Appendix C: Air Quality Discipline Report

Point Defiance Bypass Project

Air Quality Discipline Report

Washington State Department of Transportation

September 2012

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Summary

What is the existing air quality in the study area?

The Project is in a maintenance area for carbon monoxide (CO) and coarse particulate matter (PM_{10}), and a nonattainment area for fine particulate matter ($PM_{2.5}$). Although this area is also designated as a maintenance area of 1-hour ozone (O_3), due to US Environmental Protection Agency's (USEPA) recent updates to the Clean Air Act (CAA), conformity regulations no longer apply.

What are the project effects on air quality in the study area?

The Project is not subject to the Transportation Conformity rules because it is not an FHWA or Federal Transit Administration (FTA) project; however, because it is located in areas designated as maintenance or nonattainment for NAAQS pollutants, it is subject to the General Conformity rules (40 CFR 93, Subpart B).

The emissions estimates presented in this report indicate that the Project's emissions, due to construction and operation, would be below the *de minimis* levels listed in the General Conformity rules, and so implementation of the Project would be in conformance with CAA requirements.

In addition, CO concentrations were calculated at busy intersections (grade crossings) expected to have peak hour delays. CO concentrations were estimated for the existing (2010) and future (2030) years using the WSDOT Washington State Intersection Screening Tool (WASIST). The results were compared to the National Ambient Air Quality Standards (NAAQS) for CO. The Project CO hot spot analysis performed for congested intersections show that both 1-hour and 8-hour averaged CO concentrations would be below the NAAQS in the existing year (2010), the year of opening (2017), and the horizon year (2030) for the constructed Project at all modeled intersections.

Based on the results of the traffic analysis, the Project is not predicted to affect regional vehicle miles traveled. MSAT levels in the study area are predicted to decrease significantly in the future due to federally mandated programs. The Project is not expected to impact this reduction.

Chapter 1 – Project Description

Introduction

Under the High-Speed Intercity Passenger Rail (HSIPR) Program and pursuant to a programmatic Tier I Environmental Assessment (EA) the Federal Railroad Administration (FRA) has approved an application from the Washington State Department of Transportation (WSDOT) to improve the Pacific Northwest Rail Corridor (PNWRC), a federally designated high-speed rail corridor. One project included in the PNWRC application is the Point Defiance Bypass Project (the Project), which would respond to deficiencies in the existing rail operations around Point Defiance. This Discipline Report has been prepared in support of the project-specific EA for the Point Defiance Bypass project.

The Project is located in Pierce County along an existing approximately 20-mile rail corridor between Tacoma and Nisqually.[1] The Project would provide for the re-routing of Amtrak passenger trains from the BNSF rail line that runs along the southern Puget Sound shoreline (Puget Sound route) to the Point Defiance Bypass route, an existing rail corridor that runs along the west side of I-5. The Project would consist of railroad track and support facility improvements, and relocation of the Tacoma Amtrak Station to Freighthouse Square in Tacoma.

Purpose and Need

As described above, the Point Defiance Bypass route is part of the larger PNWRC. Within Washington State, the vision for the PNWRC is to "…improve intercity passenger rail service by reducing travel times and achieving greater schedule reliability in order to accommodate growing intercity travel demand…"[2].

The purpose of the Project is to provide more frequent and reliable high-speed intercity passenger rail service along the PNWRC between Tacoma and Nisqually. In conformity with the decisions under the Tier 1 Programmatic EA, the PNWRC Improvement Program has reduced the overall environmental effects of providing improved passenger rail service

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[1] *The three owners of the project corridor are Sound Transit, Tacoma Rail, and BNSF.*
[2] *WSDOT 2009*

with the use of an existing transportation corridor and associated infrastructure, rather than creating a new corridor.

The Project is needed to address the deficiencies in the existing rail alignment around Point Defiance. The existing alignment (Puget Sound route), shared by freight and passenger rail traffic, is near capacity and is therefore unable to accommodate additional high-speed intercity passenger rail service without substantial improvements. In addition, the existing alignment has physical and operational constraints that adversely affect both passenger train scheduling and reliability.

Improving intercity passenger rail service in the project area and meeting the Project needs would be accomplished by:

- Enhanced Frequency: Increasing Amtrak Cascades round-trips from four to six by 2017 to meet projected service demands.
- Improved Reliability: Reducing scheduling conflicts with freight trains that often result in delays, and by minimizing or avoiding operational delays (e.g., drawbridge openings) and weather-related delays (e.g., mudslides), and improving on-time performance from 68 percent to 88 percent.
- Enhanced Efficiency: Enhancing the efficient movement of people by decreasing trip times by 10 minutes, and reducing the amount of time passenger trains spend yielding to freight movements.
- Improved Safety: Constructing at-grade crossings with upgraded safety features, including wayside horns, median barriers, advance warning signals, and traffic signal improvements.

What alternatives are being considered for the Point Defiance Bypass Project?

FRA and WSDOT conducted an evaluation of three build alternatives: the Point Defiance Bypass Alternative, the Shoreline Alternative, and the Greenfield Alternative. Two of the alternatives (the Shoreline Alternative, and the Greenfield Alternative) were eliminated from further study. Although both alternatives could meet the Project’s purpose and need, they were determined to be impracticable and unfeasible due to technical constraints, high construction costs, and significant environmental effects. Grade separations were also evaluated for further consideration. FRA and WSDOT’s preliminary analysis revealed that current and projected future traffic volumes do not warrant the construction of new grade-separated crossings.

What's happening in the bypass corridor today?

The rail line between TR Junction and East "D" Street in Tacoma hosts both freight and commuter trains, including freight operators Tacoma Rail and BNSF, and Sound Transit's *Sounder* commuter rail service. Freight train traffic between TR Junction and East "D" Street averages under two trains per day, while Sound Transit currently operates 18 trains per day between Freighthouse Square and Seattle each weekday, and also offers occasional special event trains, usually on weekends, to serve sporting and other events in Seattle. *Sounder* service to Lakewood begins in late 2012.

What would happen if the Project were not built?

If the Project were not built (the No Build Alternative), Amtrak's Cascades and Coast Starlight passenger train service would continue to use the existing Puget Sound route. The No Build Alternative includes only the minor maintenance and repair activities necessary to keep the existing Puget Sound route operational. With the No Build Alternative, it would be expected that as freight traffic increases, congestion would adversely affect Amtrak service reliability, and the travel time for Amtrak trains between Seattle and Portland would increase.

Along the Point Defiance Bypass route, the Tacoma Rail and BNSF freight services would continue. The at-grade crossings at Clover Creek Drive Southwest, North Thorne Lane Southwest, Berkeley Street Southwest, 41st Division Drive, and Barksdale Avenue Southwest would not be upgraded.

Sound Transit's Sounder commuter passenger trains will become operational in late 2012 between the Tacoma Dome Station at Freighthouse Square in Tacoma and Sound Transit's Lakewood Station (on the Point Defiance Bypass route) with as many as 18 Sounder trains per day.

What are the proposed improvements and related activities of the Point Defiance Bypass Project?

The Project consists of railroad track and support facility improvements, and the relocation of Amtrak's Tacoma Station. Exhibit 1 shows the components of the Build Alternative. The following details specific components of the Build Alternative.

- **Construct New Track Adjacent to the Existing Main Line –** A new 3.5-mile track adjacent to the existing main line would be constructed from South 66th Street (Rail MP 6.9) in Tacoma to between Bridgeport

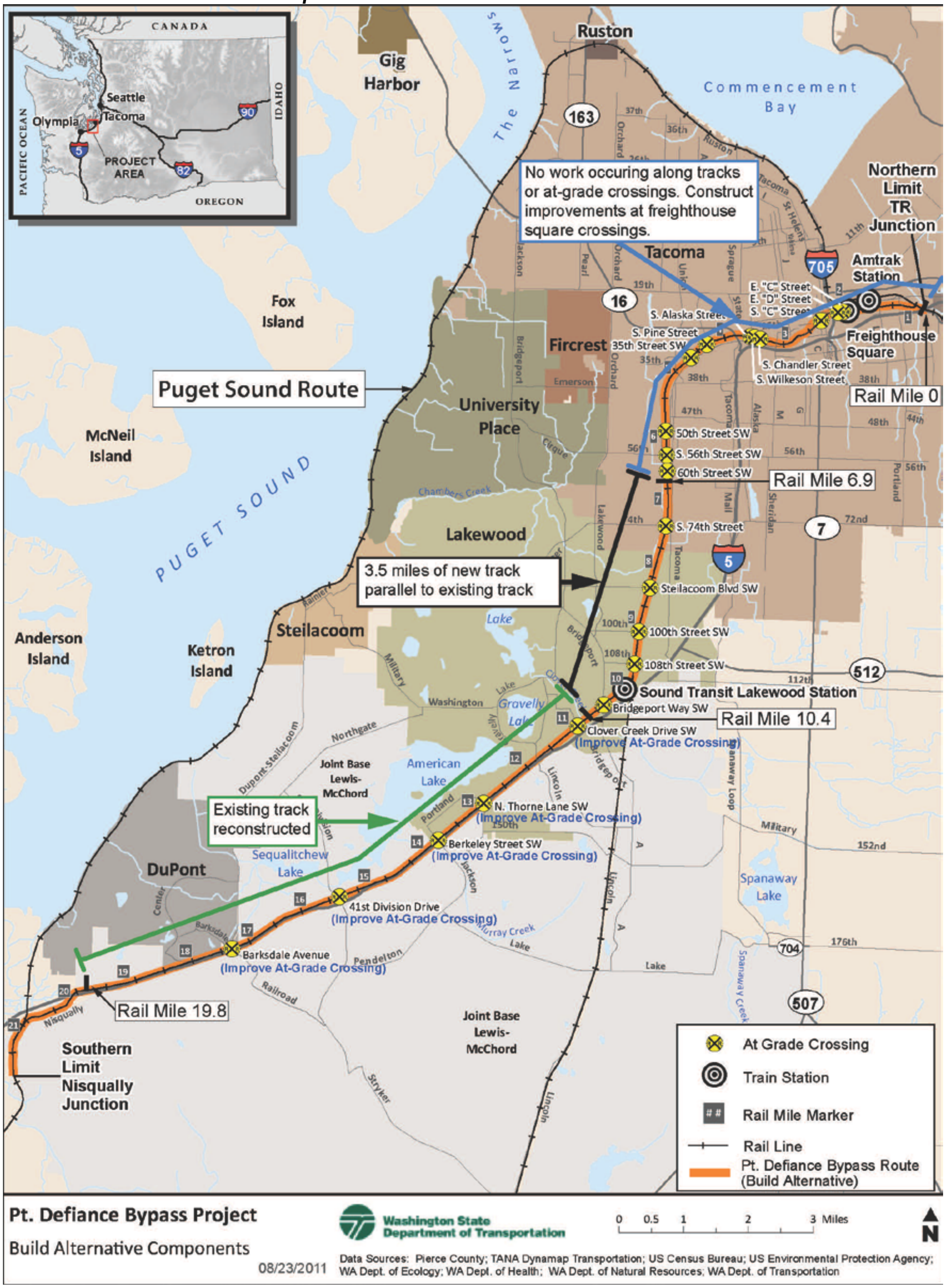
Way SW (Rail MP 10.4) and Clover Creek Drive SW (Rail MP 10.9) in Lakewood.

- **Reconstruct and Rehabilitate the Existing Main Line –** Starting just southwest of Bridgeport Way Southwest (Rail MP 10.4) in Lakewood, the existing track would be reconstructed to a location southeast of the I-5/Mounts Road Southwest interchange (Rail MP 19.8) at Nisqually Junction.
- **Improvements at at-Grade Crossings –** Several grade crossings would be improved with wayside horns, gates, traffic signals and signage, sidewalks, median separators, and warning devices. These crossings include Clover Creek Drive Southwest, North Thorne Lane Southwest, Berkeley Street Southwest, 41st Division Drive and Barksdale Avenue.
- **Tacoma Amtrak Station Relocation –** The existing Tacoma Amtrak Station would be relocated from its Puyallup Avenue location to the Tacoma Dome Station at Freighthouse Square, at 430 E. 25th Street in Tacoma.

What are the proposed operational changes that would result from the Point Defiance Bypass Project?

Amtrak's existing Cascades and Coast Starlight passenger train service would be rerouted from the Puget Sound route along the Puget Sound shoreline to the Point Defiance Bypass route. The Project would also provide for additional Amtrak Cascades service by increasing the number of round trips provided from 4 to 6, or a total of 12 Cascades service train trips. Amtrak Coast Starlight would also travel on the Point Defiance Bypass route for a total of two Coast Starlight service train trips. The speed of these passenger trains would be up to 79 mph.

Exhibit 1. Build Alternative Components



Chapter 2 – Methodology

Why should air quality be reviewed?

Air quality is typically evaluated, either qualitatively or quantitatively, as part of the NEPA review process for large projects that receive federal funding or approvals. The level and type of such analysis is selected proportional with the potential for adverse air quality effects due to construction or operation of a project.

In addition to meeting the general NEPA review requirements, projects that are funded, approved, or permitted by federal agencies, may need to meet air quality conformity requirements. Conformity refers to the need for federal actions to be in conformance with the applicable State Implementation Plans (SIPs) to attain or maintain compliance with National Ambient Air Quality Standards as required under the federal CAA.

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

Air quality resources are managed and regulated by multiple agencies. Governing air quality plans and policies, as well as applicable regulations and regulatory agencies are listed below.

The federal CAA and its amendments and the Washington State Clean Air Act regulate air quality in the Puget Sound region, and the USEPA, the Washington State Department of Ecology (Ecology), and the Puget Sound Clean Air Agency (PSCAA) enforce those regulations in the study area. The USEPA delegates authority to manage air quality issues to the states.

In Washington State, the USEPA and Ecology further delegate authority to local air quality agencies. PSCAA is the local air agency for the Puget Sound region. Projects that potentially affect air quality in nonattainment or maintenance areas must conform to air quality plans, policies, and time tables for attaining or maintaining federal health-based air quality standards through the air quality conformity rules.

What are the requirements for evaluating air quality?

Criteria (NAAQS) Pollutants

A conformity determination is required for each federal action, excluding exempt actions, which may adversely impact a nonattainment or maintenance area. A nonattainment area is defined as an area that is currently designated as not meeting NAAQS; a maintenance area is defined as an area that has not met NAAQS at some time during the past 20 years.

There are two bodies of conformity rules that can apply to federal actions:

1. Transportation Conformity rules, provided under 40 CFR 93, Subpart A, which apply to projects funded or approved by the FHWA or FTA; or where any funds are provided under Title 23 of the United States Code (USC), or the Federal Transit Act (49 USC 1601 et seq.); and
2. General Conformity rules (40 CFR 93, Subpart B), which apply to all other federal actions.

If a project is not subject to the Transportation Conformity rules, it is then covered under the General Conformity rules. Because the Project is not an FHWA/FTA project as defined in 40 CFR 93, it must be reviewed with respect to the General Conformity requirements. The air quality analysis presented in this report quantifies annual operational locomotive CO, PM_{10}, and $PM_{2.5}$ (including $PM_{2.5}$ precursors SO_2, NO_x, and Volatile organic compound [VOC]) emissions associated with the Amtrak Cascades and Amtrak Coast Starlight service within the project limits and compares it to annual emission limits allowable under the General Conformity rules.

In the past, the region has exceeded O_3 standards. The current status, as determined by the USEPA is that the Pierce County portion of the Seattle-Tacoma air quality management area is a maintenance area for the revoked 1-hour O_3 standard.

The Phase 1 final rule to implement the 8-hour O_3 standard was published on April 30, 2004. The anti-backsliding provisions in that rule set forth specific requirements for areas that are designated attainment for the 8-hour O_3 standard; and that were - at the time of the 8-hour designations (generally June 15, 2004) - either attainment areas with maintenance plans for the 1-hour standard; or nonattainment for the 1-hour standard.

Specifically, 40 CFR part 51, section 51.905(a)(3) and (4) requires these areas to submit a maintenance plan under section 110(a)(1) of the CAA. That maintenance plan must demonstrate maintenance out to 10 years after designation. This maintenance plan does not, however, carry with it any conformity obligations, unlike maintenance plans required under section 175A of the CAA.

Therefore, the Pierce County portion of the historic 1-hour O_3 maintenance area maintains a 1-hour ozone maintenance plan, but does not require O_3 standard conformity analyses for projects located within this region. Therefore, estimates of O_3 or O_3 precursors were not included in the General Conformity analysis included in the report.

While the Project is not covered under Transportation Conformity requirements, the Project is expected to impact traffic conditions at a number of highway/rail (at-grade) crossings. Therefore, some air quality analysis procedures typically used for projects covered by Transportation Conformity rules were used to assess potential air quality effects of the Project for NEPA review purposes.

One of these procedures, a CO hot-spot analysis, was performed. CO hot-spots were modeled using the WSDOT WASIST model (version 2.0). WASIST is a Windows-based screening model used for determining worst-case CO concentrations at signalized intersections throughout the State of Washington. WASIST uses readily available data in a user-friendly application to make a conservative estimate of project-related CO levels. This is done by using a combination of worst-case conditions that, when occurring simultaneously, produce the highest levels of CO. If the results from WASIST do not violate NAAQS for CO, the impact from any other combination of conditions would also be below the standards and no further modeling is required.

In some cases, projects subject to the Transportation Conformity requirements in $PM_{2.5}$ nonattainment and maintenance areas also perform a PM hot spot analysis for projects of local air quality concern (as described in 40 CFR 93.123).

Section 93.123(b)(1) of the Transportation Conformity rule defines the projects that require a $PM_{2.5}$ or PM_{10} hot-spot analysis as:

1. New highway projects that have a significant number of diesel vehicles, and expanded highway projects that have a significant increase in the number of diesel vehicles;
2. Projects affecting intersections that are at LOS D, E, or F with a significant number of diesel vehicles, or those that would change to LOS D, E, or F because of increased traffic volumes from a significant number of diesel vehicles related to the project;

3. New bus and rail terminals and transfer points that have a significant number of diesel vehicles congregating at a single location;
4. Expanded bus and rail terminals and transfer points that significantly increase the number of diesel vehicles congregating at a single location; and
5. Projects in or affecting locations, areas, or categories of sites which are identified in the $PM_{2.5}$ or PM_{10} applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation.

The Project does not include significant numbers of diesel vehicles, would not significantly change the roadway network, and would not include terminals or transfer points where vehicles would congregate. Therefore, a PM hot spot analysis was not performed.

Mobile Source Air Toxics (MSATs)

In addition to the criteria pollutants for which there are NAAQS, the USEPA also regulates air toxics. Toxic air pollutants are those pollutants known or suspected to cause cancer or other serious health effects.

The CAA identified 188 air toxics, and 21 have been identified with mobile sources. In 2001, the USEPA identified six of the 21 mobile sources as priority MSATs. The six priority MSATs include:

- Benzene
- Formaldehyde
- Diesel particulate matter/diesel exhaust organic gases
- Naphthalene
- Acrolein
- 1,3-Butadiene

In 2009, the FHWA issued interim guidance on MSATs is considered the best practice for determining the appropriate level of MSAT analysis for transportation projects. FHWA has suggested the following three-tiered approach for determining potential project-induced MSAT effects:

- Tier 1 – No analysis for projects that have no potential for meaningful MSAT effects;
- Tier 2 – Qualitative analysis for projects with a low potential MSAT effects; and
- Tier 3 – Quantitative analysis to differentiate alternatives for projects that have higher potential MSAT effects.

MSAT emissions are discussed qualitatively for the Project because the types of projects included in this category improve operations of highway, transit, or freight without adding substantial new capacity or creating a facility that is likely to meaningfully increase MSAT emissions.

What standards apply to air quality?

Washington State is subject to air quality regulations issued by the USEPA, Ecology, and local air agencies. USEPA's NAAQS set limits on concentration levels of 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 to compare the levels of criteria pollutants found in the atmosphere with the NAAQS.

The NAAQS consist of two sets of standards: the primary standards, and the secondary standards. The "primary" standards have been established to protect the public health. The "secondary" standards are intended to protect the nation's welfare, and they account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the general welfare. 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, the USEPA's NAAQS. Exhibit 2 summarizes the ambient air quality standards applicable in the study area.

