

FINAL ENVIRONMENTAL IMPACT STATEMENT
AND FINAL SECTION 4(F) AND 6(f) EVALUATIONS
SR 520 BRIDGE REPLACEMENT AND HOV PROGRAM

MAY 2011

SR 520, I-5 to Medina: Bridge Replacement and HOV Project

Energy Discipline Report
Addendum and Errata

SR 520, I-5 to Medina: Bridge
Replacement and HOV Project
Final EIS

**Energy Discipline Report
Addendum and Errata**



Prepared for
Federal Highway Administration
Washington State Department of Transportation

Consultant Team
Parametrix, Inc.
CH2M HILL
HDR Engineering, Inc.
Parsons Brinckerhoff
ICF Jones & Stokes
Confluence Environmental Company, Inc.
Michael Minor and Associates
PRR, Inc.
Critigen

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Acronyms and Abbreviations

CAFE	corporate average fuel economy
CTC	Concrete Technology Corporation, Inc.
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
GHG	greenhouse gas
HOV	high-occupancy vehicle
I-5	Interstate 5
I-90	Interstate 90
MBtu	million British thermal unit(s)
MOVES	Motor Vehicle Emissions Simulator
NHTSA	National Highway Traffic Safety Administration
PSRC	Puget Sound Regional Council
SDEIS	Supplemental Draft Environmental Impact Statement
SR	State Route
SR 520, I-5 to Medina project	SR 520, I-5 to Medina: Bridge Replacement and HOV Project
VMT	vehicle miles traveled
WSDOT	Washington State Department of Transportation



Introduction

What is the purpose of this addendum?

This addendum to the SR 520, I-5 to Medina: Bridge Replacement and HOV Project Supplemental Draft Environmental Impact Statement (SDEIS) Energy Discipline Report (Washington State Department of Transportation [WSDOT] 2009a) presents the environmental consequences of the Preferred Alternative for the SR 520, I-5 to Medina: Bridge Replacement and HOV Project. This document compares the Preferred Alternative's effects to those of design Options A, K, and L discussed in the SDEIS for the project (WSDOT 2010). In addition, this addendum reflects additional analyses that resulted from the public and agency comments received on the SDEIS. These analyses are shown in the context of the Preferred Alternative. The information contained in the 2009 Energy Discipline Report on affected environment and project effects is still pertinent to the Preferred Alternative and its effects, except where this addendum specifically revises it. Text updated to reflect the Preferred Alternative has been cross-referenced using the page numbers contained within the 2009 Energy Discipline Report. Where an addendum exhibit updates or adds new data and/or different potential effects to an exhibit contained in the 2009 Energy Discipline Report, the exhibit name is followed by "(update to Exhibit # of the 2009 Discipline Report)."

New information used in the description of the affected environment includes project design and construction information used in the analysis of potential effects includes the Description of Alternatives Discipline Report Addendum (WSDOT 2011a), the Construction Techniques and Activities Discipline Report Addendum and Errata (WSDOT 2011b), and the Final Transportation Discipline Report (WSDOT 2011c). The Puget Sound Regional Council (PSRC) Travel Demand Model provided traffic data. Motor Vehicle Emissions Simulator (MOVES) 2010 was used to develop emission factors for the analysis. The Washington State Department of Ecology provided county-specific vehicle fraction data.

An errata sheet is attached to this addendum (Attachment 1) to show revisions and clarifications to the 2009 Energy Discipline Report that do not constitute new findings or analysis.

What key issues were identified in the public and agency comments on the SDEIS?

Key energy concerns identified in public comments were as follows:

- Concerns about transportation network assumptions, with questions about accounting for light rail on Interstate 90 (I-90) and possible system-wide tolling
- Request for regional analysis of greenhouse gas (GHG) emissions, reflecting both concerns about trips diverted to State Route (SR) 522 and I-90, and more general climate change concerns



- Request for qualitative analysis of embodied emissions, that is, the emissions generated in producing the materials that are used in the construction process.

The errata sheet in Attachment 1 presents revisions to the 2009 Energy Discipline Report that respond to the public and agency comments.

Note that in 2008 Washington State established statewide greenhouse gas reduction goals to reduce emissions to:

- 1990 levels by 2020
- 25 percent below 1990 levels in 2035
- 50 percent below 1990 levels in 2050

The state has not apportioned the goals to specific sectors such as transportation, electricity use and generation, or industrial sources. Achieving statewide greenhouse gas emissions targets will require reducing emissions from all sources.

