Appendix H

Air Quality Analysis

CROSS-BASE HIGHWAY

Air Quality Analysis

February 19, 2002

Prepared for:

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INTRODUCTION

This report describes the air quality analyses conducted by MFG, Inc. in support of the environmental studies for the proposed Cross-Base Highway project. Technical details of the methods and assumptions applied in this analysis are included throughout this report.

Purpose and Need

The proposed Cross-Base Highway project is located in mid-Pierce County where continuous east-west transportation facilities are limited to circuitous routes around McChord Air Force Base (AFB) and Fort Lewis. Recent and planned residential and industrial development in Pierce County has created traffic volumes that exceed current system capacity. Areas to the east and west of the corridor are expected to become major employment centers within the next 20 years, further straining local highway routes. A major east-west corridor is proposed through portions of Fort Lewis, McChord AFB, and the City of Lakewood as well as through unincorporated areas of Pierce County. The proposed Cross-Base Highway is intended to reduce congestion on existing arterial roadways and provide a more direct connection for the efficient movement of people and goods between Interstate 5 (I-5) and Pierce County. Figure 1 is a vicinity map for the project.

The purpose of this analysis is to examine potential project-related air quality impacts due to traffic within the project vicinity using approved modeling techniques to calculate worst-case carbon monoxide (CO) concentrations. The predicted CO levels are then compared to established air quality standards to determine compliance with federal, state, and local regulatory requirements.

Description of Alternatives

The design alternatives evaluated in this discipline report include one No Build Alternative and three Build Alternatives designated South, South A, and South B. Each alternative is described below.

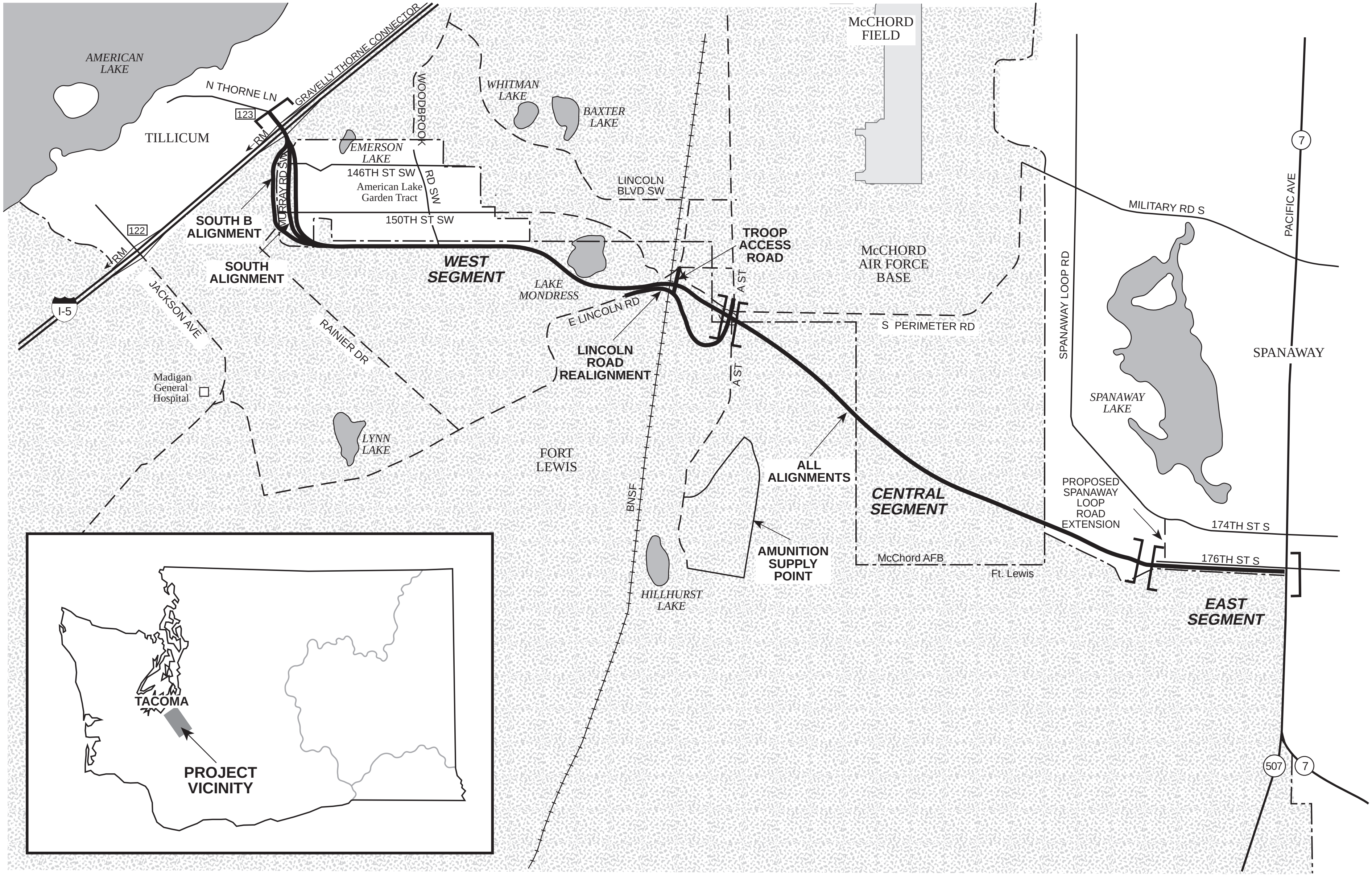
No Build Alternative

The No Build Alternative assumes no new highway facilities would be constructed in the corridor as part of this project except that Spanaway Loop Road would be extended to meet SR7.

Build Alternatives

The corridor alignment consists of three naturally-divided segments: (1) a western segment beginning at the I-5/ Thorne Lane interchange crossing American Lake Gardens to the vicinity of A Street., Lincoln Boulevard and the BNSF railroad; (2) a central segment crossing the south approach zone on McChord AFB to the existing portion of 176th Street South near Spanaway Marsh; and (3) an eastern segment that would parallel the south side of 176th Street South. merging with 176th Street South prior to the SR-7 intersection. All three Build Alternatives cross these three segments of the project corridor, with the possible alignment variations comprising the possible alternatives. Each alternative is described further below. All Build Alternatives share an eastern terminus at 176th Street South and SR-7.

The proposed Cross-Base Highway would be a four-lane limited access highway designed to WSDOT P-1 Principal Arterial standards between the proposed Woodbrook Road SW and Spanaway Loop Road S intersections. In the American Lake Gardens area between I-5 and Woodbrook Road SW, and on the eastern end of the project area between Spanaway Loop Road S and SR-7, the highway would be designed to WSDOT P-6 Principal Arterial standards.