Exhibit 2. National, State, and Local Ambient Air Quality Standards

Pollutant	National Standards		Washington State	Puget Sound Region
	Primary	Secondary		
Nitrogen Dioxide (NO_2)				
Annual Average (ppm) [a]	0.053	0.053	0.05	0.05
1-hour Average (ppm)	0.1	NS	NS	NS
Carbon Monoxide (CO)				
8-hour Average (ppm) [b]	9	NS	9	9
1-hour Average (ppm) [b]	35	NS	35	35
Ozone (O_3)				
8-hour Average (ppm) [c]	0.075	0.075	0.08	NS
1-hour Average (ppm)	NS	NS	0.12	0.12
Lead (Pb)				
Maximum Arithmetic Mean (µg/m^3 averaged over calendar quarter)	1.5	1.5	NS	1.5
Sulfur Dioxide (SO_2)				
Annual Arithmetic Average (ppm)	NS	NS	0.02	0.02
24-hour Average (ppm)	NS	NS	0.10	0.10
3-hour Average (ppm) [d]	NS	0.50	NS	NS
1-hour Average (ppm) [e]	0.075	NS	0.40	0.40
Particulate Matter				

Exhibit 2. National, State, and Local Ambient Air Quality Standards

Pollutant	National Standards		Washington State	Puget Sound Region
	Primary	Secondary		
PM_{10}				
Annual Arithmetic Average (µg/m^3)	**NS**	**NS**	**50**	**50**
24-hour Average (µg/m^3)	**150**	**150**	**150**	**150**
$PM_{2.5}$				
Annual Arithmetic Average (µg/m^3) [f]	**15**	**15**	**NS**	**NS**
24-hour Average (µg/m^3) [g]	**35**	**35**	**NS**	**NS**
Total Suspended Particulates (TSP)				
Annual Arithmetic Average (µg/m^3)	**NS**	**NS**	**60**	**NS**
24-hour Average (µg/m^3)	**NS**	**NS**	**150**	**NS**

ppm = parts per million
µg/m^3 = 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
NS = no standard

Notes:

a To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm (effective January 22, 2010).

b Not to be exceeded more than once per year.

c To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm (effective May 27, 2008).

d Note that the federal 3-hour SO2 standard is a secondary standard set to protect public welfare, rather than a primary standard set to protect public health.

e To attain this standard, the 3-year average of the 99th percentile of the annual distribution of the daily maximum 1—hour average concentration must not exceed 75 ppb.

f To attain this standard, the 3-year average of the weighted annual mean PM2.5 concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m3.

g To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m3.

How is the analysis methodology applied?

As described earlier, the Project would be subject to the General Conformity rules to demonstrate that the proposed action is in conformance with the SIP. This type of conformity determination is required only for those pollutants for which the area is classified as nonattainment or maintenance, or for pollutants which are precursors to the nonattainment or maintenance pollutants.

The study areas for air quality are based on the NAAQS pollutants of concern for transportation-related projects, and vary in their extents based upon the characteristics of specific pollutants of concern and their resulting area of influence.

For on-road vehicle-related CO, the areas of concern are highly localized and typically occur close to congested roadway intersections. Therefore, the study area for the CO hot spot analysis related to congested roadway intersections is a series of intersections which have traffic flows that are affected by the Project and that are within a narrow corridor along either side of the railroad tracks.

For the General Conformity analysis, emissions of nonattainment and maintenance area pollutants (CO, PM_{10} and $PM_{2.5}$ [(including $PM_{2.5}$ precursors SO_2, NO_x, and VOCs]) from construction and locomotive operations on the project rail alignment were considered on a wider geographic scale. Therefore, the study area for these pollutants consists of the entire Seattle/Tacoma metropolitan area.

Estimated construction and operational emissions under the General Conformity analysis would not be subject to the requirements of 40 CFR 93, Subpart B, if the total emissions of each pollutants are below the General Conformity applicability threshold of 100 tons per year.

How were Project operational emissions analyzed?

Operational emissions from Amtrak locomotives were calculated as part of the General Conformity analysis to determine annual emissions of CO, PM_{10}, and $PM_{2.5}$ (including $PM_{2.5}$ precursors).

Emissions were calculated using operational data for Amtrak service under the Build Alternative and USEPA emission factors for locomotives (USEPA, 1997). Annual operational emissions estimates were conservatively derived assuming Tier 0 locomotives (manufacture years 1973 to 2001) emission factors for the Amtrak trains. Remanufactured Tier 0 (Tier 0+) or later locomotives (Tier 1 through Tier 4) would have emissions lower then the estimate made for this discipline report.

What Project intersections were analyzed?

Although many pollutants are present in vehicle exhaust, CO is the major pollutant of concern for transportation projects. Because the study area is in a maintenance area for CO, a project-level analysis is necessary to verify that no localized effects would cause or contribute to a violation of the NAAQS. The analysis of operational effects involves estimating the CO emissions generated by vehicles in the project vicinity and using the WASIST screening tool to estimate the ambient concentration at receptors placed around the intersections analyzed.

Intersection screening begins with a ranking of project-affected, signalized intersections by level of service (LOS), and average delay. LOS is a measure of the weighted average vehicle delay during the peak traffic period at a signalized intersection on a scale of A to F, with A being the least congested with a short delay, and F representing the worst congested with a longer delay.

Because the LOS in the study area during the PM peak hour is generally worse than during the AM peak hour LOS, the PM peak hour traffic data and LOS in the existing year, opening year, and design year were used to rank intersections for the Project. At grade crossing intersections within the study area are listed in Exhibit 2.

Exhibit 3. Level of Service and Delay for the At-Grade Intersections (PM Peak Hour)

	2010 Existing Year LOS/Delay		2030 LOS/Delay			
			No-Build		Build	
Intersection Name	***LOS***	***Average Delay***	***LOS***	***Average Delay***	***LOS***	***Average Delay***
E. "D" Street and E. 26th Street	**B**	**10.7**	**E**	**72.5**	**E**	**72.6**
E. "D" Street and E. 25th Street	**B**	**12.8**	**C**	**21.6**	**C**	**21.9**
E. "C" Street and E. 25th Street	**A**	**10.0**	**B**	**17.3**	**B**	**17.4**
S. Wilkeson Street and S. Tacoma Way	**B**	**13.3**	**B**	**19.3**	**B**	**19.4**
S. Wilkeson Street and S. Center Street	**C**	**24.1**	**D**	**38.1**	**D**	**38.2**
S. Pine Street and S. Tacoma Way	**C**	**26.8**	**D**	**38.0**	**D**	**38.9**
S. Pine Street and S. Center Street	**C**	**32.3**	**D**	**35.3**	**D**	**36.6**
35th Street SW and S. Tacoma Way	**B**	**17.1**	**B**	**18.2**	**B**	**18.2**
S. 56th Street and S. Tacoma Way	**C**	**24.4**	**C**	**27.2**	**C**	**27.9**
S. 74th Street and S. Tacoma Way	**D**	**36.9**	**D**	**36.1**	**D**	**37.2**
Steilacoom Blvd SW and Lakeview Avenue SW	**A**	**9.6**	**A**	**9.9**	**B**	**10.2**
100th Street SW and Lakeview Avenue SW	**B**	**13.1**	**B**	**16.5**	**B**	**16.9**
108th Street SW and Lakeview Avenue SW	**B**	**11.1**	**B**	**12.7**	**B**	**13.0**
Bridgeport Way SW and Pacific Hwy SW	**C**	**21.5**	**C**	**27.2**	**C**	**26.8**
N. Thorne Lane SW and Union Street	**F**	**52.4**	**F**	**202.7**	**F**	**186.2**
Berkeley Street SW and Union Street	**F**	**75.4**	**F**	**108.6**	**D**	**47.7**
41st Division Drive at SB Ramps	**A**	**4.0**	**A**	**9.7**	**B**	**11.3**
41st Division Drive at NB Ramps	**B**	**17.3**	**F**	**105.5**	**F**	**103.8**
Barksdale Ave and NB I-5 Ramps	**D**	**53.1**	**F**	**168.5**	**E**	**69.6**

Source: HDR Traffic Data Submittals

Notes: Delay is shown in seconds

Unsignalized intersections were not selected because they are not assumed to be "critical."

How were signalized intersections analyzed using the WASIST model?

For the Project, WASIST (version 2.0[3]) was used. The results from WASIST are based on USEPA approved MOBILE6 model (USEPA, 2003). The purpose of the model is to allow the user to conservatively estimate the highest CO concentrations that would be found at an intersection without having to perform a more time-consuming detailed analysis.

The WASIST program allows a two-phase approach to evaluating the CO concentrations of an intersection, the Pre-Screening Analysis and WASIST Screening Analysis. The pre-screening feature allows users to determine if a complete WASIST screening analysis is required by entering only a minimal amount of information. Passing results from the pre-screening analysis indicate that project effects do not violate the NAAQS for CO, and no further CO modeling is required. If a “fail” test result is indicated during the pre-screening analysis, a full WASIST screening analysis is required. The pre-screening and full WASIST screening analysis use a combination of worst-case conditions that, when occurring simultaneously, produce the highest levels of CO.

The full WASIST screening analysis requires additional project-specific details in order to calculate project CO levels. The results of the WASIST analysis provide a pass or fail test result for the 1-hour and 8-hour worst-case CO concentrations. To verify compliance with the 8-hour CO NAAQS, the WASIST model adjusts by the USEPA-recommended persistence factor of 0.7 to conservatively estimate model-predicted 8-hour average CO effects (USEPA, 1992). The WASIST model also factors in background concentrations to estimate maximum ambient 1-hour average and 8-hour average CO concentrations, which are then compared against the CO NAAQS of 35 parts per million (ppm: 1-hour average) and 9 ppm (8-hour average). The 3.0 ppm background CO level used in this model is a WASIST model default value.

WASIST modeling file printouts of input and output data and modeling results are presented in Attachment A. Traffic data used in the WASIST model was based on PM peak hour volumes, which was provided by the Project office.

[3] *A computerized screening model, used for estimating worst-case CO concentrations near signalized intersections and metered roadways.*

Chapter 3 – Affected Environment

What are the Puget Sound regional air quality trends?

Regional air pollutant trends have generally followed national patterns over the last 20 years. Although the average weekday VMT in the central Puget Sound region have increased from 30 million miles in 1981 to 65 million in 1999 (PSRC, 2000), the pollutants associated with transportation sources have decreased. This is due to more stringent federal emission standards for new vehicles and the gradual replacement of older, more polluting vehicles.

Prior to 1996, the Puget Sound area was classified as a non-attainment area for CO because monitoring sites showed that CO concentrations had exceeded the NAAQS. The Puget Sound area encompasses a large portion of the Everett-Seattle-Tacoma urban area. In 1996, the area was reclassified as a maintenance area for CO, meaning that the area has met NAAQS, and a maintenance plan would be implemented to prevent the area from being reclassified to non-attainment.

Another pollutant of interest in the Puget Sound region is particulate matter or dust, particularly the portion of dust that is less than 10 microns in size (PM_{10}) or less than 2.5 microns ($PM_{2.5}$). Particles of this size are small enough to enter the lungs when inhaled. The region is in attainment (meets NAAQS) for PM_{10}, but since 2009 has been a designated as a nonattainment area for $PM_{2.5}$.

Over the past 20 years, air quality in the region has improved, even with a growth in both population and vehicle mile traveled (VMT). Much of the improvement in air quality is due to improvements made to emission controls on motor vehicles, the vehicle Inspection and Maintenance (I&M) program administered by Ecology, and the retirement of older, more polluting vehicles. However, over the past several years, levels of emissions of fine particulates have been on the rise, and new concerns such as air toxics and visibility have grown.

Emissions of nitrogen dioxide, sulfur oxides, and lead are below levels of concern in the region. Levels of sulfur dioxide (SO_2) in the region have shown significant decreases in the last 20 years, and monitoring by the PSCAA ceased in 1999 for this pollutant. Lead in the ambient air is no longer considered a public health concern, and has not been monitored in the region since 1999. NO_x are a concern in the region due to their role in the formation of O_3 (along with VOCs in the presence of sunlight);

however, emissions of this pollutant have been dramatically reduced in the region.

The National Air Toxic Assessment is an ongoing comprehensive evaluation of air toxics in the United States conducted by the USEPA. The assessment indicates that air toxics risk in the Puget Sound region is similar to other major urban areas. The diesel exhaust contribution to the area's toxic air pollutant concentrations should be reduced in the future as a result of federal regulations that require cleaner-burning diesel fuel for on-road vehicles and for off-road diesel engines.

Voluntary programs, such as the local Diesel Solutions Program and Ecology's Clean Cities Program, are in place to encourage public and private fleet operators to use ultra-low sulfur diesel and/or to install retrofit devices to filter or oxidize vehicle exhaust (PSCAA, 2005). Ecology and the USEPA support other voluntary programs that encourage diesel emission reductions.

What are the current air quality characteristics in the study area?

The project corridor traverses areas that are designated as maintenance areas for PM_{10} and CO; and as nonattainment for $PM_{2.5}$.

In 1978, the central Puget Sound region was classified as a nonattainment area by the USEPA for CO. In 1987, the industrial areas of the Seattle Duwamish River, Kent Valley and Tacoma Tideflats were classified as nonattainment areas for PM_{10}.

The Seattle and Tacoma industrial areas include the ports of both those cities. Areas designated as nonattainment have exceeded the NAAQS for those pollutants. In 1996, having met the federal standards for several years, the region was redesignated by the USEPA as a maintenance area for CO. The three PM_{10} areas have also met the federal standards for the past several years, and were redesignated as maintenance areas effective May 14, 2001.

A small part of Pierce County, the Tacoma tide flats, previously designated as a nonattainment area for PM_{10} is now a maintenance area for PM_{10}. This PM_{10} maintenance area is within the project corridor.

Most of Pierce County was designated a nonattainment area for fine particle pollution ($PM_{2.5}$) in 2009 because fine particle pollution levels too frequently exceeded the national limit. The study area is in attainment with the other NAAQS criteria pollutants – nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and lead (Pb).

For most pollutants, no air quality monitoring data are available for the immediate area to be affected by construction and operation of the project corridor. Depending on the pollutant, the nearest monitoring site is located anywhere from approximately one mile to 25 miles from the north end of the project corridor. Exhibit 2 below summarizes recent Puget Sound Clean Air Agency (PSCAA) ambient pollutant data from monitors closest to the project study area.

Exhibit 4. Ambient Criteria Pollutant Concentrations near the Study Area

Year	Location	Pollutant	Standard	Pollutant Concentration
2010	7802 South L St, Tacoma WA	$PM_{2.5}$	Annual Arithmetic Average (µg/m^3)	6.9 µg/m^3
			24-hour Average (µg/m^3)	38 µg/m^3
	Beacon Hill, Seattle WA	CO	8-hour Average (ppm)	0.8 ppm
			1-hour Average (ppm)	1.2 ppm
2009	7802 South L St, Tacoma WA	$PM_{2.5}$	Annual Arithmetic Average (µg/m^3)	9.8 µg/m^3
			24-hour Average (µg/m^3)	46 µg/m^3
	Beacon Hill, Seattle WA	CO	8-hour Average (ppm)	1.0 ppm
			1-hour Average (ppm)	1.4 ppm
2008	7802 South L St, Tacoma WA	$PM_{2.5}$	Annual Arithmetic Average (µg/m^3)	9.8 µg/m^3
			24-hour Average (µg/m^3)	44 µg/m^3
	Beacon Hill, Seattle WA	CO	8-hour Average (ppm)	1.0 ppm
			1-hour Average (ppm)	1.6 ppm
2007	Port of Tacoma, 2301 Alexander Ave, Tacoma WA	PM_{10}	Annual Arithmetic Average (µg/m^3)	17.7 µg/m^3
			24-hour Average (µg/m^3)	54 µg/m^3
	7802 South L St, Tacoma WA	$PM_{2.5}$	Annual Arithmetic Average (µg/m^3)	9.7 µg/m^3
			24-hour Average (µg/m^3)	43 µg/m^3
	Beacon Hill, Seattle WA	CO	8-hour Average (ppm)	1.0 ppm
			1-hour Average (ppm)	1.4 ppm
2006	Port of Tacoma, 2301 Alexander Ave, Tacoma WA	PM_{10}	Annual Arithmetic Average (µg/m^3)	21 µg/m^3
			24-hour Average (µg/m^3)	59 µg/m^3
	7802 South L St, Tacoma WA	$PM_{2.5}$	Annual Arithmetic Average (µg/m^3)	9.5 µg/m^3
			24-hour Average (µg/m^3)	37 µg/m^3
	Beacon Hill, Seattle WA	CO	8-hour Average (ppm)	1.5 ppm
			1-hour Average (ppm)	2.3 ppm
2005	Port of Tacoma, 2301 Alexander Ave, Tacoma WA	PM_{10}	Annual Arithmetic Average (µg/m^3)	23 µg/m^3
			24-hour Average (µg/m^3)	64 µg/m^3
	7802 South L St, Tacoma WA	$PM_{2.5}$	Annual Arithmetic Average (µg/m^3)	11.5 µg/m^3
			24-hour Average (µg/m^3)	35 µg/m^3
	Beacon Hill, Seattle WA	CO	8-hour Average (ppm)	1.9 ppm
			1-hour Average (ppm)	2.7 ppm

Source: Puget Sound Clean Air Agency, Annual Air Quality Data Summary Reports, 2005 through 2010.

What pollutants of concern exist in the study area?

Pollutants of concern in the study area are CO, PM_{10}, and $PM_{2.5}$ due to the historical and current exceedances of these criteria pollutants in the vicinity of the project. The sources of these pollutants, their effects on human health and the nation's welfare, and their final deposition in the atmosphere vary considerably. A brief description of each pollutant is provided below. In addition to criteria pollutants, greenhouse gases and MSATs are also a concern and are described below.

Carbon Monoxide

CO is a colorless gas that interferes with the transfer of oxygen to the brain. CO is emitted almost exclusively from the incomplete combustion of fossil fuels. Prolonged exposure to high levels of CO can cause headaches, drowsiness, loss of equilibrium, or heart disease. CO concentrations can vary greatly over relatively short distances. Relatively high concentrations of CO are typically found near congested intersections, along heavily used roadways carrying slow-moving traffic, and in areas where atmospheric dispersion is inhibited by urban "street canyon" conditions. Consequently, CO concentrations are predicted on a localized, or microscale basis.

Because the Project is in a CO maintenance area, conformity rules require analysis of potential CO concentrations with applicable air quality plans.

Hot-spot modeling for CO emissions conducted showed that the Project is not predicted to cause or exacerbate a violation of the applicable NAAQS. No intersections would exceed the CO levels established in the NAAQS.

Particulate Matter

PM pollution is composed of solid particles or liquid droplets that are small enough to remain suspended in the air. Of particular concern are those particles that are smaller than, or equal to, 10 microns (PM_{10}) or 2.5 microns ($PM_{2.5}$).

PM_{10} consists of very small liquid and solid particles floating in the air, which can include smoke, soot, dust, salts, acids, and metals. It also forms when gases emitted from motor vehicles or industrial sources undergo chemical reactions in the atmosphere. Major sources of PM_{10} include motor vehicles; wood-burning stoves and fireplaces; dust from construction, landfills, and agriculture; wildfires and brush/waste burning; industrial sources; windblown dust from open lands; and atmospheric chemical and photochemical reactions. Suspended particulates produce haze and reduce visibility.

PM_{10} poses a greater health risk than larger-sized particles. When inhaled, these tiny particles can penetrate the human respiratory system's natural defenses and damage the respiratory tract. PM_{10} can increase the number and severity of asthma attacks, cause or aggravate bronchitis and other lung diseases, and reduce the body's ability to fight infections. 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. (USEPA 2001)

Because the Project is in a PM_{10} maintenance area, conformity rules require analysis of potential project-related PM_{10} emissions.

$PM_{2.5}$ results from fuel combustion (from motor vehicles, power generation, and industrial facilities), residential fireplaces, and wood stoves. In addition, $PM_{2.5}$ can be formed in the atmosphere from gases such as sulfur dioxide, NO_x, and VOCs. The main health effects of airborne $PM_{2.5}$ are on the respiratory system. Like PM_{10}, $PM_{2.5}$ can penetrate the human respiratory system's natural defenses and damage the respiratory tract when inhaled. Whereas particles 2.5 - 10 microns in diameter tend to collect in the upper portion of the respiratory system, particles 2.5 microns or less in diameter are so tiny that they can penetrate deeper into the lungs and damage lung tissues.