Reducing transportation sector greenhouse gas emissions requires a systems approach to reduce inefficient movement of people, goods, and services over a variety of travel modes, geographic areas and economic and social activities. WSDOT is working with regional and local jurisdictions and other interested parties to develop and implement strategies to reduce emissions throughout the state. For more information about recent work on statewide transportation greenhouse gas emissions, please see the WSDOT 2010 Sustainable Transportation report (available at: <http://www.wsdot.wa.gov/SustainableTransportation/report.htm>).

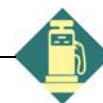
What are the key points of this addendum?

The following bullets summarize the main effects of the Preferred Alternative on energy consumption and GHG emissions. In general, many of the effects would be similar to those of Option A. The effects of the Preferred Alternative are discussed in the sections that follow.

The SDEIS evaluated three design options for the Build Alternative, each with different project components – Options A, K, and L. Since publication of the SDEIS, WSDOT has identified a Preferred Alternative to evaluate further in the Final Environmental Impact Statement (EIS). The Preferred Alternative is a build alternative very similar to Option A, but with design refinements to further reduce potential project effects.

For the Final EIS, analysis of the No Build Alternative was completed using up-to-date assumptions about tolling and other transportation projects that would be built and operating in the region even if the SR 520, I-5 to Medina project were not built. For this reason, the updated No Build Alternative differs from the original No Build Alternative, and the two should not be compared. In this addendum, Options A, K, and L are compared to the Preferred Alternative.

- The construction and operation of the Preferred Alternative or any of the SDEIS options would consume large amounts of energy resources, particularly petroleum. Because GHGs released



during construction and operation come primarily from the fuel burned, GHGs would be emitted by these activities and would be roughly proportional to these activities.

- Energy consumption during construction of the Preferred Alternative is expected to be about the same as under Option A, with generally the same types and numbers of equipment over the construction period.
- Operation of the Preferred Alternative would consume less energy than operation of the roadway under the updated No Build Alternative because it would result in a reduction in vehicle miles traveled (VMT) along the SR 520 corridor. The reduction in VMT is based on traffic modeling that assumed that tolls would be charged for the Preferred Alternative. Tolling might encourage some travelers to seek alternative routes across Lake Washington. Other travelers would likely change transportation modes and benefit from the addition of high-occupancy vehicle (HOV) lanes.
- No tolls would be in effect in 2030 under the No Build Alternative condition.
- Under the updated No Build Alternative, GHG emissions along the SR 520 corridor would increase by about 20 percent over existing conditions due to increased traffic volumes and lower travel speeds. The Preferred Alternative would result in about a 10 percent increase in emissions on the corridor over existing conditions, about 10 percent less than under the No Build Alternative.
- Improved vehicle fuel efficiency required by existing law (current corporate average fuel economy [CAFE] standards) will further reduce emissions on the corridor by over 20 percent. Taking into account these new vehicle standards, the Preferred Alternative is expected to provide almost a 15 percent decrease in GHG emissions in comparison to existing conditions, whereas the No Build Alternative would not result in a measurable reduction in emissions. In addition, the U.S. Environmental Protection Agency (EPA) and National Highway Traffic Safety Administration (NHTSA) are working to establish additional standards for light duty vehicles out to 2025 and, for the first time, standards for medium and heavy-duty vehicles for the years 2014 to 2018. With these additional standards in place, emissions on the corridor would likely decrease further under both the Build and No Build alternatives.
- A sub-regional analysis of GHGs was completed for area roadways on which the project would cause changes to traffic. These roadways were SR 520, I-90, I-5, I-405, and arterials in central Seattle (including the University District), north Mercer Island, and most of Bellevue, Kirkland, and Redmond. In this sub-region, on-road GHG emissions are expected to increase by about 20 percent between now and 2030, regardless of the alternative or option identified for SR 520.

Vehicle Miles Traveled

Vehicle miles traveled (VMT) is the number of miles vehicles travel each year. For transportation projects with set boundaries, VMT refers to the aggregate number of miles that all the vehicles travel using the specified roadways. VMT in Washington has held steady at about 9,000 miles per person since the 1980s, meaning the statewide VMT has grown at roughly the same pace as population.

Methods of reducing VMT typically target transferring trips from single occupant vehicles to multiple person vehicles like carpools, vanpools, and transit. VMT can also be lowered by reducing the distance of travel through changes in land use.



- From a regional perspective, VMT would be the same for the updated No Build Alternative and the Preferred Alternative. Therefore, on a large scale there would not be a noteworthy difference between energy consumed under the No Build Alternative and energy consumed under the Preferred Alternative within the central Puget Sound region.

What is the SR 520, I-5 to Medina: Bridge Replacement and HOV Project?

