

AIR QUALITY REPORT

I-5 Southbound Off-Ramp at North Broadway Street Project Multnomah County

Key Number 18262

Prepared by:
Natalie Liljenwall P.E., Air Quality Lead
Oregon Department of Transportation
June, 2015

Contents

1. Introduction	1
2. Project Description	1
3. Traffic Analysis	1
4. Existing Air Quality	2
5. CO Hot Spot Analysis Methodology	2
6. CO Hot Spot Results	5
7. Construction Activities	5
8. MSAT	6
9. Project-Level Conformity Determination	7
10. References	8
Table 1. Traffic Summary for I-5 Southbound Off-Ramp at Broadway	
Table 2. MOVES Runspec Selections	
Table 3. ODOT MOVES Project Level Data Manager Inputs	
Table 4. CO Emission Rates used in CAL3QHC Modeling	
Table 5. CAL3QHC Model Inputs	
Table 6. CO Concentration for I-5 Southbound Off-Ramp at Broadway Street	
Figure 1. Project Location Map	9
Figure 2. Project Element Map	10
Figure 3. Design Drawing	11
Appendix A - Amended STIP, 2015-2018	12
Appendix B -Traffic Data	13
Appendix C - Modeling Files	14

1. Introduction

An Air Quality analysis was conducted for the I-5 Southbound Off-Ramp at North Broadway Project located in Portland Oregon. The project will realign the slip lane of the southbound I-5 off-ramp onto North Broadway Street and is located within the Portland carbon monoxide (CO) maintenance area. The 8 Hour CO concentrations in the opening year (2016) and design year (2036) were predicted to be 2.3 parts per million (ppm) and 2.0 ppm respectively. These concentrations are well below the 8 hour CO National Ambient Air Quality standards (NAAQs) of 9 ppm. The 1 hour CO concentrations for 2016 and 2036 will be 3.0 ppm and 2.6 ppm respectively, which are also well below the 1 hour CO NAAQs of 35 ppm.

The project area Mobile Source Air Toxic (MSAT) emissions are expected to decrease in the future relative to existing conditions.

2. Project Description

The project will realign the right turn lane (slip lane) located at the southbound I-5 off-ramp onto North Broadway Street. The slip lane will be incorporated into the existing intersection of North Vancouver Street, North Broadway Street and the southbound I-5 off-ramp. The project will replace the existing traffic signal at the intersection of North Broadway, I-5 off-ramp and North Vancouver with a standard signal. The project will also include bicycle and pedestrian improvement on North Broadway, North Wheeler Avenue and North Wielder Street. These improvements will likely include pedestrian signals, bulbouts, and other minor improvements. Small amounts of right-of-way may be required for the pedestrian improvements. The slip lane realignment will remain within existing public right-of-way.

Figure 1 shows the project location, Figure 2 shows the project elements and Figure 3 shows the project design.

3. Traffic Analysis

The traffic data was provided by ODOT's Region 1 Traffic Section (ODOT, 2015). The traffic data included peak hour operation data for the signalized intersection for opening year (2016) and design year (2036). The worst-case scenario in terms of air quality was selected based on the level of service data (LOS), delay, V/C and sum of approaching volumes for opening year 2016 and design year 2036. For design year 2036, PM hour was used for worst-case scenario selection. Table 1 shows the operation traffic data for the Build scenario in 2016 and 2036. Appendix B shows the traffic data for all years for No-Build and Build scenarios. The synchro data used in modeling is included in Appendix B.

Table1. Traffic Summary for I-5 Southbound Off-Ramp at Broadway				
Peak Hour	LOS¹	Delay (sec./veh.)	V/C	Sum of Approaching Volumes
2016 AM	D	50.5	0.80	2520
2016 PM	D	39.7	0.82	2620
2036 AM	E	60.8	1.00	3235
2036 PM	F	87.5	1.10	3440
¹ LOS- Level of Service				
² Bold shows the scenario selected for quantitative analysis				

4. Existing Air Quality

Portland is a CO maintenance area. Metro is responsible for regional transportation conformity in the Portland area. In accordance with the guidance in the ODOT Air quality Manual (September 2008), a concentration of 2.0 ppm was used as the ambient background concentration in the project area.