Parametrix, Inc. Cross-Base EIS/55-1588-19/02(300) 11/01 (K)

SCALE IN METERS
0 500 1,000

SCALE IN FEET
0 2,000 4,000

N

Military Property

122 I-5 Exit Number

Roads on Military Reservation
Public Use Subject to Military Permission

Military Property Boundary

[ ] Segment Boundaries

Figure 1
Vicinity Map

Western Segment at American Lake Gardens Community

Build Alternatives considered in the western segment of the corridor include three alignments in the American Lake Gardens area. Each alignment begins at the I-5/Thorne Lane interchange, which is proposed for widening and re-construction under all alternatives. In addition, a connector road is proposed to link Gravelly Lake Drive and Thorne Lane, west of I-5 at Union Avenue.

South Alignment

The South Alignment proceeds south from I-5 Exit 123 paralleling Murray Road SW to the east. The alignment then turns east to follow the northern border of Fort Lewis.

South A Alignment

The South A Alignment follows a southerly direction through the western end of the Woodbrook Middle School property before turning east to follow the northern border of Fort Lewis.

South B Alignment

The South B Alignment travels in a southerly direction west of Murray Road SW on Fort Lewis property through a portion of the Clover Park Technical Institute Landscape Construction training facility, and then turn east to follow the northern border of Fort Lewis.

Depending on the alignment selected, access to American Lake Gardens would be provided at 150th Street SW or Spring St. SW, and Woodbrook Road SW. For the purpose of this air quality study, the alternative alignments within this segment do not affect the signalized intersections considered, because the intersection configurations and traffic volumes remain essentially the same for each alternative alignment. Consequently, one set of modeling results represent all three alignment alternatives.

Central Segment

Between American Lake Gardens and the Spanaway Lake area, the proposed Cross-Base Highway traverses both Fort Lewis and McChord AFB. In this area, only one alignment is proposed due to the need to maintain security at both military installations, to accommodate existing and proposed military operations, and to avoid sensitive environmental areas.

Access to Fort Lewis and McChord AFB would be provided at the proposed A Street Interchange. Additionally, an access road would pass beneath the Cross-Base Highway to the east of the BNSF tracks. This access road would provide an exclusive roadway for military use.

Eastern Segment

At the east end of the corridor, the single proposed alignment parallels the south side of 176th Street South on Fort Lewis property, merging with 176th Street South east of C Street. prior to the SR-7 intersection. This alignment allows the western portion of 176th Street South to continue as local access, and minimizes direct impacts to adjacent residential areas.

Additional access to the Spanaway community is provided at Spanaway Loop Road and SR-7 intersections with the Cross-Base Highway.

STUDIES AND COORDINATION

Models Used

The U.S. Environmental Protection Agency (EPA) established guidelines to predict traffic-related air quality impacts from a proposed roadway (EPA, 1992a). These guidelines present screening methods to determine which intersections to model and approved modeling techniques to predict potential impacts. The EPA requires that a Mobile series emission factor model be employed in analyses investigating the air quality implications of transportation projects and plans. For this project, both Mobile5a (EPA 1993a) and Mobile5b (EPA 1996) were used to generate emission factors for use in dispersion modeling.

The EPA-recommended CAL3QHC dispersion model (EPA 1992b) was used to estimate CO concentrations based on emissions from free flowing and queued traffic under different wind and stability conditions near signalized roadway intersections. CO concentrations were calculated for three different project years; base (existing), opening year, and design year. Calculated concentrations were then compared with pertinent air quality standards to determine compliance. Details of the operational parameters and other assumptions employed in the modeling are discussed below.

Methods of Analysis

Summary

A project-level air quality impact analysis was performed in accordance with the requirements and procedures of federal, state, and local authorities. This analysis took part in two distinct phases. In 1999, the first phase of the air quality study began with analyses focusing on the new corridor. In 2001, additional analysis and LOS impacts to I-5 were completed. The second phase of the review included an expanded analysis that also examined the potential impacts of the proposed project on the I-5 interchanges.

Screen Evaluation of Intersections

The intent of a transportation related air quality analysis is to examine the potential for impacts at the signalized intersections most likely to be adversely affected by a project. EPA guidance therefore focuses on performing modeling analyses by ranking signalized intersections (EPA 1992a). A comparison is made between the three intersections with the worst (most congested) levels of service (LOS)[1], and the three with the highest daily or peak-hour volumes. Intersections can also be selected when it is shown that they would be directly affected by a project to the degree that the LOS would be degraded. EPA suggests modeling intersections whose LOS would deteriorate to a "D" or worse due to a project.

Because the LOS during the PM peak hour is generally worse than the LOS during the AM peak hour, the PM peak-hour traffic data and LOS in the base year, opening year, and design year were used to rank intersections for this project. The interchanges along I-5 were also taken into consideration for modeling selection using the same ranking scheme. Intersections and interchanges within the project area are listed in Table 1.

[1]LOS is a measure of the weighted average vehicle delay during the peak traffic period at a signalized intersection. LOS "A" is the least congested, with an average delay of less than 10 seconds per vehicle. LOS "F" represents a weighted average delay of more than 80 seconds per vehicle. Please refer to the traffic report or the traffic section of the EIS for additional information.

Table 1. Summary of LOS and Delay Analysis for PM Peak Hour

Signalized Intersection	Existing Conditions		Year 2005 - Opening Year				Year 2025 - Design Year			
			No Build		With Cross-Base		No Build		With Cross-Base	
	LOS	Average Delay	LOS	Average Delay	LOS	Average Delay	LOS	Average Delay	LOS	Average Delay
SR-7/112th Street South	E	66.6	E	63.7	D	41.1	F	124.7	E	66.6
SR-7/152nd Street South	F	84.0	F	95.8	D	43.4	F	151.6	E	75.6
SR-7/176th Street South/Cross-Base (*)	E	71.5	F	128.4	D	37.8	F	176.0	E	56.2
Spanaway Loop Road/Military Road	D	46.2	D	49.3	D	39.9	E	64.4	D	45.8
Spanaway Loop Road/176th Street South/Cross-Base (*)	---	---	---	---	C	26.3	---	---	D	53.6
Cross-Base/Woodbrook Road SW – South Alignment	---	---	---	---	A	5.6	---	---	A	6.9
Cross-Base/150th Street SW/Murray Road - South Alignment (*)	---	---	---	---	D	41.5	---	---	E	77.7
Interchange										
Berkley Avenue SW Interchange NB Ramps (*)	B	16.2	B	19.6	B	19.6	D	38.9	D	37.2
Berkley Avenue SW Interchange SB Ramps (*)	B	16	B	18.8	B	17.7	E	57.9	E	59.2
Thorne Lane Interchange NB Ramps (*)	B	19.7	D	36	---	---	F	145.8	---	---
Thorne Lane Interchange SB Ramps (*)	B	17.3	B	18.7	---	---	F	96.1	---	---
Thorne Lane Interchange SPUI (*)	---	---	---	---	C	22	--	---	D	43
Gravelly Lake Drive SW Interchange NB Ramps (*)	B	17	B	19.2	B	18.3	E	68.3	E	55.4
Gravelly Lake Drive SW Interchange SB Ramps (*)	B	18.1	B	19.5	C	20.9	E	69.9	D	54.2

Source: Parametrix Traffic Data Submittals
Notes: Delay is shown in seconds.
Unsignalized intersections were not shown because they are not assumed to be "critical. "
-- The intersection does not exist under the corresponding Build Alternative.
(*) Intersection chosen for dispersion modeling with CAL3QHC.

