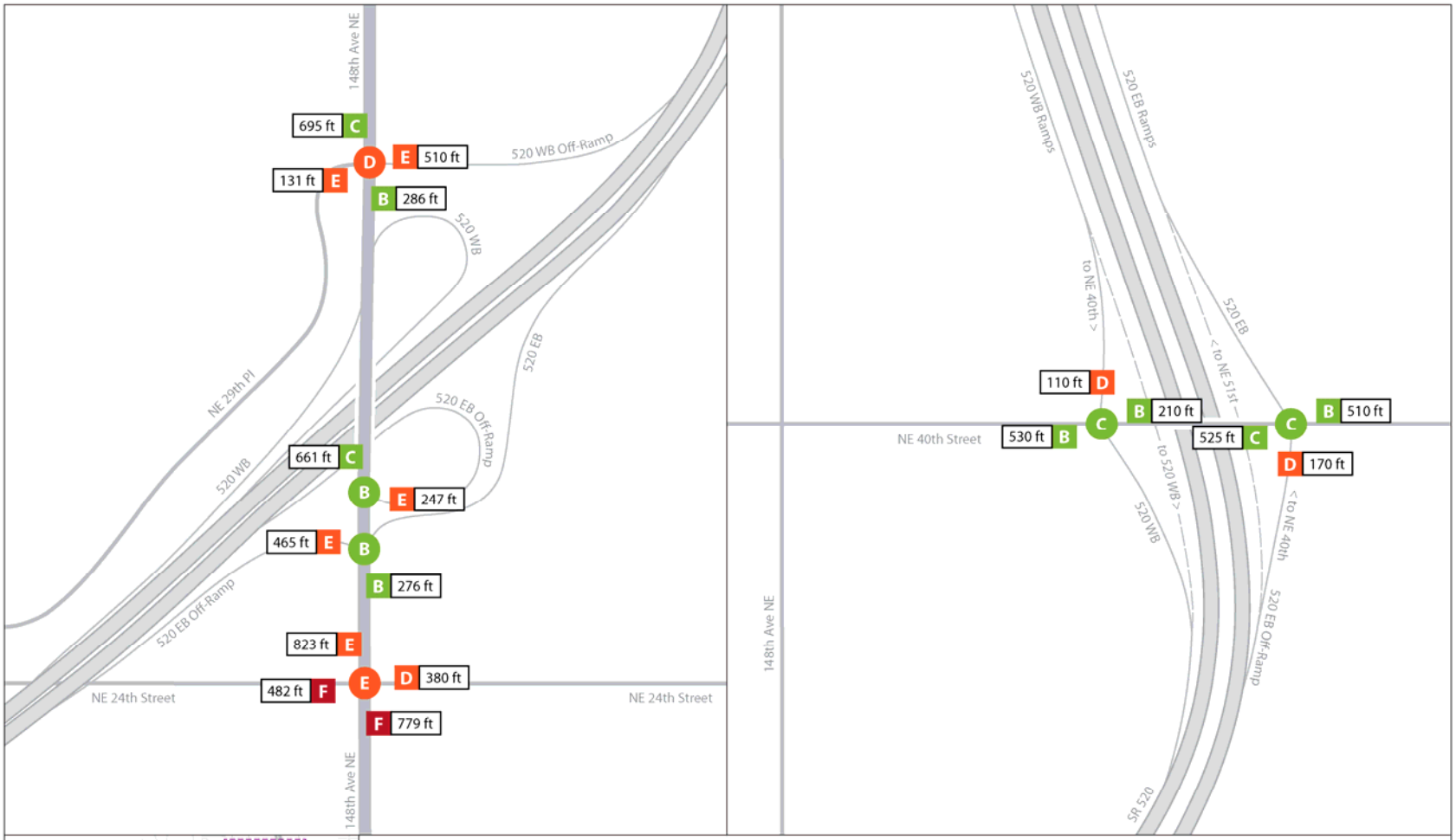


Figure 9

Existing PM Peak Hour LOS
148th Ave NE / NE 40th Street

SR 520 Overlake Access Ramp – Interchange Justification Report

Opening Year (2015) and Design Year (2035) Traffic Volumes on Freeway and Ramps

The 2015 No-Build scenario assumed that the Overlake Access Ramp will not be built and no other improvements would be made to the 148th Avenue interchange or adjacent interchanges. The 2015 Build scenario assumed that the Overlake Access Ramp will be built and that is the only road network difference from the 2015 No-Build scenario. The Overlake access ramp is connected to 152nd Avenue through local connections.

The 2035 No-Build scenario assumed that the Overlake Access Ramp will not be built and assumed that the 124th Avenue NE full interchange and the auxiliary lane will be built. The 2035 Build scenario assumed that the Overlake Access Ramp will be built and that is the only road network difference from the 2035 No-Build scenario. The Overlake access ramp is connected to 152nd Avenue through local connections. The local street connections are assumed to be the same as those in the 2015 Build scenario.

Figure 10 and **Figure 11** present AM and PM peak hour traffic volume forecasts for both No-Build and Build scenarios in 2015 Year of Opening and 2035 Design Year, respectively. The following are key findings:

- The 2015 Year of Opening Overlake Access off-ramp would experience up to 830 vehicle trips during AM peak hour.
- Under 2015 Year of Opening Condition, the SR 520 eastbound segments between 148th Avenue NE and NE 40th Street do not exceed 5700 vehicle trips, below the capacity of two GP lanes (up to 4400 vphpl) and one HOV lane (1500 vphpl).
- The 2035 Design Year Overlake Access ramp would have vehicle trips of up to 1280, staying within its planning capacity of 1200-1300 vphpl.
- Under 2035 Design Year conditions, no matter with or without the Build Scenario, the SR 520 southbound segments between 148th Avenue NE and NE 40th Street would reach up to 7100 vehicle trips, exceeding the capacity of two GP lanes (up to 4400 vphpl) and one HOV lane (1500 vphpl); and northbound would reach up to 6700, also exceeding the capacity of two GP lanes and one HOV lane.
- SR 520 eastbound segment between 124th Avenue NE interchange and 148th Avenue NE interchange would reach 7400 traffic volumes under 2035 conditions as an auxiliary lane was assumed in both 2035 No-Build and Build scenarios to accommodate traffic growth.

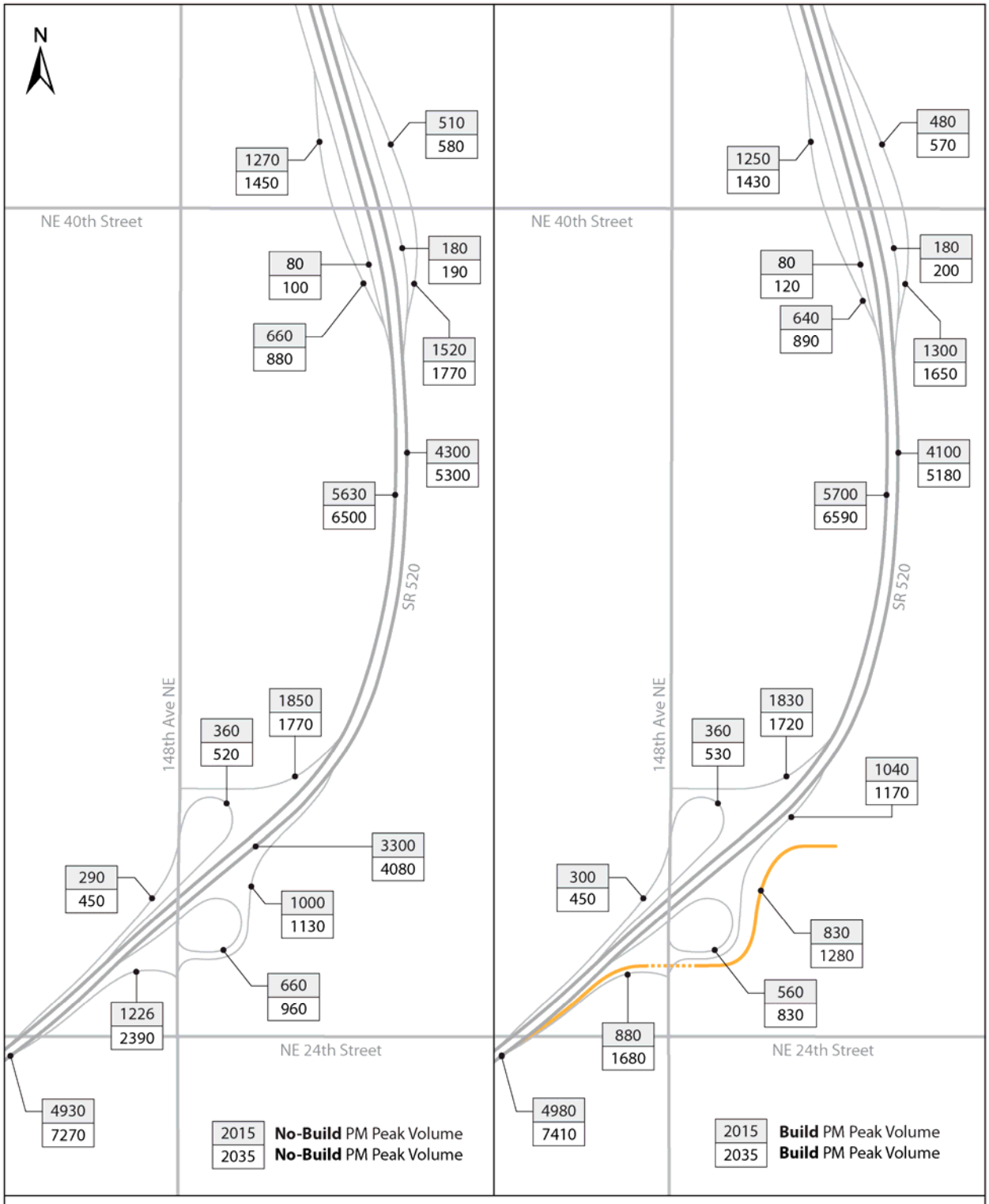


Figure 10

Future No-Build and Build Scenarios – AM Peak Hour Traffic Volume Summary

SR 520 Overlake Access Ramp – Interchange Justification Report

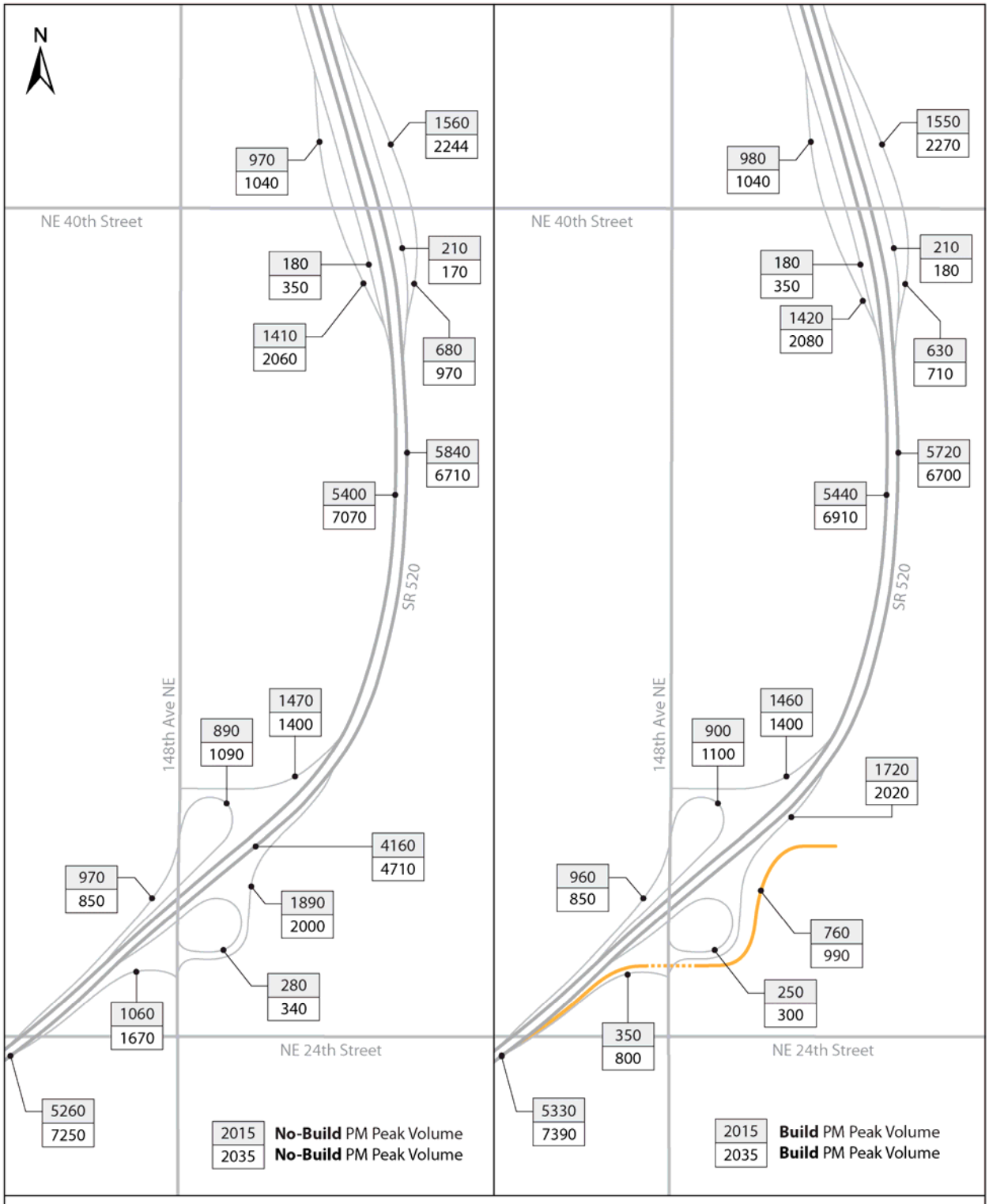


Figure 11

Future No-Build and Build Scenarios – PM Peak Hour Traffic Volume Summary

SR 520 Overlake Access Ramp – Interchange Justification Report

Critical Link Traffic Volume Changes

In comparison with the No-Build scenario, the Build scenario will redistribute traffic accessing the Overlake area and the major employment area close to the proposed Overlake Access Ramp.