Because the Project is in a PM2.5 nonattainment area, conformity rules require analysis of potential project-related PM2.5 emissions.

Ozone

O_3 is a colorless toxic gas that enters the blood stream and interferes with the transfer of oxygen, depriving sensitive tissues in the heart and brain of oxygen. O3 also damages plants by inhibiting their growth. Although O_3 is not directly emitted, it forms in the atmosphere through a chemical reaction between reactive organic gases and nitrogen oxides, which are emitted from industrial sources and automobiles. Substantial O_3 formations generally require a stable atmosphere with strong sunlight.

In the proposed Project study area, the highest O_3 concentrations occur from mid-May until mid-September, when urban emissions are trapped by temperature inversions followed by intense sunlight and high temperatures. Maximum O_3 levels generally occur between noon and early evening at locations several miles downwind from the sources, after nitrogen oxides and hydrocarbons have time to mix and react under sunlight. For these reasons, the effects of the proposed Project on O_3 levels are considered only on a regional basis.

Nitrogen Dioxide

NO_2 is a brownish gas that irritates the lungs. It can cause breathing difficulties at high concentrations. Like O_3, NO_2 is not directly emitted but is formed through a reaction between nitric oxide (NO) and atmospheric oxygen. NO and NO_2 are collectively referred to as nitrogen oxides (NO_x) and are precursors to O_3 and $PM_{2.5}$ formation. NO_2 also contributes to the formation of PM_{10}. At atmospheric concentrations, NO_2 is only potentially irritating. In high concentrations, the result is a brownish-red cast to the atmosphere and reduced visibility. There is some indication of a relationship between NO_2 and chronic pulmonary fibrosis. Some increase in bronchitis in children (2-3 years old) has also been observed at concentrations below 0.3 parts per million (ppm).

Because the Project is not anticipated to substantially affect regional emissions of NO_2, a regional NO_2 analysis is not warranted; however, annual operational NOx emissions were calculated because NOx is a $PM_{2.5}$ precursor.

Lead

Pb is a stable element that persists and accumulates in the environment and in animals. Its principal effects in humans are on the blood-forming, nervous, and renal systems. Pb levels in the urban environment from mobile sources, such as automobiles, have significantly decreased since the federally mandated switch to unleaded gasoline in 1995.

Because the proposed Project is not anticipated to substantially affect regional emissions of Pb, a regional Pb analysis is not warranted.

Sulfur Dioxide

SO_2 is a product of high-sulfur fuel combustion, and can be a precursor to $PM_{2.5}$ formation. The main sources of SO_2 are coal and oil used in power stations, industry, and domestic heating. Industrial chemical manufacturing is another source of SO_2. SO_2 is an irritant gas that attacks the throat and lungs. It can cause acute respiratory symptoms and diminished ventilator function in children. SO_2 can also yellow plant leaves and corrode iron and steel.

Because the Project is not anticipated to substantially affect regional emissions of SO_2, a regional SO_2 analysis is not warranted; however, annual operational SO_2 emissions were calculated because SO_2 is a $PM_{2.5}$ precursor.

Mobile Source Air Toxic (MSAT) Emissions

In addition to the criteria pollutants for which there are NAAQS, the USEPA also regulates air toxics. Toxic air pollutants are those pollutants known or suspected to cause cancer or other serious health effects. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories or refineries).

The CAA identified 188 air toxics, and 21 have been identified with mobile sources. In 2001, the USEPA identified six of the 21 mobile sources as priority MSATs. The six priority MSATs include:

- Benzene
- Formaldehyde
- Diesel particulate matter/diesel exhaust organic gases
- Naphthalene
- Acrolein
- 1,3-Butadiene

Benzene

Benzene (C_6H_6) is a volatile, colorless, highly flammable liquid that dissolves easily in water. It is found in emissions from burning coal and oil, motor vehicle exhaust, evaporation from gasoline service stations, and in industrial solvents. These sources contribute to elevated levels of C_6H_6 in the ambient air, which the public may subsequently breathe in. If humans are subjected to acute (short-term) inhalation exposure to C_6H_6, the following may occur: drowsiness, dizziness, and headaches; eye, skin, and respiratory tract irritation; and unconsciousness at high levels of exposure. Chronic (long-term) inhalation exposure has caused various disorders in the blood. Reproductive effects have also been reported for women exposed by inhalation to high levels of C_6H_6.

Formaldehyde

Formaldehyde (CH_2O) is a colorless gas with a pungent, suffocating odor at room temperature. It has been detected in ambient air, and the average concentrations reported in US urban areas range from 11 - 20 parts per billion (ppb). The major sources appear to be power plants, manufacturing facilities, incinerators, and automobile exhaust emissions. If humans are subjected to acute (short-term) and chronic (long-term) inhalation exposure, the following can result: respiratory symptoms; and eye, nose, and throat irritation. Limited studies involving human subjects have associated CH_2O exposure with lung and nasopharyngeal cancer.

Diesel Particular Matter/Diesel Exhaust Organic Gases

Diesel Particular Matter/Diesel Exhaust Organic Gases (DPM/DEOG) are a complex mixture of thousands of gases and fine particles emitted by a diesel-fueled internal combustion engine. One of the main characteristics of diesel exhaust is the release of particles at a relatively rate that is about 20 times greater than from gasoline-fueled vehicles (on an equivalent fuel energy basis). Almost 94% of these particles have a mass that is less than 2.5 microns in diameter. These particles are primarily composed of aggregates of spherical carbon particles coated with organic and inorganic substances that are mutagenic, cytotoxic, or carcinogenic.

Naphthalene

Naphthalene ($C_{10}H_8$) is a slightly water-soluble, two-ring aromatic hydrocarbon and is the most volatile member of the polycyclic aromatic hydrocarbons (PAHs). $C_{10}H_8$ is used in moth repellents, lavatory scent discs, and soil fumigants. It is also found in light petroleum fractions and in residues from refineries. Acute (short-term) exposure to $C_{10}H_8$ can induce the production of meth hemoglobin in the blood which does not bind oxygen and destruction of red blood cells in humans. Symptoms of chronic (long-term) exposure by $C_{10}H_8$ are less known possibly because humans are less efficient at $C_{10}H_8$ oxidation.

Acrolein

Acrolein (C_3H_4O) is a water-white or yellow liquid that burns easily and is easily volatilized. C_3H_4O can be formed from the breakdown of certain pollutants found in outdoor air, from burning tobacco, or from burning gasoline. It is extremely toxic to humans from inhalation and dermal exposure. Acute (short-term) inhalation exposure may result in upper respiratory tract irritation and congestion.

1,3-Butadiene

1,3-butadiene (C_4H_6) is a colorless gas with a mild gasoline-like odor. Motor vehicle exhaust is the most common source of C_4H_6. In humans, acute (short-term) exposure to C_4H_6 by inhalation results in irritation of the eyes, nasal passages, throat, and lungs. Epidemiological studies have reported a possible association between C_4H_6 exposure and cardiovascular diseases.

What are the health effects from MSATs?

Only limited tools and techniques are available for assessing project-specific health effects from MSATs. These limitations relate to emissions, dispersion, exposure levels, and health effects.

Emissions

USEPA tools available for estimating motor vehicle MSAT emissions are not sensitive to key variables that determine MSAT emissions for highway projects.

Dispersion

The tools available for predicting MSATs dispersion into the environment are limited. The current dispersion models were developed for the purpose of predicting episodic concentrations of CO, to determine compliance with the NAAQS. Dispersion models more accurately predict maximum concentrations, rather than exposure patterns.

Exposure Levels and Health Effects

Even if emissions levels and MSAT episodic concentrations could be accurately predicted, shortcomings in current techniques for exposure assessment and risk analysis prevent reaching meaningful conclusions on project-specific health effects. Exposure assessments are difficult to make, because it is difficult to accurately calculate annual MSAT concentrations and to determine durations that people are exposed to those concentrations at a specific location.

In addition, the USEPA has not established regulatory concentration targets for the six priority MSATs that are appropriate for use in the project development process.

How do climate and weather affect air quality?

Weather directly influences air quality. Important meteorological factors include wind, 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.

What are the existing meteorology conditions?

Ambient air quality is a function of many factors, including climate, topography, meteorological conditions, and the production of airborne pollutants by natural or artificial sources.

The study area is subject to the same meteorological conditions that affect the Puget Sound. This region has a marine climate, dominated by cool, moist winds coming off the ocean. Temperature inversions are common throughout the Puget Sound area in the fall and winter. They are characterized by stagnant atmospheric conditions that tend to trap and concentrate pollutants. In most cases, pollutant-trapping inversions have an upper "lid" at an altitude between 1,000 and 3,000 feet and occur during the night and break up by early afternoon. The Project lies at less than 1,000 feet elevation and thus lies within the areas subject to inversions.

During the summer, winds typically tend to be light and variable. The average wind velocity is less than 10 miles per hour (mph). Persistent high-pressure cells often dominate summer weather, creating stagnant air conditions. This weather pattern sometimes contributes to the formation of photochemical smog. Due to its location north of the major urban centers of Seattle/Tacoma and the northerly winds during the summer months, the study area generally experiences fewer instances of stagnant air conditions.

Although the Puget Sound lowland is the most densely populated and industrialized area in Washington, there is sufficient wind most of the year to disperse air pollutants released into the atmosphere. Air pollution is usually most noticeable in the late fall and winter, under conditions of clear skies, light wind, and a sharp temperature inversion, when particulates and CO from wood stoves and vehicle sources can be trapped close to the ground. If poor dispersion persists for more than 24 hours, the PSCAA can declare an "air pollution episode" or local "impaired air quality."

Ecology issues a daily Air Quality Index (AQI) using forecast meteorology and real-time pollutant monitoring. Since adoption of the AQI in the Puget Sound region, there have been several instances of air quality advisories in the "moderate" and "unhealthy to sensitive populations" categories.

Chapter 4 – Potential Project Effects

What air pollutants would the Project generate?

The major airborne pollutants of interest for transportation-related projects are CO, particulate matter (PM), O_3, and NO_x; these are commonly referred to as criteria pollutants. Federal and state standards regulate these pollutants, along with two other criteria pollutants: SO_2, and lead. Lead and SO_2 are not pollutants of air quality concern for transportation-related projects and therefore are not addressed in this analysis.

Mobile sources emit six pollutants that the USEPA classifies as MSATs: benzene, formaldehyde, diesel particulate matter/diesel exhaust organic gases, naphthalene, acrolein, and 1,3-butadiene.

These six priority 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 are the construction effects caused by the Project?

Construction activities typically associated with roadway projects can temporarily generate PM (mostly dust) and small amounts of other pollutants. These emissions are often associated with earthwork and demolition activities. If uncontrolled, PM would also be generated by construction trucks entering roadways, depositing dust and mud on paved streets.

Heavy trucks and construction equipment powered by gasoline and diesel engines would generate CO and NO_x in exhaust emissions. The use of diesel construction equipment will result in a temporary increase in MSAT emissions in the project area. If construction traffic were to reduce the speed of other vehicles in the area, emissions from traffic would increase slightly while those vehicles are delayed. These emissions would be temporary and limited to the immediate area surrounding the construction site. In addition, temporary odors may be detected by people near asphalt paving operations. These odors would decrease with increased distance from the source.

Construction activities would include demolition of pavement and other structures, earthwork, new rail construction, and new paving. Equipment to be used for construction would include truck cranes, vibratory oscillator, dump trucks, loaders, excavators, and typical paving equipment such as graders, asphalt pavers, and rollers. The air emissions from these types of construction projects would slightly be greater for the Build Alternative than the No Build Alternative.

PM_{10} emissions may be associated with project construction, particularly for earthwork or demolition activities. PM_{10} emissions can vary from day to day, depending on the level of activity, specific operations, and weather conditions. PM_{10} emissions depend on soil moisture, silt content of soil, wind speed, and amount and type of equipment operating. Larger dust particles settle near the source, while fine particles are dispersed over greater distances from the construction site.

PM_{10} from construction activities is noticeable if uncontrolled. Mud and particulates from trucks are also noticeable if construction trucks are routed through residential neighborhoods. Minimization measures would be in place during construction to ensure compliance with PSCAA's regulations, which require the control of dust during construction and prevention of deposition of mud on paved streets. Burning would not be allowed in the study area, so there would be no contribution of PM from burning.

What are the operational effects caused by the Project?

As discussed earlier, the Project must be reviewed under General Conformity rules (40 CFR 93, Subpart B) to ensure that the proposed federal actions to fund and approve the Project are in conformance with SIPs. This type of conformity determination is required only for those pollutants for which the area is classified as nonattainment or maintenance, or for pollutants which are precursors to the nonattainment or maintenance pollutants.

General Conformity

Air quality was evaluated for rail operations as well as project construction. The focus of the General Conformity analysis was on short-term construction effects as well as rail operational effects.

Project Construction Emissions

The Project would involve construction of approximately 3.5 miles of new track and upgrading of approximately 14.5 miles of track within the existing rail corridor. This construction is of similar size to a project analyzed in 2001 by the Surface Transportation Board (STB), for construction of 3.2 miles of new rail line in Louisiana (STB 2001). The pollutant of greatest concern for that project was nitrogen oxides (NO_x) due to construction equipment exhaust emissions. Total NO_x emissions from that construction project were estimated by STB at 7.81 tons/year, using 1985 emission factors. Total annual emissions of other criteria pollutants were estimated at levels that were less than the estimated NO_x emissions for that project.

In comparison, the Project construction would have only slightly more new line construction, and upgrading of some existing rail line as described above. Even if the construction equipment activity were double that of the Louisiana project, and if old (pre-1985) construction equipment was used for the Project, total construction emissions for each individual criteria pollutant would be less than 16 tons/year. Also, because construction equipment engines have become cleaner in recent years with the advent and inclusion of better emission reduction technology, pollutant emissions from the existing construction equipment fleet are likely to be lower than assumed in the Louisiana study.

Therefore, based on experience with other similar projects, the conclusion of this qualitative analysis is that the construction-related emissions from the Project would be far below the 100 tons/year General Conformity thresholds for NO_x, VOCs, PM_{10}, SO_2, and CO (40 CFR 93, Subpart B).

Project Operational Emissions

During operation of the Project, increased Amtrak service would result in a small decrease in the emissions of pollutants in the study area, and would change the location of operational emissions from the current coastal track alignment to the proposed in-land Point Defiance Bypass track alignment. The decrease in overall operational emissions comes despite the addition of daily Amtrak Cascade and Starlight trips due to the more direct route within the study area (and therefore fewer train miles traveled and fuel used overall on this section of track). Exhibit 4 presents estimated annual operational emissions for the Build and No Build Alternative.

Exhibit 5. Estimated Operational Emissions

Pollutant	Annual No Build Alternative Emissions (Tons)	Annual Build Alternative Emissions (Tons)	Annual Emissions Reduction under Build Alt (Tons)
CO	7.58	7.46	0.12
PM_{10}	1.90	1.86	0.04
$PM_{2.5}$	1.84	1.81	0.03
NOx	50.94	50.12	0.82
SO_2	4.81	4.73	0.08
VOC	2.99	2.95	0.04

The estimated operational emissions would be unlikely to affect overall ambient air quality in the study area. Diesel particulate matter would be small in relation to other nearby diesel sources, particularly the diesel truck traffic on local roads and highways. Also, Amtrak would use trains that have substantially lower emissions than USEPA standards for all pollutants in order to minimize health effects from diesel emissions such as CO, NO_x, hydrocarbons, and PM.

Conformity Statement

This discipline report provides an evaluation of potential air quality emissions from construction and operation of the project. The project corridor crosses areas that are designated as maintenance areas with respect to the NAAQS for CO and PM_{10}; and as a nonattainment area for $PM_{2.5}$. As a federally-funded or federally-approved action, the Project must be determined to conform to CAA requirements, in that the Project must not interfere with approved state implementation plans to attain or maintain compliance with NAAQS in the area.

Conservatively assuming that construction-related emissions of any criteria pollutant would be below 16 tons per year based on experience with similar projects, combined with the operational emissions annual estimates presented in Exhibit 4, the analysis shows that project-related emissions of pollutants of concern to the maintenance and nonattainment areas crossed by the project would be below the *de minimis* levels listed in General Conformity rules. Therefore, a General Conformity determination is not required for the Project, and implementation of the Project would be in conformance with CAA requirements. In other words, the Project is not expected to:

- Cause or contribute to any new violations of the NAAQS;
- Increase the frequency or severity of any existing violation of the NAAQS; or
- Delay the timely attainment of the NAAQS.

Local Carbon Monoxide Concentrations in the Study Area

The Project is not anticipated to create any new violations, nor increase the frequency of an existing violation of the CO standard at project-affected, signalized roadway intersections; it would conform with the purpose of the current SIP and the requirements of the federal CAA and the Washington CAA.

Air quality hot-spot modeling for all selected intersections was performed for the existing year (2010) and for all the alternatives of the year of opening (2017) and the horizon year (2030), including the No Build

Alternative, and were modeled using the WASIST model. A full hot spot analysis was completed for all selected intersections.

The following intersections were analyzed for CO effects:

- East “D” Street and East 26th Street
- Barksdale Avenue and NB I-5 Ramps
- Berkeley Street and Union Avenue

The results for the worst-case receptor are below the 1-hour average NAAQS for CO of 35 ppm and below the 8-hour average standard of 9 ppm. Te results show that the project would not be expected to cause exceedances of CO NAAQS at project-affected, signalized intersections under either the Build or No Build condition in any of the analysis years. Exhibit 6 provides the maximum CO concentrations of WASIST Model Outputs.

Exhibit 6. Maximum Predicted CO Concentrations

Alternatives	Intersections					
	East “D” Street and East 26th Street		*Barksdale Avenue and NB I-5 Ramp*		*Berkeley Street and Union Avenue*	
Averaging Time	*1 hr*	*8 hr*	*1 hr*	*8 hr*	*1 hr*	*8 hr*
2010 (Existing)	**4.5**	**4.0**	**4.8**	**4.3**	**4.4**	**4.0**
2017 No Build	**4.1**	**3.8**	**4.3**	**3.9**	**4.0**	**3.7**
2017 Build	**4.1**	**3.8**	**4.3**	**3.9**	**4.0**	**3.7**
2030 No Build	**5.1**	**4.5**	**4.6**	**4.1**	**4.3**	**3.9**
2030 Build	**5.1**	**4.5**	**4.6**	**4.1**	**4.3**	**3.9**

Notes: Concentration values are in parts per million. The one-hour NAAQS for CO is 35 ppm and for the eight-hour CO is 9 ppm. A background ambient CO concentration of 3 ppm was used in the WASIST modeling.

Mobile Source Air Toxic Emissions Level in the Study Area

The MSAT evaluation for the Project was prepared according to the *FHWA 2009 Interim Guidance on Air Toxic Analysis in NEPA Documents* as a project with low potential MSAT effects. Based on the FHWA’s recommended approach for determining MSAT effects, the Project falls within this Tier 2-approach.

MSAT emissions are discussed qualitatively for the Project because operations are not expected to change among alternatives. The types of projects included in this category improve operations of highway, transit, or freight without adding substantial new capacity or creating a facility that is likely to meaningfully increase MSAT emissions.

For each alternative in the Project, the amount of MSATs emitted would be proportional to the vehicle miles traveled (VMT), assuming that other variables such as fleet mix are the same for each alternative. Also, regardless of the alternative chosen, MSAT emissions would be lower than present levels in the design year as a result of the USEPA's national control programs that are projected to reduce annual MSAT emissions by 72 percent between 1999 and 2050.

Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures; however, the magnitude of the USEPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

What are the indirect and cumulative effects of the Project?

Indirect

The Project is located within an existing rail corridor and urbanized area. The only potential indirect effect tied to the Project is that it may indirectly influence limited redevelopment near the relocated Amtrak Station at Freighthouse Square (see Land Use Discipline Report[4]). The PSCAA's 2007 Growth Management Policies provide guidance for "air and climate friendly development" and redevelopment in the Freighthouse Square would be consistent with those policies (PSCAA 2007). Minimization measures would be in place during construction to ensure compliance with PSCAA's regulations, which require the control of dust during construction and prevention of deposition of mud on paved streets. Thus, no indirect effect to air quality is expected.