MFG selected three intersections along the new corridor and three freeway interchanges with I-5 for detailed dispersion modeling. The selection of critical intersections was based on the LOS in the design year.

The intersections selected for modeling included the Cross-Base Highway intersections with: 150th Street SW, Spanaway Loop Road, and SR-7. Three signalized intersections that would operate at LOS D or worse were not selected for analysis because the Cross-Base Highway would not adversely affect them. These intersections are SR-7 with 112th Street South, SR-7 with 152nd Street South, and Spanaway Loop Road with Military Road. The traffic analysis (Table 1) indicates the proposed project would improve the LOS at these intersections.

The three I-5 interchanges examined with modeling include: the Berkley Avenue SW Interchange, the Gravelly Lake Drive SW Interchange, and the Thorne Lane Interchange. According to EPA guidelines, intersections within 1,000 feet of each other should be modeled simultaneously to allow for possible interactions among the traffic emission sources. With each of these interchanges the I-5 southbound and northbound ramp intersections were configured into a single modeling run along with any other nearby crossroads.

MOBILE Emission Factor Modeling

The first phase of the air quality analysis for this project employed vehicle emission factors calculated with the EPA Mobile5a model. Between the first and second analysis phases, a new and more accurate method for computing vehicle emission factors was adopted in the Puget Sound region. This new method is based on the Mobile5b model, and it results in generally lower emission rates.

The dispersion modeling impact assessment conducted in the first phase of this analysis using Mobile5a emission factors did not result in predictions of significant air quality impacts. Consequently, there was no need to redo this modeling in phase 2 of the analysis. Therefore the newer, lower, vehicle emission factors derived from the Mobile5b model were used only in the latter stages of air quality modeling for this project. The derivations of both the Mobile5a and the Mobile5b emission factors employed in this analysis are described further below.

MOBILE 5.0a Emission Factor Modeling Parameters

The U.S. EPA Mobile5a was used to calculate CO emission factors for current and future years for the modeling conducted during the first phase of this study. Mobile5a is the fifth in a series of models for predicting vehicle emission factors (in grams per vehicle mile-of-travel) based on a specific traffic description for an area of interest. For instance, south Tacoma vehicles are, on average, older and pollute more than vehicles in a metropolitan area like incorporated Seattle that has been in an EPA-required Inspection and Maintenance (I/M) program since 1982. Tacoma is now included in an I/M program; however, it did not start until 1994. The Mobile models can consider programs in effect in an area and adjust the emission factors accordingly. Other than region-specific programs, parameters such as temperature, hot and cold starts, speed, year, etc., are incorporated into the model to produce composite emission factors for use in dispersion modeling.

The Washington State Departments of Ecology and Transportation (Ecology, WSDOT) recommended using Mobile5a input parameters consistent with those used in the development of the CO Washington State Implementation Plan (SIP). Accordingly, the following assumptions and parameters were used in Mobile5a to determine emission factors in the local area. These same parameters were employed in Ecology's modeling for the CO SIP at the time of the analysis.

- Consistent with EPA guidance, idle emission rates were calculated by multiplying the emission rate for 2.5 mph by 2.5 (USEPA 1993b); Mobile5a produces average emission factors for all speeds between 2.5 and 65 mph, but cannot calculate idle emission rates.
- The project area was included in the expanded 1994 vehicle Inspection & Maintenance program (I&M). Accordingly, 87% of vehicles traveling through this area in the peak-hour were assumed to be subject to this program.
- The percentages assumed in the federal testing procedure were used to represent the percentages of vehicles in cold-start and hot-start modes.
- To simulate conditions when carbon monoxide violations are most likely to occur in northwestern Washington, outdoor minimum and maximum daily temperatures of 34 and 50°F were used. From these temperatures, Mobile5a calculated a PM peak-hour temperature of about 46°F.
- The CO Maintenance Plan contains the Washington state vehicle-registration patterns for 1995, 1998, 2001, 2007, and 2010. The 1998 Washington state vehicle-registration pattern was used to represent the distribution of vehicles by type and age in the existing year (1999) evaluated, while the 2007 and 2010 Washington State vehicle-registration patterns were used to represent opening (2005) and design (2025) years.

MOBILE 5.0b Emission Factor Modeling Parameters

Mobile5a and Mobile5b are the latest approved tools for use in traffic-related analyses, but a new version, Mobile6, is due to be released for general use sometime in 2001. The new model is expected to produce lower estimates of vehicle emission rates because it will consider all the latest emission controls required by federal clean air statutes and regulations. Until such time as Mobile6 is completed and released for general use, EPA has given the Puget Sound Regional Council (PSRC) correction factors to apply to output from the Mobile5b model. These correction factors produce results that are close to those expected from Mobile6. The correction factors are based on region-specific input parameters, and are intended to reflect the requirements of the "Tier II" emission controls that require all vehicles manufactured after 2003 to meet strict emission limits.

In accordance with the agreement between EPA and PSRC, PSRC was contacted regarding the years of analysis being considered for the interchanges in this study. PSRC ran the Mobile5b model, made appropriate adjustments, and provided MFG with the CO emission factors for use in this analysis.[2] Thus, the *Tier II Adjusted CO Mobile5b Emission Factors, February 2001* were used in the dispersion modeling for each interchange.

CAL3QHC Dispersion Modeling Parameters and Applications

The CAL3QHC dispersion model (Version 2) was used to calculate peak-hour CO concentrations near intersections that would be affected by the project. CAL3QHC is a dispersion model designed to calculate pollutant concentrations near signalized intersections caused by transportation sources (EPA 1992a). It considers "free-flow" and "queue" emissions (based on MOBILE emission factors) together with intersection geometry, wind direction, and other meteorological factors.

The following assumptions and parameters were used in the CAL3QHC modeling and are consistent with the Washington State CO SIP and EPA guidance for dispersion modeling:

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[2]MFG was not privy to either the input modifications nor the post-processing adjustments involved in this process, but defers to the expertise of the PSRC in assuming the resulting CO emission factors are correct.