Figure 11 and **Figure 12** present AM and PM peak hour roadway traffic volume changes between No-Build and Build scenarios in 2015 Year of Opening and 2035 Design Year, respectively. The following are key findings:

- The Overlake Access ramp would reduce traffic volume on SB left turns to NE 24th Street by up to 390 vehicle trips during 2015 AM peak hour and up to 560 vehicle trips during 2035 AM peak hour.
- The existing 148th Avenue NE off-ramp volume would decrease by up to 360 vehicle trips for 2015 Year of Opening and up to 710 vehicle trips by 2035 Design Year.
- There would be a reduction of 220 vehicle trips on the NB off-ramp at the NE 40th Street interchange due to the Overlake Access off-ramp, exceeding one quarter of Overlake Access off-ramp volumes (830) by 2015 Year of Opening.
- The reduction on the NB off-ramp at the NE 40th Street interchange would be decreased to 110 by the 2035 Design Year, being equivalent to 9% of the Overlake Access off-ramp volume of 1280 vehicle trips.
- There would also be a reduction of NB traffic volumes of up to 200 vehicle trips on the SR 520 segment between 148th Avenue NE and NE 40th Street, indicating weaving volume will decrease under the Build Scenario.
- There would be reduction of 190 vehicle trips on 156th Avenue NE south of NE 40th Street due to the Build Overlake Access off-ramp by 2015 Year of Opening; the reduction would be up to 140 vehicle trips by 2035 Design Year due to the Build scenario.
- No traffic impact to westbound SR 520 with or without the Overlake Access off-ramp.

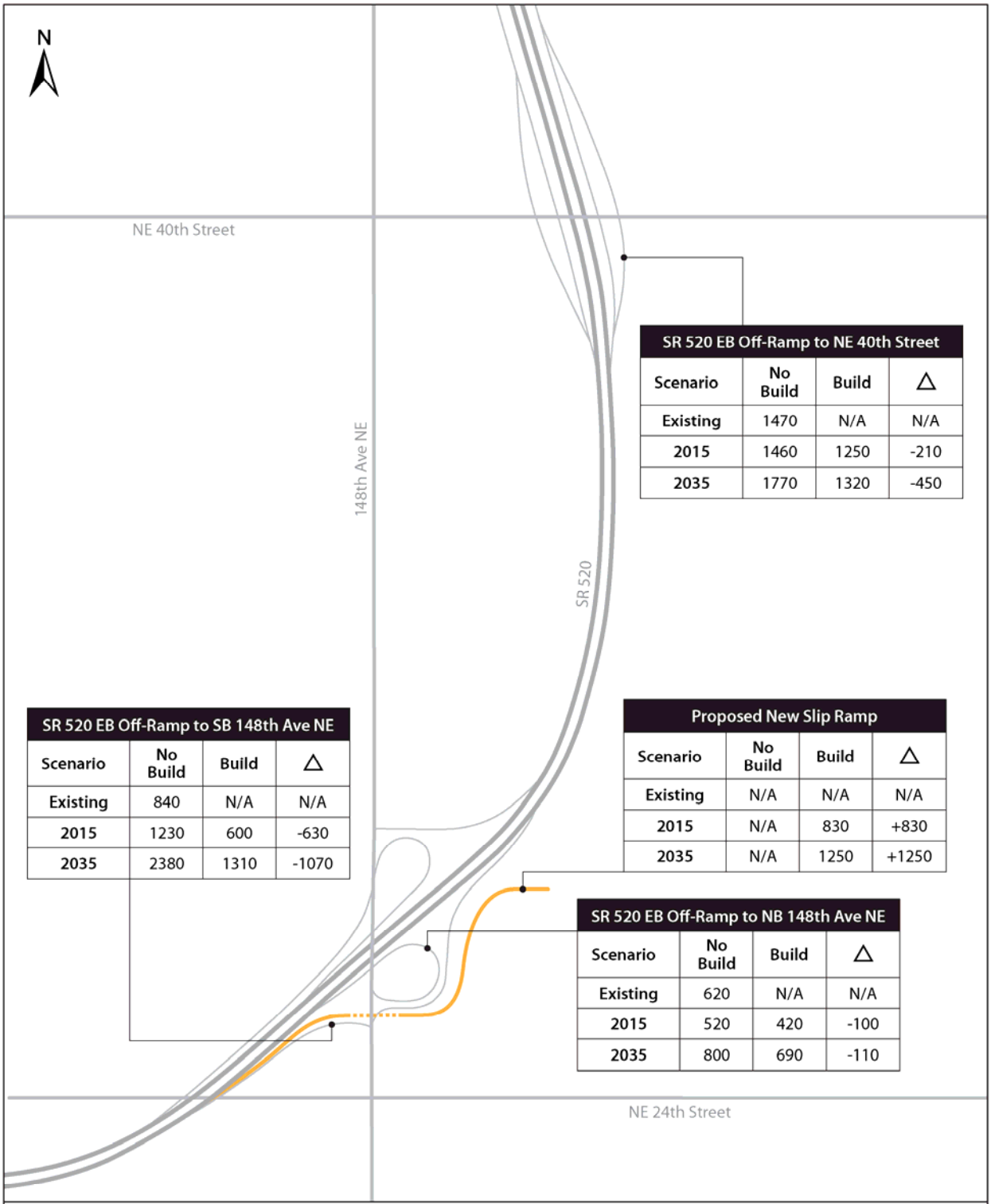


Figure 12

AM Peak Hour Critical Link Volume Changes

SR 520 Overlake Access Ramp – Interchange Justification Report

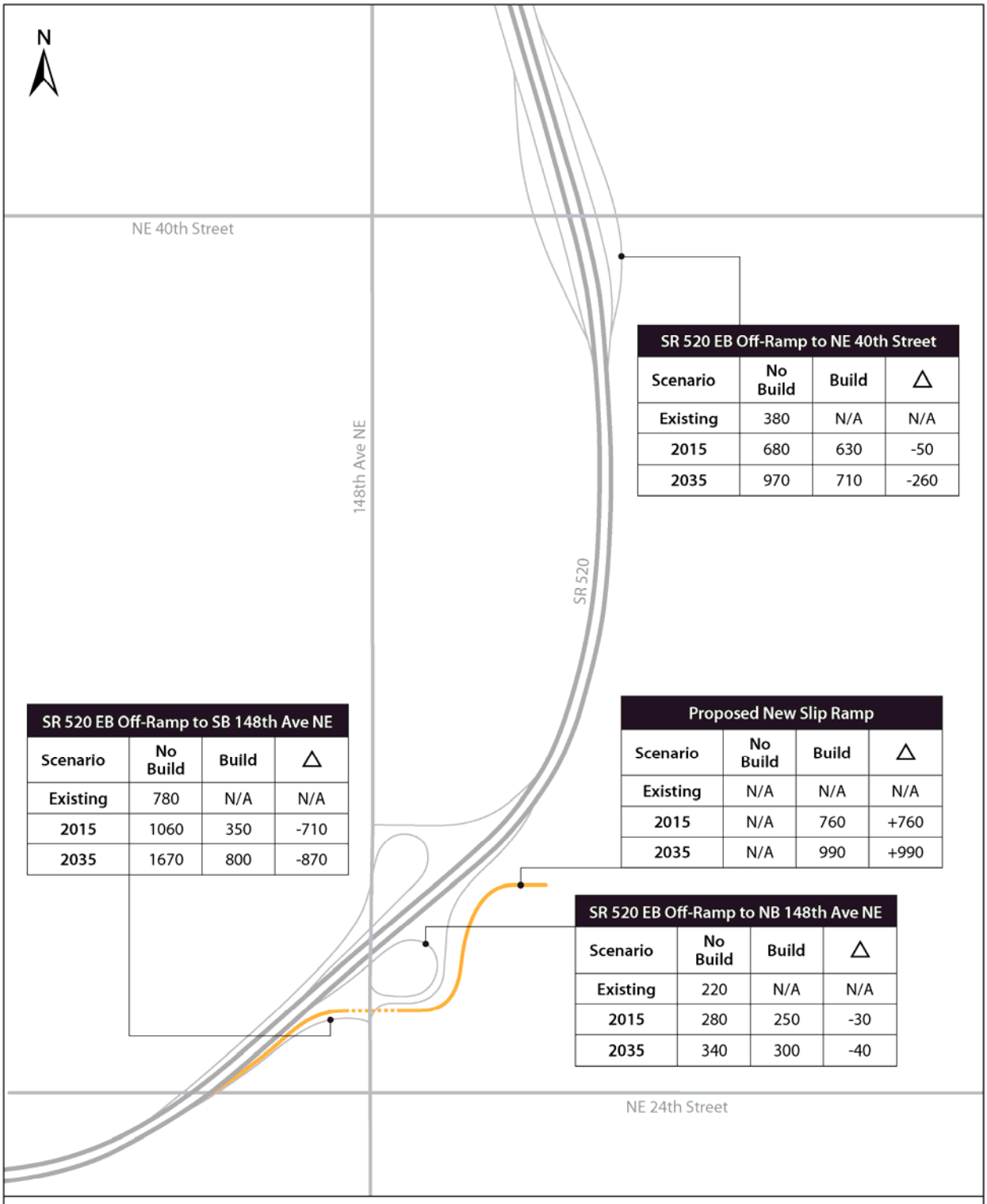


Figure 13

PM Peak Hour Critical Link Volume Changes

SR 520 Overlake Access Ramp – Interchange Justification Report

Future Traffic Volumes at Arterial Intersections

Future turning movement volumes at intersections and ramp terminals along 148th Avenue NE and NE 40th Street are shown in **Figure 14 through Figure 21.** Build scenario includes a ramp terminal intersection at NE 150th Avenue. The ramp terminal intersection is assumed be a four-leg intersection in both 2015 and 2035 Build scenarios. All intersections shown in this section are analyzed in the section of Future Operations Analysis.

Region-wide Measure of Effectiveness (MOE)

Table 7 presents the 2015 Year of Opening and 2035 Design Year roadway system-wide measure of effectiveness in terms vehicle miles travelled (VMT) and vehicle hours travelled (VHT). Except for 2035 AM peak hour scenarios, all other scenarios show consistent VMT and VHT decreases due to the Build scenario, indicating that Build Scenario will provide system-wide benefits.