Cumulative

In considering the cumulative effects of the Project on air quality, the Project's direct and indirect air quality effects are evaluated in the context of the existing air quality conditions in the project area (which represent the past and ongoing activities that affect air quality) and the reasonably foreseeable future actions that would also affect air quality. As noted in Chapter 4, the study area is in a region that has experienced improved air quality over the past 20 years as a result of improvements made to emission controls on motor vehicles, the vehicle Inspection and Maintenance (I&M) program administered by Ecology, and the retirement of older, more polluting vehicles. Part of the PSCAA's mission is "to improve neighborhood air quality and reduce greenhouse gases" through enforcing air quality regulations, conducting educational activities, and providing incentive programs to businesses and individuals to reduce emissions. While the region continues to grow and bring more traffic and other sources of emissions, improved access to transit, continued

[4] *WSDOT 2012*

retirement of older vehicles, and technological advances to reduce industrial and household emissions will help to further improve regional air quality. The Project would not contribute to an adverse cumulative impact on air quality because it results in fewer emissions than current operations and is consistent with PSCAA's policies for improving air quality in the region.

Chapter 5 – Recommended Minimization Measures

The Build Alternative would reduce operational rail emissions in the study area as a result of fewer overall train miles traveled. The Project would have short-term increases in construction-related emissions, but is not anticipated to have a significant effect of regional air quality. The estimated annual combined construction and operational air pollutant emissions are calculated to be below the *de minimis* levels under the General Conformity rules.

The Project will include some changes and upgrades to highway crossing intersections in the vicinity of the rail corridor, but would not result in CO NAAQS exceedances at bust intersections in the study area.

The results of this air quality study indicate that no exceedance of the NAAQS will occur as a result of Project implementation.

What minimization measure will be taken during Project construction?

Construction effects will be reduced by incorporating minimization measures into the construction specifications for the Project. Possible minimization measures that may be implemented during construction to ensure compliance with NAAQS standards and PSCAA's regulations to control PM_{10}, deposition of PM, and emissions of CO and NO_x during construction are listed below.

If uncontrolled, fugitive dust from construction activities would be noticeable near construction sites. During construction, minimization measures that comply with PSCAA regulations will be implemented. These regulations require the control of dust and mud deposits on paved streets during construction.

In addition to particulate emissions, heavy trucks and construction equipment powered by gasoline and diesel engines generate CO and NO_x in exhaust emissions. If construction traffic reduces the speed of other vehicles in the area, emissions from traffic would increase slightly while those vehicles are delayed. These emissions would be temporary and limited to the immediate area surrounding the construction site.

Construction emissions would contribute a small amount to total emissions in the study area, because construction traffic would be a very small fraction of the area's total traffic.

Some construction phases would result in short-term odors, particularly if asphalt is used for paving operations. Odors might be detectable to some people near the construction site. These odors would decrease as distance from the site increases.

Construction effects will be reduced by incorporating the minimization measures outlined in the Associated General Contractor of Washington (AGCW) Guidelines into the Project's construction specifications (AGCW, 1997). Possible minimization measures to control emissions of PM, CO, and NO_x during construction include the following:

- Include specifications to comply with federal and state air quality regulations to cover temporary construction conditions such as dust and smoke emissions in the construction contract.
- To minimize fugitive dust emissions created during Project-related construction activities, the contractor will implement appropriate fugitive dust suppression controls, such as spraying water or other established measures, and operating water trucks on haul roads where possible to reduce dust.
- Spraying exposed soil with water to reduce PM_{10} emissions from soil disturbance and wind erosion.
- Covering and/or wetting materials transported by trucks, or providing adequate freeboard (space from the top of the material to the top of the truck) to reduce PM_{10} emissions during transportation.
- Providing wheel washers to remove PM that vehicles would otherwise carry offsite to decrease PM on area roadways.
- Removing PM deposited on paved roadways to reduce mud and windblown dust on area roadways.
- To limit Project-related construction emissions, FRA and WSDOT will work with the contractor(s) to ensure that construction equipment is properly maintained and that required pollution-control devices are in working condition.
- Using appropriate emission-control devices on all construction equipment powered by gasoline or diesel fuel, to PM_{10}, CO, and NO_x emissions in vehicular exhaust.
- Using well-maintained equipment to reduce CO and NO_x emissions as it normally would if the equipment were operating within its first five years of operation.
- Covering dirt, gravel, and debris piles as needed with appropriate BMPs within the timeframes specified in the WSDOT *Standard Specifications Manual* to protect soil from wind erosion.

- Routing and scheduling construction trucks in a manner that will reduce delays and the indirect air quality effects associated with traffic slowing to accommodate construction vehicles.

Based on these findings, no significant air quality effects would be expected with or without the Project, and no operational air quality minimization measures are necessary or proposed. However, BMPs for construction-related emissions could be implemented to reduce potential temporary air quality effects during construction of the Project.

What minimization measures will be taken during Project operation?

Minimization measures would not be required for the Project since air quality impacts are not predicted to occur as a result of the implementation of the Build Alternative.

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Attachment A

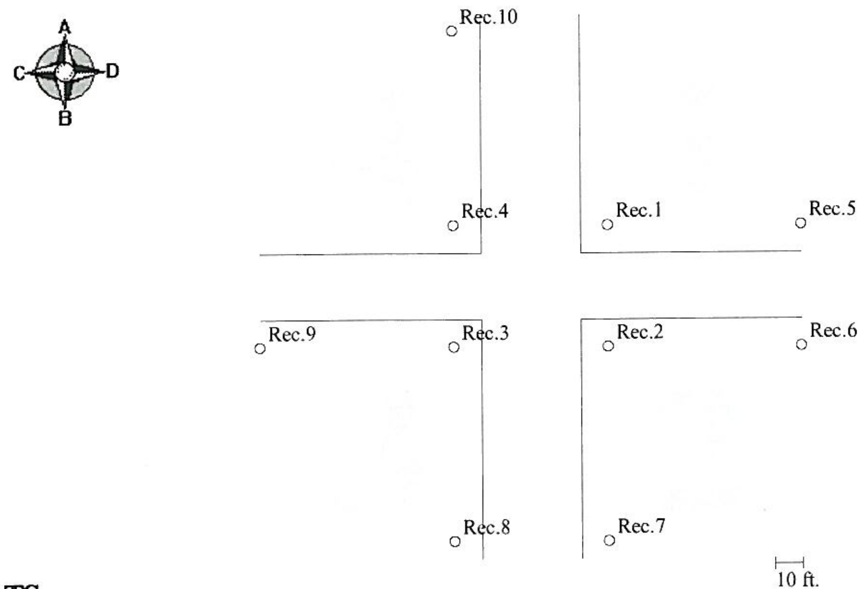
Washington State Intersection Screening Tool 1.0

09-22-11

09:45 AM

Point Defiance Bypass Project

Description:	**E "D" St. & 26th Street existing**
Performed by:	**Akberet Ghebre - WSDOT**
	206-440-4547 - Ghebrea@wsdot.wa.gov
Intersection Type:	**Four-Way Intersection, 2 x 2 w/2 Lt Turns**
Street Names:	**A-B: Barksdale Ave C-D: NB I-5 Ramp**



RESULTS:

Receptor#	Quadrant	Distance from A-B roadway (feet)	Distance from C-D roadway (feet)	CO 1-hour avg. Conc. (ppm)	CO 8-hour avg. Conc. (ppm)	Pass/Fail*
1	**1**	**10**	**10**	**4.7**	**4.2**	**Pass**
2	**2**	**10**	**10**	**5.3**	**4.6**	**Pass**
3	**3**	**10**	**10**	**4.9**	**4.3**	**Pass**
4	**4**	**10**	**10**	**4.8**	**4.3**	**Pass**
5	**1**	**80**	**10**	**4.7**	**4.2**	**Pass**
6	**2**	**80**	**10**	**4.5**	**4.0**	**Pass**
7	**2**	**10**	**80**	**4.2**	**3.8**	**Pass**
8	**3**	**10**	**80**	**4.2**	**3.8**	**Pass**
9	**3**	**80**	**10**	**4.8**	**4.3**	**Pass**
10	**4**	**10**	**80**	**4.6**	**4.1**	**Pass**

*Project **PASSES** 1-hr and 8-hr NAAQS of 35 ppm and 9 ppm, respectively.
Largest modeled CO concentrations are at **receptor 2**.

- All CO concentrations include a background concentration of **3.0** ppm.
- 8-hr average CO concentrations are calculated by multiplying the 1-hr average concentrations (without background) by a persistence factor of 0.7 and then adding the background concentration.

Washington State Intersection Screening Tool 1.0

USER INPUTS

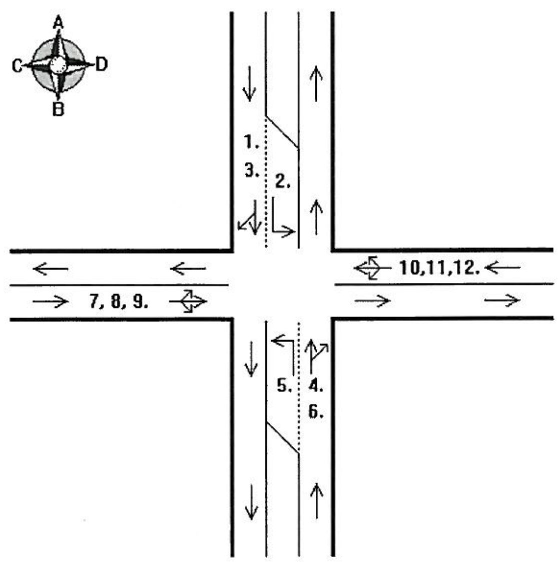
Point Defiance Bypass Project

Intersection Data:

Predominant Surroundings: **Central Business District**

Traffic Volumes:

Vol. Index	Movement	Volume (vph)
1	**A-B Thru**	**189**
2	**A-D Left Turn**	**6**
3	**A-C Right Turn**	**126**
4	**B-A Thru**	**64**
5	**B-C Left Turn**	**36**
6	**B-D Right Turn**	**7**
7	**C-D Thru**	**232**
8	**C-A Left Turn**	**114**
9	**C-B Right Turn**	**153**
10	**D-C Thru**	**280**
11	**D-B Left Turn**	**54**
12	**D-A Right Turn**	**24**



CO Emission Factors Based On:

Location: **Western Washington - PIERCE County**
CO Maint. Area: **Puget Sound**
I/M Program: **Yes**
Model Year: **2010**
Gasoline sulfur content of 160 ppm for 2005-2006, 60 ppm for 2007, & 30 ppm for 2008-2050.

MOBILE6.2 CO Emission Factors:

Idle Emission Factor (g/hr): **103.49**

Approach	Speed (mph)	EF (g/mile)
Leg A	**10**	**20.72**
Leg B	**10**	**20.72**
Leg C	**10**	**20.72**
Leg D	**10**	**20.72**

***Note: Local roadways should be modeled using an approach speed of 15 mph or less. Highway ramps should be modeled using an approach speed of 5 mph.**

Traffic Signal Timing:

Total Cycle Length (sec): **165**

Red Times:

Type of Movement	Red Times (sec)
Leg A Thru & Rt	**115**
Leg A Left Turn	**140**
Leg B Thru & Rt	**115**
Leg B Left Turn	**140**
Leg C Thru & Rt	**115**
Leg C Left Turn	**---**
Leg D Thru & Rt	**115**
Leg D Left Turn	**---**

***Red times are equal to the "Quick and Easy" values.**

User Comments:

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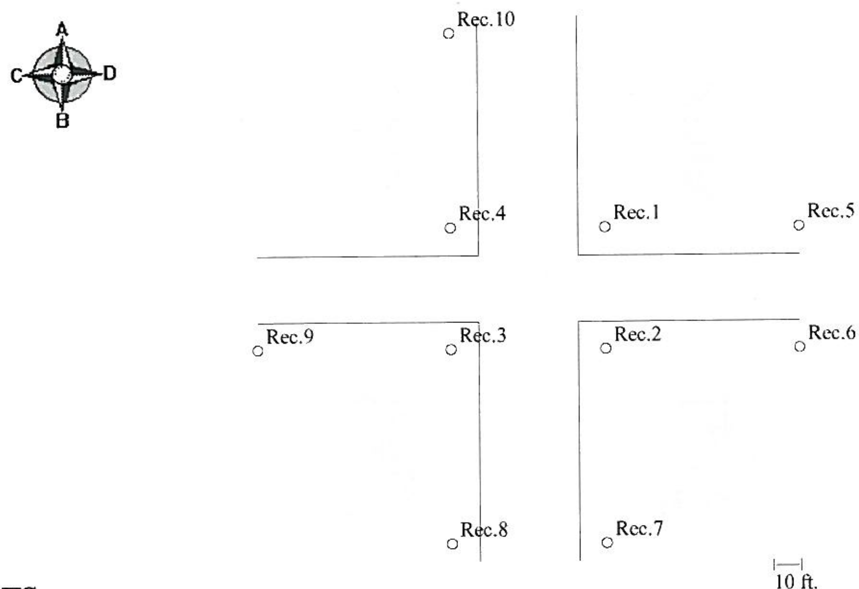
Washington State Intersection Screening Tool 1.0

09-22-11
09:46 AM

Point Defiance Bypass Project

Description:	**E "D" St. & 26th Street 2017 NB**
Performed by:	**Akberet Ghebre - WSDOT**
	206-440-4547 - Ghebrea@wsdot.wa.gov
Intersection Type:	**Four-Way Intersection, 2 x 2 w/2 Lt Turns**
Street Names:	**A-B: E D street C-D: East 26th Street**



RESULTS:

Receptor#	Quadrant	Distance from A-B roadway (feet)	Distance from C-D roadway (feet)	CO 1-hour avg. Conc. (ppm)	CO 8-hour avg. Conc. (ppm)	Pass/Fail*
1	**1**	**10**	**10**	**4.4**	**4.0**	**Pass**
2	**2**	**10**	**10**	**4.9**	**4.3**	**Pass**
3	**3**	**10**	**10**	**4.5**	**4.0**	**Pass**
4	**4**	**10**	**10**	**4.7**	**4.2**	**Pass**
5	**1**	**80**	**10**	**4.3**	**3.9**	**Pass**
6	**2**	**80**	**10**	**4.2**	**3.8**	**Pass**
7	**2**	**10**	**80**	**4.6**	**4.1**	**Pass**
8	**3**	**10**	**80**	**4.2**	**3.8**	**Pass**
9	**3**	**80**	**10**	**4.4**	**4.0**	**Pass**
10	**4**	**10**	**80**	**4.1**	**3.8**	**Pass**

*Project **PASSES** 1-hr and 8-hr NAAQS of 35 ppm and 9 ppm, respectively.
Largest modeled CO concentrations are at **receptor 2**.

- All CO concentrations include a background concentration of **3.0** ppm.
- 8-hr average CO concentrations are calculated by multiplying the 1-hr average concentrations (without background) by a persistence factor of 0.7 and then adding the background concentration.

Washington State Intersection Screening Tool 1.0

USER INPUTS

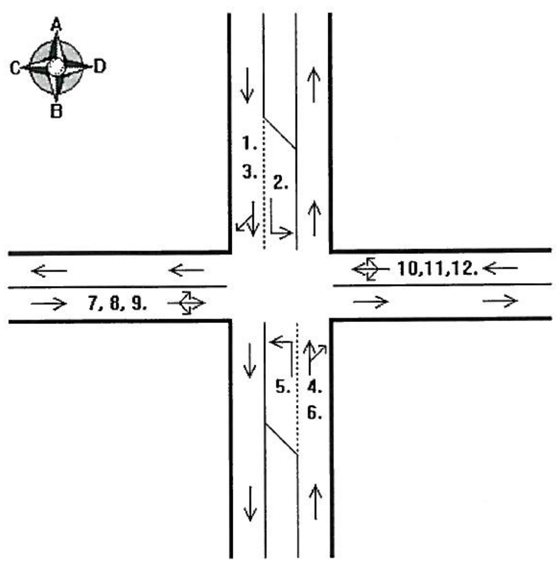
Point Defiance Bypass Project

Intersection Data:

Predominant Surroundings: **Central Business District**

Traffic Volumes:

Vol. Index	Movement	Volume (vph)
1	**A-B Thru**	**238**
2	**A-D Left Turn**	**6**
3	**A-C Right Turn**	**124**
4	**B-A Thru**	**105**
5	**B-C Left Turn**	**116**
6	**B-D Right Turn**	**27**
7	**C-D Thru**	**268**
8	**C-A Left Turn**	**128**
9	**C-B Right Turn**	**238**
10	**D-C Thru**	**287**
11	**D-B Left Turn**	**75**
12	**D-A Right Turn**	**24**



CO Emission Factors Based On:

Location: **Western Washington - PIERCE County**
CO Maint. Area: **Puget Sound**
I/M Program: **Yes**
Model Year: **2017**
Gasoline sulfur content of 160 ppm for 2005-2006, 60 ppm for 2007, & 30 ppm for 2008-2050.

MOBILE6.2 CO Emission Factors:

Idle Emission Factor (g/hr): **70.75**

Approach	Speed (mph)	EF (g/mile)
Leg A	**10**	**14.89**
Leg B	**10**	**14.89**
Leg C	**10**	**14.89**
Leg D	**10**	**14.89**

***Note: Local roadways should be modeled using an approach speed of 15 mph or less.**
Highway ramps should be modeled using an approach speed of 5 mph.

Traffic Signal Timing:

Total Cycle Length (sec): **165**

Red Times:

Type of Movement	Red Times (sec)
Leg A Thru & Rt	**115**
Leg A Left Turn	**140**
Leg B Thru & Rt	**115**
Leg B Left Turn	**140**
Leg C Thru & Rt	**115**
Leg C Left Turn	**---**
Leg D Thru & Rt	**115**
Leg D Left Turn	**---**

***Red times are equal to the "Quick and Easy" values.**

User Comments:

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Washington State Intersection Screening Tool 1.0

09-22-11

09:46 AM

Point Defiance Bypass Project

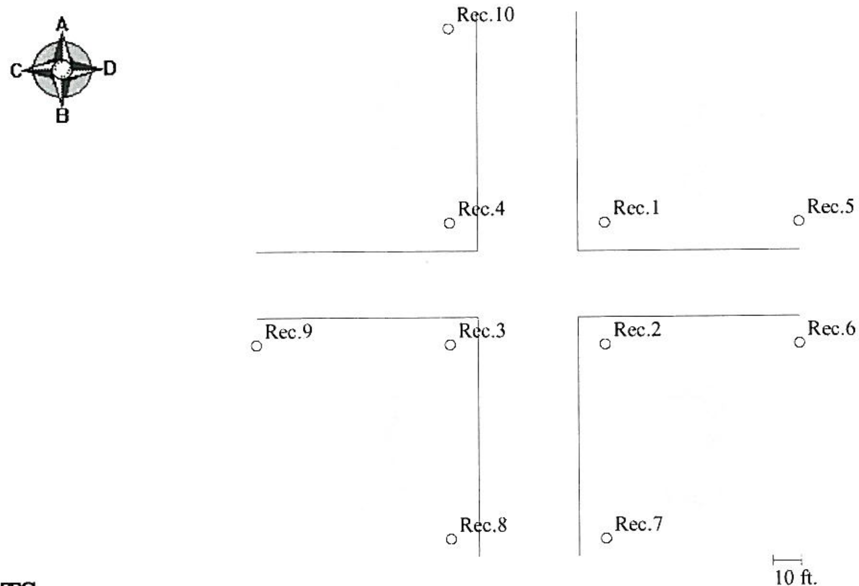
Description: **E "D" St. & 26th Street 2017 Build**

Performed by: **Akberet Ghebre - WSDOT**

206-440-4547 - Ghebrea@wsdot.wa.gov

Intersection Type: **Four-Way Intersection, 2 x 2 w/2 Lt Turns**

Street Names: **A-B: E D street C-D: East 26th Street**



RESULTS:

Receptor#	Quadrant	Distance from A-B roadway (feet)	Distance from C-D roadway (feet)	CO 1-hour avg. Conc. (ppm)	CO 8-hour avg. Conc. (ppm)	Pass/Fail*
1	**1**	**10**	**10**	**4.4**	**4.0**	**Pass**
2	**2**	**10**	**10**	**4.9**	**4.3**	**Pass**
3	**3**	**10**	**10**	**4.5**	**4.0**	**Pass**
4	**4**	**10**	**10**	**4.7**	**4.2**	**Pass**
5	**1**	**80**	**10**	**4.3**	**3.9**	**Pass**
6	**2**	**80**	**10**	**4.2**	**3.8**	**Pass**
7	**2**	**10**	**80**	**4.6**	**4.1**	**Pass**
8	**3**	**10**	**80**	**4.2**	**3.8**	**Pass**
9	**3**	**80**	**10**	**4.4**	**4.0**	**Pass**
10	**4**	**10**	**80**	**4.1**	**3.8**	**Pass**

*Project **PASSES** 1-hr and 8-hr NAAQS of 35 ppm and 9 ppm, respectively.