- Critical meteorological parameters were a 1000-meter mixing height, low wind speed (1 meter/second), and a stable atmosphere (Class E) (EPA 1992b).
- The modeling evaluated 36 wind directions (in 10° increments) to ensure worst-case conditions were considered for each receptor location (EPA 1992b).
- A "background" 1-hour carbon monoxide concentration of 3 ppm was assumed to represent emissions from other sources in the area. Use of a background level was based on EPA guidance documents that suggest applying a 3-ppm background concentration in "suburban" settings (EPA 1992b).
- The modeling configuration considered road links extending 1000 feet from each intersection. Using the procedures required for the CAL3QHC dispersion model, both free-flow and queue links were configured approaching and departing the intersections evaluated. Model iterations included at least eight near-road receptors for each intersection. Receptors were placed beyond the mixing zone, 10 feet from the road edge of the free flow link, at a height of 6 feet, as per EPA guidance. Additional locations representing existing or future receptors were also included where necessary.
- The p.m. peak-hour traffic conditions that would result in the most traffic congestion (based on the traffic analysis) were considered in the modeling, because these conditions would lead to the highest possible 1-hour and 8-hour CO concentrations.
- Modeled one-hour concentrations were converted to 8-hour concentrations using a "persistence factor" (i.e., the ratio of 8-hour to 1-hour CO concentrations) to represent variability in both traffic volumes and meteorological conditions. Since only limited monitoring data are available for the study area, the EPA-recommended "default" persistence factor of 0.7 was used (EPA 1992b). This approach was confirmed in discussions with Puget Sound Clean Air Agency (PSCAA).

Coordination

Air quality data compiled and published by the Puget Sound Clean Air Agency (PSCAA) and the Washington State Department of Ecology (Ecology) were reviewed and included in the Affected Environment section of this report. Parametrix Inc. provided all level of service (LOS) analysis summaries, intersection configurations and other traffic data. The Mobile5a model was configured to use modeling parameters consistent with those employed in the carbon monoxide SIP and maintenance plan developed by the PSCAA and Ecology. Puget Sound Regional Council (PSRC) provided the Mobile5b model results. The CAL3QHC modeling was performed using parameters suggested by PSCAA and Washington State DOT (WSDOT). The PSRC web page was consulted regarding conformity issues.

AFFECTED ENVIRONMENT

Local Climate and Terrain

In the Puget Sound region, summers are cool and comparatively dry and winters are mild, wet, and cloudy. The winter months are dominated by a stronger south wind and frequent precipitation. Annual average precipitation in the region is around 38 inches. Annual mean temperature measured at Fort Lewis is 51°F. The annual mean wind speed is about 4 mph, with a predominately southern wind direction.

Weather is one of several variables that influence air quality. Nighttime thermal inversions due to the low solar heating of the land in winter create stable atmospheric conditions. It is during these very stable atmospheric conditions when little vertical dispersion occurs that monitoring instruments measure high concentrations of air pollutants emitted at ground level. Such ground-level emitted pollutants include CO from motor vehicles and particulate matter from vehicles and wood stoves.

In some instances terrain can also influence air quality. While the greater Puget Sound Area is located between mountainous terrain, the study area is characterized by flat terrain or slight rolling hills along the proposed corridor. There are no major terrain features within the vicinity of modeled intersections that would affect the modeling results.

Regulatory Overview

Air quality is generally assessed in terms of whether concentrations of air pollutants are higher or lower than ambient air quality standards set to protect human health and welfare. Three agencies have jurisdiction over the ambient air quality in the proposed project area: the EPA, Ecology, and the Puget Sound Clean Air Agency (PSCAA). These agencies establish regulations that govern both the concentrations of pollutants in the outdoor air and contaminant emissions from air pollution sources. Applicable local, state, and federal ambient air quality standards are displayed in Table 2.

Ecology and PSCAA maintain a network of air quality monitoring stations throughout the Puget Sound region to measure existing air quality. The siting of these stations is dependent upon the intended use of the data. Most locations focus on a single source or group of sources and are usually in or near urban areas, or close to specific large air pollution sources. Monitoring stations in remote areas may provide an indication of regional air pollution levels. Based on monitoring information collected over a period of years, regions are designated as "attainment" or "nonattainment" areas for particular air pollutants. Attainment status is therefore a measure of whether air quality in an area complies with the National Ambient Air Quality Standard (NAAQS).

Typical existing sources of air pollution in the study area include automobile and bus traffic, commercial space heating, airplane approach and departures, and a variety of industrial sources. For this study, vehicular traffic is the source of concern, and carbon monoxide (CO) is the pollutant of primary concern.

Other pollutants generated by traffic include the ozone precursors: hydrocarbons and nitrogen oxides. Fine particulate matter (PM_{10} and $PM_{2.5}$) is emitted in automobile exhaust and generated by tire friction on pavement (or unpaved areas), but the amounts of particulate matter generated by automobiles are small compared to diesel-powered buses and other sources (e.g., wood-burning stoves). Sulfur oxides and nitrogen dioxide are emitted by motor vehicles in trace amounts, but are generally not influential on ambient concentrations unless large industrial facilities are nearby.

There are special requirements in federal and state air quality rules for nonattainment and maintenance areas to ensure that proposed transportation and transit projects do not cause or contribute to existing air quality problems. These so-called "conformity rules" require analyses to demonstrate compliance with existing air quality control plans and programs. The specific requirements for air quality conformity are discussed later in this report.

Table 2. Ambient Air Quality Standards

Pollutant	National		Washington State	PSCAA
	Primary	Secondary		
Total Suspended Particulate Matter				
Annual Geometric Mean ($\mu g/m^3$)			60	
24-Hour Average ($\mu g/m^3$)			150 [(a)]	
Inhalable Particulate Matter (PM_{10})				
Annual Average ($\mu g/m^3$) [(b)]	50	50	50	50
24-Hour Average ($\mu g/m^3$)	150 [(c)]	150 [(c)]	150 [(d)]	150 [(d)]
Fine Particulate Matter ($PM_{2.5}$) (**)				
Annual Average ($\mu g/m^3$)	15 [(e)]	15 [(e)]	[(g)]	[(g)]
24-Hour Average ($\mu g/m^3$)	65 [(f)]	65 [(f)]		
Sulfur Dioxide (SO_2)				
Annual Average (ppm)	0.03	--	0.02	0.02
24-Hour Average (ppm)	0.14 [(a)]	--	0.10 [(a)]	0.10
3-Hour Average (ppm)	--	0.50 [(a)]	--	--
1-Hour Average (ppm)	--	--	0.25 [(h)]	0.25 [(h)]
1-Hour Average (ppm)	--	--	0.40 [(a)]	0.40
Carbon Monoxide (CO)				
8-Hour Average (ppm) [(a)]	9	9	9	9
1-Hour Average (ppm) [(a)]	35	35	35	35
Ozone (O_3)				
8-Hour Average (ppm) [(**)]	0.08 [(i)]	0.08 [(i)]	[(g)]	[(g)]
1-Hour Average (ppm)	0.12 [(j)]	0.12 [(j)]	0.12 [(d,j)]	0.12 [(d,j)]
Nitrogen Dioxide (NO_2)				
Annual Average (ppm)	0.053	0.053	0.05	0.053
Lead (Pb)				
Quarterly Average ($\mu g/m^3$)	1.5	1.5		1.5

