Southbound I-405 to SR 520 Improvements

- Realign the southbound I-405 to eastbound SR 520 loop ramp.
- Realign eastbound SR 520 to match the proposed improvements.

Construction Staging

Construction funding is currently available for only some of the proposed improvements in the Build Alternative. Consequently, the project will be constructed in stages. The funded first stage will include the northbound I-405 improvements, including the braided ramps, the NE 12th Street bridge reconstruction, and the northbound NE 10th Street on-ramp. Additionally, one of the three proposed collector-distributor lanes from northbound I-405 to eastbound SR 520 will be constructed. This collector-distributor lane will cross over the existing NE 124th Street on-ramp before merging with SR 520. Construction of these funded improvements is scheduled to begin in 2009 and will be completed in approximately 3 years.

The unfunded project improvements include the remaining two lanes of the three-lane collector-distributor system, improvements from southbound I-405 to the eastbound SR 520 collector-distributor, and the improvements from eastbound and westbound SR 520 to southbound I-405. Construction of these remaining improvements depends on when project funding becomes available.

Stormwater Management System Improvements

Stormwater for the I-405, NE 8th Street to SR 520 Improvement Project will be managed for both water quality and quantity using currently accepted best management practices (BMPs).

The I-405 Project Team is designing the stormwater management facilities to comply with the WSDOT *Highway Runoff Manual* (HRM),[2] M 31-16, and *Hydraulics Manual*,[3] M 23-03. The Department of Ecology has conditionally approved WSDOT's revised HRM for use as an equivalent

[2] *WSDOT, 2006a.*

[3] *WSDOT, 2006b.*

approach to Ecology's *Stormwater Management Manual for Western Washington.*[4]

Runoff from existing paved surfaces on I-405 and SR 520 within the project limits is generally discharged to streams and ditches without treatment. The project will provide water quality treatment for all of the new impervious surfaces and a portion of the existing untreated impervious surfaces. Existing conveyance facilities will be modified as required to satisfy water quality treatment and flow control design standards noted above, while maintaining existing flow patterns to each of the receiving water bodies.

What are peak flows?
The maximum instantaneous rate of stormwater flow during a storm, usually in reference to a specific design storm event.

The I-405, NE 8th Street to SR 520 Improvement Project will also manage peak flows and duration in accordance with the WSDOT *Highway Runoff Manual*. The stormwater management facilities will also manage peak flows and durations in accordance with the HRM. Six new flow control facilities and one existing facility (constructed as part of the NE 10th Street Bridge Project) will be used to provide stormwater detention. The proposed locations of these facilities are shown in Exhibit 2-3.

Wetland and Stream Mitigation Sites

To compensate for the permanent effects on wetlands, WSDOT will provide mitigation at a wetland mitigation site that is about one mile southeast of the southern project limit. Mitigation at this site was approved as part of the I-405, Bellevue Nickel Improvement Project and has been constructed. The wetland mitigation site is within the boundaries of Kelsey Creek Park (Exhibit 2-1). The site is located north of the intersection of Richards Road SE and the Lake Hills Connector. The mitigation site is an upland area adjacent to a large wetland complex that will be transformed to an emergent wetland. Its wildlife habitat will be enhanced by constructing habitat structures and replanting adjacent upland areas with forest-type vegetation.

We will also mitigate for unavoidable effects on the unnamed tributary to Sturtevant Creek. The mitigation will be in-kind and will be located within WSDOT right-of-way on the east side of I-405 south of NE 4th Street (Exhibit 2-3). Stream mitigation for permanent effects to the unnamed tributary to

[4] *Ecology, 2005.*

Sturtevant Creek will occur at Sturtevant Creek and will be designed to meet specific goals. Stream mitigation goals include:

- Increased hydrologic connectivity with two small riparian wetlands;
- Increased fish rearing habitat; and
- Improved riparian buffer conditions.

WSDOT will meet these goals by installing large woody debris and other in-stream channel enhancements. The stream's buffer will be revegetated with plant species native to the area, and invasive vegetation will be removed.

We provide more detailed information about mitigation efforts planned in conjunction with the I-405, NE 8th Street to SR 520 Improvement Project in the Water Resources and Ecosystems Discipline Reports.

Does this project relate to any other improvements on I-405 or connecting highways?

In 1998, WSDOT joined with the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), Central Puget Sound Regional Transit Authority (Sound Transit), King County, and local governments to develop strategies to reduce traffic congestion and improve mobility in the I-405 corridor. In fall 2002, the combined efforts of these entities culminated in the I-405 Corridor Program NEPA/SEPA Final Environmental Impact Statement (EIS) and Record of Decision (ROD).

WSDOT created the I-405 Corridor Program as a comprehensive strategy to reduce congestion and improve mobility throughout the I-405 corridor. The corridor begins at the I-405/I-5 interchange in the city of Tukwila and extends northward 30 miles to the I-405/I-5 interchange in the city of Lynnwood. The program's purpose is to provide an efficient, integrated, and multimodal system of transportation solutions.

The I-405, NE 8th Street to SR 520 Improvement Project is one of several I-405 projects (see links to WSDOT's project-specific web pages at http://www.wsdot.wa.gov/projects/). Other projects along the I-405 corridor and connecting highways include:

- Renton Nickel Improvement Project, 1-5 to SR 169 (under construction)
- Renton to Bellevue Project, SR 169 to I-90 (proposed)
- South Bellevue Widening (112th Avenue SE to SE 8th Street) Project (under construction)
- NE 10th Street Bridge Crossing Project (under construction)
- SR 520 Bridge Replacement and HOV Project (proposed)
- SR 520 to I-5 Widening Project (proposed)

What are express toll lanes?