Table 7: Region-wide Measure of Effectiveness

Scenarios	AM Peak Hour VMT	AM Peak Hour VMT	PM Peak Hour VMT	PM Peak Hour VMT
2015 Base (1)	5,063,621	250,661	5,969,568	293,961
2015 Build (2)	5,061,357	250,438	5,967,884	293,857
2015 MOE Difference (3)=(2)-(1)	-2,264	-223	-1,724	-104
2035 Base (4)	6,437,748	415,830	7,634,563	488,187
2035 Build (5)	6,435,909	415,831	7,628,220	487,424
2035 MOE Difference (6)=(5)-(4)	-1,839	1	-6,343	-763

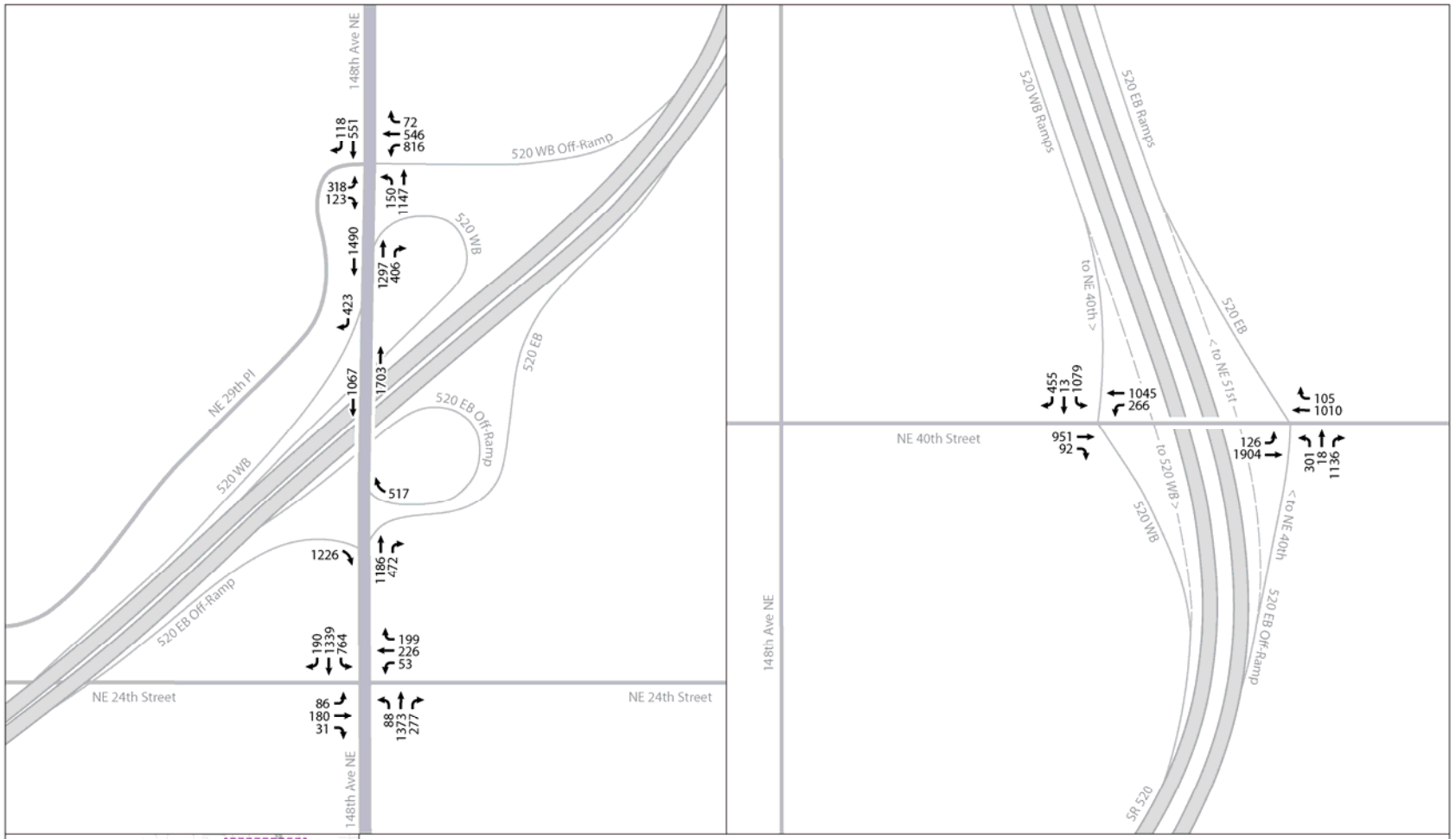


Figure 14

2015 No-Build AM Peak Hour Traffic Volumes
148th Ave NE / NE 40th Street

SR 520 Overlake Access Ramp – Interchange Justification Report