NOTES: $\mu g/m^3$ = micrograms per cubic meter; **ppm** = parts per million; blank cells indicate no standard.
All values not to be exceeded except as noted; all averages arithmetic except TSP annual geometric mean.
[(a)] Not to be exceeded more than once per year
[(b)] Attainment based on 3-year average
[(c)] Attainment based on 3-year average of the 99th percentile of 24-hour PM_{10} concentrations
[(d)] Attainment if expected number of events above this limit is less than or equal to one
[(e)] Attainment based on 3-year average of annual arithmetic mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors
[(f)] Attainment based on 3-year average of the 98th percentile of 24-hour $PM_{2.5}$ concentrations
[(g)] Not yet established
[(h)] Not to be exceeded more than twice in seven consecutive days
[(i)] Attainment based on 3-year average of the 4th highest daily maximum 8-hour ozone concentration
[(j)] Federal 1-hour ozone standard may lapse in each existing nonattainment area after attainment demonstration based on existing standard as per note (d).
(**) Soon after the adoption of the revised standards for ozone and particulate matter, these new standards were subject to a number of court reviews. In February 2001, the U.S. Supreme Court upheld the bases and the substance of the new rules. The EPA is now in the process of devising plans to implement these new standards.

Existing Ambient Air Quality

Ozone

Ozone is a highly reactive form of oxygen created by sunlight-activated chemical transformations of nitrogen oxides and volatile organic compounds (hydrocarbons) in the atmosphere. Unlike CO concentrations that tend to occur very close to the emission source(s), ozone problems tend to be regional in nature because the atmospheric chemical reactions that produce ozone occur over time. During the delay between emission and ozone formation, ozone precursors can be transported far from their sources and affect receptors at distant locations. Transportation sources are one of a number of sources that produce ozone precursors.

During the summer of 1990, ozone concentrations exceeded the 0.12-ppm NAAQS then in effect several times at monitoring stations in both Enumclaw and Lake Sammamish State Park. Because of these violations, EPA designated all of Snohomish, King, and Pierce Counties as nonattainment for ozone. In late 1992 the ozone nonattainment area was reduced to include all of Pierce County, all except a small portion in the northeast corner of King County, and the western portion of Snohomish County.

In 1997, the EPA determined the Puget Sound ozone nonattainment area had attained the public health-based NAAQS for ozone. Based on this determination, EPA redesignated the Puget Sound to attainment, and approved the associated air quality maintenance plan (Ecology 1997). This plan includes measures to continue controlling ozone emissions, and is intended to assure the standard is maintained for at least ten years. In 1998 the 1-hour ozone standard was exceeded twice at two sites in Enumclaw and one at Pack Forest in LaGrande, WA. If this standard were exceeded twice more in the next few years it would tip the area back into nonattainment for ozone. Currently, the Puget Sound region adheres to the 1-hour ozone standard. No measured ozone concentrations have violated the 1-hour ozone NAAQS since 1994 (PSCAA 2001).

The Cross-Base Highway project study area is partially within an ozone air quality maintenance area. Under current air quality plans and policies, this status has no direct implications for the alternative plans being considered.

Inhalable Particulate Matter (PM_{10})

Federal, state, and local regulations set limits for particles less than or equal to about 10 micrometers in diameter. This fraction of particulate matter, called PM_{10}, is important in terms of potential human health impacts because particles this size can be inhaled deeply into the human lung. PM_{10} is generated by industrial activities and operations, fuel combustion sources like residential wood burning, motor vehicle engines and tires, and other sources. Such sources occasionally cause high PM_{10} levels in the Puget Sound region where PM_{10} concentrations have exceeded health standards. As a result three areas in Seattle, Tacoma and Kent were declared nonattainment areas. A review of available data indicates that all recently measured PM_{10} concentrations have been less than the levels allowed by federal, state, and local standards. (EPA 2001)

Because the proposed project is not in a PM_{10} nonattainment area, conformity rules do not require in-depth analysis of potential PM_{10} concentrations with applicable air quality plans.

Fine Particulate Matter ($PM_{2.5}$)

Effective September 16, 1997, EPA implemented a new federal standard for particulate matter less than or equal to 2.5 micrometers (microns) in diameter. This fine fraction of particulate matter is called $PM_{2.5}$, and is a subset of PM_{10}. Such small particles (e.g., a typical human hair is about 100 microns in diameter) can be breathed deeply into the lungs where they have been found to represent the most dangerous risk to human health. Implementation of the new $PM_{2.5}$ standard has been delayed due to court challenges. However, the US Supreme Court upheld the standards in February 2001, and the EPA is currently developing implementation strategies

PSCAA operates several $PM_{2.5}$ monitoring locations in the southern Puget Sound region, but none in or near the project study area. A review of available data indicates that $PM_{2.5}$ levels will likely comply with the new $PM_{2.5}$ 24-hour standard (65 $\mu g/m^3$). There is incomplete data to derive the average annualized over 3 years, but preliminary analysis shows compliance with the new annual average standard (15 $\mu g/m^3$) is possible. (PSCAA 2001.)

Carbon Monoxide

Carbon monoxide is the product of incomplete combustion. It is generated by transportation sources and other fuel-burning activities like residential space heating, especially heating with solid fuels like coal or wood. Carbon monoxide is usually the pollutant of greatest concern related to transportation sources because it is the pollutant emitted in the greatest quantity for which short-term health standards exist. Short-term standards (as opposed to annual-average standards) are often the controlling or most restrictive NAAQSs. There are two air quality standards for CO: a 1-hour average standard of 35 ppm and an 8-hour average standard of 9 ppm. These levels may be exceeded once per year without violating the standard. A calculated 8-hour CO concentration of 9.1 ppm or higher exceeds the NAAQS.

CO can cause adverse effects to human health, because it chemically combines with the hemoglobin in red blood cells decreasing the oxygen-carrying capacity of the blood. It can weaken heart contractions, thus reducing the amount of blood transported to organs and tissues such as the lungs and brain. At lower doses, CO causes headaches, dizziness, nausea, and listlessness. At high levels people can experience blurred vision, reduced manual dexterity and reduced ability to exercise. At extremely high levels, CO is poisonous and may even cause death. People with heart disease or women who are pregnant have higher risks from exposure to CO. The national ambient air quality standards for CO are designed to protect human health with "an adequate margin of safety."

Unlike ozone, CO is a pollutant whose impact is usually localized. The highest ambient concentrations of CO usually occur near congested roadways and intersections during periods of cold temperatures (autumn and winter months), light winds, and stable atmospheric conditions. Such weather conditions reduce the mechanisms that disperse pollutants emitted into the air.