An express toll lane is a limited-access freeway lane that is actively managed through a variable toll system to regulate its use and thereby maintain express travel speeds and reliability. Toll prices rise or fall in real time as the lane approaches capacity or becomes less used. This ensures that traffic in the express toll lane remains flowing at express travel speeds of 45 to 60 miles per hour. Toll prices may differ for carpools, transit, motorcycles, and single-occupant vehicles. Tolls are collected electronically using overhead scanners that read a transponder inside the vehicle and automatically debit the operator's account.

In addition to improvements along I-405 and SR 520, WSDOT has planned projects on SR 167, I-90, and SR 522 as recorded in WSDOT's *Highway System Plan*.[5] This plan forecasts transportation needs for the next 20 years. The Metropolitan Transportation Plan for the central Puget Sound region, *Destination 2030*, revised in 2003, defines the region's action plan for the next 30 years.

The I-405 Corridor Program EIS identified possibilities to better manage the corridor through tolling. WSDOT could achieve this through the use of express toll lanes that would be managed through a variable toll system to regulate their use and thereby maintain express travel speeds and reliability. The footprint of the project identified in this document would not preclude implementation of express toll lanes. The freeway system would, however, operate differently if express toll lanes are used. If express toll lanes are to be implemented in the future, additional operational analysis and any necessary environmental documentation would be prepared. Therefore, an operational change to express toll lanes would be a future decision.

What is the No Build Alternative?

The No Build Alternative assumes the new NE 10th Street bridge across I-405 that is being constructed as part of another project will be in place. The No Build Alternative assumes that only routine activities such as road maintenance, repair, and minor safety improvements would take place over the next 20 years. The No Build Alternative does not include improvements that would increase roadway capacity, reduce

[5] *WSDOT, 2007b.*

congestion, or improve safety on I-405 or SR 520. For these reasons, it does not satisfy the project's purpose—to reduce congestion created by weaving traffic on I-405 and SR 520.

The No Build Alternative has been evaluated in this discipline report to establish a reference point for comparing the effects associated with the Build Alternative.

SECTION 3 STUDY APPROACH

What is the study area and how was it determined?

The study area is the airshed in the vicinity of the project limits. Although the airshed has no physical boundaries, boundaries were established for purposes of this analysis. The boundaries include local streets and 18 intersections adjacent to I-405 and SR 520 that may experience operational changes because of the project improvements. Project emissions were considered in terms of their effects on the air quality of the Puget Sound region.

Airshed

An airshed can be compared to a watershed. A watershed is a geographic area where rivers, streams, and run-off flow into a specific body of water. By comparison, an airshed is a geographic area where air pollutants from sources "upstream" or within the area flow and are present in the air.

What policies or regulations are related to effects on air quality?

Who regulates air quality?

EPA, the Washington State Department of Ecology (Ecology), and the Puget Sound Clean Air Agency (PSCAA) together regulate air quality in the study area.

What are the air pollutants generated by transportation projects?

The major airborne pollutants of interest for transportation projects are CO, particulate matter, ozone, volatile organic compounds (VOCs), and oxides of nitrogen (NO_x). These are commonly referred to as criteria pollutants. Both federal and state standards regulate these, along with two other criteria pollutants, sulfur dioxide (SO_2) and lead. However, lead is not a pollutant of concern in the Puget Sound Region and the primary sources of SO_2 are industrial processes rather than mobile sources. Therefore lead and SO_2 are not addressed in this analysis. Appendix A describes in more detail the characteristics and health effects of the criteria pollutants.

Ozone

A compound consisting of three atoms of oxygen that can develop when oxides of nitrogen (NO_X), volatile organic compounds (VOCs), and sunlight interact in the lower atmosphere; ozone is the primary component of smog.

MSATs generated in vehicle exhaust, particularly from diesel-fueled vehicles, have been addressed in both local and national studies. MSATs are known or suspected to cause cancer or other serious health effects. For example, benzene is a known carcinogen found in gasoline. MSATs can also cause other environmental effects, such as damage to plants and animals.

What standards apply to air quality?

Washington state is subject to air quality regulations issued by EPA, Ecology, and local air agencies. EPA's NAAQS set limits on concentration levels of certain pollutants, commonly referred to as the "criteria pollutants." Concentration levels of the criteria pollutants must not exceed the NAAQS over specified time periods. Ecology and PSCAA monitor air quality in the Puget Sound region by measuring and comparing the levels of criteria pollutants found in the atmosphere with the NAAQS.

The NAAQS comprise two sets of standards: the primary standards are intended to protect public health; the secondary standards are intended to protect the natural environment. In addition to these standards, Ecology and PSCAA have adopted state and local ambient air quality standards that are equivalent to or more stringent than EPA's NAAQS. Exhibit 3-1 summarizes the air quality standards applicable to transportation projects in the state of Washington.

The Central Puget Sound region is currently in attainment for all criteria pollutants. EPA designated the Central Puget Sound region as maintenance attainment status for CO in 1996. The I-405, NE 8th Street to SR 520 Improvement Project, therefore, is located in an area that is currently designated a maintenance area for CO.