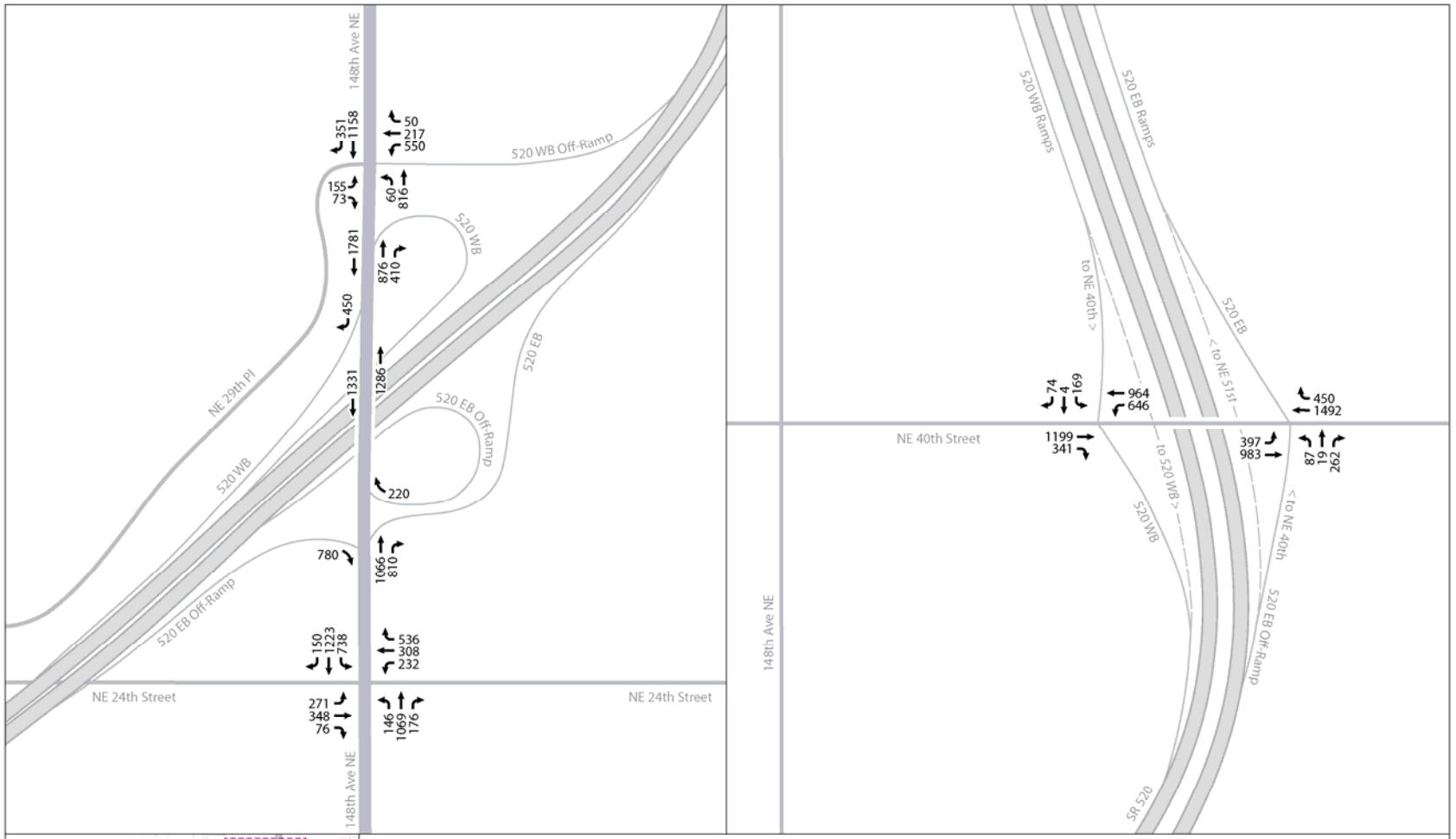


Figure 15

2015 No-Build PM Peak Hour Traffic Volumes
148th Ave NE / NE 40th Street

SR 520 Overlake Access Ramp – Interchange Justification Report

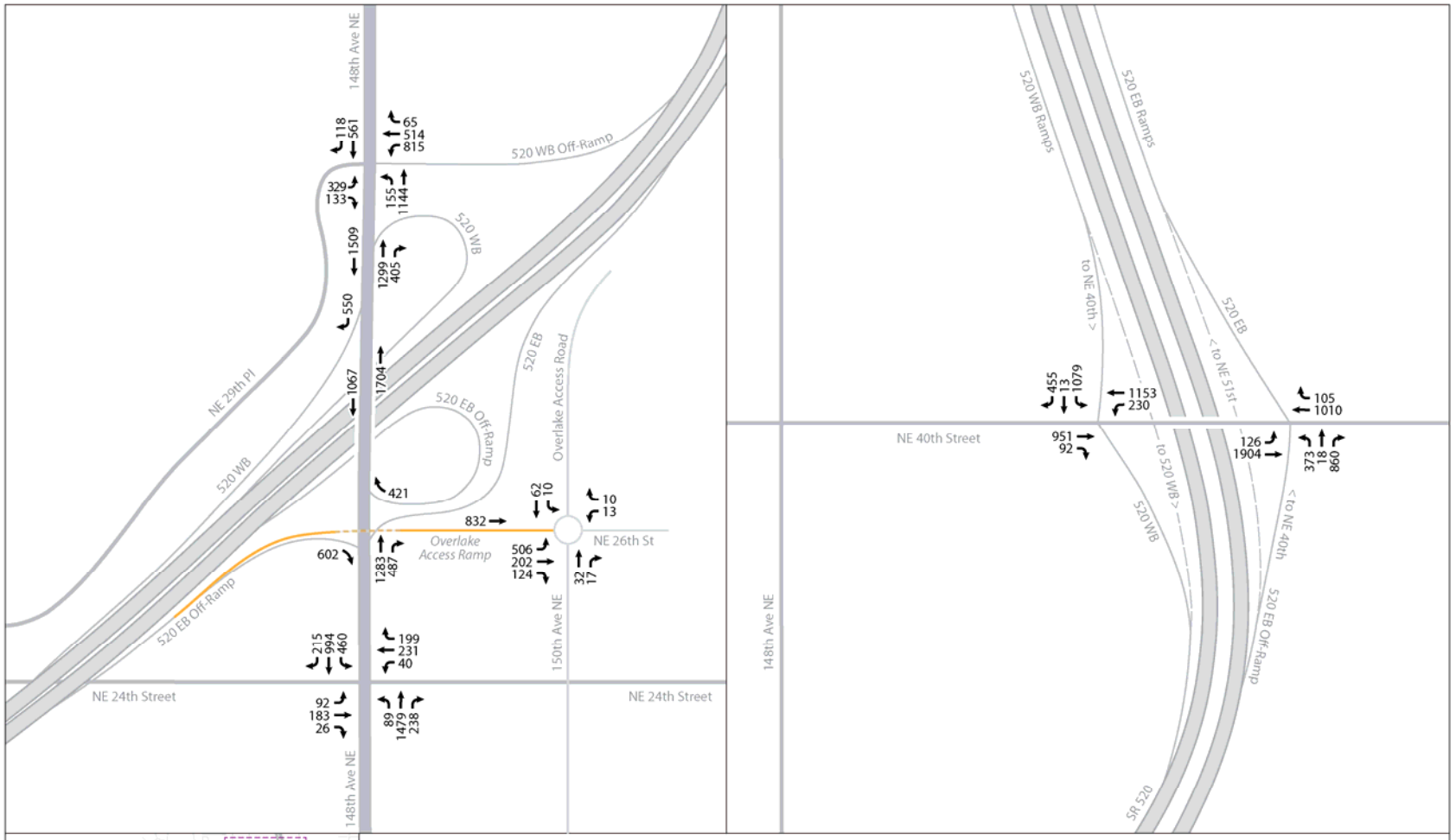


Figure 16

2015 Build AM Peak Hour Traffic Volumes
148th Ave NE / NE 40th Street

SR 520 Overlake Access Ramp – Interchange Justification Report

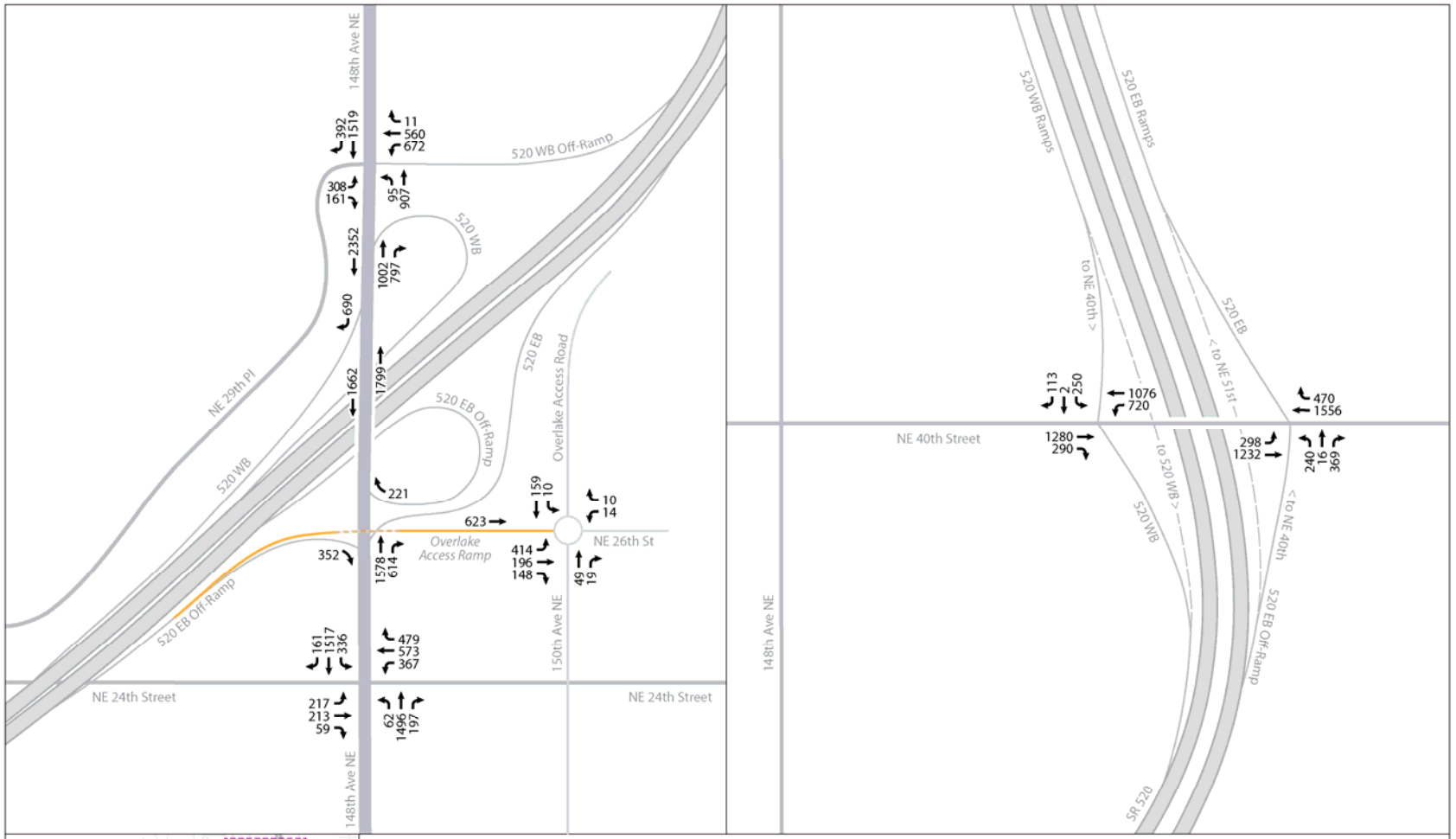


Figure 17

2015 Build PM Peak Hour Traffic Volumes
148th Ave NE / NE 40th Street

SR 520 Overlake Access Ramp – Interchange Justification Report

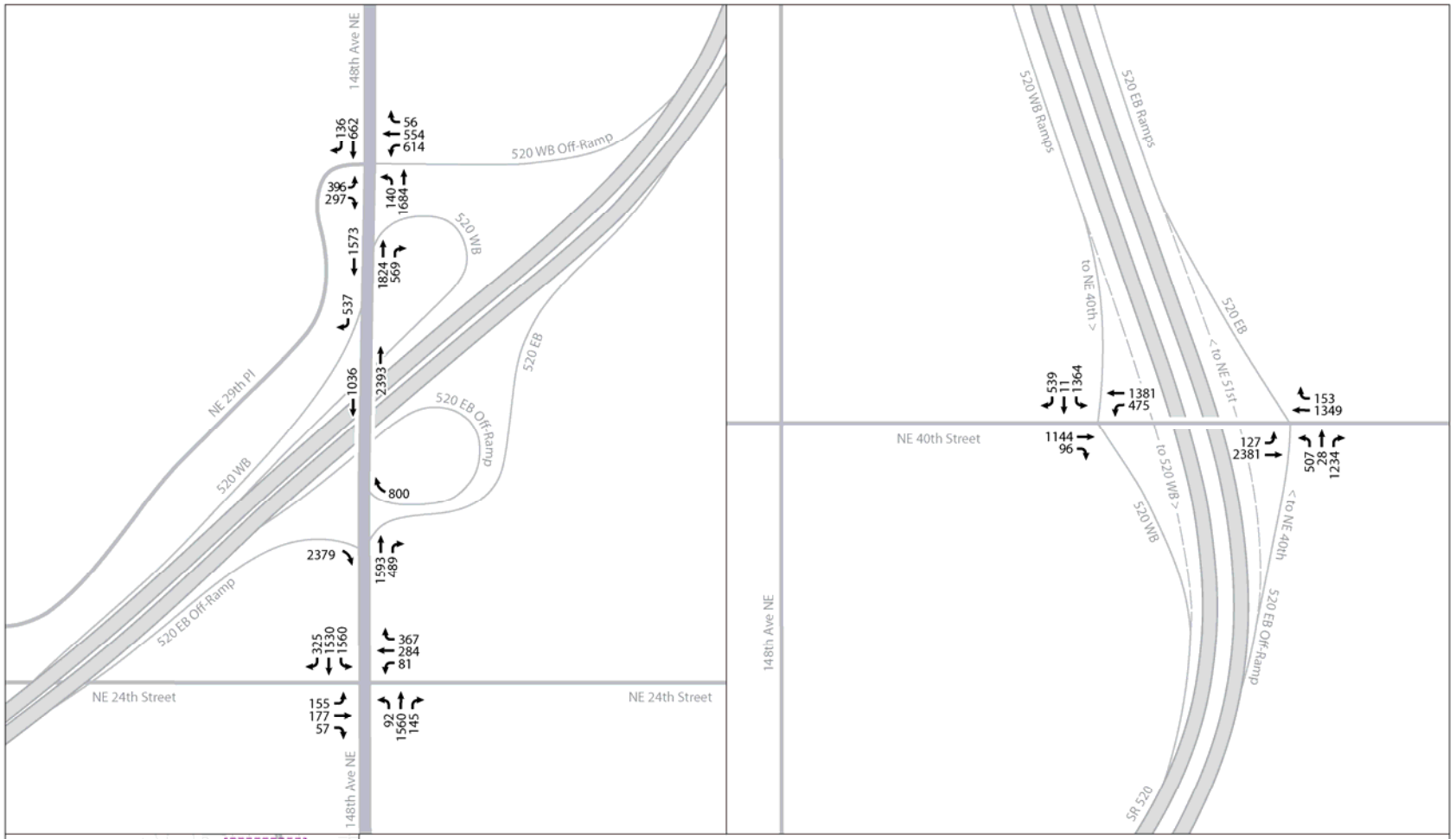
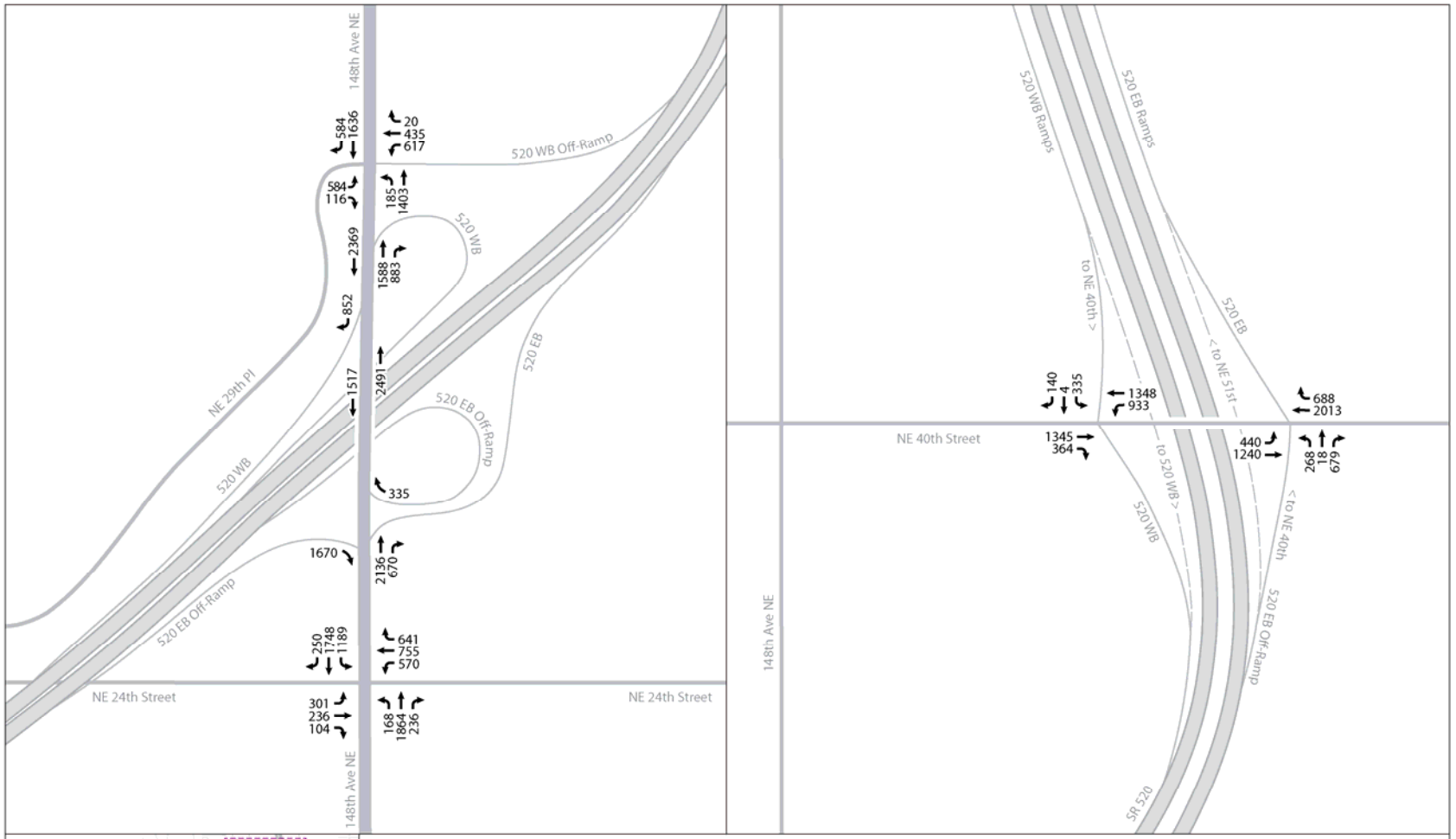