The project study area is located partially in the CO nonattainment area established in 1991 that encompasses a large portion of the Everett-Seattle-Tacoma urban area. This designation required PSCAA and Ecology to develop strategies and plans to work toward complying with the ambient standards, and affected transportation planning and emission control policies throughout the nonattainment area.

Because no monitoring stations have recorded violations of the standards in recent years, in 1997 the EPA redesignated the Central Puget Sound region as attainment for CO. EPA also approved the associated maintenance plan to insure the area remains in attainment for the CO NAAQS. That plan relies on continuing the existing vehicle Inspection and Maintenance program.

Traffic generated by the project would affect CO emissions in the CO maintenance area. Consequently, any major changes to the road network are subject to review under state and federal air quality conformity rules. These rules are intended to ensure that projects and actions affecting air quality will conform to existing plans and time tables for attaining and then maintaining federal health-based air quality standards.

The closest CO monitoring station is located at 1101 Pacific Avenue, a heavily congested area in Tacoma. This station and others in the Puget Sound region have not measured a violation of the 1-hour or 8-hour

CO standard in recent years. Because CO impacts occur so close to the source; it is not possible to extrapolate CO concentrations from regional data or distant monitors.

For this study existing conditions at intersections where traffic would have the greatest potential to generate high concentrations of CO were analyzed using dispersion modeling techniques. Future conditions were also examined with modeling to predict potential ambient CO concentrations as a result of the project. A discussion of the modeled impacts is included in this report.

CONSTRUCTION IMPACTS

No Build Alternative

With the No Build Alternative, the Build Alternatives would not be constructed. However, an extension of the Spanaway Loop Road to SR7 will be constructed which could create construction-related air quality impacts similar to those of the Build Alternatives. Construction impacts and mitigation measures common to each of these scenarios are discussed below.

Impacts Common to the Build Alternatives

During construction, dust from excavation and grading would contribute to ambient concentrations of suspended particulate matter; however, air quality impacts would be temporary. The construction contractor(s) would be required to comply with the Puget Sound Clean Air Agency's Regulation I, Section 9.15, requiring reasonable precautions to avoid dust emissions.

Burning of slash and debris resulting from clearing and demolition is prohibited by PSCAA rules within incorporated cities, urban growth areas, and areas where violations of the CO standard have occurred. Consequently, outdoor burning is prohibited within the project area, and burning of slash and debris will not occur during the construction of the project.

Construction would require the use of heavy trucks and smaller equipment such as generators and compressors. These engines would emit air pollutants that would slightly degrade local air quality, but these emissions and resulting concentrations would be far outweighed by emissions from traffic normally in and around those portions of the project area near busy roads.

Some phases of construction would cause odors detectible to some people away from the project site. This would be particularly true during paving operations using tar and asphalt. The construction contractor(s) would have to comply with the PSCAA regulations requiring the best available control measures to control the emissions of odor-bearing air contaminants (Regulation I, Section 9.11). Such odors would be short-term.

Construction equipment, material hauling, and detours for excavation and grading could affect traffic flow in the project area. If construction delays traffic enough to significantly reduce travel speeds in the area, general traffic-related emissions would increase.

The proposed new roadway may require demolition of some existing buildings, some of which may contain asbestos. Demolition contractors would be required to comply with strict EPA and PSCAA regulations concerning the safe removal and disposal of any asbestos-containing materials.

CONSTRUCTION IMPACT MITIGATION

Construction impacts are generally localized and short-term, and are not expected to be significant. Dust produced by construction could be minimized using several techniques. Areas of exposed soils such as storage yards and construction roadways could be paved or sprayed with water or other dust suppressants.

Roads and other areas that might be exposed for prolonged periods could be paved, planted with a vegetation ground cover, or covered with gravel. The quantity of soils accidentally dispersed by trucks would be reduced by wheel washing and covering truckloads. Finally, soil that does escape the construction area on exiting vehicles would be reduced with an effective street-cleaning effort.

Using well-maintained equipment can reduce emissions from construction equipment and trucks. Avoiding prolonged periods of vehicle idling and engine-powered equipment would also reduce emissions.

Trucking materials to and from the project area could be scheduled to minimize congestion during peak travel times. This would minimize secondary air quality impacts caused by traffic having to travel at reduced speeds.

OPERATION IMPACTS

The proposed project is subject to review under the state and federal air quality conformity rules. As indicated earlier in this report, the pollutant of major concern for transportation project analyses is CO, thus CO is the primary focus of this project-level conformity analysis.

Under the air quality conformity rules, a proposed project may not cause a new air pollution problem nor make an existing problem worse. Consequently, if calculated existing CO concentrations are below the standard, they also must be below the standard with the project during the opening and design years. In situations where calculated existing CO levels exceed the standard, future "with-project" levels also may exceed the standard, but may not be higher than either existing or No-Build conditions.

Table 3 displays the results of the CAL3QHC dispersion modeling for existing year (1999), and the Build and No Build alternatives in the opening (2005), and design (2025) years. Modeling of the Build Alternative considered proposed changes in roadway configurations and expected changes in traffic conditions with implementation of the proposed project.

In 2005 and 2025, CO concentrations near all intersections with the proposed project were equal to or less than concentrations expected with the No-Build Alternative. Furthermore, CO concentrations near all the intersections examined were less than the 1-hour and 8-hour standards except at one location. As shown in Table 3, the calculated existing 8-hour CO level exceeds the 9-ppm standard at only one intersection: SR-7/176th S/Cross Base.

Cross-Base/176th Street South and SR-7 Intersection

The dispersion modeling results for existing roadway conditions show that the maximum 1-hour CO concentrations are well below 35 ppm, the 1-hour ambient CO standard. However, calculated maximum existing 8-hour CO concentrations are above 9 ppm, the 8-hour CO standard (Table 3). The high CO concentrations at this LOS E intersection are caused by traffic delay.

With the No Build Alternative, the calculated maximum 1-hour CO concentrations are less than the 35-ppm ambient CO standard at all receptor locations in both the opening year and design year. However, the predicted 8-hour CO concentration in 2005 exceeds the 9-ppm 8-hour standard. By 2025, the calculated 8-hour concentration falls to less than the standard. The predicted highest 1-hour and 8-hour CO concentrations are 13.2 and 9.2 ppm, respectively, in the opening year, and 11.4 and 8.0 ppm, respectively, in the design year. Although the expected level of service decreases at this intersection due to future increases in traffic volume, the calculated maximum CO concentrations also decrease in future years because the future emission factors are expected to be much lower than current emission factors.