Largest modeled CO concentrations are at **receptor 2**.

- All CO concentrations include a background concentration of **3.0** ppm.
- 8-hr average CO concentrations are calculated by multiplying the 1-hr average concentrations (without background) by a persistence factor of 0.7 and then adding the background concentration.

USER INPUTS

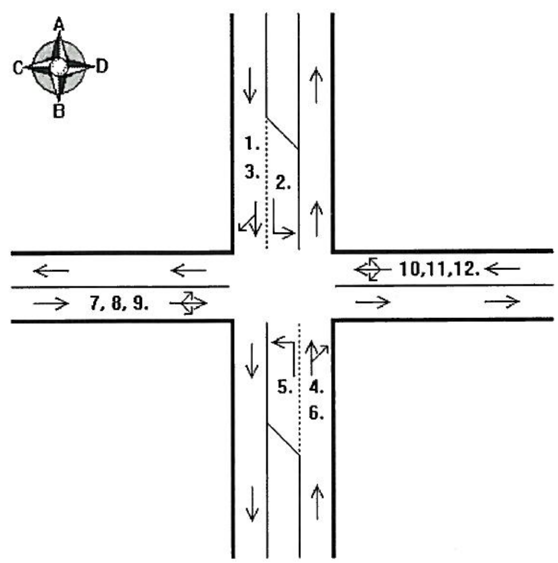
Point Defiance Bypass Project

Intersection Data:

Predominant Surroundings: **Central Business District**

Traffic Volumes:

Vol. Index	Movement	Volume (vph)
1	**A-B Thru**	**238**
2	**A-D Left Turn**	**6**
3	**A-C Right Turn**	**124**
4	**B-A Thru**	**105**
5	**B-C Left Turn**	**116**
6	**B-D Right Turn**	**27**
7	**C-D Thru**	**268**
8	**C-A Left Turn**	**128**
9	**C-B Right Turn**	**238**
10	**D-C Thru**	**287**
11	**D-B Left Turn**	**75**
12	**D-A Right Turn**	**24**



CO Emission Factors Based On:

Location: **Western Washington - PIERCE County**
CO Maint. Area: **Puget Sound**
I/M Program: **Yes**
Model Year: **2017**
Gasoline sulfur content of 160 ppm for 2005-2006, 60 ppm for 2007, & 30 ppm for 2008-2050.

MOBILE6.2 CO Emission Factors:

Idle Emission Factor (g/hr): **70.75**

Approach	Speed (mph)	EF (g/mile)
Leg A	**10**	**14.89**
Leg B	**10**	**14.89**
Leg C	**10**	**14.89**
Leg D	**10**	**14.89**

***Note: Local roadways should be modeled using an approach speed of 15 mph or less. Highway ramps should be modeled using an approach speed of 5 mph.**

Traffic Signal Timing:

Total Cycle Length (sec): **165**

Red Times:

Type of Movement	Red Times (sec)
Leg A Thru & Rt	**115**
Leg A Left Turn	**140**
Leg B Thru & Rt	**115**
Leg B Left Turn	**140**
Leg C Thru & Rt	**115**
Leg C Left Turn	**---**
Leg D Thru & Rt	**115**
Leg D Left Turn	**---**

***Red times are equal to the "Quick and Easy" values.**

User Comments:

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Washington State Intersection Screening Tool 1.0

09-22-11

09:47 AM

Point Defiance Bypass Project

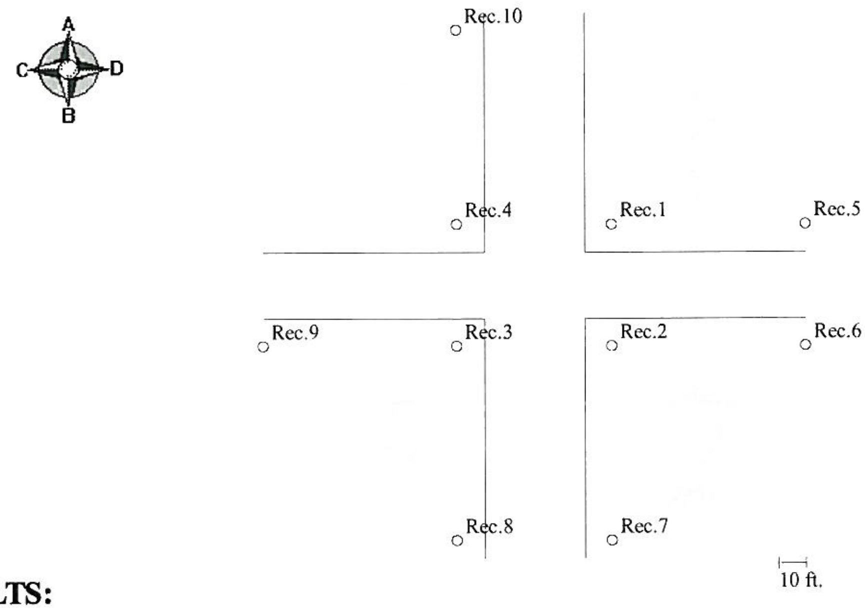
Description: **E "D" St. & 26th Street 2040 NB**

Performed by: **Akberet Ghebre - WSDOT**

206-440-4547 - Ghebrea@wsdot.wa.gov

Intersection Type: **Four-Way Intersection, 2 x 2 w/2 Lt Turns**

Street Names: **A-B: E D street C-D: East 26th Street**



RESULTS:

Receptor#	Quadrant	Distance from A-B roadway (feet)	Distance from C-D roadway (feet)	CO 1-hour avg. Conc. (ppm)	CO 8-hour avg. Conc. (ppm)	Pass/Fail*
1	**1**	**10**	**10**	**5.0**	**4.4**	**Pass**
2	**2**	**10**	**10**	**5.1**	**4.5**	**Pass**
3	**3**	**10**	**10**	**4.9**	**4.3**	**Pass**
4	**4**	**10**	**10**	**5.1**	**4.5**	**Pass**
5	**1**	**80**	**10**	**4.4**	**4.0**	**Pass**
6	**2**	**80**	**10**	**4.3**	**3.9**	**Pass**
7	**2**	**10**	**80**	**4.6**	**4.1**	**Pass**
8	**3**	**10**	**80**	**4.6**	**4.1**	**Pass**
9	**3**	**80**	**10**	**4.7**	**4.2**	**Pass**
10	**4**	**10**	**80**	**4.5**	**4.0**	**Pass**

*Project **PASSES** 1-hr and 8-hr NAAQS of 35 ppm and 9 ppm, respectively.

Largest modeled CO concentrations are at **receptor 2**.

- All CO concentrations include a background concentration of **3.0** ppm.
- 8-hr average CO concentrations are calculated by multiplying the 1-hr average concentrations (without background) by a persistence factor of 0.7 and then adding the background concentration.

Washington State Intersection Screening Tool 1.0

USER INPUTS

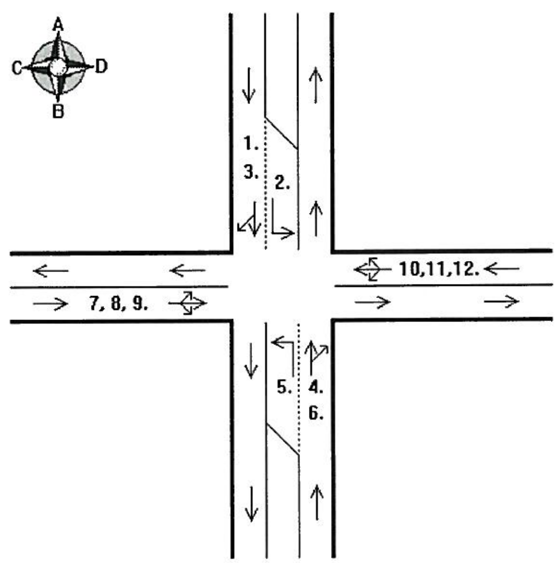
Point Defiance Bypass Project

Intersection Data:

Predominant Surroundings: **Central Business District**

Traffic Volumes:

Vol. Index	Movement	Volume (vph)
1	**A-B Thru**	**401**
2	**A-D Left Turn**	**5**
3	**A-C Right Turn**	**117**
4	**B-A Thru**	**238**
5	**B-C Left Turn**	**380**
6	**B-D Right Turn**	**94**
7	**C-D Thru**	**387**
8	**C-A Left Turn**	**176**
9	**C-B Right Turn**	**516**
10	**D-C Thru**	**310**
11	**D-B Left Turn**	**146**
12	**D-A Right Turn**	**26**



CO Emission Factors Based On:

Location: **Western Washington - PIERCE County**
CO Maint. Area: **Puget Sound**
I/M Program: **Yes**
Model Year: **2040**
Gasoline sulfur content of 160 ppm for 2005-2006, 60 ppm for 2007, & 30 ppm for 2008-2050.

MOBILE6.2 CO Emission Factors:

Idle Emission Factor (g/hr): **57.09**

Approach	Speed (mph)	EF (g/mile)
Leg A	**10**	**12.01**
Leg B	**10**	**12.01**
Leg C	**10**	**12.01**
Leg D	**10**	**12.01**

***Note: Local roadways should be modeled using an approach speed of 15 mph or less. Highway ramps should be modeled using an approach speed of 5 mph.**

Traffic Signal Timing:

Total Cycle Length (sec): **165**

Red Times:

Type of Movement	Red Times (sec)
Leg A Thru & Rt	**115**
Leg A Left Turn	**140**
Leg B Thru & Rt	**115**
Leg B Left Turn	**140**
Leg C Thru & Rt	**115**
Leg C Left Turn	**---**
Leg D Thru & Rt	**115**
Leg D Left Turn	**---**

***Red times are equal to the "Quick and Easy" values.**

User Comments:

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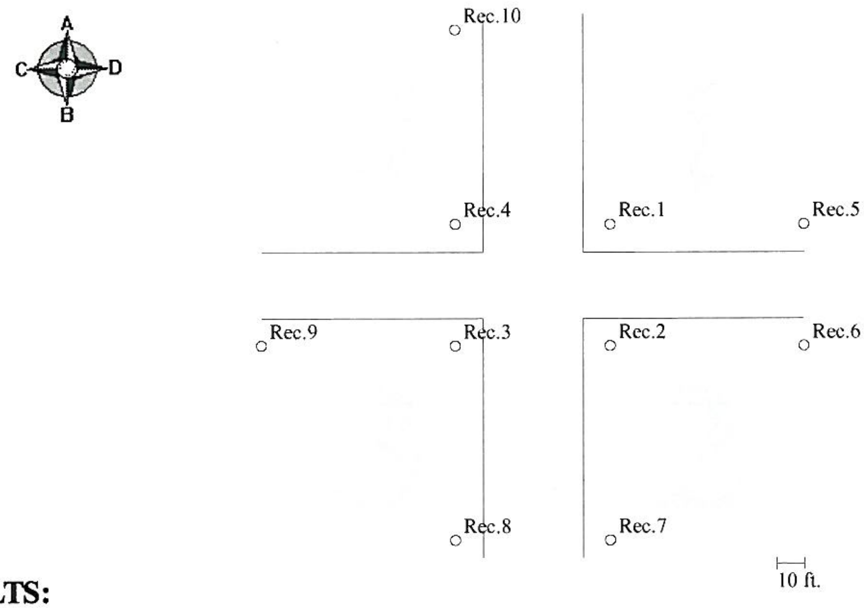
Washington State Intersection Screening Tool 1.0

09-22-11

09:47 AM

Point Defiance Bypass Project

Description:	**E "D" St. & 26th Street 2040 Build**
Performed by:	**Akberet Ghebre - WSDOT**
	206-440-4547 - Ghebrea@wsdot.wa.gov
Intersection Type:	**Four-Way Intersection, 2 x 2 w/2 Lt Turns**
Street Names:	**A-B: E D street C-D: East 26th Street**



RESULTS:

Receptor#	Quadrant	Distance from A-B roadway (feet)	Distance from C-D roadway (feet)	CO 1-hour avg. Conc. (ppm)	CO 8-hour avg. Conc. (ppm)	Pass/Fail*
1	**1**	**10**	**10**	**5.0**	**4.4**	**Pass**
2	**2**	**10**	**10**	**5.1**	**4.5**	**Pass**
3	**3**	**10**	**10**	**4.9**	**4.3**	**Pass**
4	**4**	**10**	**10**	**5.1**	**4.5**	**Pass**
5	**1**	**80**	**10**	**4.4**	**4.0**	**Pass**
6	**2**	**80**	**10**	**4.3**	**3.9**	**Pass**
7	**2**	**10**	**80**	**4.6**	**4.1**	**Pass**
8	**3**	**10**	**80**	**4.6**	**4.1**	**Pass**
9	**3**	**80**	**10**	**4.7**	**4.2**	**Pass**
10	**4**	**10**	**80**	**4.5**	**4.0**	**Pass**

*Project **PASSES** 1-hr and 8-hr NAAQS of 35 ppm and 9 ppm, respectively.
Largest modeled CO concentrations are at **receptor 2**.

- All CO concentrations include a background concentration of **3.0** ppm.
- 8-hr average CO concentrations are calculated by multiplying the 1-hr average concentrations (without background) by a persistence factor of 0.7 and then adding the background concentration.

Washington State Intersection Screening Tool 1.0

USER INPUTS

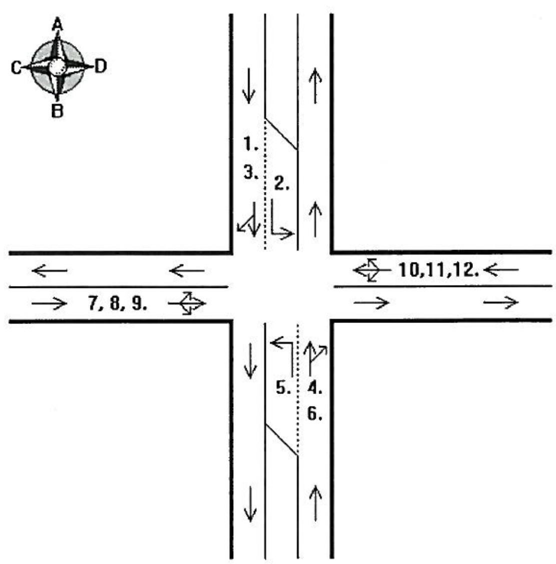
Point Defiance Bypass Project

Intersection Data:

Predominant Surroundings: **Central Business District**

Traffic Volumes:

Vol. Index	Movement	Volume (vph)
1	**A-B Thru**	**401**
2	**A-D Left Turn**	**5**
3	**A-C Right Turn**	**117**
4	**B-A Thru**	**238**
5	**B-C Left Turn**	**380**
6	**B-D Right Turn**	**94**
7	**C-D Thru**	**387**
8	**C-A Left Turn**	**176**
9	**C-B Right Turn**	**516**
10	**D-C Thru**	**310**
11	**D-B Left Turn**	**146**
12	**D-A Right Turn**	**26**



CO Emission Factors Based On:

Location: **Western Washington - PIERCE County**
CO Maint. Area: **Puget Sound**
I/M Program: **Yes**
Model Year: **2040**
Gasoline sulfur content of 160 ppm for 2005-2006, 60 ppm for 2007, & 30 ppm for 2008-2050.

MOBILE6.2 CO Emission Factors:

Idle Emission Factor (g/hr): **57.09**

Approach	Speed (mph)	EF (g/mile)
Leg A	**10**	**12.01**
Leg B	**10**	**12.01**
Leg C	**10**	**12.01**
Leg D	**10**	**12.01**

***Note: Local roadways should be modeled using an approach speed of 15 mph or less. Highway ramps should be modeled using an approach speed of 5 mph.**

Traffic Signal Timing:

Total Cycle Length (sec): **165**

Red Times:

Type of Movement	Red Times (sec)
Leg A Thru & Rt	**115**
Leg A Left Turn	**140**
Leg B Thru & Rt	**115**
Leg B Left Turn	**140**
Leg C Thru & Rt	**115**
Leg C Left Turn	**---**
Leg D Thru & Rt	**115**
Leg D Left Turn	**---**

***Red times are equal to the "Quick and Easy" values.**

USER COMMENTS

Point Defiance Bypass Project

User Comments:

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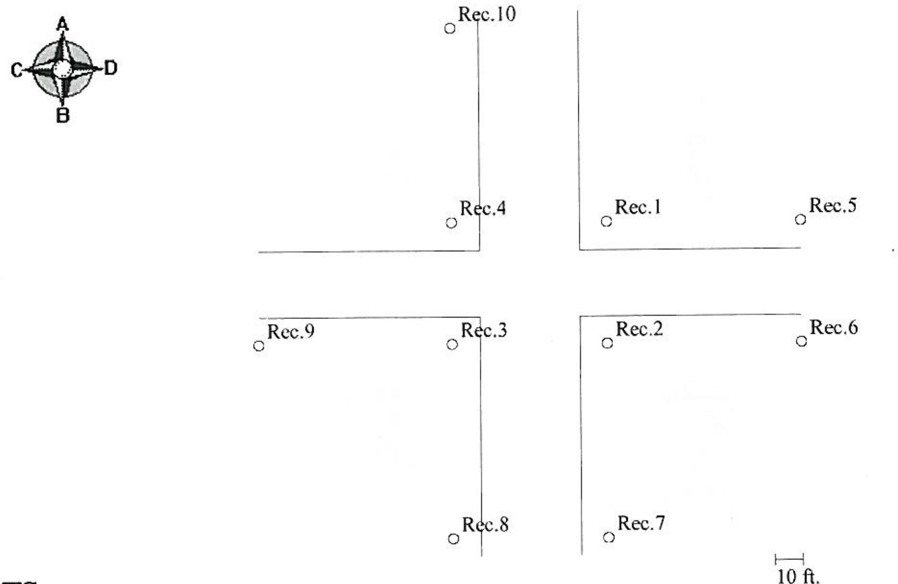
Washington State Intersection Screening Tool 1.0

09-22-11
09:48 AM

Point Defiance Bypass Project

Description: **Barksdale Ave & NB I-5 Ramp existing**
Performed by: **Akberet Ghebre - WSDOT**
206-440-4547 - Ghebrea@wsdot.wa.gov
Intersection Type: **Four-Way Intersection, 2 x 2 w/2 Lt Turns**
Street Names: **A-B: Barksdale Ave C-D: NB I-5 Ramp**



RESULTS:

Receptor#	Quadrant	Distance from A-B roadway (feet)	Distance from C-D roadway (feet)	CO 1-hour avg. Conc. (ppm)	CO 8-hour avg. Conc. (ppm)	Pass/Fail*
1	**1**	**10**	**10**	**5.3**	**4.6**	**Pass**
2	**2**	**10**	**10**	**5.5**	**4.8**	**Pass**
3	**3**	**10**	**10**	**5.2**	**4.5**	**Pass**
4	**4**	**10**	**10**	**5.2**	**4.5**	**Pass**
5	**1**	**80**	**10**	**5.4**	**4.7**	**Pass**
6	**2**	**80**	**10**	**4.7**	**4.2**	**Pass**
7	**2**	**10**	**80**	**4.9**	**4.3**	**Pass**
8	**3**	**10**	**80**	**4.7**	**4.2**	**Pass**
9	**3**	**80**	**10**	**5.1**	**4.5**	**Pass**
10	**4**	**10**	**80**	**4.3**	**3.9**	**Pass**

*Project **PASSES** 1-hr and 8-hr NAAQS of 35 ppm and 9 ppm, respectively.
Largest modeled CO concentrations are at **receptor 2**.
- All CO concentrations include a background concentration of **3.0** ppm.
- 8-hr average CO concentrations are calculated by multiplying the 1-hr average concentrations (without background) by a persistence factor of 0.7 and then adding the background concentration.