Currently, no standards establish allowable concentrations of toxic air pollutants (of which MSATs are a subset) in the air. Ecology conducted a study to monitor several air toxic compounds in 2000 to 2001. The study indicated that the primary contributors to air toxics are diesel exhaust and wood smoke.[6]

[6] *Ecology, 2001.*

Exhibit 3-1: Summary of Ambient Air Quality Standards

Pollutant	Standard	Averaging Period
Nitrogen dioxide (NO_2)	0.05 ppm	Annual
Carbon monoxide (CO)	9 ppm	8 hours
	35 ppm	1 hour
Ozone	0.08 ppm	8 hours
Lead	1.5 µg/m³	Quarterly
Sulfur dioxide (SO_2)	0.02 ppm	Annual
	0.10 ppm	24 hours
	0.05 ppm	3 hours
	0.40 ppm	1 hour
Particulate matter (PM_{10})	150 µg/m³	24 hours
Particulate matter ($PM_{2.5}$)[a]	15 µg/m³	Annual
	35 µg/m³	24 hours

Source: EPA (2007), PSCAA (2006), and Washington State Standards.

[a]The 24-hour $PM_{2.5}$ standard was reduced to 35 ppm from 65 ppm (effective December 17, 2006).

µg/m³ = micrograms per cubic meter
PM_{10} = particulate matter smaller than 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than 2.5 microns in diameter
ppm = parts per million

EPA's ongoing National Air Toxic Assessment indicates that the air toxics risk in the Puget Sound area is similar to other major urban areas. Major urban areas are in the top five percent in the nation for lifetime cumulative cancer risk.[7] The diesel exhaust contribution to the area's toxic air pollutants should be reduced in the near future as a result of federal regulations that required cleaner-burning diesel fuel for on-highway vehicles by 2007, and for off-road diesel engines used for construction by 2010.

CO_2 is not currently subject to federal or state ambient air quality standards.

[7] *EPA, 2006b.*

Nonattainment Area

Any area that does not meet the national primary or secondary ambient air quality standard for the pollutant. These standards are per pollutant, so it is possible for a zone to meet these standards for a certain substance and not for another.

Attainment Area

Any area that meets the national primary or secondary ambient air quality standard for the pollutant.

Maintenance Area

A region previously designated as nonattainment, and subsequently redesignated to attainment.

What are conformity requirements?

In Washington state, transportation projects that are located in maintenance and nonattainment areas must meet the conformity requirements set out in the federal Clean Air Act (implemented by EPA regulations 40 Code of Federal Regulation [CFR] Parts 51 and 93) and the Washington Clean Air Act (Washington Administrative Code [WAC] 173-420). The I-405, NE 8th Street to SR 520 Improvement Project is subject to these conformity requirements because it is a transportation project that is located in a maintenance area for CO.

In nonattainment and maintenance areas, the federal Clean Air Act and the Washington Clean Air Act require transportation projects to conform to the State Implementation Plan (SIP), the state's plan for meeting and maintaining compliance with the NAAQS. Conformity with the SIP means that transportation activities will not produce new air quality violations, worsen existing violations, or delay timely attainment of the NAAQS.

How do climate and weather affect air quality?

Weather directly influences air quality. Important meteorological factors include temperature and sunlight intensity. Temperature inversions, which are associated with higher air pollution concentrations, occur when warmer air overlies cooler air. During temperature inversions in late fall and winter, particulates and CO from wood stoves and vehicle sources can be trapped close to the ground, which can lead to violations of the NAAQS. Ozone formation requires warm weather and direct sunlight. In the Puget Sound area, the highest ozone concentrations occur from mid-May until mid-September, when urban emissions are trapped by temperature inversions followed by intense sunlight and high temperatures.

Who is the Puget Sound Regional Council?

The Puget Sound Regional Council (PSRC) is an inter-governmental agency that addresses regional transportation issues in western Washington.

How did we collect information on air quality for this report?

The I-405 Team coordinated with WSDOT, PSRC, PSCAA, Federal Highway Administration (FHWA), EPA, and Ecology to obtain air quality information and guidance for preferred analysis methodology.

Where were carbon monoxide (CO) concentrations modeled?

One of the primary objectives of the project is to improve mobility on I-405 and SR 520, which translates to fewer delays for motor vehicles and lower vehicle exhaust emissions. Regionwide, fewer delays and lower emissions are a positive effect of the project. However, shifts in traffic patterns could result in localized increases in concentrations of pollutants from motor vehicles. The I-405 Team performed a CO "hot-spots" analysis at affected intersections to identify whether the emissions would cause a substantial effect. The analysis was conducted for the AM and PM peak hours, which are the hours in the morning and afternoon when the maximum traffic demand occurs on a given transportation facility or corridor. Peak traffic volumes are measured in number of vehicles per hour (vph).

Exhibit 3-2 shows levels of service (LOS) and peak traffic volumes for several intersections adjacent to I-405 and SR 520. Six of these intersections were selected to represent the worst-case intersections in terms of traffic volume and delay. The six intersections were evaluated using WSDOT's Washington State Intersections Screening Tool (WASIST). Intersection-specific traffic volumes and signal timing were input to WASIST, and the tool estimated the maximum CO concentration in the vicinity of the intersection.

Level of Service

A measure of how well a freeway or local signalized intersection operates. For freeways, LOS is a measure of traffic congestion typically based on volume-to-capacity ratios. For local intersections, LOS is based on how long it takes a typical vehicle to clear the intersection. Other criteria also may be used to gauge the operating performance of transit, non-motorized, and other transportation modes. LOS ranges from A (least delay) to F (longest delay).

How did we evaluate mobile source air toxic (MSAT) emissions?

We evaluated air toxic emissions on a regional level according to FHWA's *Interim Guidance on Air Toxic Analysis in NEPA Documents*.[8] We considered the roadway links for which there would be greater than 5 percent change in average daily volume. MOBILE6.2 emission factors were obtained from the PSRC and multiplied by the daily VMT per link, then summed for the study area.