With the proposed project, the projected LOS at this intersection in the opening and design years decreases average delay significantly compared to the No Build scenario (Table 1). As a result,

Table 3. Calculated Maximum CO Concentrations (ppm)

Intersection	Averaging Time	Existing (1999)	2005 Opening Year Alternatives		2025 Design Year Alternatives	
			No Build	Build	No Build	Build
SR-7/ 176th St S / Cross-Base	1-hour	18.2	13.2	12.3	11.4	12.7
	8-hour	12.7	9.2	8.6	8.0	8.9
Spanaway Loop Rd / 176th St S / Cross-Base (New)	1-hour			9.2		9.9
	8-hour			6.4		6.9
Cross-Base/150th Street SW/ Murray Rd – South Alignment (New)	1-hour			9.7		9.7
	8-hour			6.8		6.8
Interchange						
Berkley Avenue SW Interchange NB Ramps	1-hour	6.1	4.9	4.9	4.2	4.1
	8-hour	4.3	3.4	3.4	2.9	2.9
Berkley Avenue SW Interchange SB Ramps	1-hour	6.6	5.7	5.3	4.8	4.3
	8-hour	4.6	4.0	3.7	3.4	3.0
Thorne Lane Interchange NB Ramps	1-hour	8.3	6.0		5.3	
	8-hour	5.8	4.2		3.7	
Thorne Lane Interchange SB Ramps	1-hour	8.2	7.9		5.6	
	8-hour	5.8	5.5		3.9	
Thorne Lane Interchange SPUI (New)	1-hour			6.1		5.6
	8-hour			4.3		3.9
Gravelly Lake Drive SW Interchange NB Ramps	1-hour	9.0	7.0	7.2	5.6	5.6
	8-hour	6.3	4.9	5.0	3.9	3.9
Gravelly Lake Drive SW Interchange SB Ramps	1-hour	8.4	7.3	7.0	5.8	5.7
	8-hour	5.9	5.1	4.9	4.1	4.0

Notes: Eight-hour concentrations were calculated from the modeled 1-hour CO concentration using a 0.7 persistence factor. Highlighted entries are results that exceed the 8-hour standard of 9 ppm. With the Proposed Action, these intersection configurations and/or operational parameters include measures developed by the transportation consultant to enhance the intersection level of service (i.e., traffic mitigation measures).

Source: CAL3QHC dispersion modeling by MFG, Inc.

the air quality modeling predicts maximum 1-hour and 8-hour CO concentrations at the 176th Street South/Cross-Base intersection would be less than the ambient CO standards with the proposed Cross-Base Highway. In the opening year, the highest calculated CO concentrations with the Build Alternative are slightly less than those expected with No Build Alternative. This improvement derives from both the improved LOS and the expected lower emission rates for future years. In the project's 2025 design year, expected increases in traffic volumes greatly offset both the better LOS and the decreased emission rates, and result in a calculated 8-hour CO concentration with the Build alternative that approaches the 8-hour standard. This level nonetheless complies with the 9-ppm limit.

Cross-Base Highway & Spanaway Loop Road/ 176th St. South

The new intersection of Spanaway Loop Road /176th Street South and the proposed Cross-Base Highway was selected for dispersion modeling due its LOS D and average delay time in the design year. This intersection was chosen over the existing Spanaway Loop Road and Military Road intersection because the potential for operational impacts was greater due to the longer delay time (45.8 seconds versus 53.6 seconds – see Table 1).

Modeling for existing and future No Build conditions was not possible for this intersection because it would only exist as part of the proposed project. Dispersion modeling results for the opening and design years with the proposed project indicate CO levels would comply with both 1-hour and 8-hour ambient CO standards. The maximum predicted 1-hour and 8-hour concentrations in the opening year are 9.2 and 6.4, and in the design year, 9.9 and 6.9 respectively.

Cross-Base Highway & 150th St. SW & Murray Road

With the South Alignment Alternative in the western segment of the proposed project a new signalized intersection would be created at the junction of 150th Street Southwest and Murray Road with the Cross-Base Highway. This intersection was selected for dispersion modeling because the design year delay is expected to be higher than all the other proposed intersections in the project area (average delay of 77.7 seconds and LOS E – see Table 1).

Modeling results for the opening and design years predict maximum 1-hour and 8-hour concentrations in both the opening and designs years would be 9.7 and 6.8 respectively. These levels easily comply with the ambient air quality standards for CO. While traffic volumes and average delay increase slightly from the opening to design years, the increase is offset by the decrease in vehicle emission rates.

Berkley Avenue SW Interchange with I-5

This interchange includes the two signalized intersections of the northbound on/off ramps and southbound on/off ramps. Because these two intersections are within 1,000 feet of each other they were analyzed in one model run. The dispersion modeling for all the freeway interchanges considered in this analysis included traffic on the ramps and surface streets. Traffic on I-5 was not considered. Modeling results for both intersections of the interchange are presented in Table 3.

Consistent with the expected traffic conditions at surface street intersections along the corridor, the LOS and average delay at this interchange degrade from the existing to opening and design years due to growth in the study area. Predicted CO concentrations remain far below the ambient standards for both the 1-hour and 8-hour time periods for each No Build scenario.

The proposed project is expected to improve the LOS compared with the No Build alternative in both the opening and design years, decreasing vehicle delay at these intersections. The result is lower predicted CO concentrations compared to the No Build alternative. Maximum predicted concentrations reach 19 percent of the 1-hour standard, and 50 percent of the 8-hour standard for all Build alternatives.

Thorne Lane/Cross-Base Interchange with I-5

The Cross-Base Highway begins in the western segment of the proposed corridor at Exit 123 of I-5. This segment has three alternative Build alignments but as discussed previously, these alternative alignments have no effect on the intersections in this area. Each of the three build alignments begins with the Thorne Lane Interchange reconfigured from a conventional diamond with an intersection for each of the on/off ramps at Thorne. The proposed new interchange would be comprised of a "single point" design with one traffic signal instead of two, and an additional signal at the northbound I-5 on ramp from Thorne westbound to allow vehicles traveling from the left-turn lane heading east on Thorne past the on ramp toward I-5 without developing a queue. The new interchange would operate at LOS D, and have an average per vehicle delay of 42 seconds in the design year. This would be far less delay than expected with the No Build Alternative and the existing intersection configuration. The proposed Gravelly-Thorne Connector intersects with Union Avenue at Thorne within 1,000 feet of the interchange and was included in the Build analysis modeling. Additionally, an elevated to at-grade pedestrian overpass is proposed for this new interchange which would traverse the Thorne/Cross-Base Highway and I-5 ramps. Receptors were selected along this overpass to represent potential pedestrian exposure to vehicle emissions.

Without the proposed project, the overall interchange LOS would degrade somewhat between the existing and the 2005 opening year, and deteriorate significantly by the 2025 design year. The maximum calculated CO concentrations at nearby receptors nonetheless comply with the respective 1- and 8-hour CO standards in both the opening and the design year.

With the proposed project and the reconfiguration of this interchange to a single point junction, air quality would be improved compared with No Build. Dispersion modeling results indicate all opening and design year CO concentrations would easily comply with the respective 1- and 8-hour CO standards (Table 3).