Washington State Intersection Screening Tool 1.0

USER INPUTS

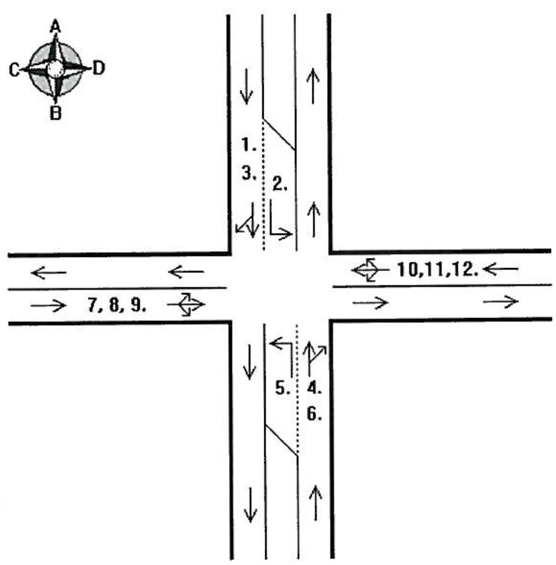
Point Defiance Bypass Project

Intersection Data:

Predominant Surroundings: **Central Business District**

Traffic Volumes:

Vol. Index	Movement	Volume (vph)
1	**A-B Thru**	**3**
2	**A-D Left Turn**	**3**
3	**A-C Right Turn**	**4**
4	**B-A Thru**	**3**
5	**B-C Left Turn**	**296**
6	**B-D Right Turn**	**137**
7	**C-D Thru**	**98**
8	**C-A Left Turn**	**234**
9	**C-B Right Turn**	**3**
10	**D-C Thru**	**739**
11	**D-B Left Turn**	**3**
12	**D-A Right Turn**	**177**



CO Emission Factors Based On:

Location: **Western Washington - PIERCE County**
CO Maint. Area: **Puget Sound**
I/M Program: **Yes**
Model Year: **2010**
Gasoline sulfur content of 160 ppm for 2005-2006, 60 ppm for 2007, & 30 ppm for 2008-2050.

MOBILE6.2 CO Emission Factors:

Idle Emission Factor (g/hr): **103.49**

Approach	Speed (mph)	EF (g/mile)
Leg A	**10**	**20.72**
Leg B	**10**	**20.72**
Leg C	**10**	**20.72**
Leg D	**10**	**20.72**

***Note: Local roadways should be modeled using an approach speed of 15 mph or less. Highway ramps should be modeled using an approach speed of 5 mph.**

Traffic Signal Timing:

Total Cycle Length (sec): **165**

Red Times:

Type of Movement	Red Times (sec)
Leg A Thru & Rt	**115**
Leg A Left Turn	**140**
Leg B Thru & Rt	**115**
Leg B Left Turn	**140**
Leg C Thru & Rt	**115**
Leg C Left Turn	**---**
Leg D Thru & Rt	**115**
Leg D Left Turn	**---**

***Red times are equal to the "Quick and Easy" values.**

USER COMMENTS

Point Defiance Bypass Project

User Comments:

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Washington State Intersection Screening Tool 1.0

09-22-11

09:49 AM

Point Defiance Bypass Project

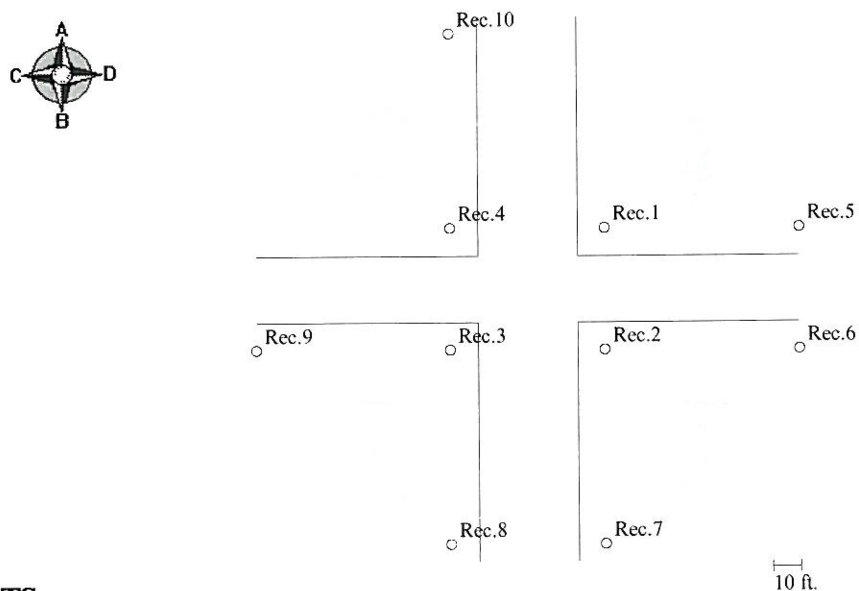
Description: **Barksdale Ave & NB I-5 Ramp 2017 NB**

Performed by: **Akberet Ghebre - WSDOT**

206-440-4547 - Ghebrea@wsdot.wa.gov

Intersection Type: **Four-Way Intersection, 2 x 2 w/2 Lt Turns**

Street Names: **A-B: Barksdale Ave C-D: NB I-5 Ramp**



RESULTS:

Receptor#	Quadrant	Distance from A-B roadway (feet)	Distance from C-D roadway (feet)	CO 1-hour avg. Conc. (ppm)	CO 8-hour avg. Conc. (ppm)	Pass/Fail*
1	**1**	**10**	**10**	**4.9**	**4.3**	**Pass**
2	**2**	**10**	**10**	**4.7**	**4.2**	**Pass**
3	**3**	**10**	**10**	**4.7**	**4.2**	**Pass**
4	**4**	**10**	**10**	**4.6**	**4.1**	**Pass**
5	**1**	**80**	**10**	**4.7**	**4.2**	**Pass**
6	**2**	**80**	**10**	**4.4**	**4.0**	**Pass**
7	**2**	**10**	**80**	**4.4**	**4.0**	**Pass**
8	**3**	**10**	**80**	**4.1**	**3.8**	**Pass**
9	**3**	**80**	**10**	**4.6**	**4.1**	**Pass**
10	**4**	**10**	**80**	**3.8**	**3.6**	**Pass**

*Project **PASSES** 1-hr and 8-hr NAAQS of 35 ppm and 9 ppm, respectively.

Largest modeled CO concentrations are at **receptor 1**.

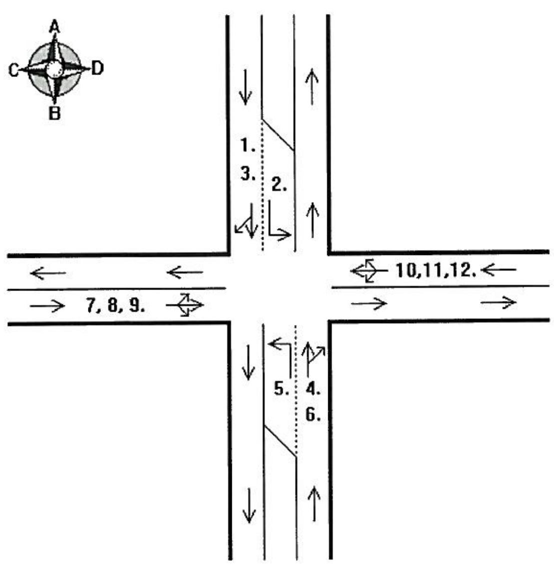
- All CO concentrations include a background concentration of **3.0** ppm.
- 8-hr average CO concentrations are calculated by multiplying the 1-hr average concentrations (without background) by a persistence factor of 0.7 and then adding the background concentration.

Intersection Data:

Predominant Surroundings: **Central Business District**

Traffic Volumes:

Vol. Index	Movement	Volume (vph)
1	**A-B Thru**	**3**
2	**A-D Left Turn**	**3**
3	**A-C Right Turn**	**4**
4	**B-A Thru**	**3**
5	**B-C Left Turn**	**336**
6	**B-D Right Turn**	**124**
7	**C-D Thru**	**113**
8	**C-A Left Turn**	**236**
9	**C-B Right Turn**	**3**
10	**D-C Thru**	**820**
11	**D-B Left Turn**	**3**
12	**D-A Right Turn**	**196**



CO Emission Factors Based On:

Location: **Western Washington - PIERCE County**
CO Maint. Area: **Puget Sound**
I/M Program: **Yes**
Model Year: **2017**
Gasoline sulfur content of 160 ppm for 2005-2006, 60 ppm for 2007, & 30 ppm for 2008-2050.

MOBILE6.2 CO Emission Factors:

Idle Emission Factor (g/hr): **70.75**

Approach	Speed (mph)	EF (g/mile)
Leg A	**10**	**14.89**
Leg B	**10**	**14.89**
Leg C	**10**	**14.89**
Leg D	**10**	**14.89**

***Note: Local roadways should be modeled using an approach speed of 15 mph or less. Highway ramps should be modeled using an approach speed of 5 mph.**

Traffic Signal Timing:

Total Cycle Length (sec): **165**

Red Times:

Type of Movement	Red Times (sec)
Leg A Thru & Rt	**115**
Leg A Left Turn	**140**
Leg B Thru & Rt	**115**
Leg B Left Turn	**140**
Leg C Thru & Rt	**115**
Leg C Left Turn	**---**
Leg D Thru & Rt	**115**
Leg D Left Turn	**---**

***Red times are equal to the "Quick and Easy" values.**

User Comments:

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Washington State Intersection Screening Tool 1.0

09-22-11

09:49 AM

Point Defiance Bypass Project

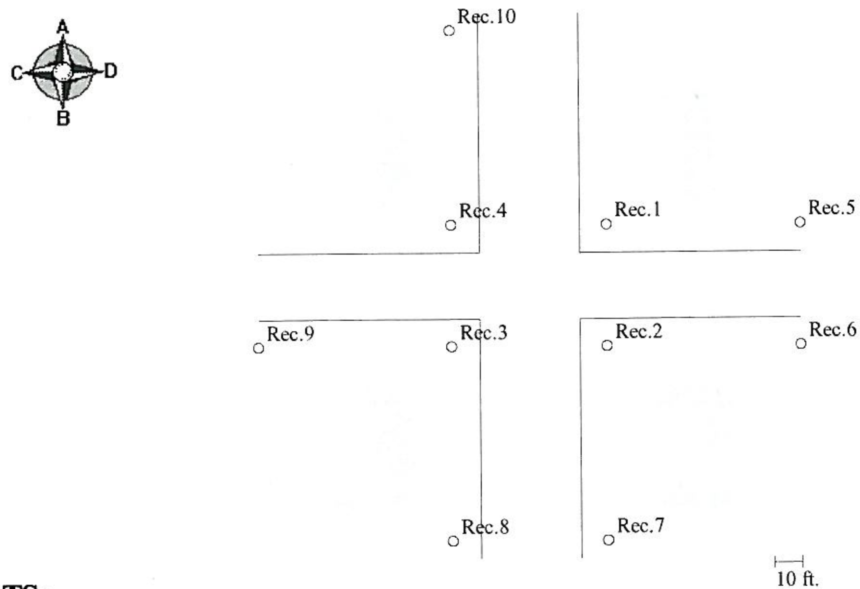
Description: **Barksdale Ave & NB I-5 Ramp 2017 Build**

Performed by: **Akberet Ghebre - WSDOT**

206-440-4547 - Ghebrea@wsdot.wa.gov

Intersection Type: **Four-Way Intersection, 2 x 2 w/2 Lt Turns**

Street Names: **A-B: Barksdale Ave C-D: NB I-5 Ramp**



RESULTS:

Receptor#	Quadrant	Distance from A-B roadway (feet)	Distance from C-D roadway (feet)	CO 1-hour avg. Conc. (ppm)	CO 8-hour avg. Conc. (ppm)	Pass/Fail*
1	**1**	**10**	**10**	**4.9**	**4.3**	**Pass**
2	**2**	**10**	**10**	**4.7**	**4.2**	**Pass**
3	**3**	**10**	**10**	**4.7**	**4.2**	**Pass**
4	**4**	**10**	**10**	**4.6**	**4.1**	**Pass**
5	**1**	**80**	**10**	**4.7**	**4.2**	**Pass**
6	**2**	**80**	**10**	**4.4**	**4.0**	**Pass**
7	**2**	**10**	**80**	**4.4**	**4.0**	**Pass**
8	**3**	**10**	**80**	**4.1**	**3.8**	**Pass**
9	**3**	**80**	**10**	**4.6**	**4.1**	**Pass**
10	**4**	**10**	**80**	**3.8**	**3.6**	**Pass**

*Project **PASSES** 1-hr and 8-hr NAAQS of 35 ppm and 9 ppm, respectively.
Largest modeled CO concentrations are at **receptor 1**.

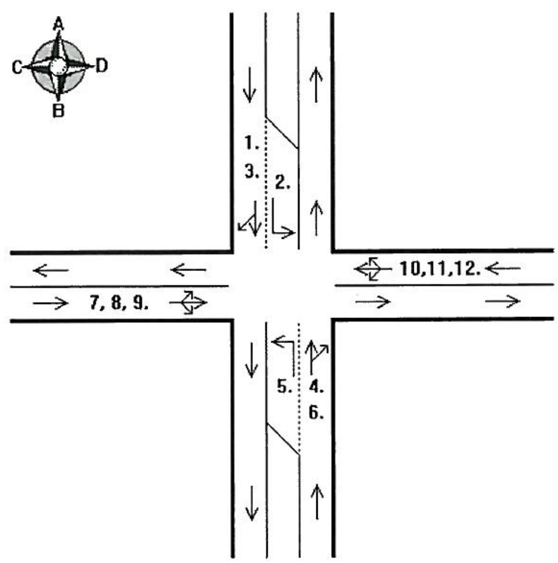
- All CO concentrations include a background concentration of **3.0** ppm.
- 8-hr average CO concentrations are calculated by multiplying the 1-hr average concentrations (without background) by a persistence factor of 0.7 and then adding the background concentration.

Intersection Data:

Predominant Surroundings: **Central Business District**

Traffic Volumes:

Vol. Index	Movement	Volume (vph)
1	**A-B Thru**	**3**
2	**A-D Left Turn**	**3**
3	**A-C Right Turn**	**4**
4	**B-A Thru**	**3**
5	**B-C Left Turn**	**336**
6	**B-D Right Turn**	**124**
7	**C-D Thru**	**113**
8	**C-A Left Turn**	**236**
9	**C-B Right Turn**	**3**
10	**D-C Thru**	**820**
11	**D-B Left Turn**	**3**
12	**D-A Right Turn**	**196**



CO Emission Factors Based On:

Location: **Western Washington - PIERCE County**
CO Maint. Area: **Puget Sound**
I/M Program: **Yes**
Model Year: **2017**
Gasoline sulfur content of 160 ppm for 2005-2006, 60 ppm for 2007, & 30 ppm for 2008-2050.

MOBILE6.2 CO Emission Factors:

Idle Emission Factor (g/hr): **70.75**

Approach	Speed (mph)	EF (g/mile)
Leg A	**10**	**14.89**
Leg B	**10**	**14.89**
Leg C	**10**	**14.89**
Leg D	**10**	**14.89**

***Note: Local roadways should be modeled using an approach speed of 15 mph or less.**
Highway ramps should be modeled using an approach speed of 5 mph.

Traffic Signal Timing:

Total Cycle Length (sec): **165**

Red Times:

Type of Movement	Red Times (sec)
Leg A Thru & Rt	**115**
Leg A Left Turn	**140**
Leg B Thru & Rt	**115**
Leg B Left Turn	**140**
Leg C Thru & Rt	**115**
Leg C Left Turn	**---**
Leg D Thru & Rt	**115**
Leg D Left Turn	**---**

***Red times are equal to the "Quick and Easy" values.**

User Comments:

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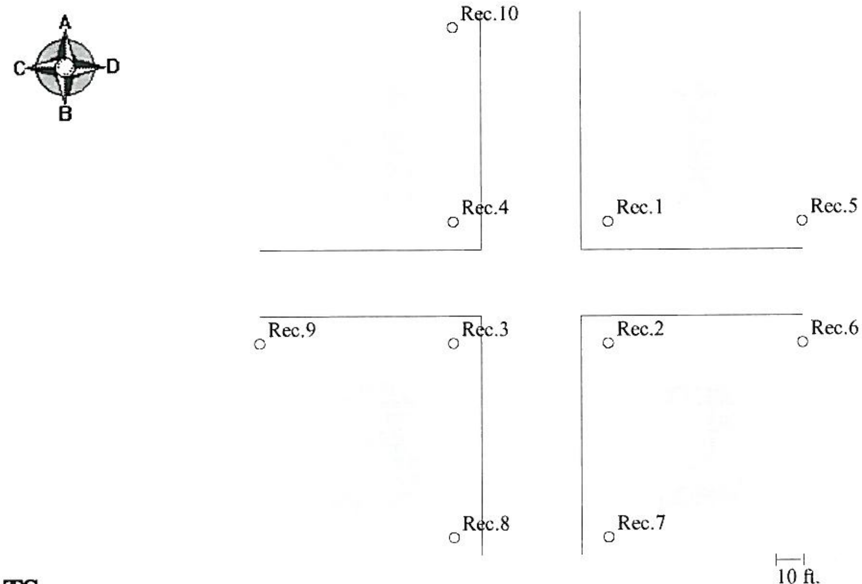
Washington State Intersection Screening Tool 1.0

09-22-11
10:07 AM
Point Defiance Bypass Project

Description:	**Barksdale Ave & NB I-5 Ramp 2040 NB**
Performed by:	**Akberet Ghebre - WSDOT**
	206-440-4547 - Ghebrea@wsdot.wa.gov
Intersection Type:	**Four-Way Intersection, 2 x 2 w/2 Lt Turns**
Street Names:	**A-B: Barksdale Ave C-D: NB I-5 Ramp**



RESULTS:

Receptor#	Quadrant	Distance from A-B roadway (feet)	Distance from C-D roadway (feet)	CO 1-hour avg. Conc. (ppm)	CO 8-hour avg. Conc. (ppm)	Pass/Fail*
1	**1**	**10**	**10**	**4.7**	**4.2**	**Pass**
2	**2**	**10**	**10**	**4.6**	**4.1**	**Pass**
3	**3**	**10**	**10**	**4.5**	**4.0**	**Pass**
4	**4**	**10**	**10**	**4.8**	**4.3**	**Pass**
5	**1**	**80**	**10**	**4.6**	**4.1**	**Pass**
6	**2**	**80**	**10**	**4.2**	**3.8**	**Pass**
7	**2**	**10**	**80**	**4.1**	**3.8**	**Pass**
8	**3**	**10**	**80**	**4.0**	**3.7**	**Pass**
9	**3**	**80**	**10**	**4.4**	**4.0**	**Pass**
10	**4**	**10**	**80**	**3.7**	**3.5**	**Pass**

*Project **PASSES** 1-hr and 8-hr NAAQS of 35 ppm and 9 ppm, respectively.
Largest modeled CO concentrations are at **receptor 4**.

- All CO concentrations include a background concentration of **3.0** ppm.
- 8-hr average CO concentrations are calculated by multiplying the 1-hr average concentrations (without background) by a persistence factor of 0.7 and then adding the background concentration.