[8] *FHWA, 2006.*

Exhibit 3-2: Peak-Hour Level of Service and Volume for 2030 Build by Intersection

Intersection Name	AM Peak Volume (vph)	AM Peak LOS	PM Peak Volume (vph)	PM Peak LOS
116th Avenue NE & NE 10th Street	3187	B	4380	D
116th Avenue NE & NE 10th Street	2392	B	3266	B
NE 10th Street & SR 520 On-Ramp	2102	A	3525	B
***NE 12th Street & 112th Avenue NE**	3894	C	5083	F
***NE 8th Street & 405 Off-Ramp**	5459	D	6472	D
***Bel-Red Road & 116th Avenue NE**	4273	C	5624	D
***NE 8th Street & 116th Avenue NE**	6233	C	8093	D
***Main Street & 112th Avenue NE**	3226	C	4663	F
SE 8th Street & 116th Avenue SE	3315	C	4195	E
***NE 4th Street & 112th Avenue NE**	3914	C	5012	E
Main Street & 116th Avenue NE	2883	B	4077	D
SE 8th Street & 112th Avenue SE	2390	B	2923	B
SE 8th Street & 118th Avenue SE	2616	C	3351	D
SE 8th Street & 121st Avenue SE	2024	A	2561	B
NE 6th Street & 112th Avenue NE	1906	A	2563	A
SE 1st Street & 116th Avenue NE	3034	D	3776	D
NE 4th Street & 116th Avenue NE	3108	B	4091	D
SE 8th Street & 14th Avenue SE	1746	B	2073	B
SE 5th Street & 116th Avenue SE	2558	A	3349	C
NE 8th Street & 405 On-Ramp	4482	A	5885	A
SE 8th Street & I-405 NB On-Ramp	2319	B	2956	B
NE 4th Street & SB Ramp	2731	B	3511	C
NE 4th Street & NB Ramp	2382	B	3101	B
SE 8th Street & I-405 SB Off-Ramp	2565	B	3391	B
112th Avenue NE & NE 10th Street	3745	D	4995	E
SE 6th Street & 114th Avenue SE	1073	A	1219	A
SE 6th Street & 112th Avenue SE	2271	B	2726	B

Note: vph = vehicles per hour; NB = northbound; SB = southbound
* Denotes modeled intersection.
Source: Michael Lapham, personal communication, March 2007.

How did we evaluate effects on air quality?

The I-405 Team evaluated effects of the project on air quality both during the construction phase and during operation of the completed project using current FHWA guidance, as described below.

How did we evaluate air pollutant emissions during construction?

The I-405 Team addressed effects during construction qualitatively. Construction activities that typically result in temporary emissions of air pollutants were addressed.

How did we evaluate air quality effects of the completed project?

In the Puget Sound region, the PSRC determines regional conformity by evaluating the combined effects on air quality of proposed projects included in the Regional Transportation Plan (RTP) and the TIP. A project must be included in a conforming RTP and TIP as a first step to meeting project-level conformity requirements.

Regional Effects

The I-405 Team performed an emissions burden analysis to evaluate emissions effects on a regional basis. The team calculated the emissions from vehicles in the study area for the Build and No Build alternatives and compared them to the emission budget for the region, as calculated by PSRC. This budget, established and approved as a part of the SIP, is the allowed pollutant emission rate for motor vehicles within the region.

Effects from MSATs are addressed according to current FHWA *Interim Guidance on Air Toxic Analysis in NEPA Documents*.[9] Because the EPA has not established ambient standards for MSAT levels, these levels are compared to 2005 conditions and between the Build and No Build alternatives to assess potential effects.

Localized Effects

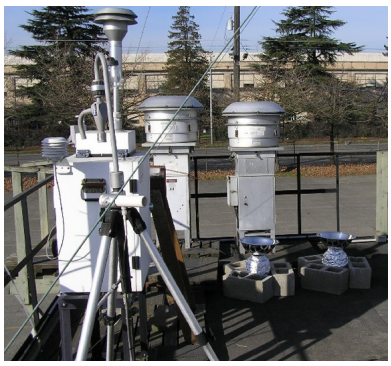
For project-level conformity, a project must demonstrate that it will not cause a localized effect, defined as an exceedance of

[9] *FHWA, 2006.*

the CO NAAQS. Dispersion modeling was performed for this project, which is subject to project-level conformity requirements for CO, to demonstrate that CO concentrations would not exceed the NAAQS in the vicinity of any intersection in the study area. This analysis compares the No Build Alternative to the Build Alternative for the year of opening (2014), and the design year (2030). The 2014 year of opening is a conservative assumption; improvements are expected to be in place by 2012.

SECTION 4 EXISTING CONDITIONS

How does air quality compare with current standards in the project area?



Duwamish air monitoring station in Seattle

Both Ecology and PSCAA operate air quality monitors to assess the levels of regulated pollutants and to verify continued compliance with the NAAQS. The photo at right is a picture of an air monitoring site. As shown in Exhibit 4-1, there are several air pollutant monitoring stations in the Seattle-Bellevue area.

The Beacon Hill Reservoir air monitoring station is the closest station to the study area that measures nitrogen dioxide and sulfur dioxide. The Beacon Hill station is approximately 7 miles southwest of the project limits.

The Duwamish monitoring station is located in an industrial area approximately 8 miles southwest of the study area and measures particulate matter smaller than 10 microns (PM_{10}). For the last 3 years, particulate matter smaller than 2.5 microns ($PM_{2.5}$) has been measured in Bellevue at two stations within 2 miles of the study area, and in Redmond approximately 8 miles from the study area.