Figure 18

2035 No-Build AM Peak Hour Traffic Volumes
148th Ave NE / NE 40th Street

SR 520 Overlake Access Ramp – Interchange Justification Report



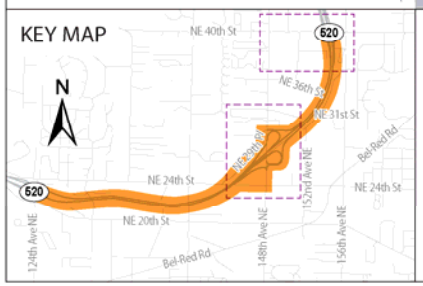


Figure 19

2035 No-Build PM Peak Hour Traffic Volumes
148th Ave NE / NE 40th Street

SR 520 Overlake Access Ramp – Interchange Justification Report

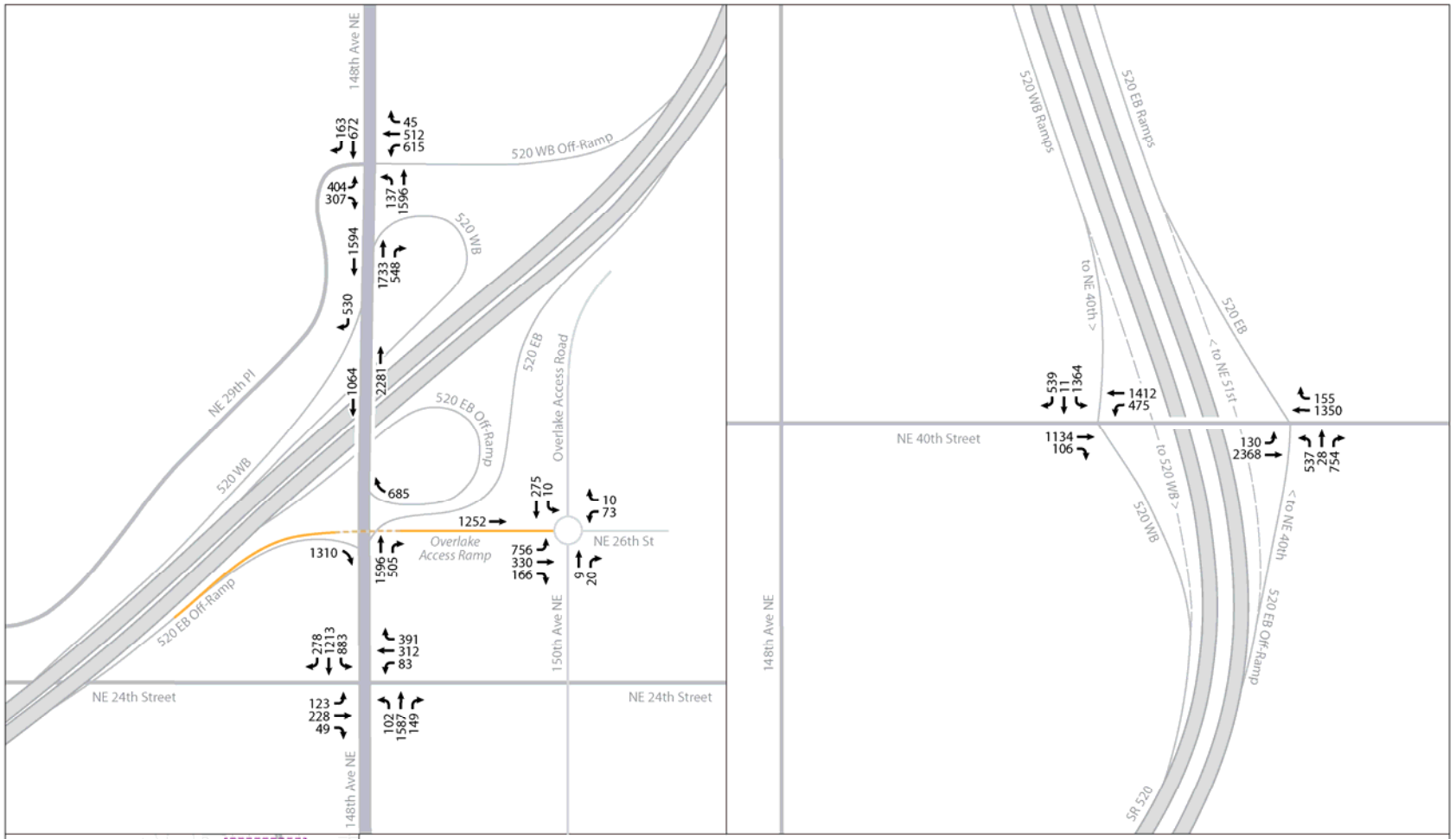


Figure 20

2035 Build AM Peak Hour Traffic Volumes
148th Ave NE / NE 40th Street

SR 520 Overlake Access Ramp – Interchange Justification Report

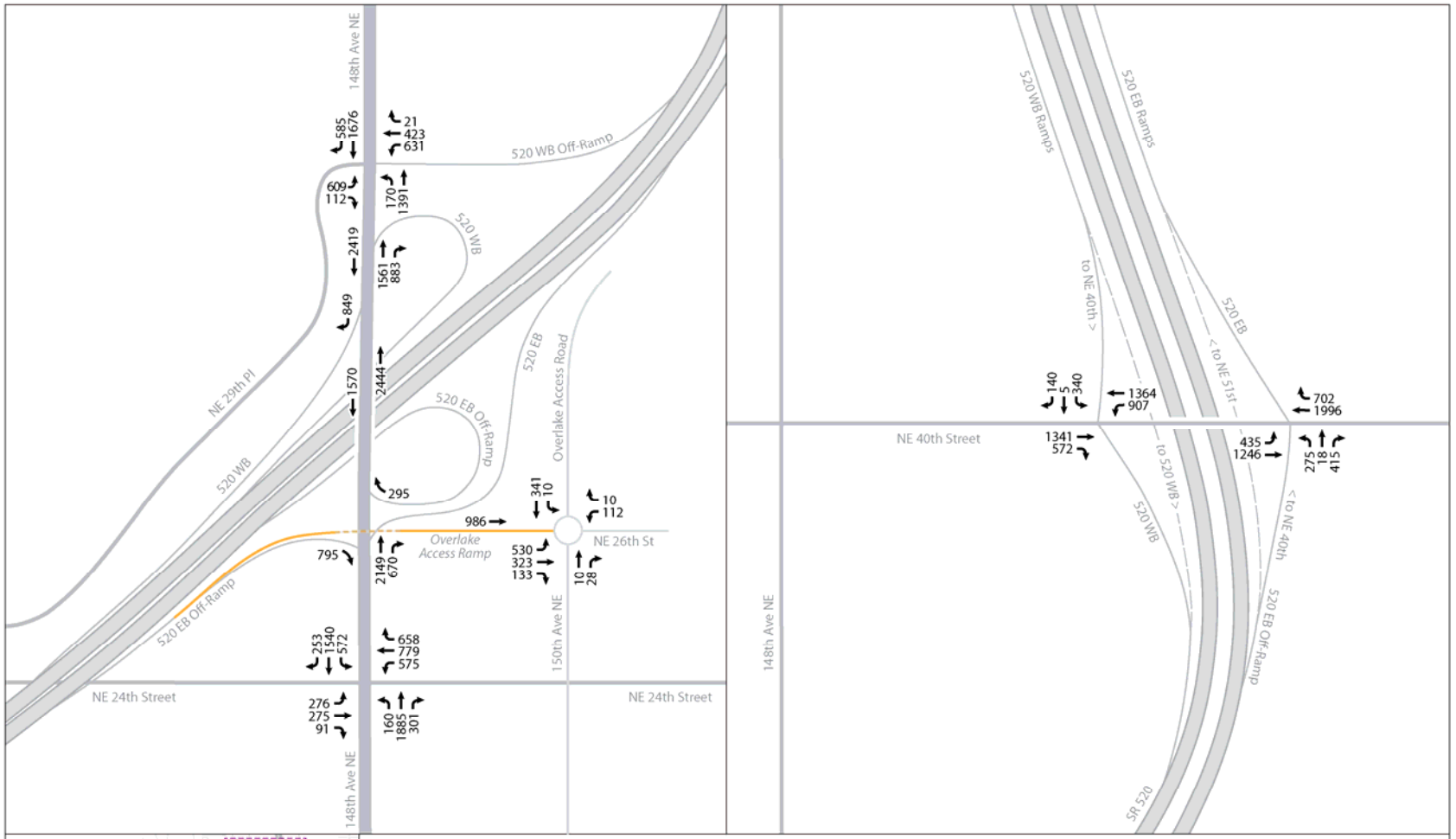


Figure 21

2035 Build PM Peak Hour Traffic Volumes
148th Ave NE / NE 40th Street

SR 520 Overlake Access Ramp – Interchange Justification Report

Future Traffic Operations

Future No-Build and Build capacity analyses were conducted for intersections along 148th Avenue NE and NE 40th Street and eastbound SR 520 merge diverge and weaving areas. **Table 8** through **Table 11** present comparisons of intersection delay and LOS between No-Build scenarios and Build scenarios in both AM and PM peak hours in 2015 and 2035. The Build scenario shows clear benefits on both arterials of 148th Avenue NE arterial and NE 40th Street, reducing eastbound off-ramp congestions at ramp terminals with NE 148th Avenue. It also significantly improves the critical intersection with NE 24th Street. Since the Build scenario provides an alternate route for traffic accessing the employment sites east of 152nd Avenue and NE 40th Street areas, it helps to reduce eastbound SR 520 mainline traffic between the 148th Avenue interchange and the NE 40th Street interchange. It will help the traffic volume reductions at the east off-ramp at NE 40th Street and the eastbound weaving section between the two interchanges.

Existing commercial (office and retail) and residential land use along both sides of 148th Avenue NE prohibit the widening 148th Avenue NE as an option. This study assumed that the intersection at 148th Avenue NE and NE 24th Street would be widened by adding one more left turn pocket along both directions of NE 24th Street and one northbound through lane along 148th Avenue NE in 2035. **Figure 23** presents AM peak hour level of service analysis results for the No-Build and Build scenarios for arterial signalized intersections in 2015 and 2035. **Figure 24** presents PM peak hour level of service analysis results for the No-Build and Build scenarios for arterial signalized intersections in 2015 and 2035.

Table 12 through **Table 15** present comparisons of freeway segment density and LOS between No-Build scenarios and Build scenarios in both AM and PM peak hours in 2015 and 2035. The Build scenario slightly increases the density at the diverge area from eastbound SR 520 to southbound 148th Avenue NE due to the new connection to the 152nd Avenue area; the increase was very small and does not impact the LOS. The Build scenario reduces the density to the eastbound SR 520 merge from northbound 148th Avenue NE, and the SR 520 weaving segment between the 148th Avenue interchange and the NE 40th Street interchange. **Figure 22** presents results of the level of service analysis for No-Build and Build scenarios for freeway analysis in both AM and PM peak hours in 2015 and 2035.

Future No-Build and Build Synchro model outputs are included in **Appendix C** and **Appendix D,** respectively. Future No-Build and Build HCS model outputs are included in **Appendix E** and **Appendix F**, respectively.

Table 8: 2015 AM Peak Hour Operational Analysis Results – Signalized Intersections

Intersection			2015 No-Build AM Peak Hour		2015 Build AM Peak Hour	
			Delay[1]	LOS	Delay	LOS
1	148th Avenue NE	NE 24th Street	78.2	E	57.2	E
2	SR 520 EB Off-Ramp	SB 148th Avenue NE	75.2	E	15.1	B
3	SR 520 EB Off-Ramp (Loop)	NB 148th Avenue NE	23.4	C	17.5	B
4	SR 520 WB Off-Ramp / NE 29th Place	148th Avenue NE	91.7	F	83.1	F
5	SR 520 EB Off-Ramp	NE 40th Street	104.3	F	81.8	F
6	SR 520 WB Off-Ramp	NE 40th Street	51.6	D	45.1	D

Note:
1. Delay, or control delay per vehicle (unit: seconds/vehicle), is a measure of all the delay contributable to traffic control measures, such as signals or stop signs.

Source: HDR, Inc.

Table 9: 2015 PM Peak Hour Operational Analysis Results – Signalized Intersections

Intersection			2015 No-Build PM Peak Hour		2015 Build PM Peak Hour	
			Delay[1]	LOS	Delay	LOS
1	148th Avenue NE	NE 24th Street	>180	F	122.4	F
2	SR 520 EB Off-Ramp	SB 148th Avenue NE	176.8	F	22.9	C
3	SR 520 EB Off-Ramp (Loop)	NB 148th Avenue NE	23.1	C	9.6	A
4	SR 520 WB Off-Ramp / NE 29th Place	148th Avenue NE	119.7	F	119.7	F
5	SR 520 EB Off-Ramp	NE 40th Street	24.3	C	24.3	C
6	SR 520 WB Off-Ramp	NE 40th Street	62.5	E	69.6	E

Note:
1. Delay, or control delay per vehicle (unit: seconds/vehicle), is a measure of all the delay contributable to traffic control measures, such as signals or stop signs.

Source: HDR, Inc.

Table 10: 2035 AM Peak Hour Operational Analysis Results – Signalized Intersections

Intersection			2035 No-Build AM Peak Hour		2035 Build AM Peak Hour	
			Delay[1]	LOS	Delay	LOS
1	148th Avenue NE	NE 24th Street	177.1	F	65.7	E
2	SR 520 EB Off-Ramp	SB 148th Avenue NE	>180	F	66.8	E
3	SR 520 EB Off-Ramp (Loop)	NB 148th Avenue NE	111.7	F	73.8	E
4	SR 520 WB Off-Ramp / NE 29th Place	148th Avenue NE	138.7	F	138.4	F
5	SR 520 EB Off-Ramp	NE 40th Street	>180	F	164.9	F
6	SR 520 WB Off-Ramp	NE 40th Street	123.8	F	111.9	F

Note:
1. Delay, or control delay per vehicle (unit: seconds/vehicle), is a measure of all the delay contributable to traffic control measures, such as signals or stop signs.

Source: HDR, Inc.

Table 11: 2035 PM Peak Hour Operational Analysis Results – Signalized Intersections

Intersection			2035 No-Build PM Peak Hour		2035 Build PM Peak Hour	
			Delay[1]	LOS	Delay	LOS
1	148th Avenue NE	NE 24th Street	172.5	F	118.3	F
2	SR 520 EB Off-Ramp	SB 148th Avenue NE	95.1	F	66.2	E
3	SR 520 EB Off-Ramp (Loop)	NB 148th Avenue NE	63.3	E	37.6	D
4	SR 520 WB Off-Ramp / NE 29th Place	148th Avenue NE	>180	F	165.4	F
5	SR 520 EB Off-Ramp	NE 40th Street	43.6	D	32.8	C
6	SR 520 WB Off-Ramp	NE 40th Street	162.4	F	109.0	F

Note:
1. Delay, or control delay per vehicle (unit: seconds/vehicle), is a measure of all the delay contributable to traffic control measures, such as signals or stop signs.

Source: HDR, Inc.

Table 12: 2015 AM Peak Hour Operational Analysis Results – Freeway Weaving/Merge/Diverge

	Location	Type	2015 No-Build AM Peak Hour		2015 Build AM Peak Hour	
			Density[2]	LOS	Density	LOS
1	SR 520 EB Off-Ramp Junction to SB 148th Avenue NE	Diverge Area	33.2	D	33.9	D
2	SR 520 EB Off-Ramp Junction to NB 148th Avenue NE	Diverge Area	25.8	C	24.8	C
3	SR 520 EB Mainline Between 148th Avenue NE On-Ramp and NE 40th Street Off-Ramp	Weaving Segment (Type A)[1]	46.2	F	43.8	F

Note:
1. Type A weaving segment requires that weaving vehicles in both directions (from on-ramp to mainline or from mainline to off-ramp) must make one lane change to successfully complete a weaving maneuver.
2. Density is the average density for all vehicles in the weaving segment (unit: pc/mi/ln)

Source: HDR, Inc.

Table 13: 2015 PM Peak Hour Operational Analysis Results – Freeway Weaving/Merge/Diverge

	Location	Type	2015 No-Build PM Peak Hour		2015 Build PM Peak Hour	
			Density[2]	LOS	Density	LOS
1	SR 520 EB Off-Ramp Junction to SB 148th Avenue NE	Diverge Area	35.2	E	35.6	E
2	SR 520 EB Off-Ramp Junction to NB 148th Avenue NE	Diverge Area	27.9	C	27.9	C
3	SR 520 EB Mainline Between 148th Avenue NE On-Ramp and NE 40th Street Off-Ramp	Weaving Segment (Type A)[1]	68.6	F	63.1	F

Note:
1. Type A weaving segment requires that weaving vehicles in both directions (from on-ramp to mainline or from mainline to off-ramp) must make one lane change to successfully complete a weaving maneuver.
2. Density is the average density for all vehicles in the weaving segment (unit: pc/mi/ln)

Source: HDR, Inc.