The Portland–Vancouver area became “in attainment” for ozone with the revocation of the federal 1-hour ozone standard in June 2005. The area is still subject to the no backsliding provisions of the revised standard but does not require a conformity analysis for ozone. All other pollutants are in attainment.

5. CO Hot Spot Analysis Methodology

A project level hot spot analysis estimates the highest CO concentration resulting from the project, which a human would be exposed to in the project area. The analysis must demonstrate that the highest CO concentration is below the CO NAAQs and the project conforms to the SIP for the Portland Area Carbon Monoxide Maintenance Plan. The CO vehicular emissions were calculated using the EPA approved model MOVES2010b (EPA, 2012). Using these emission rates, the worst case CO concentration was predicted using the EPA-approved CAL3QHC dispersion model (version 95221, Environmental Protection Agency (EPA) 1992 and 1995). If the modeled worst case scenario does not cause a violation of the NAAQs, then it is assumed all other project scenarios would also not cause a violation of the NAAQs.

The EPA approved model MOVES2010b calculates emission factors for a variety of gasoline and diesel fueled roadway vehicles. MOVES2010b accounts for progressively more stringent tailpipe emission standards over the vehicle model years evaluated. The MOVES2010b files include the applicable climate data, fuel characteristics, local vehicle mix and anti-tampering programs for the project area. Emissions were calculated based on a typical winter day because colder temperatures result in higher CO concentrations. The afternoon hour was selected as the worst-case scenario based on LOS, V/C ratio and vehicle volume. MOVES peak hour 17:00-17:59 was

used to represent the afternoon peak hour of 5:00 to 6:00 pm. The model was run for 2016 and 2036 for multiple roadway speeds within the project area.

MOVES2010b input files were developed by ODOT using databases files provided by ODEQ and Metro (ODEQ, 2013 and Metro, 2014). The databases from Metro include fuel supply, fuel formulation, inspection and maintenance program and source type age distribution (Metro, 2014). ODEQ provided the meteorology database (ODEQ, 2013). Using the MOVES2010b database provided by Metro ensures consistency between project level and regional conformity analyses. Two project specific databases were developed by ODOT based on the vehicle speeds by link, and also the vehicle type distribution for the project area. Table 2 and 3 summarize the MOVES runspec inputs and MOVES database sources.

Table 2. MOVES Runspec Selections	
Input Name	Selection
Scale	Project
Calculation Type	Inventory
Time Span	Hour, analysis year (2016 & 2036), January, weekday, 5:00 - 6:00 p.m.
Geographic Bounds ^a	Oregon, Multnomah County (consistent with Metro regional conformity analysis)
Vehicles/Equipment ^a	Used same vehicle/fuel types (consistent with Metro regional conformity analysis)
Road Types	Urban unrestricted and urban restricted specific to project
Pollutants and Processes ^b	Running exhaust and crankcase running as given in EPA guidance
Input Data Sets ^a	Low Emitting Vehicles (LEV) database provided by Metro
Output	Selected distance traveled and population and grams, miles
Post Processing	Run CO_CAL3QHC_EF.sql
Note:	
^a Provided by Metro, June 2014	
^b Using MOVES2014 in Project-level Carbon Monoxide Analyses, March 2015. EPA-420-B-15-028	

Table 3. ODOT MOVES Project Level Data Manager Inputs	
MOVES Database Name	Data Source
Fuel Supply and Fuel Formulation	MOVES2010b files provided by Metro, June 2014
Meteorology	MOVES2010b provided by DEQ, May 2013
Inspection and Maintenance Coverage	MOVES2010b files provided by Metro, June 2014
Source Type Age Distribution	MOVES2010b files provided by Metro, June 2014
Project Links	Project specific. One link per roadway project speed. The specific roadway length and types will be characterized in dispersion model.
Link Source Type Hour ^a	Used Metro MOVES run at county level to determine distance traveled by each vehicle type for applicable roadway type. For motorcycle used 2013 ATR Trend data (Station- 26-026)
Notes:	
^a Used roadway type of urban unrestricted and urban restricted based on project location.	