The nearest CO monitoring location to the project is on NE 148th Street in Bellevue, approximately 2 miles east of the study area. The nearest ozone monitoring station is at Lake Sammamish State Park in Bellevue approximately 7 miles southeast of the study area.

Concentrations of the monitored air pollutants have been below the NAAQS for the last several years, as shown in Exhibit 4-1.

Exhibit 4-1: Ambient Criteria Pollutant Concentration Levels Measured from 2003 to 2005

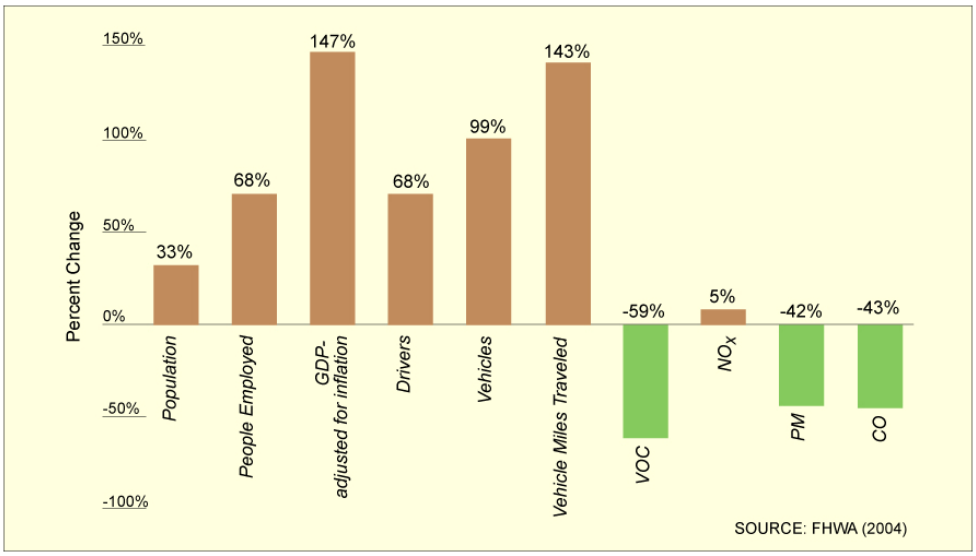
	Parameter	Maximum Concentration			
		2003	2004	2005	Standard[a]
Particulate Matter (PM_{10})[b]					
Duwamish	24-hour average (µg/m³)	65	57	76	150
Particulate Matter ($PM_{2.5}$)[c]					
Bellevue (601 143rd Avenue NE)	Annual arithmetic mean (µg/m³)	8.3	8.3	7.3	15
	24-hour average (µg/m³)	28	22	28	65
Bellevue (305 Bellevue Way NE, Bellevue)	Annual arithmetic mean (µg/m³)	7.0	7.7	7.1	15
	24-hour average (µg/m³)	34	30	26	65
Redmond (Redmond City Hall 15670 NE 85th Redmond)	Annual arithmetic mean (µg/m³)	7.2	7.0	7.1	15
	24-hour average (µg/m³)	36	34	42	65
Carbon Monoxide[c]					
Bellevue (2421 148th NE Bellevue)	8-hour average (ppm)	6.5	4.8	4.0	9
	1-hour average (ppm)	9.0	3.2	5.9	35
Ozone[b]					
Lake Sammamish State Park	8-hour average (ppm)	0.066	0.063	0.054	0.08
Nitrogen Dioxide[b]					
Beacon Hill Reservoir	Annual average (ppm)	0.018	0.018	0.018	0.05
Sulfur Dioxide[b]					
Beacon Hill Reservoir	Annual average (ppm)	0.003	0.003	0.004	0.02
	24-Hour average (ppm)	0.010	0.019	0.014	0.10
	3-Hour average (ppm)	0.026	0.045	0.028	0.05
	1-Hour average (ppm)	0.077	0.060	0.044	0.40

[a] NAAQS, PSCAA, or State of Washington Standard.
[b] EPA, 2006a.
[c] PSCAA (2004a, 2005, 2006).

What is the trend for Puget Sound regional carbon monoxide concentrations?

Emission projections and ongoing air quality monitoring throughout the Central Puget Sound region indicate that the air pollution concentrations for CO and PM_{10} have been decreasing over the past decade. Measured ozone concentrations, in contrast, have remained fairly constant. The decline of CO is due primarily to improvements made to emission controls on motor vehicles and the retirement of older, higher-polluting vehicles. Exhibit 4-2 shows, based on national data, that progress has been made in reducing emissions from motor vehicles in comparison to the changes in other demographics, such as population, over the same period. The exhibit shows an increase in NO_X emissions since 1970. Efforts to reduce NO_X emissions have been offset by the rapid growth of vehicle miles traveled. The EPA has been implementing a series of emissions limits since the 1970s to reduce the growth of NO_X emissions.

Exhibit 4-2: Percent Change in Amount of Vehicle Emissions Compared to Demographics and Transportation (1970 to 1999)



Voluntary programs, such as the local Diesel Solutions Program and the Department of Energy's Clean Cities Program, are in place to encourage public and private fleet operators to use ultra-low sulfur diesel and/or install retrofit

devices to filter or oxidize vehicle exhaust.[10] Other voluntary programs which encourage diesel emission reductions are supported by Ecology and EPA. Federal rules for cleaner diesel fuel were phased in beginning in fall 2006 and required that new on-highway diesel vehicles be considerably cleaner starting in 2007.