Table 14: 2035 AM Peak Hour Operational Analysis Results – Freeway Weaving/Merge/Diverge

	Location	Type	2035 No-Build AM Peak Hour		2035 Build AM Peak Hour	
			Density[2]	LOS	Density	LOS
1	SR 520 EB Off-Ramp Junction to SB 148th Avenue NE	Diverge Area	31.5	D	31.1	D
2	SR 520 EB Off-Ramp Junction to NB 148th Avenue NE	Diverge Area	32.1	D	31.7	D
3	SR 520 EB Mainline Between 148th Avenue NE On-Ramp and NE 40th Street Off-Ramp	Weaving Segment (Type A)[1]	59.2	F	59.0	F

Note:
1. Type A weaving segment requires that weaving vehicles in both directions (from on-ramp to mainline or from mainline to off-ramp) must make one lane change to successfully complete a weaving maneuver.
2. Density is the average density for all vehicles in the weaving segment (unit: pc/mi/ln)

Source: HDR, Inc.

Table 15: 2035 PM Peak Hour Operational Analysis Results – Freeway Weaving/Merge/Diverge

	Location	Type	2035 No-Build PM Peak Hour		2035 Build PM Peak Hour	
			Density[2]	LOS	Density	LOS
1	SR 520 EB Off-Ramp Junction to SB 148th Avenue NE	Diverge Area	26.5	C	27.7	C
2	SR 520 EB Off-Ramp Junction to NB 148th Avenue NE	Diverge Area	34.3	D	34.3	D
3	SR 520 EB Mainline Between 148th Avenue NE On-Ramp and NE 40th Street Off-Ramp	Weaving Segment (Type A)[1]	77.9	F	77.9	F

Note:
1. Type A weaving segment requires that weaving vehicles in both directions (from on-ramp to mainline or from mainline to off-ramp) must make one lane change to successfully complete a weaving maneuver.
2. Density is the average density for all vehicles in the weaving segment (unit: pc/mi/ln)

Source: HDR, Inc.

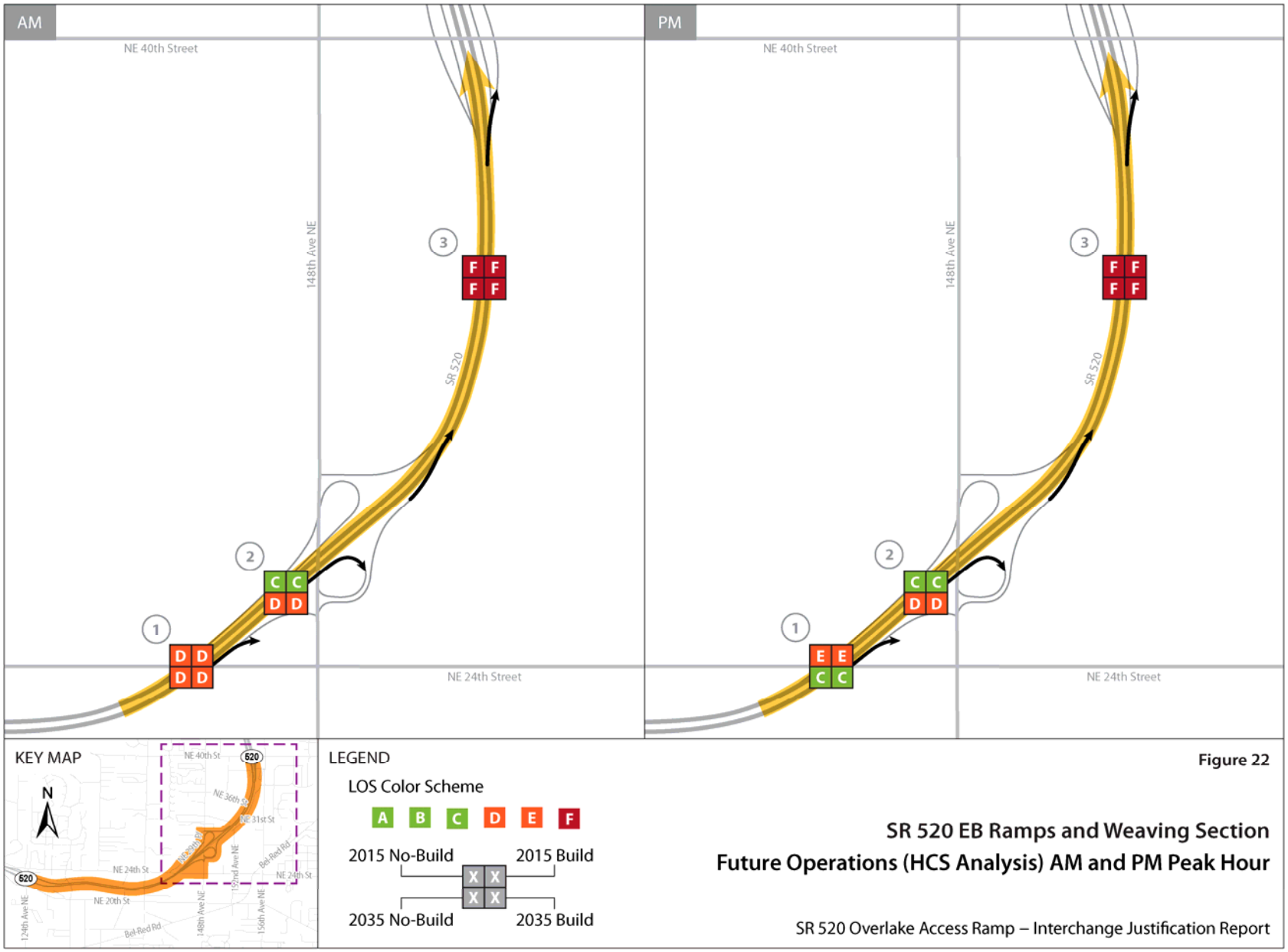


Figure 22

SR 520 EB Ramps and Weaving Section
Future Operations (HCS Analysis) AM and PM Peak Hour

SR 520 Overlake Access Ramp – Interchange Justification Report

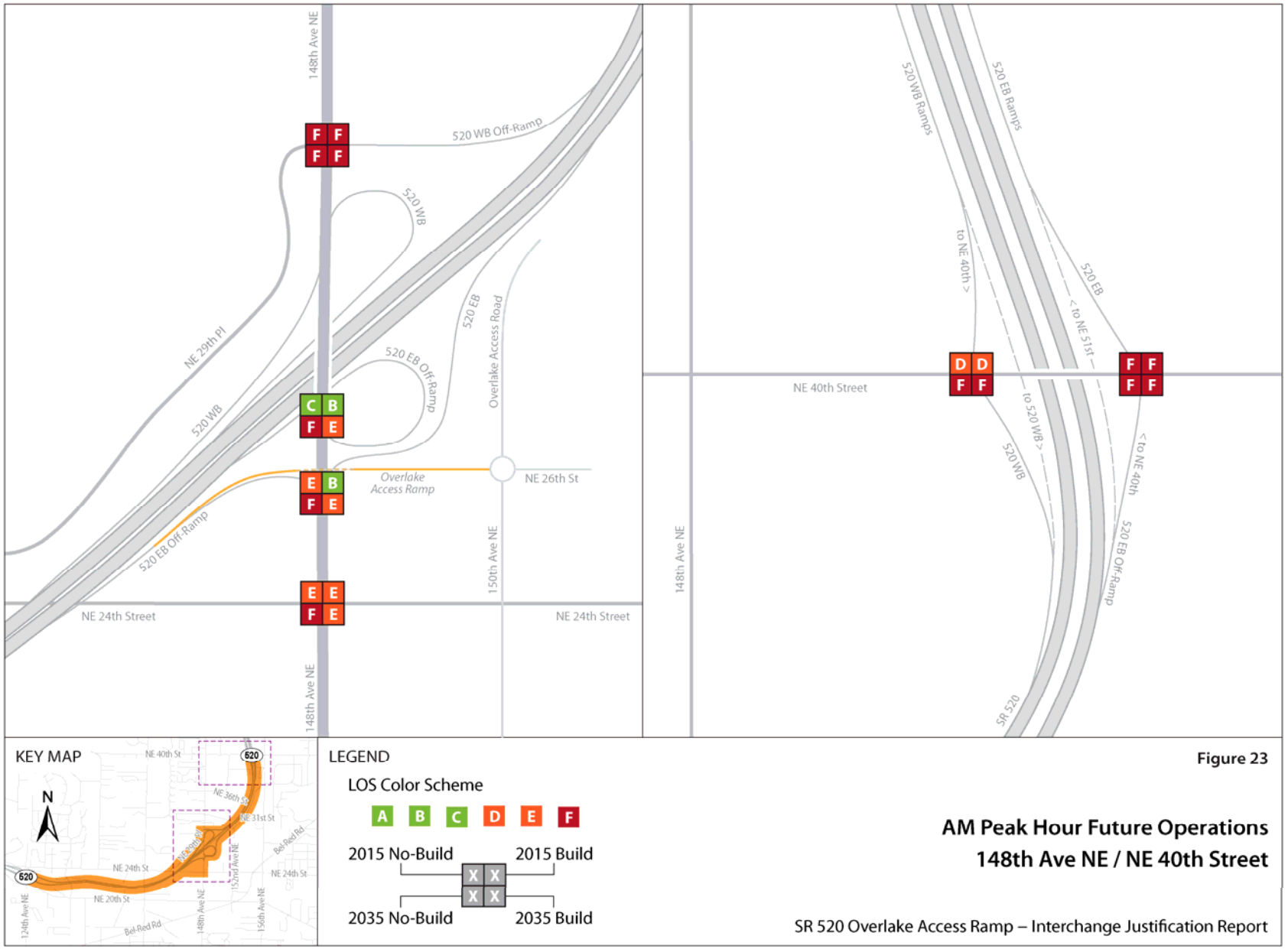


Figure 23

AM Peak Hour Future Operations
148th Ave NE / NE 40th Street

SR 520 Overlake Access Ramp – Interchange Justification Report

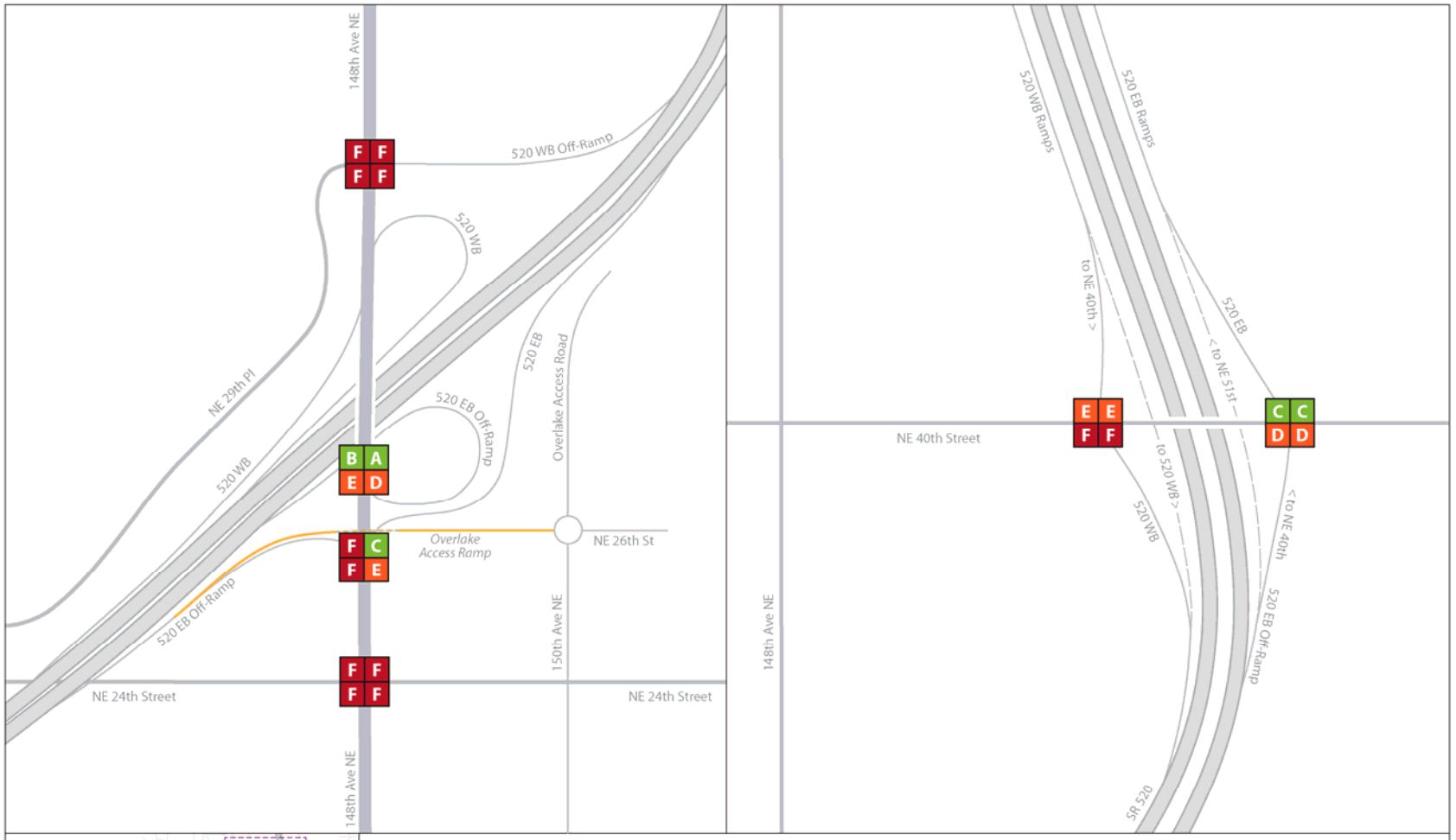


Figure 24

PM Peak Hour Future Operations
148th Ave NE / NE 40th Street

SR 520 Overlake Access Ramp – Interchange Justification Report

New Ramp Terminal Analysis

The Overlake Access ramp will create a new ramp terminal intersection when it connects to 150th Street. Two ramp terminal controls were evaluated – a roundabout and a signalized intersection – and are illustrated in **Figure 27**. This section presents the operational performance in terms of average delay and LOS. **Table 16** presents comparisons of delay and LOS between the roundabout and the signalized intersection for both AM and PM peak hours in 2015 and 2035. Based on this analysis, the IJR support team concluded that a roundabout was the preferred and therefore proposed intersection control type for the new access ramp. Detailed geometry data and performance data for roundabout analysis are included in **Appendix G**.