Using best professional judgment, ODOT developed the link and link source type databases. The link database was developed based on the post vehicle speeds for project roadways. The link source type data was developed based on the vehicle miles traveled by each vehicle type in the regional emission types for urban roadways. The missing data for motorcycles were obtained from the automatic traffic recorders (ODOT, 2013).

The emission rates calculated by MOVES2010b are shown in Table 4 and the MOVES2010b input and output files are included in Appendix C.

Vehicle Speed	2016	2036
	(grams/hour)	
idle	29.04	6.84
(miles/hour)	(grams/vehicle-mile)	
35	5.44	3.13
45	4.32	2.56

The CO project concentrations were calculated using the CAL3QHC dispersion model for both the opening year 2016 and design year 2036. Inputs into the dispersion model include traffic volumes, signal timing, intersection geometry and receptor locations. CAL3QHC inputs were selected by using the guidance provided in the ODOT Air Quality Manual (ODOT, 2008) and EPA Guideline for Modeling Carbon Monoxide from Roadway Intersections (EPA, 1992). Table 5 summarizes CAL3QHC model inputs. The CAL3QHC input and output files are included in Appendix C.

Meteorological Variables	
Averaging Time	60 minutes
Surface Roughness	175 (office)
Wind Speed	1 meter per second
Wind Angle	0 to 360 degrees in 10-degree increments
Stability Class	4 (D) neutral
Mixing Height	1,000 meters
Ambient Background Concentration	
Portland	2 parts per million
Persistence Factor	0.76
Site Variables	
Receptor Coordinates	10 feet from each traveled roadway on both sides of the street at distances of 10 feet, 82.5 feet (25m) and 164 feet (50 m) from the cross street. Height 6.0 feet

The maximum 1 hour CO concentration for each model run was added to the ambient background CO concentration of 2 ppm as recommended in the ODOT Air Quality Manual, (ODOT, 2008). The 1 hour CO concentrations were converted to the 8 hour concentrations using a persistence factor of 0.76 which was also recommended by ODOT Manual. These resulting concentrations were compared to the applicable 1 hour and 8 hour CO NAAQs.

6. CO Hot Spot Results

CO concentrations are the same for Build and No-Build scenario since the volumes are the same. In 2016, the highest build concentration occurred in the northeast and westbound approach of the intersection. In 2036, the highest concentration occurred at the southwest corner of the intersection. Table 6 summarizes the CAL3QHC modeling results by year and scenario type. The modeled concentrations are well below the 1 hour and 8 hour CO NAAQs for all scenarios and analysis years.

The maximum modeled 1-hour and 8-hour concentrations are 3.0 ppm and 2.3 ppm, respectively which will occur in 2016. Since the worst case intersection has a CO concentration well below the NAAQs for the all modeled scenarios, all other intersections in the project area are expected to have equal or lower concentrations and also be well below the 1 hour and 8 hour CO NAAQs.

Alternative	Analysis Year	LOS ¹	1 Hour Concentration ²	8 Hour Concentration ²	Location of Highest Conc.
			(ppm ³)	(ppm ³)	
No Build	2016	D	3	2.3	multiple locations
Build	2016	D	3	2.3	NE corner and WB approach
No Build	2036	E	2.6	2.0	NW and SW corners
Build	2036	F	2.6	2.0	NW corner
NAAQS ³ (ppm)			35	9	
¹ LOS – Level of service ² Includes background concentration of 2 ppm and persistence factor of 0.76. ³ PPM- Parts per million ³ NAAQs – National Ambient Air Quality Standard					

7. Construction Activities

During construction carbon monoxide (CO) and PM₁₀ are expected to increase. These increased emissions are due to heavy construction vehicles, lowered traffic speeds and earth excavation. These emissions create temporary impacts on the ambient air quality

7.1 Construction Mitigation

Construction contractors are required to comply with Division 208 of OAR 340, which addresses visible emissions and nuisance requirements. Subsection of OAR 340-208 places limits on fugitive dust that causes a nuisance or violates other regulations. Violations of the regulations can result in enforcement action and fines. The regulation provides that the following reasonable precautions be taken to avoid dust emissions (OAR 340-208, Subsection 210):