Over time, however, other factors have the potential to counteract this downward emission trend. For example, each year more motor vehicles travel on the region's roadways, and people in the area are making more trips of greater distance. Estimates by the PSRC[11] project that VOC and PM_{10} emissions will gradually increase between 2010 and 2030, while CO and NO_x emissions are predicted to decline between 2010 and 2020, then gradually increase by 2030. If emissions increased to a point where local air monitoring data indicated that concentrations were again above the NAAQS, the region's nonattainment status could change. This would force more stringent constraints on travel and economic growth, and the possible loss of state transportation funds for highway expansion.[12]

What are the existing mobile source air toxic levels?

The Beacon Hill site has been monitoring hazardous air pollutants since 2000. Five of the monitored pollutants are MSATs. Concentrations measured at the monitor include contributions from not only mobile sources, but also any other nearby sources of pollution. 2006 levels are shown in Exhibit 4-3.

What is the national trend for mobile source air toxic emissions?

EPA regulations for vehicle engines and fuels will cause overall MSATs to decline substantially over the next 20 years. Even after accounting for a 64 percent increase in VMT, FHWA predicts MSATs will decline in the range of 57 percent

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[10] *PSCAA, 2004b.*

[11] *PSRC, 2004b.*

[12] *PSRC, 2001.*

to 87 percent, from 2000 to 2020, based on regulations now in effect. This will reduce the background level of MSATs.[13]

Exhibit 4-3: Ambient MSAT Concentration Levels Measured in 2006

MSAT	Concentration
1-3, Butadiene	1.48 ppbC
Formaldehyde	1.9 ppbC
Acetaldehyde	3.2 ppbC
Benzene	10.02 ppbC

Note: ppbC = parts per billion carbon
To convert from ppbC to parts per billion by volume (ppb), divide pollutant concentration by the number of carbon atoms in the pollutant molecule. In other words, ppbC = ppb * (number of carbon atoms).

Source: EPA, 2006a.

[13] *FHWA, 2006.*

SECTION 5 PROJECT EFFECTS

How will project construction affect air quality?

During construction of this project, activities that could affect air quality include soil-disturbing activities, heavy-duty equipment exhaust, commuting workers' motor vehicle exhaust, removal of structures, and asphalt paving. The total emissions and the timing of the emissions from these sources would vary depending on the phasing of the construction activities and would certainly not all occur simultaneously.

Typical sources of emissions during construction of transportation projects include the following:

- Fugitive dust generated during excavation, grading, loading, and unloading activities
- Dust generated during demolition of structures and pavement
- Engine exhaust emissions from construction vehicles, worker vehicles, and diesel-fuel-fired construction equipment
- Increased motor vehicle emissions associated with increased traffic congestion during construction
- VOCs and odorous compounds emitted during asphalt paving

The regulated pollutant of concern for the first two source types is PM_{10}. Engine and motor vehicle exhaust would result in emissions of VOCs, NO_x, PM_{10}, $PM_{2.5}$, and air toxics.

What is fugitive dust?

Fugitive dust consists of particulates emitted during outdoor activities such as construction. The dust particles are very small solids, suspended in air or water, and can vary widely in size, shape, density, and electrical charge.

How will project operation affect localized air quality after the project is completed?

Exhibits 5-1 and 5-2 summarize the WASIST screening results for 2005, year of opening, and horizon year. The modeled concentrations for 2005 are above the 8-hour NAAQS of 9 ppm at four of the intersections evaluated, and the results for the Build Alternative in subsequent years show a decreasing trend in CO concentrations. The project would neither cause new violations of the 1-hour or 8-hour CO NAAQS in future years, nor increase the frequency or severity of any existing violation.

Exhibit 5-1: Maximum 1-Hour Carbon Monoxide Concentrations (ppm)

Intersection Name	2005 (Existing Conditions)	2014 No Build	2014 Build	2030 No Build	2030 Build
NE 8th Street & 116th Avenue NE	13.5	10.2	10.1	9.3	9.2
NE 8th Street & I-405 Off-Ramp	12.9	9.6	9.6	8.7	8.7
Bel-Red Road and 116th Avenue NE	11.1	8.7	8.8	8.1	8.1
NE 12th Street & 112th Avenue NE	10.9	8.5	8.5	8.0	8.0
NE 4th Street & 112th Avenue NE	10.0	8.4	8.3	7.6	7.6
Main Street & 112th Avenue NE	10.5	8.5	8.5	8.0	7.9
CO NAAQS	35 ppm				

The results for CO can be extrapolated to conclude that the roadway improvements proposed by this project would not result in adverse effects on air quality from other pollutants, including toxic air pollutants. Roadway improvements proposed by the project have the overall effect of improving traffic flow and reducing idling time, when motor vehicle emissions are highest.

Appendix B contains the WASIST output files for the air quality analysis. The forms in Appendix B have the former project name: Bellevue Improvement Project.

Exhibit 5-2: Maximum 8-Hour Carbon Monoxide Concentrations (ppm)

Intersection Name	2005 (Existing Conditions)	2014 No Build	2014 Build	2030 No Build	2030 Build
NE 8th Street & 116th Avenue NE	10.9	8.6	8.6	8.0	7.9
NE 8th Street & I-405 Off-Ramp	10.5	8.2	8.2	7.6	7.6
Bel-Red Road and 116th Avenue NE	9.3	7.6	7.7	7.2	7.2
NE 12th Street & 112th Avenue NE	9.1	7.4	7.4	7.1	7.1
NE 4th Street & 112th Avenue NE	8.5	7.4	7.3	6.8	6.8
Main Street & 112th Avenue NE	8.8	7.4	7.4	7.1	7.0
CO NAAQS	9 ppm				

How will the project affect regional air quality?