The physical location and design of the Thorne Lane and Union Avenue intersection changed after completion of the air quality modeling analysis presented in this report. In the revised configuration, the intersection would be moved 60 feet farther west from the I-5 interchange area, and a section of Union Avenue would move closer to existing buildings, including the residential property northwest of the intersection of Union Avenue and Spruce Street.

Moving the intersection of Thorne Lane and Union Avenue farther from the I-5 interchange has no effect on the air quality modeling results for the I-5 SPUI interchange performed using the previous intersection location and configuration. With the previous configuration, the queuing movements of the eastbound approach to the SPUI would not reach capacity by 2025. Moving the Thorne Lane and Union Avenue intersection farther west would increase the capacity available to handle the eastbound queue, while the number of vehicles in the queue would not increase as a result of the change. Without an increase in the number of vehicles in the queue or a change in the signalization, the input parameters and the results of the previous modeling remain the same. Therefore based on the previous modeling results, shifting this intersection's location and configuration would have no negative air quality affects.

Moving Union Avenue closer to the residence northwest of the intersection of Union Avenue and Spruce Street would move CO sources closer to this residence, which could in turn slightly increase CO levels near this home. But based on results of the previous air quality modeling, worst-case CO concentrations would remain well below allowed ambient levels. The air quality modeling for this interchange includes sidewalk model receptors at a number of locations, including along both sides of Union Avenue. With the revised intersection/roadway configuration, the model receptor west of Union Avenue and closest to the intersection with Thorne Lane is representative of a sidewalk location near the residence on Spruce Street. The previous modeling predicted worst-case maximum 1-hour and 8-hour CO concentrations at this receptor of 3.9 ppm and 2.8 ppm, respectively, in both opening and design years 2005 and 2025. These levels are well below the health-based air quality standards. Moving the roadway laterally as in the new intersection/interchange configuration would not change this result. Consequently, the new proposed configuration of Thorne Lane and Union Avenue would not result in air quality impacts at this closest residence.

Gravelly Lake Drive SW and Interchange with I-5

The Gravelly Lake Drive interchange was examined with air quality modeling because its design year LOS and overall average delay was the worst of the three interchanges considered as part of the scope of this study. From an existing LOS of B, design year LOS with No Build deteriorates to E at both ramp intersections. Consequently, the maximum predicted CO concentrations along this interchange are the highest among the interchanges, but far below the CO ambient air quality standards. The 1-hour and 8-hour maximum concentrations reach 9 ppm and 6.3 ppm for existing roadway conditions decreasing to 5.7 ppm and 4.0 ppm respectively for the No Build design year.

For the three Build alternatives, opening year CO concentrations increase slightly over No Build at the northbound ramp intersection but are slightly less than the No Build concentrations at the southbound ramp intersection. In the project design year, calculated worst-case CO concentrations are the same as or slightly less than expected No Build levels at both ramp intersections. All calculated future CO concentrations near this interchange comply with the respective 1- and 8-hour CO standards.

SECONDARY AND CUMULATIVE IMPACTS

Because the transportation data provided for the air quality analysis considered expected traffic related to the proposed project and to other planned actions and growth in the area, the air quality analysis of traffic sources based on these data is an assessment of projected cumulative impacts of future alternatives. No additional air quality analysis is necessary.

OPERATION IMPACT MITIGATION

The air quality impact analysis indicates the proposed Cross-Base Highway project would not result in any significant air quality impacts in the study area. Calculated worst-case maximum CO concentrations at all locations examined comply with applicable ambient air quality standards. Consequently, no operational impact mitigation measures are warranted or proposed.

COMPLIANCE WITH APPLICABLE STANDARDS

Compliance with Ambient Air Quality Standards

Predicted ambient levels of CO that would result from the proposed Cross-Base Highway project comply with applicable ambient air quality standards. The maximum 1-hour and 8-hour CO concentrations at receptors near roadway intersections affected by the proposed project would be less than 1-hour and 8-hour standards for CO in the project's opening year and design year. Predicted maximum CO concentrations at all sensitive receptors examined all would be less than the 1-hour and 8-hour CO standards.

Conformity

The Federal Clean Air Act requires states to take actions to reduce air pollution in nonattainment areas so that federal health-based standards are not exceeded. States must also provide control measures in maintenance areas that will assure attainment for at least ten years. The framework for meeting these goals is the State Implementation Plan (SIP). As required by the Federal Clean Air Act, Ecology and the PSCAA submitted the ozone and the CO SIPs to the EPA for review, and these plans were approved.

Under section 176(c) of the Clean Air Act, as amended in 1990 and adopted by chapter 70.94 RCW of the Washington Clean Air Act of 1991, the PSRC, as the responsible metropolitan planning organization, and WSDOT cannot adopt, approve, or accept any transportation improvement plans, programs, or projects unless they conform to the Washington SIPs.

Conformity with an SIP is defined as complying with the plan's intent to reduce or eliminate the number and severity of violations of an ambient air quality standard, and to achieve expeditious attainment of such standards. The federal and state rules and regulations governing conformity are described in 40 CFR parts 51 and 93 and in WAC 174-420.

In accordance with the conformity guidelines, the PSRC was consulted on project conformance with existing transportation and air pollution control plans. The PSRC provided the following information (PSRC 2001).

- The proposed project is included in the Metropolitan Transportation Plan (MTP) entitled Destination 2030. The regional plan was prepared and adopted by the PSRC, and reviewed by United States Department of Transportation. The plan meets all federal and state air quality conformity requirements.
- The proposed project is included in the Regional Transportation Improvement Program (RTIP) entitled 2001-04 Regional Transportation Improvement Program, which was modeled in 1999. This regional program, prepared and adopted by the PSRC, was reviewed by United States Department of Transportation. It was found to meet all federal and state air quality conformity requirements.

The conformity analysis performed by PSRC for Destination 2030 and the TIP must show that the regional emissions of CO, PM10 and ozone precursors from all projects included in the plans do not exceed the emissions budget in the maintenance plan afforded for motor vehicles. The findings of the regional air quality conformity analyses indicate that Destination 2030 and RTIP 2001-2004 conform to the maintenance plans and federal and state clean air requirements. Additionally, the design concept and scope of this project have not changed since inclusion into the transportation plans.

In many circumstances, a site-specific air quality analysis, which may include dispersion modeling, constitutes a "project-level" conformity review as defined in the clean air rules. For the proposed project, the modeling analysis described above represents a project-level review, and the following project-level conformity statement applies.

Local CO concentrations related to the Build Alternative of the proposed project were predicted using approved regulatory models and protocol. All predicted CO concentrations are less than ambient air quality standards. The proposed project would not, therefore, create a new violation nor worsen the current situation. Consequently, at the project level, the proposed Cross-Base Highway project conforms with the purpose of the current SIP, and to all requirements of the Clean Air Act Amendments of 1990 and the Washington State Clean Air Act of 1991.

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