- Use of water or chemicals, where possible, for the control of dust in the demolition of existing buildings or structures, construction operations, the grading of roads or the clearing of land;
- Application of asphalt, oil, water, or other suitable chemicals on unpaved roads, materials stockpiles, and other surfaces which can create airborne dusts;
- Full or partial enclosure of materials stockpiled in cases where application of oil, water, or chemicals are not sufficient to prevent particulate matter from becoming airborne;
- Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials;
- Adequate containment during sandblasting or other similar operations;
- When in motion, always cover open-bodied trucks transporting materials likely to become airborne;
- The prompt removal from paved streets of earth or other material that does or may become airborne.

In addition, contractors are required to comply with ODOT standard specifications Section 290 that has requirements for environmental protection, which include air-pollution control measures. These control measures, which include vehicle and equipment idling limitations, are designed to minimize vehicle track-out and fugitive dust. These measures would be documented in the erosion and sediment control plan that the contractor is required to submit prior to the pre-construction conference. To reduce the impact of construction delays on traffic flow and resultant emissions, road or lane closures should be restricted to non-peak traffic periods when possible.

8. MSAT

The purpose of this project is to improve the safety and operations at the southbound I-5 off-ramp at the Rose Quarter/City Center (Exit 302-A) that connects to North Broadway. This project will have no meaningful impacts on traffic volumes or vehicle mix as the 2036 Average Annual Daily Traffic (AADT) for Build and No-Build scenarios are identical for all approach lanes with the highest 2036 AADT occurring of 21,000 vehicles approaching on Broadway Street. This project has been determined to generate minimal air quality impacts for CAAA criteria pollutants and has not been linked with any special MSAT concerns. As such, this project will not result in changes in traffic volumes, vehicle mix, basic project location, or any other factor that would cause an increase in MSAT impacts of the project from that of the No-Build scenario. The project will also move vehicle traffic on the off-ramp future away from the existing daycare called Grandma's Place Daycare. Therefore, this project is exempt from analysis based on FHWA's Interim Guidance on Mobile Source Air Toxics Analysis in NEPA Documents, dated December 6, 2012. (FHWA, 2012)

Finally, EPA regulations for vehicle engines and fuels will cause overall MSAT emissions to decline significantly over the next several decades. Based on regulations now in effect, an analysis of national trends with EPA's MOVES2010b model forecasts a combined reduction of 80 percent in the total annual emission rate for the priority MSAT from 2010 to 2050 while vehicle-miles of travel are projected to increase by 100 percent. This will both reduce the background level of MSAT as well as the possibility of even minor increases in MSAT emissions from this project.

9. Project-Level Conformity Determination

A project level hot spot analysis predicted that at the closest receptor, the 8 Hour CO concentration will be well below the NAAQs in 2016 (opening year) and 2036 (design year).

The proposed project is fiscally constrained and is in the 2014 Regional Transportation Plan (RTP) and Metro's financially constrained Air Quality Conformity Determination for the amended 2015-2018 Metropolitan Transportation Improvement Program (MTIP) which were both adopted on July 17, 2014. The air quality conformity finding for RTP and MTIP was issued by FHWA and FTA on May 20, 2015. The design concept and scope of the proposed project in this report is consistent with the project description in the RTP, the MTIP and the assumptions in the Metro's regional emissions analysis. Appendix A contains project documentation from the amended State Transportation Improvement Program (STIP).

The project will be in conformance with SIP for the Portland Area Carbon Monoxide Maintenance Plan (ODEQ, 2004) and the project will not:

- Cause or contribute to any new violations of any standard,
- Increase the frequency or severity of any existing violation or any standard, or
- Delay timely attainment of any transportation control measures (TCM).

The project area Mobile Source Air Toxic (MSAT) emissions are expected to decrease in the future relative to existing conditions.

10. References

Environmental Protection Agency. U.S. Code of Federal Regulations. 40 CFR Part 93, Subpart A. “*Conformity to State or Federal Implementation Plans of Transportation Plans, Programs, and Projects Developed, Funded or Approved Under Title 23 U.S.C. or the Federal Transit Laws.*”

Environmental Protection Agency, “*Guideline for Modeling Carbon Monoxide from Roadway Intersections*, EPA-454/R-82-005”, November 1992.