Criteria Pollutants

Criteria pollutants vehicle emissions of CO, VOCs, and NO_x for the Build and No Build alternatives were estimated based on regional travel demand forecasts. MOBILE6.2 emission factors, in grams per vehicle mile traveled, along with projected vehicle miles traveled (VMT), were used to estimate the daily emissions for each scenario analyzed.

Exhibit 5-3 summarizes the results of this analysis, showing the daily estimated emissions for 2005 and the forecast year (2030) for the Build and No Build alternatives.

As Exhibit 5-3 shows, the Build Alternative would result in slightly higher mobile source pollutant emissions as compared to the No Build Alternative. This is because 2030 traffic volumes are projected to be higher for the Build Alternative due to improved traffic operations. Emissions for the Build Alternative were compared to the SIP budget for CO, the only pollutant that is subject to conformity requirements. Project CO emissions are less than one percent of the regional emissions budget for all years and build alternatives.

Exhibit 5-3: Burden Analysis Emissions

Scenario	CO (tons/day)	NO_X (tons/day)	VOC (tons/day)	PM_{10} (pounds/day)
2005 (Existing Conditions)	3.65	0.15	0.17	4.50
2030 No Build Alternative	4.57	0.21	0.19	4.42
2030 Build Alternative	4.60	0.22	0.19	4.45
SIP Emissions Budget	1,497.0	NA	NA	NA
2030 Build Alternative % of Emissions Budget	0.3%	NA	NA	NA

Note: Emissions based on MOBILE6.2 emission factors and traffic forecast data.
2030 values calculated for comparison to SIP budget, and 2005 provided for comparison. 2014 values are not required for this analysis.
NA = Not applicable

Mobile Source Air Toxics

As shown in Exhibit 5-4, MSAT emissions in the study area are predicted to decrease in the future. Build Alternative

emissions in the 2030 design year are expected to be lower than existing conditions (2005), even though VMT is predicted to increase by 44 percent. Slight increases will occur under the Build Alternative compared to the No Build Alternative. This is because 2030 traffic volumes are projected to be higher for the Build Alternative due to improved traffic operations. However, both the Build and No Build MSAT emission rates are predicted to be 70 percent lower than those of existing conditions (2005). This is a result of the EPA's national control programs, which are projected to reduce MSAT emissions by 57 percent to 87 percent between 2000 and 2020. Local trends differ slightly from national trends due to fleet mix and turnover, VMT growth rates, and local control measures.

Exhibit 5-4: Mobile Source Air Toxic Emissions—Daily Project Emissions for the Region (tons per day)

Alternative	1,3-Butadiene	Acetal-dehyde	Acrolein	Benzene	Formaldehyde	Diesel Particulate Matter
2005 (Existing Conditions)	0.29	0.48	0.06	3.41	1.02	1.04
2030 No Build	0.08	0.15	0.02	1.13	0.30	0.08
2030 Build	0.09	0.16	0.02	1.20	0.32	0.09

Note: 2014 emissions not required for this analysis

Does the project have other effects that could be delayed or distant from the project?

An effect is considered to be indirect when it occurs later in time or farther removed from an original project action. Indirect effects may include those related to changes in land use patterns, population density or growth rate, and related effects on other natural systems.

The air quality analysis for this project is based on the transportation demand forecasting model, and includes the effects of unmet demand on the transportation system. Because unmet demand is included, the results of the air quality analysis reflect the potential delayed and distant effects of the I-405, NE 8th Street to SR 520 Improvement Project.

Does the project meet project-level conformity requirements?

The project is not anticipated to create any new violations, nor increase the frequency of an existing violation of the CO standard. It is determined to conform with the purpose of the current SIP and the requirements of the Clean Air Act and the Washington Clean Air Act. The proposed project is included in the RTP, Destination 2030 Update for 2007,[14] and in the 2007-2010 TIP.[7] The RTP and the TIP meet the conformity requirements identified by federal and state regulations for both CO and ozone. Because the project is included in these plans, which conform to federal and state regulations, the project is also considered to demonstrate project-level conformity for ozone. This is supported by the estimated reduction in VOC emissions, calculated regionally, for the Build Alternative as compared to the No Build Alternative.

Were potential cumulative effects for air quality considered?

Cumulative air quality effects for the I-405, NE 8th Street to SR 520 Improvement Project are evaluated in a separate Cumulative Effects Analysis Technical Memorandum. That report discusses cumulative effects in the areas of air quality, surface water, wetlands, and fish and aquatic habitat. Cumulative effects analysis for other disciplines was determined to be unnecessary for this project.

What effects would occur under the No Build Alternative?

No exceedence of the NAAQS for CO is predicted for the No Build Alternative.

Similar to the Build Alternative, local CO concentrations of the No Build Alternative are expected to decrease from existing conditions (see Exhibits 5-2 and 5-3). However, CO concentrations are estimated to be slightly higher in 2014 and 2030 for the No Build Alternative compared to the Build Alternative. If the project is not constructed, projected increases in traffic volumes on local streets and I-405 will increase delays and lower travel speeds of motor vehicles,

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[14] *PSRC, 2007.*

both of which would mean higher emissions from vehicle exhaust.

As shown in Exhibit 5-3, 2030 CO emissions from vehicles in the study area are a small percentage of the SIP budget.

As shown in Exhibit 5-4, MSAT emissions in the study area are predicted to decrease in the future under the No Build Alternative, even though VMT is predicted to increase.