Table 16: Ramp Terminal Roundabout and Signal Operational Results – Delay and LOS

Control Type	Performance Measure	2015 AM Peak Hour	2035 AM Peak Hour	2015 PM Peak Hour	2035 PM Peak Hour
Roundabout	Intersection Overall	A (4.1)	C (25.7)	A (4.1)	B (13.4)
	Overlake Access Ramp (Eastbound)	A (4.3)	D (32.7)	A (5.0)	B (18.5)
Signal	Intersection Overall	B (11.3)	D (39.0)	B (13.1)	C (29.6)
	Overlake Access Ramp (Eastbound)	B (10.4)	D (35.1)	B(12.2)	C (27.5)

LEGEND

Roundabout

Signalized Intersection

Figure 25

Ramp Terminal Types
Overlake Access Ramp and 150th Ave NE

SR 520 Overlake Access Ramp – Interchange Justification Report

Collision Analysis

Three-Year Accident History

A detailed accident analysis of the freeway segments, interchange ramps, and local arterial streets was conducted to evaluate the safety and operations of the existing roadway system. Accidents from January 2007 through December 2009 were obtained from the WSDOT Statewide Travel & Collision Data Office, as shown in **Appendix I**, for the area along SR 520 and 148th Avenue NE within the study area. Within the study area, the average collision rate for the SR 520 mainline is 0.75 crashes per million vehicle miles of travel, excluding ramps in the study area. According to the 2009 State and NW Regional Average Collision Rates shown in **Figure 27**, this collision rate is lower than both the Statewide and Northwest Region 2009 average rates. The calculation of the average collision rate was based on the following equation.

$$\text{Collision Rate} = \frac{(\text{Number of Collisions}) \text{ x } (1 \text{ Million})}{(\text{Section Length} *) \text{ x } (\text{AADT} **) \text{ x } (365 \text{ Days})}$$

Where:
AADT: Annual Average Daily Volume (47400 vehicles per day)
Section Length: From Milepost (MP) 7.55 to MP 10.14. (2.59 mile)
Number of Collisions: Crashes SR 520 Mainline within the Study Area. (101 crashes)

Table 17-A: Number of Crashes by Severity

Location	From	To	Number of Crashes by Severity				
			Fatal	Injury	PDO	NR[1]	Total
SR 520 Mainline in Both Directions (from MP7.55 to MP 10.14)	124th Avenue NE	NE 40th Street	0	38	62	1	101
148th Avenue Bridge (520LX00918)	NE 29th Place	EB SR 520 Ramp Terminal	0	20	38	1	59
EB 520 Off-Ramp P100874	EB SR 520	SB 148th Ave. NE	0	10	11	0	21
EB 520 Off-Ramp P500901	EB SR 520	NB 148th Ave. NE	0	1	17	0	18
WB 520 On-Ramp S500869	NB 148th Ave. NE	WB SR 520	0	5	11	0	16
WB 520 Off-Ramp R100954	WB SR 520	NB 148th Ave. NE	0	2	9	0	11
WB 520 On-Ramp S100869	SB 148th Ave. NE	WB SR 520	0	2	5	0	7
EB 520 On-Ramp Q100960	NB 148th Ave. NE	EB SR 520	0	1	2	0	3

Source: WSDOT and HDR, Inc. [1]-Non-Reportable accident.

A summary of the severity and types of crashes is shown in **Table 17-A** and **Table 17-B**. The summary showed that the highest crash type was rear-end (about 40%) on the SR 520 mainline within the vicinity of the interchange and 148th Avenue NE within the study area. The second highest crash type was fixed-object (about 25%) and the third highest was sideswipe (about 23%). The accident history data appears to be related directly with the traffic congestion in the study area. **Table 17-C** and **Table 17-D** also presented SR 520 mainline crash summary on the weather and light conditions.

Table 17-B: Number of Crashes by Type on SR 520 Mainline

Accident Type	Number	Percent
Rear-end	40	39.6%
Hit Fixed-object	25	24.8%
Sideswipe (opposite or same direction)	23	22.8%
Overturn	6	5.9%
Run Off the Road	0	0%
All Other - Same Direction	2	2%
Hit Non-fixed-object	3	3%
All Other Non-collision	1	1%
One Parked - One Moving	1	1%
Total	101	100%

Table 17-C: Number of Crashes by Weather Conditions on SR 520 Mainline

Weather Condition	Number	Percent
Clear/Partly Cloudy	54	53.5%
Overcast	16	15.8%
Raining	28	27.7%
Snowing	2	2.0%
Fog	1	1.0%
Sleet	0	0%
Severe Crosswind	0	0%
Unknown/Not Stated	0	0%
Total	101	100%

Table 17-D: Number of Crashes by Light Conditions on SR 520 Mainline

Light Condition	Number	Percent
Daylight	73	72.3%
Dawn	3	3.0%
Dusk	4	4.0%
Dark-St Lights On	18	17.8%

Dark-St Lights Off	0	0%
Dark-No St Lights	2	2.0%
Unknown/Not Stated	1	1.0%
Total	101	100%

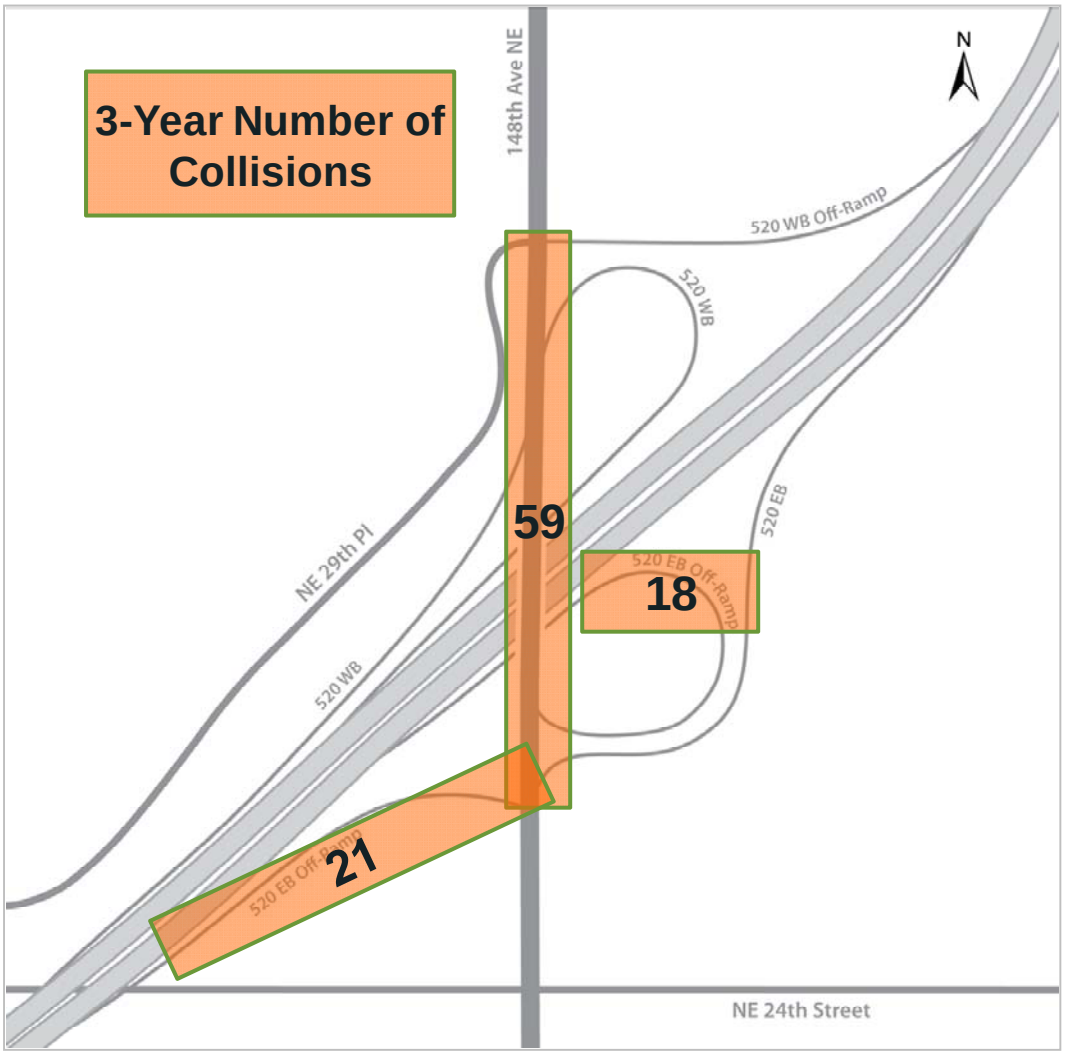


Figure 26: Top Three Accident Locations Within Project Study Area

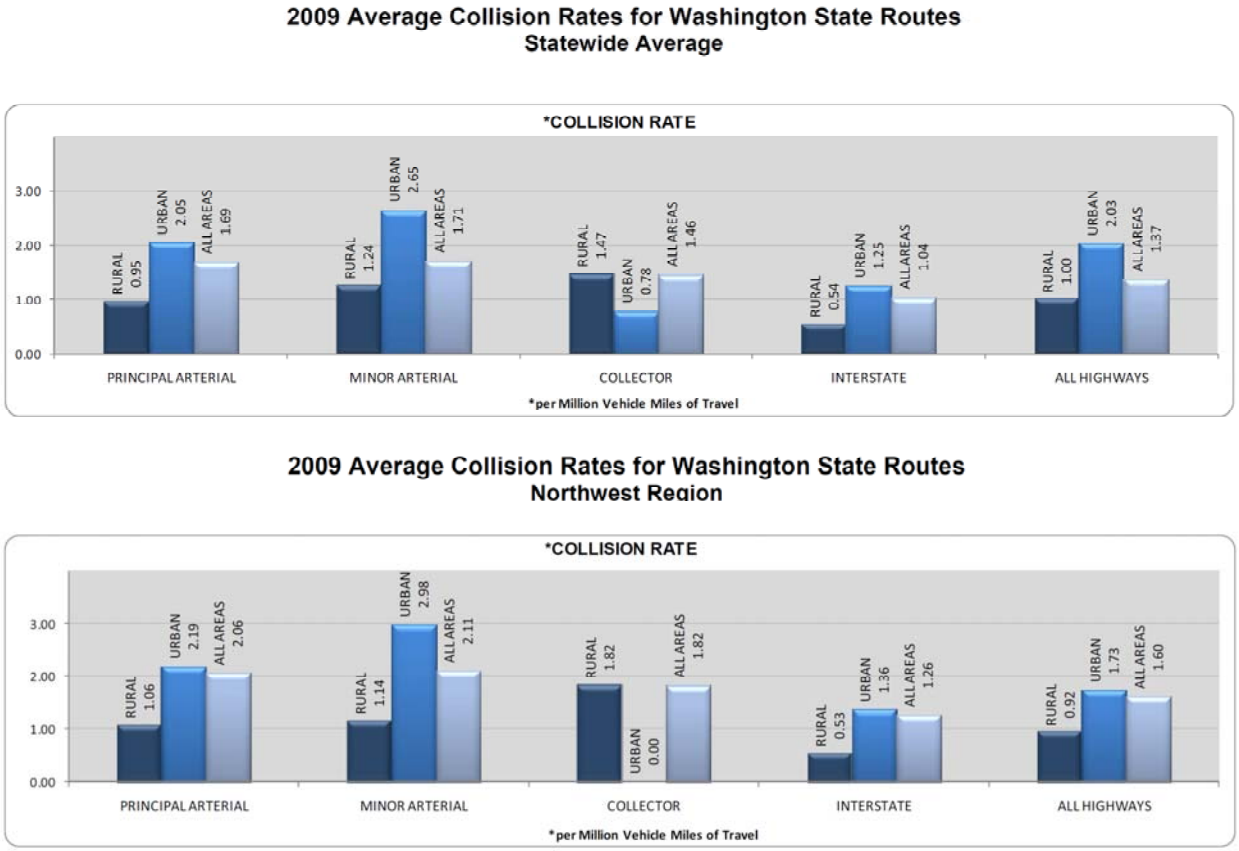


Figure 27: 2009 State and NW Regional Average Collision Rates

Collision Analysis Conclusions

Although accident rates for this study area are below both the statewide average rate as well as the NW region rate, there were nonetheless a number of possible injury and property damage collisions within the study area. Rear-end accidents were the predominant accident type and are normally attributed to congestion and queuing. Because this project will reduce queuing at two existing eastbound off-ramps within the study area, it is expected that the total number of accidents would drop by a similar percentage. One could also surmise that overall accident rate could decrease because the number of total minutes of congestion at these off-ramps and interchanges will be reduced compared to the no-build alternative.