Environmental Protection Agency. “*User’s Guide to CAL3QHC Version 2.0.*” EPA 454-R-92-006R. 1995.

Environmental Protection Agency. “*Using MOVES in Project- Level Carbon Monoxide Analysis.*” EPA-420-B-10-041. March, 2015.

Federal Highway Administration. FHWA, 2012. “*Interim Guidance on Air Toxic Analysis in NEPA Documents.*” Memorandum from Cynthia J. Burbank, Associate Administrator for Planning, Environment and Realty. December 6, 2012.

Metro, 2014. MOVES2010b database files from Metro Regional Conformity Analysis performed in 2014. June, 2014.

Oregon Department of Environmental Quality. Oregon Administrative Rules, Division 252. “*Transportation Conformity*”.

ODEQ, 2004. Oregon Department of Environmental Quality. “*Portland Area Carbon Monoxide Maintenance Plan, State Implementation Plan, Volume 2, Section 4.58*”_ December 10, 2004.

ODEQ, 2013. MOVES2010b Meteorological data for Portland area. May, 2013.

ODOT, 2008. “*Oregon Department of Transportation Air Quality Manual*” September, 2008.

ODOT, 2013, “Summary of Trends at Automatic Traffic Recorder Stations: 2013.” 2013
http://www.oregon.gov/ODOT/TD/TDATA/pages/tsm/tvt.aspx#Permanent_ATR_Station_Trends

ODOT, 2015. “*Multiple email correspondence between Katherine Carlos and Natalie Liljenwall regarding traffic data needed for air quality analysis*”.