If the project is not built, the air quality effects associated with construction activities would not occur.

SECTION 6 MEASURES TO AVOID OR MINIMIZE EFFECTS

What measures will be taken to mitigate effects during construction?

Temporary effects on air quality may occur during construction activities. State law requires construction site owners and/or operators to take reasonable precautions to prevent fugitive dust from becoming airborne. Fugitive dust may become airborne during demolition, material transport, grading, driving of vehicles and machinery on and off the site, and through wind events. WSDOT will comply with the procedures outlined in the Memorandum of Agreement between WSDOT and the PSCAA for controlling fugitive dust.[15] These measures are particularly important where construction will occur in close proximity to Overlake Hospital Medical Center and other medical facilities that have air intake filters. Controlling fugitive dust emissions may require some of the following actions:

- Spray exposed soil with water or other suppressant to reduce emissions of PM_{10} and deposition of particulate matter.
- Use phased development to keep disturbed areas to a minimum.
- Use wind fencing to reduce disturbance to soils.
- Minimize dust emissions during transport of fill material or soil by wetting down or by ensuring adequate freeboard (space from the top of the material to the top of the truck bed) on trucks.
- Promptly clean up spills of transported material on public roads.
- Schedule work tasks to minimize disruption of the existing vehicle traffic on streets.
- Restrict traffic onsite to reduce soil upheaval and the transport of material to roadways.
- Locate construction equipment and truck staging areas away from sensitive receptors as practical and in consideration of potential effects on other resources.

[15] *WSDOT and PSCAA, 1999.*

- Provide wheel washers to remove particulate matter that would otherwise be carried offsite by vehicles to decrease deposition of particulate matter on area roadways.
- Cover dirt, gravel, and debris piles as needed to reduce dust and wind-blown debris.
- Minimize odors onsite by covering loads of hot asphalt.

Emissions of PM_{10}, VOCs, NO_x, oxides of sulfur, and CO will be minimized whenever reasonable and possible. Since these emissions primarily result from construction equipment, machinery engines and exhaust systems will be kept in good mechanical condition to minimize exhaust emissions.

Federal regulations have been adopted that require the use of ultra-low-sulfur diesel fuel in on-road trucks and will require the ultra low-sulfur diesel for all construction equipment by 2010. Construction of the project is anticipated to begin in late 2009, and will be subject to these regulations. This will reduce the sulfur content of diesel fuel from its current level of 500 ppm to 15 ppm million—a 97 percent reduction, and will result in a decrease in both SO_2 and PM emissions from these engines. Contractors will be encouraged by WSDOT to reduce idling time of equipment and vehicles and to use newer construction equipment or equipment with add-on emission controls.

What measures will be taken to mitigate effects of operation?

The Build Alternative will not require any mitigation because no adverse effects are anticipated.

SECTION 7 UNAVOIDABLE ADVERSE EFFECTS

Does the project cause any substantial adverse effects that cannot be avoided?

A substantial adverse air quality effect is defined as a violation of the NAAQS, or any activity that results in a public nuisance through the generation of dust or odors. None of the identified effects associated with the Build Alternative are considered substantial effects on air quality.

SECTION 8 REFERENCES

GIS Sources

Exhibit 2-1

WSDOT. 2006 – 2007. I-405 Staff; project limits.

Exhibit 2-3 – Sheets 1 through 6

WSDOT. 2006 – 2007. I-405 Staff; project limits, existing right-of-way, proposed right-of way, relocated noise wall, proposed retaining wall, proposed stormwater features, proposed new pavement.

Text References and Verbal Communications

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APPENDIX A
CHARACTERISTICS AND HEALTH EFFECTS OF POLLUTANTS

Ozone and Volatile Organic Compounds (VOCs): VOCs come from vehicle exhaust, paint thinners, solvents, and other petroleum-based products. VOCs and nitrogen oxides react in the presence of sunlight to form ozone. Ozone irritates the eyes, impairs the lungs, and aggravates respiratory problems. Ozone can cause chest pain, coughing, nausea, pulmonary congestion, and possible long-term lung damage. A number of exhaust VOCs are also toxic, with the potential to cause cancer.

Nitrogen Oxides (NO_x): Under the high pressure and temperature conditions in an engine, nitrogen and oxygen atoms in the air react to form various nitrogen oxides, collectively known as NO_x. NO_x, like hydrocarbons, is a precursor to the formation of ozone and also contributes to the formation of acid rain. NO_x impacts the respiratory system, causing a high incidence of acute respiratory diseases. Pre-school children are especially at risk. NO_x also degrades visibility due to its brownish color and its conversion to nitrate particles.

Carbon Monoxide(CO): Carbon monoxide is a product of incomplete combustion and occurs when carbon in the fuel is partially oxidized rather than fully oxidized to carbon dioxide (CO_2). Carbon monoxide reduces the flow of oxygen in the bloodstream and is particularly dangerous to persons with heart disease. Exposure to carbon monoxide impairs visual perception, manual dexterity, learning ability, and performance of complex tasks.

Particulate Matter (PM): These are tiny particles of dust that cause irritation and damage to the respiratory system. This can result in difficulty breathing, induce bronchitis, and aggravate existing respiratory disease. Exposure to particulates affects individuals with chronic pulmonary or cardiovascular disease, people with influenza or asthma, children, and elderly persons. Particulates aggravate breathing difficulties, damage lung tissue, alter the body's

defense against foreign materials, and can lead to premature mortality.[1]

[1] *Transportation Conformity: A Basic Guide for State and Local Officials. Federal Highway Administration. Revised June 19, 2000.*