Washington State Intersection Screening Tool 1.0

USER INPUTS

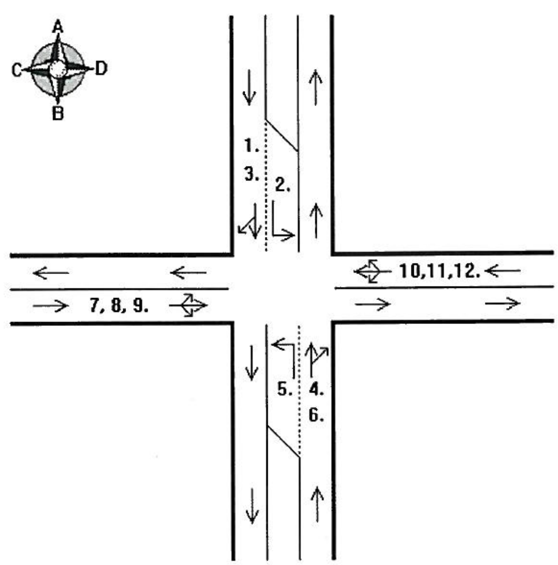
Point Defiance Bypass Project

Intersection Data:

Predominant Surroundings: **Central Business District**

Traffic Volumes:

Vol. Index	Movement	Volume (vph)
1	**A-B Thru**	**3**
2	**A-D Left Turn**	**3**
3	**A-C Right Turn**	**15**
4	**B-A Thru**	**3**
5	**B-C Left Turn**	**467**
6	**B-D Right Turn**	**82**
7	**C-D Thru**	**161**
8	**C-A Left Turn**	**243**
9	**C-B Right Turn**	**3**
10	**D-C Thru**	**1086**
11	**D-B Left Turn**	**3**
12	**D-A Right Turn**	**257**



CO Emission Factors Based On:

Location: **Western Washington - PIERCE County**
CO Maint. Area: **Puget Sound**
I/M Program: **Yes**
Model Year: **2040**
Gasoline sulfur content of 160 ppm for 2005-2006, 60 ppm for 2007, & 30 ppm for 2008-2050.

MOBILE6.2 CO Emission Factors:

Idle Emission Factor (g/hr): **57.09**

Approach	Speed (mph)	EF (g/mile)
Leg A	**10**	**12.01**
Leg B	**10**	**12.01**
Leg C	**10**	**12.01**
Leg D	**10**	**12.01**

***Note: Local roadways should be modeled using an approach speed of 15 mph or less.**
Highway ramps should be modeled using an approach speed of 5 mph.

Traffic Signal Timing:

Total Cycle Length (sec): **165**

Red Times:

Type of Movement	Red Times (sec)
Leg A Thru & Rt	**115**
Leg A Left Turn	**140**
Leg B Thru & Rt	**115**
Leg B Left Turn	**140**
Leg C Thru & Rt	**115**
Leg C Left Turn	**---**
Leg D Thru & Rt	**115**
Leg D Left Turn	**---**

***Red times are equal to the "Quick and Easy" values.**

User Comments:

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Washington State Intersection Screening Tool 1.0

09-22-11

09:50 AM

Point Defiance Bypass Project

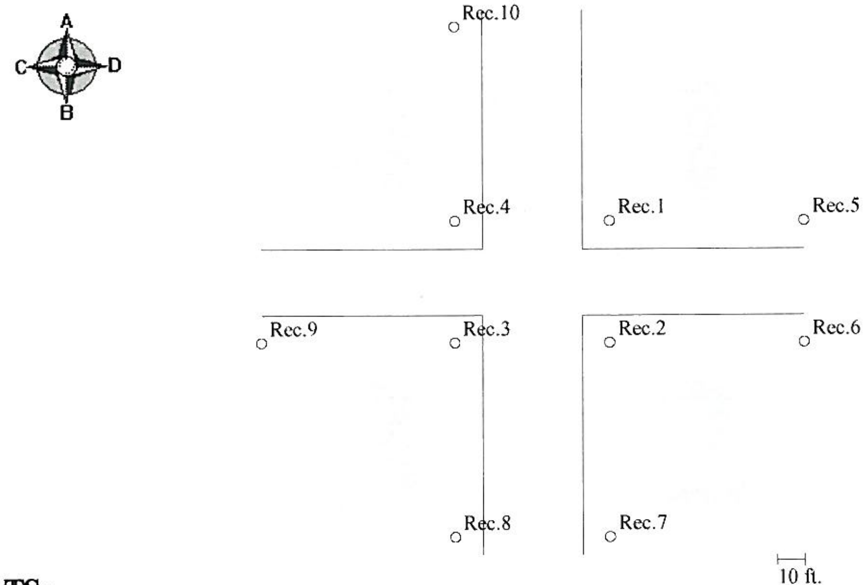
Description: **Barksdale Ave & NB I-5 Ramp 2040 Build**

Performed by: **Akberet Ghebre - WSDOT**

206-440-4547 - Ghebrea@wsdot.wa.gov

Intersection Type: **Four-Way Intersection, 2 x 2 w/2 Lt Turns**

Street Names: **A-B: Barksdale Ave C-D: NB I-5 Ramp**



RESULTS:

Receptor#	Quadrant	Distance from A-B roadway (feet)	Distance from C-D roadway (feet)	CO 1-hour avg. Conc. (ppm)	CO 8-hour avg. Conc. (ppm)	Pass/Fail*
1	**1**	**10**	**10**	**4.7**	**4.2**	**Pass**
2	**2**	**10**	**10**	**4.6**	**4.1**	**Pass**
3	**3**	**10**	**10**	**4.5**	**4.0**	**Pass**
4	**4**	**10**	**10**	**4.8**	**4.3**	**Pass**
5	**1**	**80**	**10**	**4.6**	**4.1**	**Pass**
6	**2**	**80**	**10**	**4.2**	**3.8**	**Pass**
7	**2**	**10**	**80**	**4.1**	**3.8**	**Pass**
8	**3**	**10**	**80**	**4.0**	**3.7**	**Pass**
9	**3**	**80**	**10**	**4.4**	**4.0**	**Pass**
10	**4**	**10**	**80**	**3.7**	**3.5**	**Pass**

*Project **PASSES** 1-hr and 8-hr NAAQS of 35 ppm and 9 ppm, respectively.
Largest modeled CO concentrations are at **receptor 4**.

- All CO concentrations include a background concentration of **3.0** ppm.
- 8-hr average CO concentrations are calculated by multiplying the 1-hr average concentrations (without background) by a persistence factor of 0.7 and then adding the background concentration.

Washington State Intersection Screening Tool 1.0

USER INPUTS

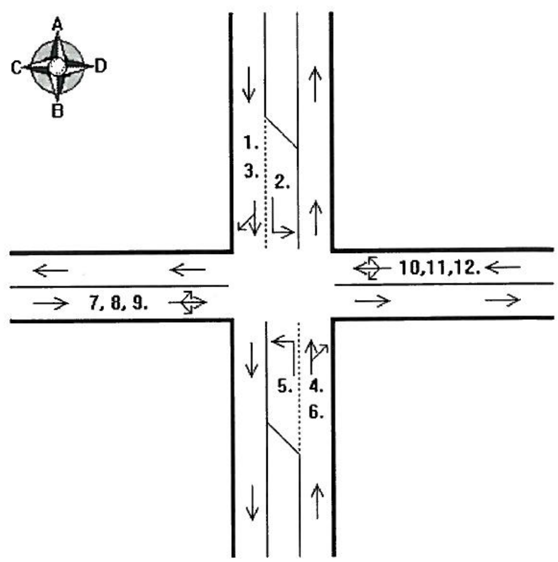
Point Defiance Bypass Project

Intersection Data:

Predominant Surroundings: **Central Business District**

Traffic Volumes:

Vol. Index	Movement	Volume (vph)
1	**A-B Thru**	**3**
2	**A-D Left Turn**	**3**
3	**A-C Right Turn**	**15**
4	**B-A Thru**	**3**
5	**B-C Left Turn**	**467**
6	**B-D Right Turn**	**82**
7	**C-D Thru**	**161**
8	**C-A Left Turn**	**243**
9	**C-B Right Turn**	**3**
10	**D-C Thru**	**1086**
11	**D-B Left Turn**	**3**
12	**D-A Right Turn**	**257**



CO Emission Factors Based On:

Location: **Western Washington - PIERCE County**
CO Maint. Area: **Puget Sound**
I/M Program: **Yes**
Model Year: **2040**
Gasoline sulfur content of 160 ppm for 2005-2006, 60 ppm for 2007, & 30 ppm for 2008-2050.

MOBILE6.2 CO Emission Factors:

Idle Emission Factor (g/hr): **57.09**

Approach	Speed (mph)	EF (g/mile)
Leg A	**10**	**12.01**
Leg B	**10**	**12.01**
Leg C	**10**	**12.01**
Leg D	**10**	**12.01**

***Note: Local roadways should be modeled using an approach speed of 15 mph or less.**
Highway ramps should be modeled using an approach speed of 5 mph.

Traffic Signal Timing:

Total Cycle Length (sec): **165**

Red Times:

Type of Movement	Red Times (sec)
Leg A Thru & Rt	**115**
Leg A Left Turn	**140**
Leg B Thru & Rt	**115**
Leg B Left Turn	**140**
Leg C Thru & Rt	**115**
Leg C Left Turn	**---**
Leg D Thru & Rt	**115**
Leg D Left Turn	**---**

***Red times are equal to the "Quick and Easy" values.**

Washington State Intersection Screening Tool 1.0

USER COMMENTS

Point Defiance Bypass Project

User Comments:

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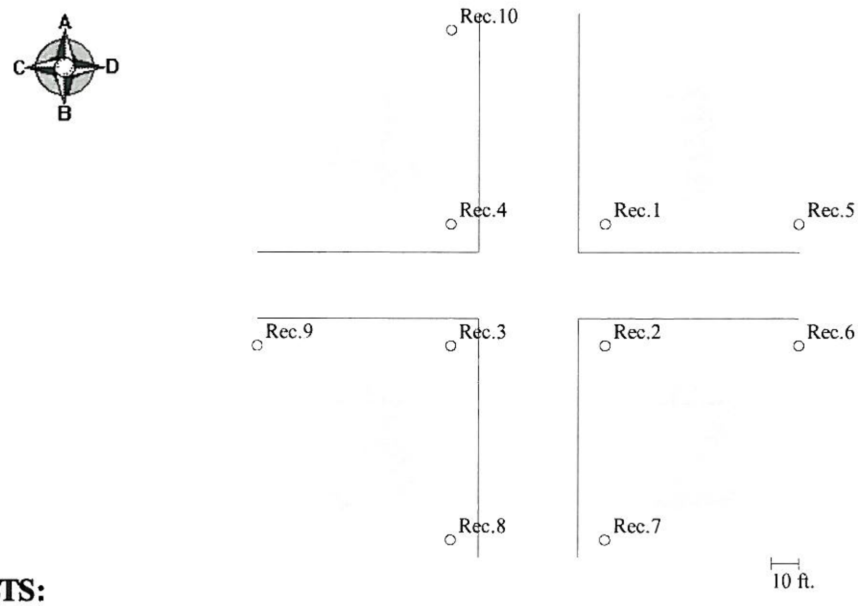
Washington State Intersection Screening Tool 1.0

09-22-11
10:04 AM

Point Defiance Bypass Project

Description:	**Berkeley St & Union Ave existing**
Performed by:	**Akberet Ghebre - WSDOT**
	206-440-4547 - Ghebrea@wsdot.wa.gov
Intersection Type:	**Four-Way Intersection, 2 x 2 w/2 Lt Turns**
Street Names:	**A-B: Union Ave Southwest C-D: Berkeley**



RESULTS:

Receptor#	Quadrant	Distance from A-B roadway (feet)	Distance from C-D roadway (feet)	CO 1-hour avg. Conc. (ppm)	CO 8-hour avg. Conc. (ppm)	Pass/Fail*
1	**1**	**10**	**10**	**5.0**	**4.4**	**Pass**
2	**2**	**10**	**10**	**5.1**	**4.5**	**Pass**
3	**3**	**10**	**10**	**4.8**	**4.3**	**Pass**
4	**4**	**10**	**10**	**5.0**	**4.4**	**Pass**
5	**1**	**80**	**10**	**4.7**	**4.2**	**Pass**
6	**2**	**80**	**10**	**4.8**	**4.3**	**Pass**
7	**2**	**10**	**80**	**4.8**	**4.3**	**Pass**
8	**3**	**10**	**80**	**4.3**	**3.9**	**Pass**
9	**3**	**80**	**10**	**4.8**	**4.3**	**Pass**
10	**4**	**10**	**80**	**4.5**	**4.0**	**Pass**

*Project **PASSES** 1-hr and 8-hr NAAQS of 35 ppm and 9 ppm, respectively.
Largest modeled CO concentrations are at **receptor 2**.

- All CO concentrations include a background concentration of **3.0** ppm.
- 8-hr average CO concentrations are calculated by multiplying the 1-hr average concentrations (without background) by a persistence factor of 0.7 and then adding the background concentration.

USER INPUTS

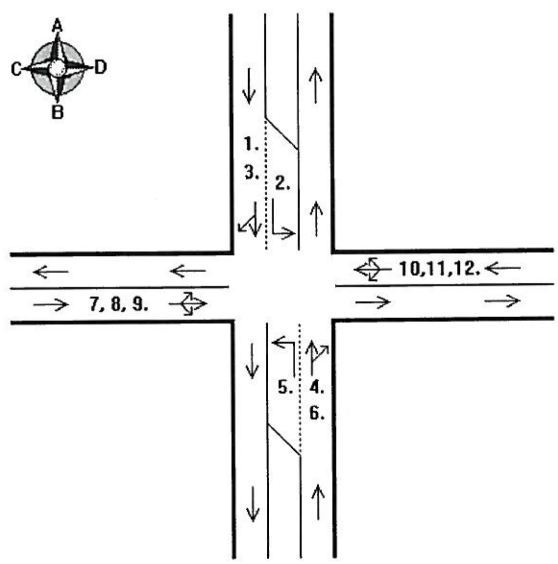
Point Defiance Bypass Project

Intersection Data:

Predominant Surroundings: **Central Business District**

Traffic Volumes:

Vol. Index	Movement	Volume (vph)
1	**A-B Thru**	**25**
2	**A-D Left Turn**	**196**
3	**A-C Right Turn**	**39**
4	**B-A Thru**	**116**
5	**B-C Left Turn**	**56**
6	**B-D Right Turn**	**206**
7	**C-D Thru**	**128**
8	**C-A Left Turn**	**196**
9	**C-B Right Turn**	**30**
10	**D-C Thru**	**95**
11	**D-B Left Turn**	**21**
12	**D-A Right Turn**	**231**



CO Emission Factors Based On:

Location: **Western Washington - PIERCE County**
CO Maint. Area: **Puget Sound**
I/M Program: **Yes**
Model Year: **2010**
Gasoline sulfur content of 160 ppm for 2005-2006, 60 ppm for 2007, & 30 ppm for 2008-2050.

MOBILE6.2 CO Emission Factors:

Idle Emission Factor (g/hr): **103.49**

Approach	Speed (mph)	EF (g/mile)
Leg A	**10**	**20.72**
Leg B	**10**	**20.72**
Leg C	**10**	**20.72**
Leg D	**10**	**20.72**

***Note: Local roadways should be modeled using an approach speed of 15 mph or less. Highway ramps should be modeled using an approach speed of 5 mph.**

Traffic Signal Timing:

Total Cycle Length (sec): **165**

Red Times:

Type of Movement	Red Times (sec)
Leg A Thru & Rt	**115**
Leg A Left Turn	**140**
Leg B Thru & Rt	**115**
Leg B Left Turn	**140**
Leg C Thru & Rt	**115**
Leg C Left Turn	**---**
Leg D Thru & Rt	**115**
Leg D Left Turn	**---**

***Red times are equal to the "Quick and Easy" values.**

User Comments:

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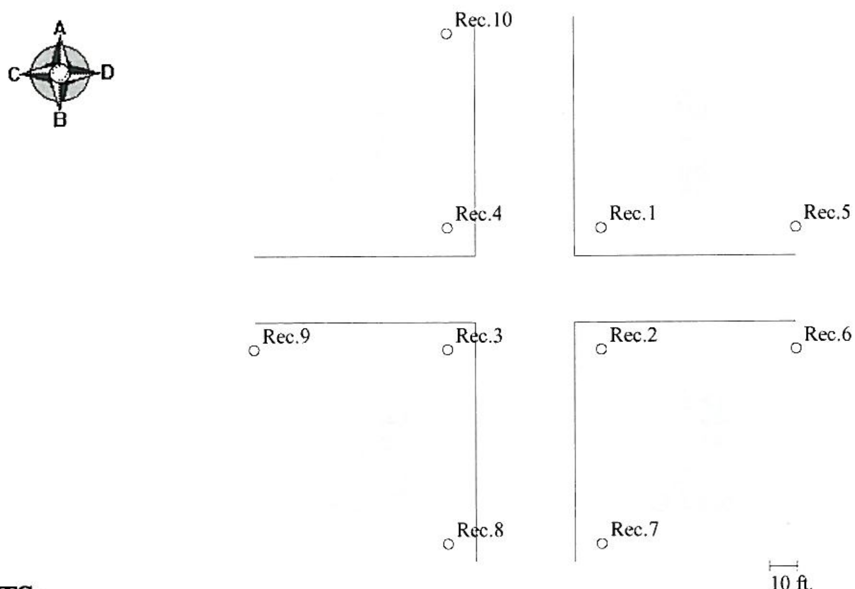
Washington State Intersection Screening Tool 2.0

06-26-11
03:52 PM

Point Defiance Bypass Project

Description:	**Berkeley St & Union Ave 2017 NB**
Performed by:	**Akberet Ghebre - WSDOT**
	206-440-4547 - Ghebrea@wsdot.wa.gov
Intersection Type:	**Four-Way Intersection, 2 x 2 w/2 Lt Turns**
Street Names:	**A-B: Union Ave Southwest C-D: Berkeley**



RESULTS:

Receptor#	Quadrant	Distance from A-B roadway (feet)	Distance from C-D roadway (feet)	CO 1-hour avg. Conc. (ppm)	CO 8-hour avg. Conc. (ppm)	Pass/Fail*
1	**1**	**10**	**10**	**3.9**	**3.6**	**Pass**
2	**2**	**10**	**10**	**4.0**	**3.7**	**Pass**
3	**3**	**10**	**10**	**3.9**	**3.6**	**Pass**
4	**4**	**10**	**10**	**3.9**	**3.6**	**Pass**
5	**1**	**80**	**10**	**3.7**	**3.5**	**Pass**
6	**2**	**80**	**10**	**3.7**	**3.5**	**Pass**
7	**2**	**10**	**80**	**3.7**	**3.5**	**Pass**
8	**3**	**10**	**80**	**3.6**	**3.4**	**Pass**
9	**3**	**80**	**10**	**3.6**	**3.4**	**Pass**
10	**4**	**10**	**80**	**3.6**	**3.4**	**Pass**

*Project **PASSES** 1-hr and 8-hr NAAQS of 35 ppm and 9 ppm, respectively.
Largest modeled CO concentrations are at **receptor 2**.

- All CO concentrations include a background concentration of **3.0** ppm.
- 8-hr average CO concentrations are calculated by multiplying the 1-hr average concentrations (without background) by a persistence factor of 0.7 and then adding the background concentration.

USER INPUTS

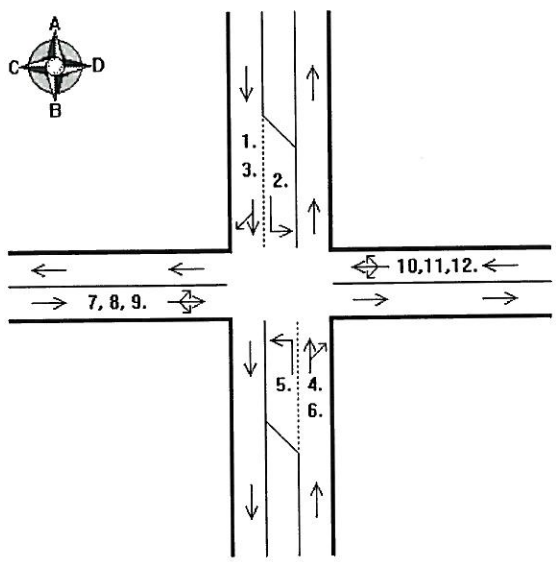
Point Defiance Bypass Project

Intersection Data:

Predominant Surroundings: **Central Business District**

Traffic Volumes:

Vol. Index	Movement	Volume (vph)
1	**A-B Thru**	**27**
2	**A-D Left Turn**	**190**
3	**A-C Right Turn**	**39**
4	**B-A Thru**	**159**
5	**B-C Left Turn**	**54**
6	**B-D Right Turn**	**165**
7	**C-D Thru**	**115**
8	**C-A Left Turn**	**190**
9	**C-B Right Turn**	**27**
10	**D-C Thru**	**93**
11	**D-B Left Turn**	**35**
12	**D-A Right Turn**	**290**



CO Emission Factors Based On:

Location: **Western Washington - PIERCE County**
CO Maint. Area: **Puget Sound**
I/M Program: **Yes**
Model Year: **2017**
Gasoline sulfur content of 30 ppm for all model years.