Figure 1. Project Location Map

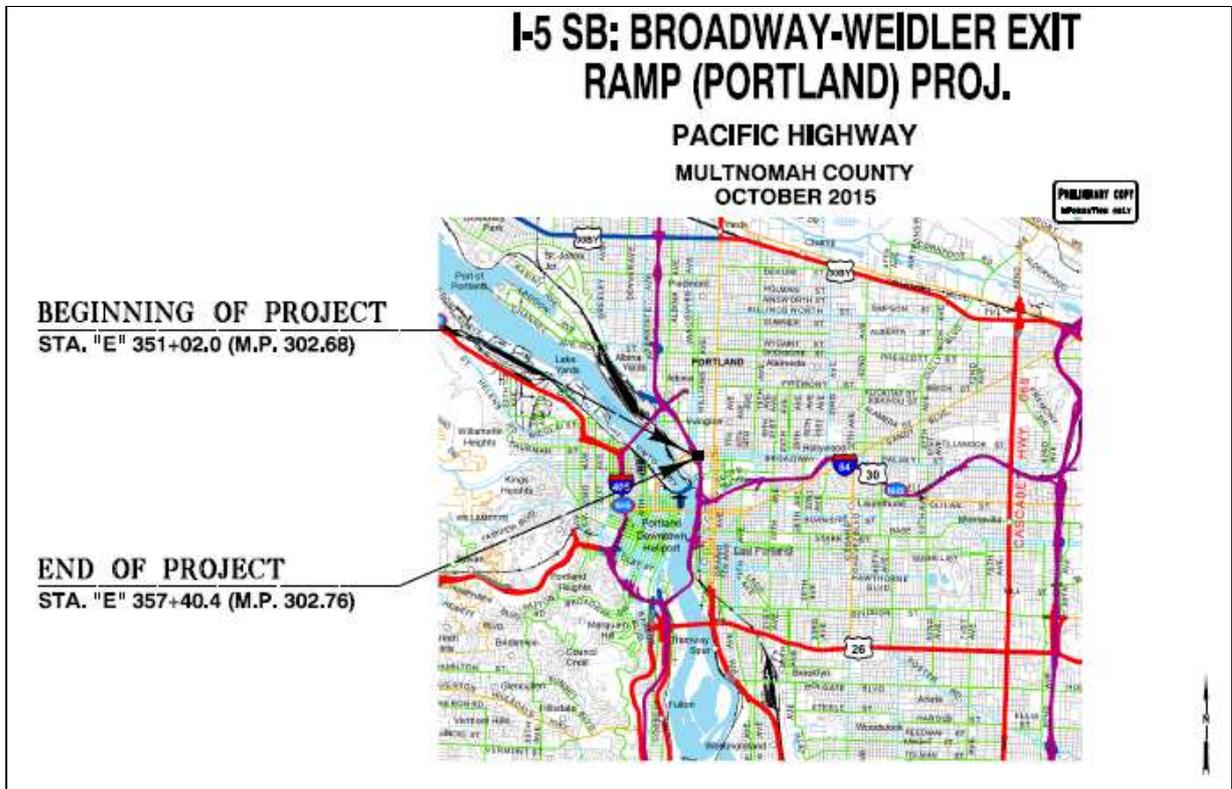
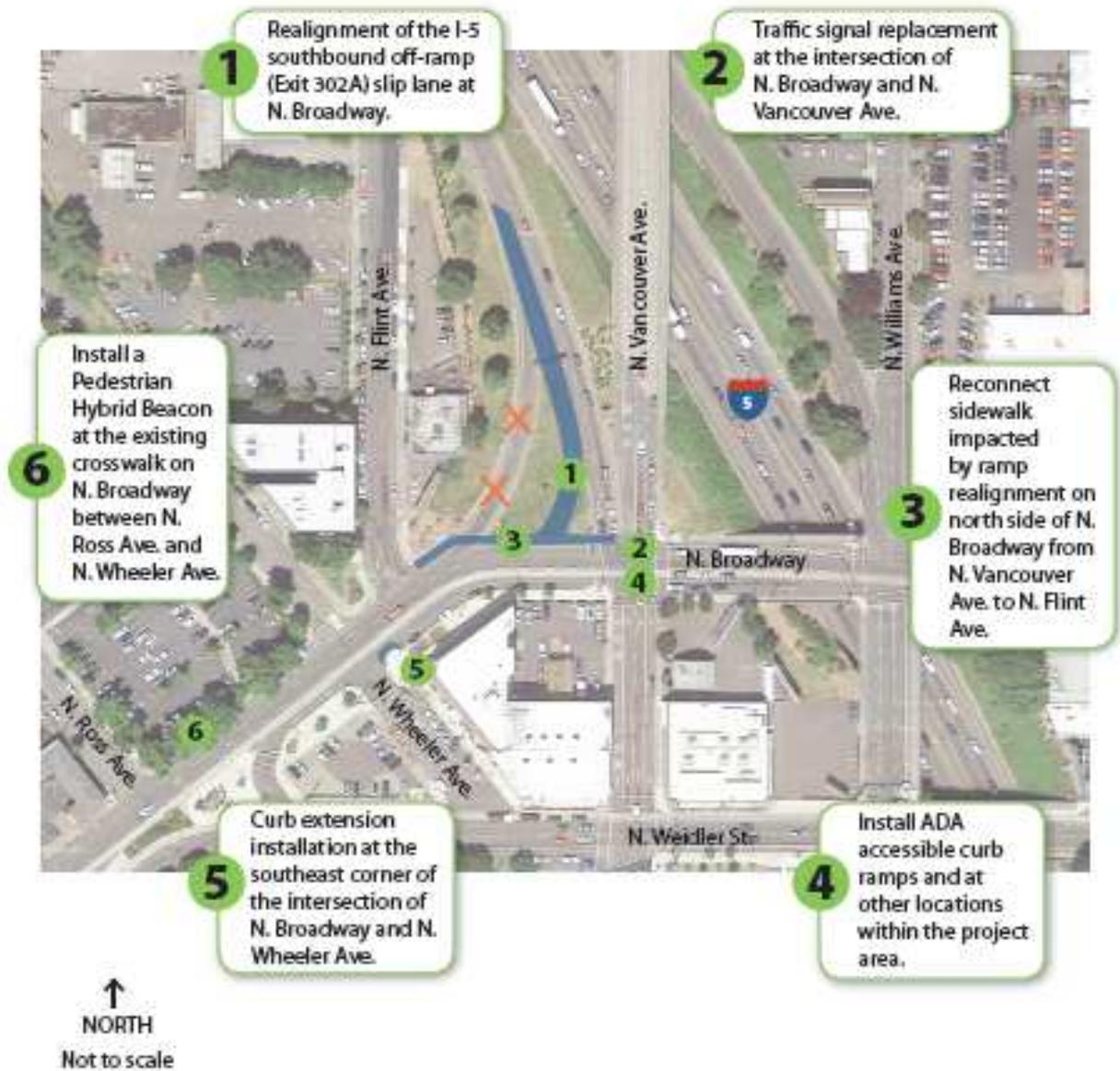