Policy Point 4: Access Connections & Design

The proposed Overlake Access Ramp connection will be designed to current WSDOT geometric standards for ramps. At this time, there are no proposed deviations for the proposed slip ramp, the existing (relocated) eastbound off-ramp, or the proposed roundabout at the ramp terminal. WSDOT limited access is proposed to meet all WSDOT standards. The proposed relocation of

the existing eastbound off-ramp will result in increased limited access for the south side of the interchange as depicted in Figure 28 below. All proposed non-motorized trails and sidewalks will meet all current ADA requirements.

Draft Channelization Plans have been prepared for this project and can be found in **Appendix H**.

The IJR support team evaluated two slightly different ramp alignment alternatives that are shown below. Alternative A as shown on **Figure 28** was selected as the preferred alternative because it has the following advantages over Alternative B shown on **Figure 29**:

1. It better aligned the ramp terminal with the ramp entrance on the opposite side of 148th Avenue NE, allowing for better north/south intersection clearance times and pedestrian crossings.
2. Increases the arterial weave distance between the ramp terminal and NE 24th Street.
3. Moved the ramp further from private property parcels to the south of the interchange.
4. Results in fewer conflicts with Sound Transit pier locations.

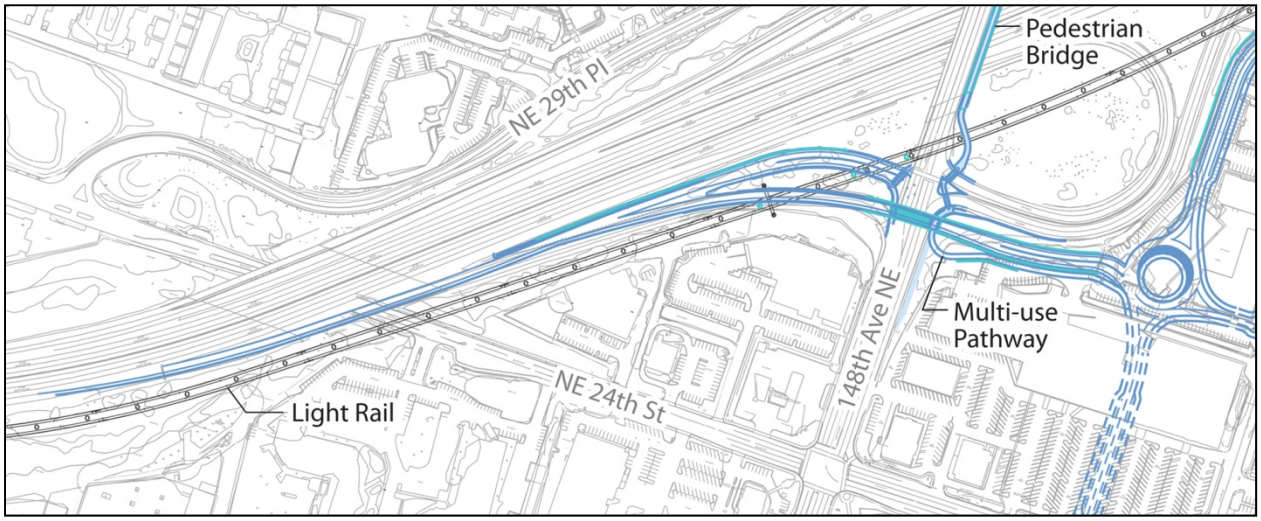


Figure 28: Overlake Access Ramp Connection Alternative A – Tunnel South

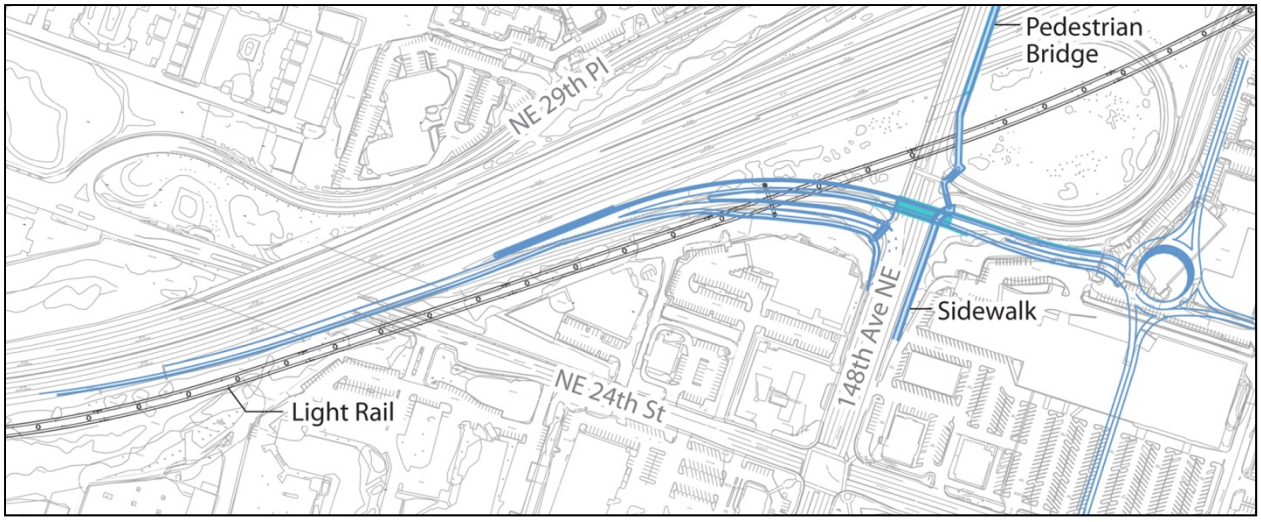


Figure 29: Overlake Access Ramp Connection Alternative B – Tunnel North

New Access Ramp and Relocated Existing Ramp Design Criteria

Based on the vertical profile of 148th Avenue NE and SR 520, it is quite feasible to construct a tunnel (short lid) under 148th Avenue NE. The ramp design criteria based on WSDOT Design Manual (DM) are presented in **Table 18**. The intersection control for the new ramp terminal intersection is proposed to be a modified multilane roundabout which will adequately handle projected traffic volumes as well as provide a traffic calming benefit between the high speed freeway environment and the much lower speed local street network that is mixed with pedestrians, access points, and on-street parking. The ramp design criteria based on the WSDOT Design Manual (DM) are presented in **Table 19**.

Table 18: Ramp Design Parameters

Design Element	Reference	Design Standard
Ramp Section with Cut Fill Tables	DM Exhibit 1230-4a	
Lane Width		
1 Lane	DM Exhibit 1360-6	15 ft
1 Lane (Tangent)		12 ft
2 Lane		25 ft (12.5 ft each)
Turning Roadway Width	DM 1240; Exhibit 1240-2a,3a	Varies
Ramp Shoulders		
Shoulder Width - Inside	DM Exhibit 1360-6	1 lane - 2 ft; 2 lane - 4 ft
Shoulder Width - Outside	DM Exhibit 1360-6	8 ft
Barrier Shy Distance	DM 1610.05 (1)	Add 2' Shy if Shoulder < 8'
Shoulder Cross Slope	DM 1230.04 (3)	Same as adjacent lane.

Table 19: Roundabout Design Parameters

Design Element	Reference	Design Standard
Single Lane Roundabout		
Inscribed Circle	DM Exhibit 1320-8	80-150' Diameter
Width		14-19' Width
Entry Width		12-18' Entry Width
Multi-Lane Roundabout		
Inscribed Circle	EM Exhibit 1320-8	150' Min Inscribed Circle
Width		29' min Width
Entry Width		25' min Entry Width
Speed (Circulating Roadway)	DM 1320.03	less than 25mph

Policy Point 5: Land Use and Transportation Plans

This proposed interchange modification is consistent with all future transportation plans by WSDOT, the City of Redmond, and the City of Bellevue and supports future land use planned for this sub-area. In 2007, this project received strong support from the cities of Bellevue and Redmond in the Overlake Neighborhood Plan Update. In 2008, this project was adopted to the Redmond Transportation Facilities Plan (project ID: RED-OV-096.1). In 2010, this project was added to WSDOT's State Highway System Plan and in January of 2011 a request was made on behalf of WSDOT to add this project to PSRC's MTP (Metropolitan Transportation Plan).

Throughout the planning process and this IJR process, close coordination has occurred between the City of Redmond, WSDOT, the City of Bellevue, and Sound Transit to assure that these proposed improvements are consistent with other planned improvements such as Eastlink (light rail between Bellevue and Redmond) as well as any potential future highway improvements to SR 520.

Future Land Uses

The future travel demand model includes future land use growth in the region and areas within and around the study area including the adopted Bel-Red Corridor Plan in Bellevue and employment growth of the major employers in the area. Areas around the SR 520 and 148th Avenue NE interchange are anticipated to continue growing with residential and commercial land uses.

The City of Redmond adopted the Overlake Neighborhood Plan which provides detailed land use data for future growth. As an example, **Table 20** presents the land use summary for just the Overlake area that was planned within the horizon years of this report.

Table 20: Overlake Area Land Use Summary

Land Use	Residential	Commercial Employment			
Year	Housing Units	Retail Employee	FIRES[4] Employee	Industry Employee	Total Employee
2006[1]	2,987	1,678	37,816	2,255	41,749
2015[2]	4,950	1,944	46,987	988	49,919
2035[3]	9,164	2,564	76,390	-	78,954

Note:
[1] Data was extracted from Bellevue, Kirkland, and Redmond Travel Demand Model.
[2] Data was interpolated based on 2006 and 2035 land use data.
[3] Data provided by the City of Redmond.
[4] "FIRES" represents Finance, Insurance, Real Estate and Service office employment.

Source: City of Redmond and HDR, Inc.

Policy Point 6: Future Interchanges

Per the current WSDOT State Highway System Plan, there are no new interchanges proposed on the SR 520 Corridor. However, in this system plan, there is a proposed modification and there continues to be ongoing dialogue between WSDOT and the City of Bellevue regarding a potential interchange modification at the SR 520/NE 124th Street interchange immediately east of I-405 and approximately 1.5 miles west of the NE 148th Street interchange. If this existing half diamond (to the west) interchange was modified to a full diamond interchange, travel demand modeling suggests that volumes on SR 520 east of 124th Avenue NE would increase. Therefore, to be conservative, we have modeled, analyzed, and sized the proposed slip ramp to accommodate those volumes in the future. This assumption is consistent with current model assumption in the Bellevue-Kirkland-Redmond (BKR) travel demand 2030 model.

Policy Point 7: Coordination

There are four separate individual project coordination efforts that have been successfully occurring throughout the duration of the preparation of this IJR document. Representatives from each of these projects were members of the IJR support team. The individual projects include:

1. Sound Transit Link Light Rail – Eastlink alignment and the Overlake Station. **This project is currently funding for design and construction.**
2. WSDOT - Potential capacity improvements to SR 520 mainline as well as the eastbound on-ramp to SR 520 from 148th Avenue NE. **These projects are undefined and unfunded**. This interchange modification has been designed to not preclude an additional eastbound land on the mainline as well as an added (third) eastbound on-ramp lane.
3. City of Bellevue – SR 520/124th Avenue NE Interchange Modification. **This project is currently unfunded**; however, it is on the WSDOT Statewide System Plan and it was decided by the support team to model (assume) a full interchange at 124th Avenue NE for 2035 modeling. This represents worst case volume assumption for the SR 520 mainline as well as associated ramp volumes for the proposed 148th Avenue NE interchange modification.
4. City of Redmond – 152nd Corridor study. **This project is funded for preliminary design**. This project defines the local street network assumptions within the study area east of 148th Avenue NE and north of NE 24th Avenue.

Coordination with these projects will continue as this project moves into the environmental and 30% design phase.

Policy Point 8: Environmental Process

The environmental process has not yet begun for this project. The City of Redmond is actively pursuing funding to complete the environmental and 30% design phase of this project. At this time, it is not anticipated that an Environmental Impact Statement (EIS) would be required for this project. If federal funding is ever obtained for either design or construction, it is currently envisioned that an Environmental Assessment (EA) following current NEPA requirements would be required.

There are no identified environmentally sensitive areas or areas of concern within the proposed project limits. There are no identified wetlands, waterways, or stream crossings within the proposed project limits.