MOBILE6.2 CO Emission Factors:

Idle Emission Factor (g/hr): **54.38**

Approach	Speed (mph)	EF (g/mile)
Leg A	**10**	**7.98**
Leg B	**10**	**7.98**
Leg C	**10**	**7.98**
Leg D	**10**	**7.98**

***Note: Local roadways should be modeled using an approach speed of 15 mph or less. Highway ramps should be modeled using an approach speed of 5 mph.**

Traffic Signal Timing:

Total Cycle Length (sec): **165**

Red Times:

Type of Movement	Red Times (sec)
Leg A Thru & Rt	**115**
Leg A Left Turn	**140**
Leg B Thru & Rt	**115**
Leg B Left Turn	**140**
Leg C Thru & Rt	**115**
Leg C Left Turn	**---**
Leg D Thru & Rt	**115**
Leg D Left Turn	**---**

***Red times are equal to the "Quick and Easy" values.**

User Comments:

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Washington State Intersection Screening Tool 1.0

09-22-11

10:08 AM

Point Defiance Bypass Project

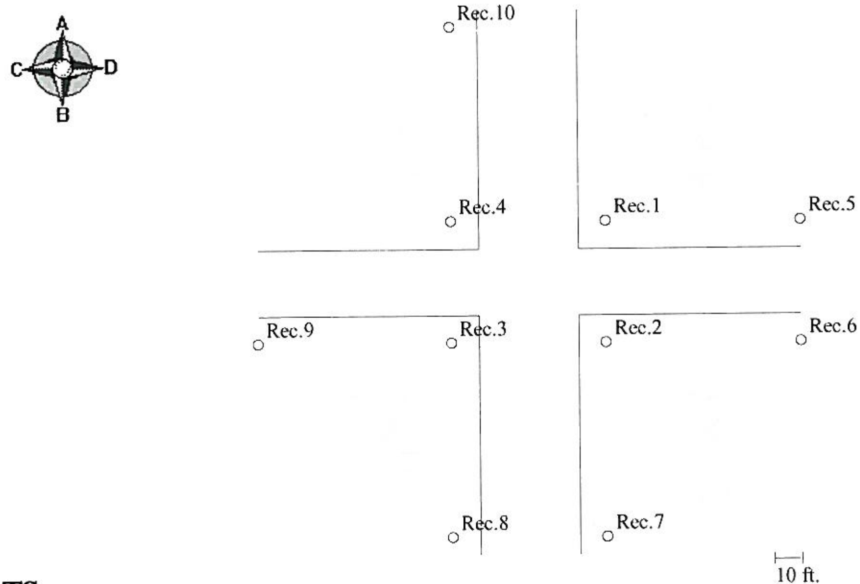
Description: **Berkeley St & Union Ave 2017 Build**

Performed by: **Akberet Ghebre - WSDOT**

206-440-4547 - Ghebrea@wsdot.wa.gov

Intersection Type: **Four-Way Intersection, 2 x 2 w/2 Lt Turns**

Street Names: **A-B: Union Ave Southwest C-D: Berkeley Street**



RESULTS:

Receptor#	Quadrant	Distance from A-B roadway (feet)	Distance from C-D roadway (feet)	CO 1-hour avg. Conc. (ppm)	CO 8-hour avg. Conc. (ppm)	Pass/Fail*
1	**1**	**10**	**10**	**4.4**	**4.0**	**Pass**
2	**2**	**10**	**10**	**4.5**	**4.0**	**Pass**
3	**3**	**10**	**10**	**4.3**	**3.9**	**Pass**
4	**4**	**10**	**10**	**4.6**	**4.1**	**Pass**
5	**1**	**80**	**10**	**4.2**	**3.8**	**Pass**
6	**2**	**80**	**10**	**4.1**	**3.8**	**Pass**
7	**2**	**10**	**80**	**4.2**	**3.8**	**Pass**
8	**3**	**10**	**80**	**4.0**	**3.7**	**Pass**
9	**3**	**80**	**10**	**4.1**	**3.8**	**Pass**
10	**4**	**10**	**80**	**4.1**	**3.8**	**Pass**

*Project **PASSES** 1-hr and 8-hr NAAQS of 35 ppm and 9 ppm, respectively.

Largest modeled CO concentrations are at **receptor 4.**

- All CO concentrations include a background concentration of **3.0** ppm.
- 8-hr average CO concentrations are calculated by multiplying the 1-hr average concentrations (without background) by a persistence factor of 0.7 and then adding the background concentration.

USER INPUTS

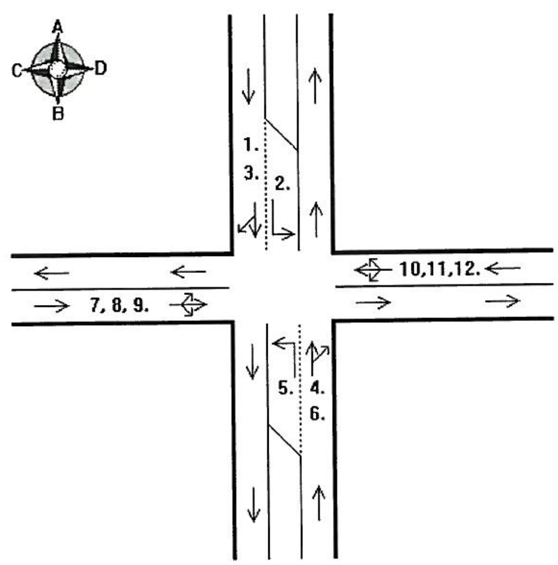
Point Defiance Bypass Project

Intersection Data:

Predominant Surroundings: **Central Business District**

Traffic Volumes:

Vol. Index	Movement	Volume (vph)
1	**A-B Thru**	**27**
2	**A-D Left Turn**	**190**
3	**A-C Right Turn**	**39**
4	**B-A Thru**	**159**
5	**B-C Left Turn**	**54**
6	**B-D Right Turn**	**165**
7	**C-D Thru**	**115**
8	**C-A Left Turn**	**190**
9	**C-B Right Turn**	**27**
10	**D-C Thru**	**93**
11	**D-B Left Turn**	**35**
12	**D-A Right Turn**	**290**



USER INPUTS continued...

Point Defiance Bypass Project

CO Emission Factors Based On:

Location: **Western Washington - PIERCE County**
CO Maint. Area: **Puget Sound**
I/M Program: **Yes**
Model Year: **2017**
Gasoline sulfur content of 160 ppm for 2005-2006, 60 ppm for 2007, & 30 ppm for 2008-2050.

MOBILE6.2 CO Emission Factors:

Idle Emission Factor (g/hr): **70.75**

Approach	Speed (mph)	EF (g/mile)
Leg A	**10**	**14.89**
Leg B	**10**	**14.89**
Leg C	**10**	**14.89**
Leg D	**10**	**14.89**

***Note: Local roadways should be modeled using an approach speed of 15 mph or less. Highway ramps should be modeled using an approach speed of 5 mph.**

Traffic Signal Timing:

Total Cycle Length (sec): **165**

Red Times:

Type of Movement	Red Times (sec)
Leg A Thru & Rt	**115**
Leg A Left Turn	**140**
Leg B Thru & Rt	**115**
Leg B Left Turn	**140**
Leg C Thru & Rt	**115**
Leg C Left Turn	**---**
Leg D Thru & Rt	**115**
Leg D Left Turn	**---**

***Red times are equal to the "Quick and Easy" values.**

User Comments:

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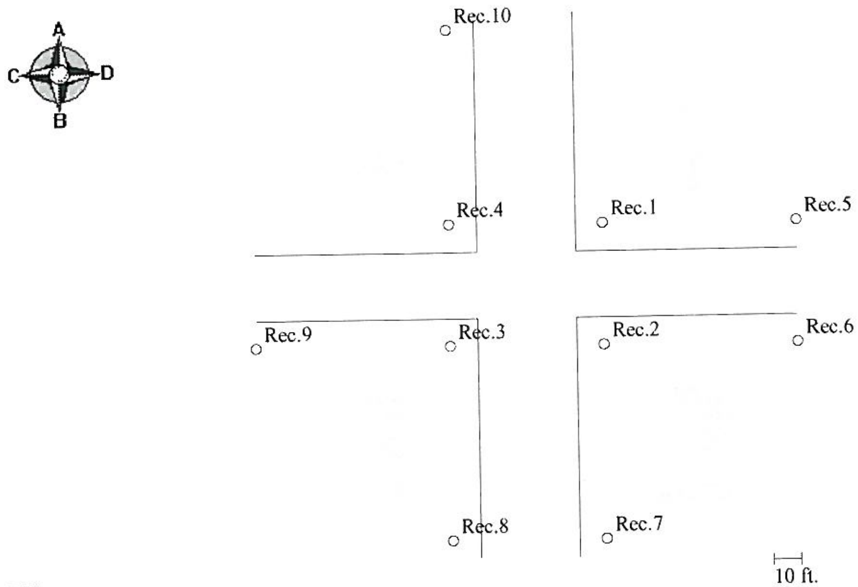
Washington State Intersection Screening Tool 2.0

10-05-11
03:49 PM

Point Defiance Bypass Project

Description: **Berkeley St & Union Ave 2040 NB**
Performed by: **Akberet Ghebre - WSDOT**
206-440-4547 - Ghebrea@wsdot.wa.gov
Intersection Type: **Four-Way Intersection, 2 x 2 w/2 Lt Turns**
Street Names: **A-B: Union Ave Southwest C-D: Berkeley Street**



RESULTS:

Receptor#	Quadrant	Distance from A-B roadway (feet)	Distance from C-D roadway (feet)	CO 1-hour avg. Conc. (ppm)	CO 8-hour avg. Conc. (ppm)	Pass/Fail*
1	**1**	**10**	**10**	**4.2**	**3.8**	**Pass**
2	**2**	**10**	**10**	**4.2**	**3.8**	**Pass**
3	**3**	**10**	**10**	**4.0**	**3.7**	**Pass**
4	**4**	**10**	**10**	**4.3**	**3.9**	**Pass**
5	**1**	**80**	**10**	**4.0**	**3.7**	**Pass**
6	**2**	**80**	**10**	**3.8**	**3.6**	**Pass**
7	**2**	**10**	**80**	**3.9**	**3.6**	**Pass**
8	**3**	**10**	**80**	**3.8**	**3.6**	**Pass**
9	**3**	**80**	**10**	**3.9**	**3.6**	**Pass**
10	**4**	**10**	**80**	**3.9**	**3.6**	**Pass**

*Project **PASSES** 1-hr and 8-hr NAAQS of 35 ppm and 9 ppm, respectively.
Largest modeled CO concentrations are at **receptor 4**.

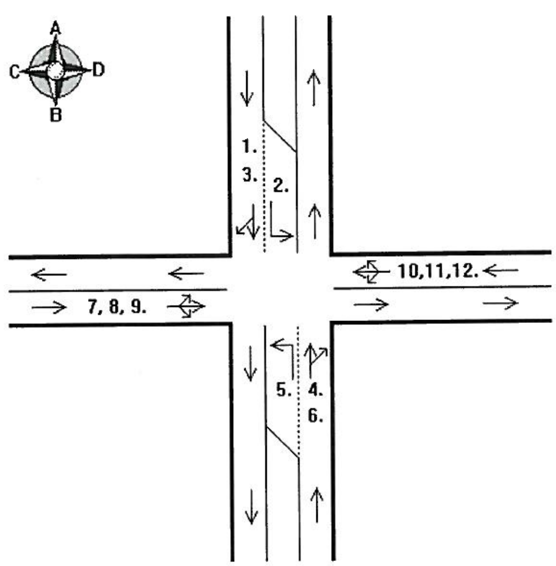
- All CO concentrations include a background concentration of **3.0** ppm.
- 8-hr average CO concentrations are calculated by multiplying the 1-hr average concentrations (without background) by a persistence factor of 0.7 and then adding the background concentration.

Intersection Data:

Predominant Surroundings: **Central Business District**

Traffic Volumes:

Vol. Index	Movement	Volume (vph)
1	**A-B Thru**	**33**
2	**A-D Left Turn**	**172**
3	**A-C Right Turn**	**41**
4	**B-A Thru**	**302**
5	**B-C Left Turn**	**47**
6	**B-D Right Turn**	**32**
7	**C-D Thru**	**71**
8	**C-A Left Turn**	**172**
9	**C-B Right Turn**	**15**
10	**D-C Thru**	**88**
11	**D-B Left Turn**	**80**
12	**D-A Right Turn**	**485**



CO Emission Factors Based On:

Location: **Western Washington - PIERCE County**
CO Maint. Area: **Puget Sound**
I/M Program: **Yes**
Model Year: **2040**
Gasoline sulfur content of 30 ppm for all model years.

MOBILE6.2 CO Emission Factors:

Idle Emission Factor (g/hr): **65.73**

Approach	Speed (mph)	EF (g/mile)
Leg A	**10**	**9.63**
Leg B	**10**	**9.63**
Leg C	**10**	**9.63**
Leg D	**10**	**9.63**

***Note: Local roadways should be modeled using an approach speed of 15 mph or less. Highway ramps should be modeled using an approach speed of 5 mph.**

Traffic Signal Timing:

Total Cycle Length (sec): **165**

Red Times:

Type of Movement	Red Times (sec)
Leg A Thru & Rt	**115**
Leg A Left Turn	**140**
Leg B Thru & Rt	**115**
Leg B Left Turn	**140**
Leg C Thru & Rt	**115**
Leg C Left Turn	**---**
Leg D Thru & Rt	**115**
Leg D Left Turn	**---**

***Red times are equal to the "Quick and Easy" values.**

User Comments:

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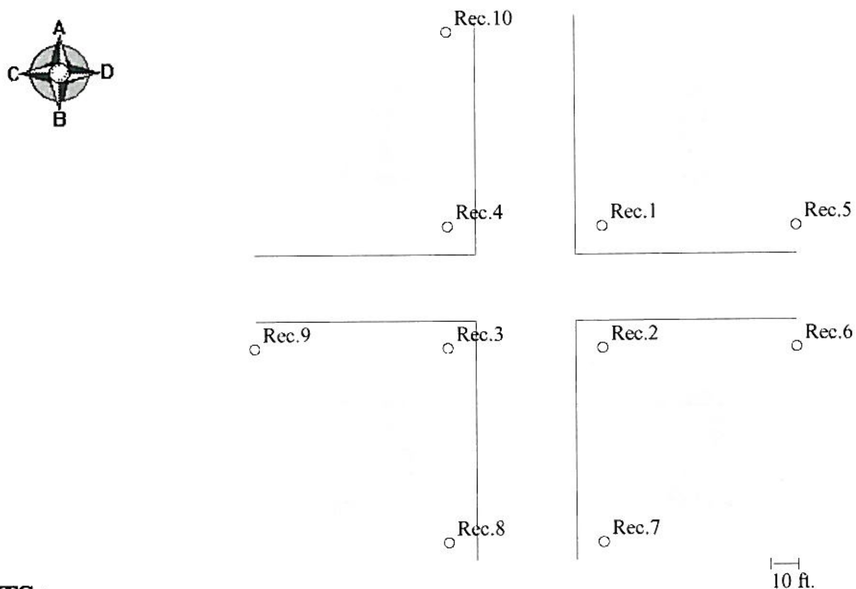
Washington State Intersection Screening Tool 1.0

09-22-11
10:10 AM
Point Defiance Bypass Project

Description:	**Berkeley St & Union Ave 2040 Build**
Performed by:	**Akberet Ghebre - WSDOT**
	206-440-4547 - Ghebrea@wsdot.wa.gov
Intersection Type:	**Four-Way Intersection, 2 x 2 w/2 Lt Turns**
Street Names:	**A-B: Union Ave Southwest C-D: Berkeley Street**



RESULTS:

Receptor#	Quadrant	Distance from A-B roadway (feet)	Distance from C-D roadway (feet)	CO 1-hour avg. Conc. (ppm)	CO 8-hour avg. Conc. (ppm)	Pass/Fail*
1	**1**	**10**	**10**	**4.3**	**3.9**	**Pass**
2	**2**	**10**	**10**	**4.3**	**3.9**	**Pass**
3	**3**	**10**	**10**	**4.2**	**3.8**	**Pass**
4	**4**	**10**	**10**	**4.4**	**4.0**	**Pass**
5	**1**	**80**	**10**	**4.0**	**3.7**	**Pass**
6	**2**	**80**	**10**	**3.8**	**3.6**	**Pass**
7	**2**	**10**	**80**	**4.0**	**3.7**	**Pass**
8	**3**	**10**	**80**	**3.8**	**3.6**	**Pass**
9	**3**	**80**	**10**	**3.9**	**3.6**	**Pass**
10	**4**	**10**	**80**	**4.0**	**3.7**	**Pass**

*Project **PASSES** 1-hr and 8-hr NAAQS of 35 ppm and 9 ppm, respectively.
Largest modeled CO concentrations are at **receptor 4**.

- All CO concentrations include a background concentration of **3.0** ppm.
- 8-hr average CO concentrations are calculated by multiplying the 1-hr average concentrations (without background) by a persistence factor of 0.7 and then adding the background concentration.

Washington State Intersection Screening Tool 1.0

USER INPUTS

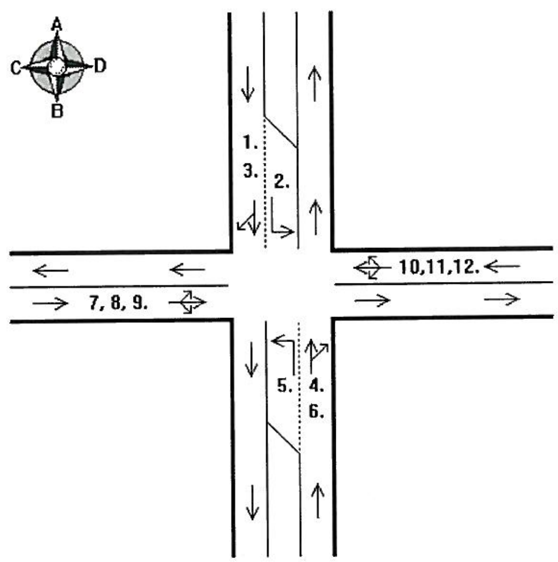
Point Defiance Bypass Project

Intersection Data:

Predominant Surroundings: **Central Business District**

Traffic Volumes:

Vol. Index	Movement	Volume (vph)
1	**A-B Thru**	**33**
2	**A-D Left Turn**	**172**
3	**A-C Right Turn**	**41**
4	**B-A Thru**	**302**
5	**B-C Left Turn**	**47**
6	**B-D Right Turn**	**32**
7	**C-D Thru**	**71**
8	**C-A Left Turn**	**172**
9	**C-B Right Turn**	**15**
10	**D-C Thru**	**88**
11	**D-B Left Turn**	**80**
12	**D-A Right Turn**	**485**



CO Emission Factors Based On:

Location: **Western Washington - PIERCE County**
CO Maint. Area: **Puget Sound**
I/M Program: **Yes**
Model Year: **2040**
Gasoline sulfur content of 160 ppm for 2005-2006, 60 ppm for 2007, & 30 ppm for 2008-2050.

MOBILE6.2 CO Emission Factors:

Idle Emission Factor (g/hr): **57.09**

Approach	Speed (mph)	EF (g/mile)
Leg A	**10**	**12.01**
Leg B	**10**	**12.01**
Leg C	**10**	**12.01**
Leg D	**10**	**12.01**

***Note: Local roadways should be modeled using an approach speed of 15 mph or less. Highway ramps should be modeled using an approach speed of 5 mph.**

Traffic Signal Timing:

Total Cycle Length (sec): **165**

Red Times:

Type of Movement	Red Times (sec)
Leg A Thru & Rt	**115**
Leg A Left Turn	**140**
Leg B Thru & Rt	**115**
Leg B Left Turn	**140**
Leg C Thru & Rt	**115**
Leg C Left Turn	**---**
Leg D Thru & Rt	**115**
Leg D Left Turn	**---**

***Red times are equal to the "Quick and Easy" values.**

Washington State Intersection Screening Tool 1.0

USER COMMENTS

Point Defiance Bypass Project

User Comments:

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