Figure 2. Project Element Map



I-5 Southbound Off-Ramp at North Broadway

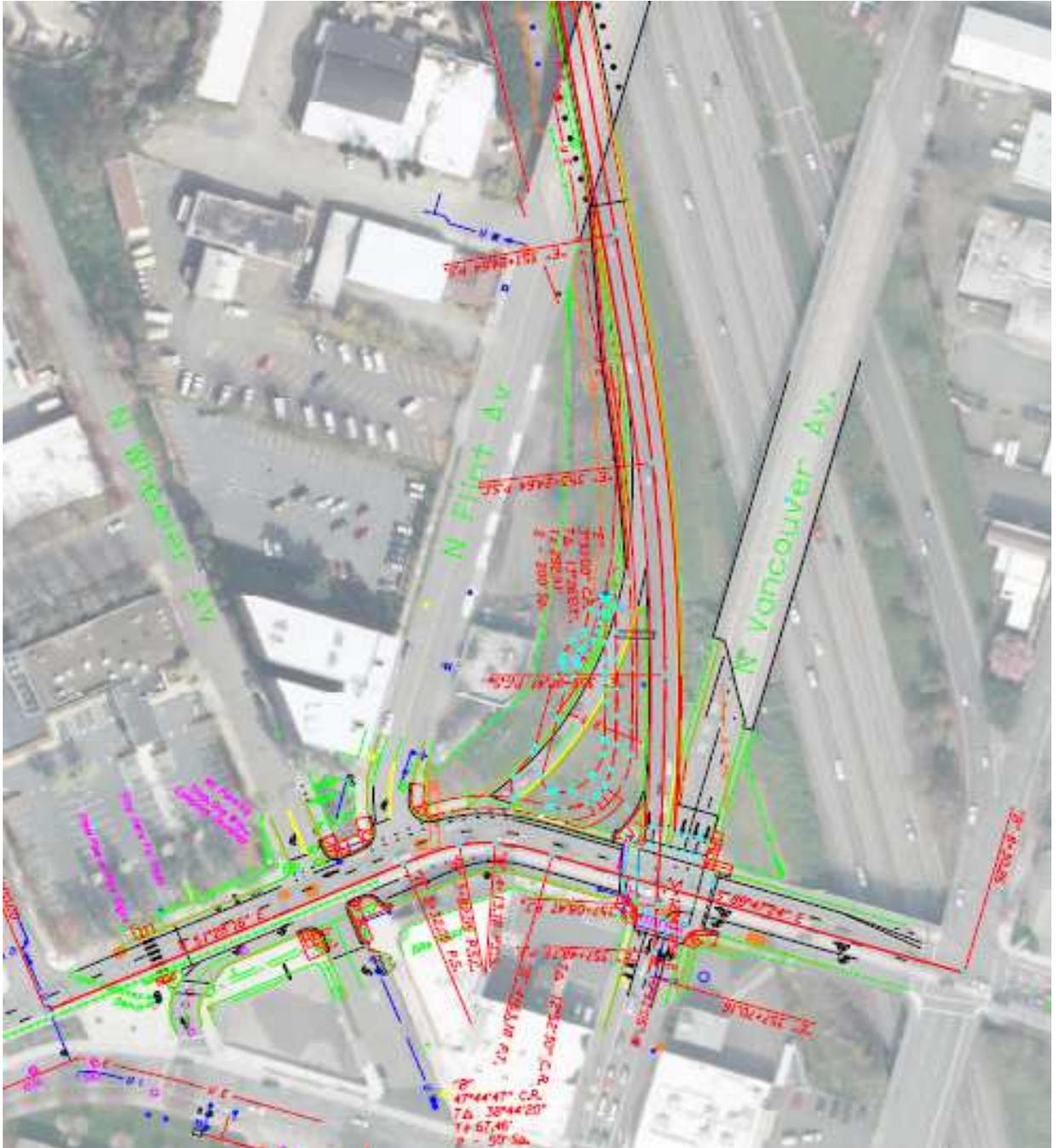
Project Elements



For Informational Purposes Only. Subject to Change.
November 2014



Figure 3. Design Drawing



Appendix A - Amended STIP, 2015-2018

MULTNOMAH

Name: I-5 SB: BROADWAY-WEIDLER EXIT RAMP (PORTLAND) **Key:** 18262

Highway:	PACIFIC HIGHWAY	ACT:	METRO EAST ACT
Route:	I-5	MPO:	Metro
Milepoints	302.80 to 302.80	Applicant:	ODOT
Mile Length	0.00	Status:	Final Plans Scheduled to Begin
Description:	REALIGNMENT OF RAMP INTERSECTION AT BROADWAY	Work Type:	Safety

	Planning	Preliminary Engineering	Right of Way	Utility Relocation	Construction	Other	<u>Project Total:</u>
Year:		2013	2015	2015			
Phase Total:		\$541,770	\$40,000	\$11,000			\$592,770
First Fund:		IM \$368,880	ADVCON \$36,888	STP-FLX \$9,870			
Match:		\$31,120	\$3,112	\$1,130			
Second Fund:		STP-FLX \$130,740					
Match:		\$11,030					

Amendment No: 12-15-222A

Approval Date: 01/27/2015

Requested Action: Change the project name. Increase PE, add RW and UR phases by adding funds Region 1 FP savings.

AMENDED

Appendix B -Traffic Data

Table B – Operation Traffic Data

	Opening Year 2016				Design Year 2036			
	No-Build		Build		No-Build		Build	
	AM	PM	AM	PM	AM	PM	AM	PM
Intersection sum of approaching volumes or (Total Entering Volume), vehicle per hour (vph)	2190	2330	2520	2620	2875	3125	3235	3440
Level of Service (LOS)	C	D	D	D	E	F	E	F
Intersection Delay (seconds)	29.1	46.1	50.5	39.7	59.7	89.7	60.8	87.5
Volume to Capacity Ratio (V/C)	0.76	0.82	0.80	0.82	1.00	1.10	1.00	1.10

Synchro pdf files available on request:

- 2016 PM No-Build
- 2016 PM Build
- 2036 PM No-Build
- 2036 PM Build

Appendix C - Modeling Files

Electronic copies of modeling files are available on request from Region 1 Environmental Section.

- A. MOVES2010b database files.
 - a. Fuelformulation_OR.csv (Metro, 2014)
 - b. FuelSupply_2012+_OR.csv (Metro, 2014)
 - c. IMCoverage_2016_OR.csv & IMCoverage_2036_OR.csv (Metro, 2014)
 - d. Links.xls (ODOT)
 - e. Linksourcetype.xls (ODOT)
 - f. Multnomah_meterology_input.xls (Oregon DEQ, 2013)
 - g. sourceTypeAgeDistribution_2016_OR.csv (Metro)
 - h. Low Emission Vehicles- Lev_or_in (Metro, 2015)

- B. MOVEs 2010B runspecs:
 - a. Broad16.mrs
 - b. Broad36.mrs

- C. MOVES 2010 B Output
 - a. Co_emissionfactors16.csv
 - b. Co-emissionfactors36.csv

- D. CAL3QHC Input Files
 - a. Broad16b.in2
 - b. Broad16nb.in2
 - c. Broad36b.in2
 - d. Broad36nb.in2

- E. CAL3QHC Output Files
 - a. Broad16b.ou2
 - b. Broad16nb.ou2
 - c. Broad36b.ou2
 - d. Broad36nb.ou2