The SR 520, I-5 to Medina: Bridge Replacement and HOV Project would widen the SR 520 corridor to six lanes from I-5 in Seattle to Evergreen Point Road in Medina, and would restripe and reconfigure the lanes in the corridor from Evergreen Point Road to 92nd Avenue NE in Yarrow Point. It would replace the vulnerable Evergreen Point Bridge (including the west and east approach structures) and Portage Bay Bridge, as well as the existing local street bridges across SR 520. The project would complete the regional HOV lane system across SR 520, as called for in regional and local transportation plans.

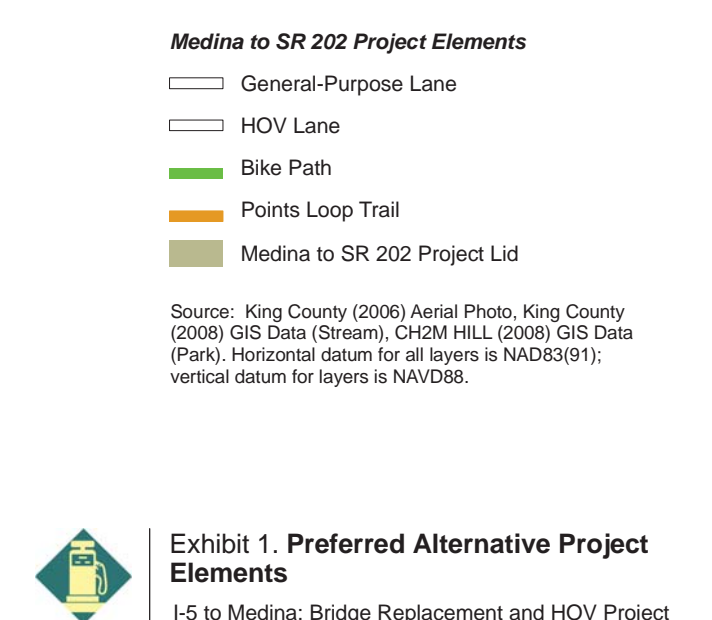
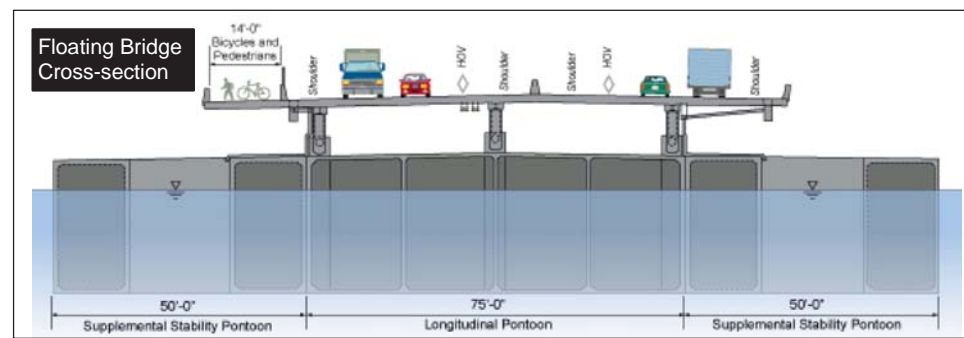
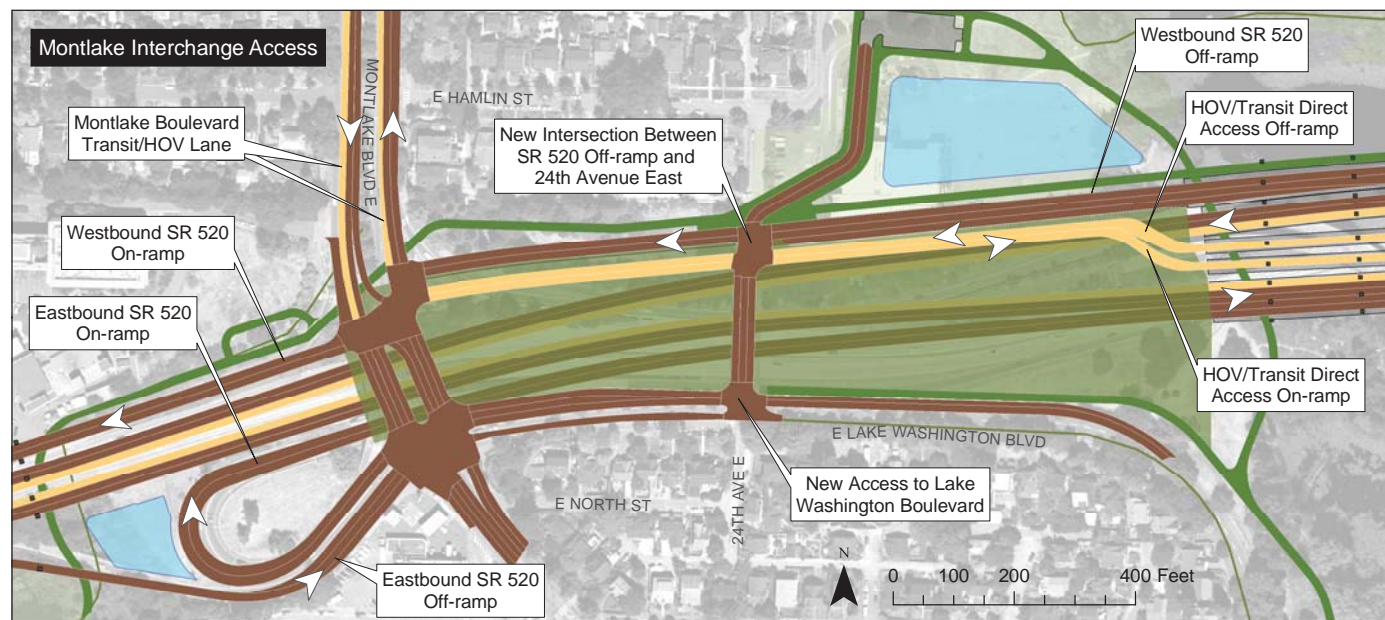
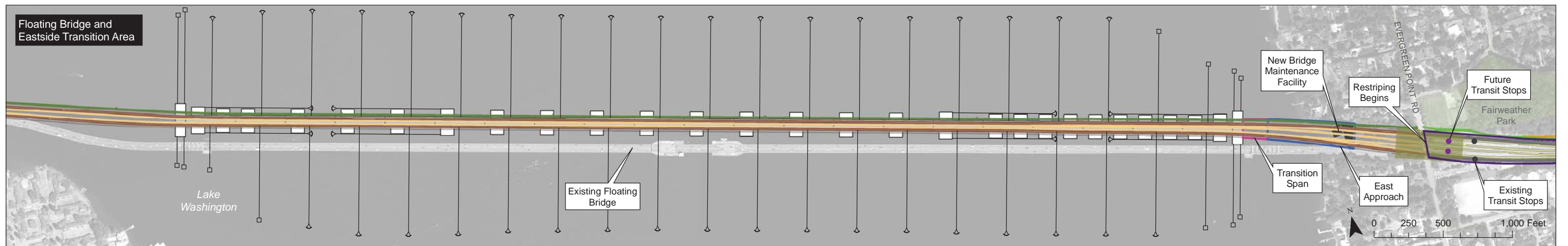
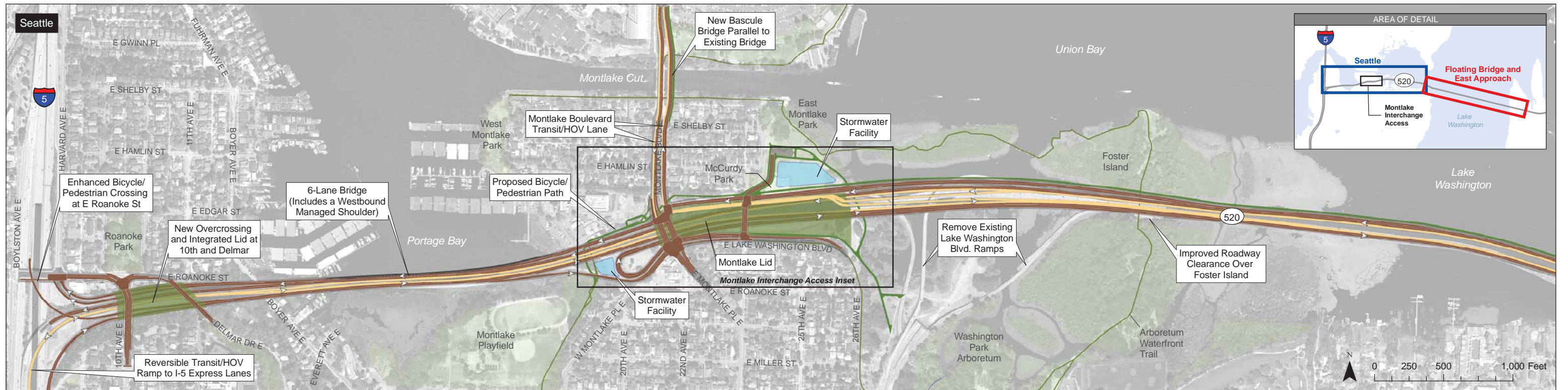
What is the Preferred Alternative?

The new SR 520 corridor would be six lanes wide (two 11-foot-wide outer general-purpose lanes and one 12-foot-wide inside HOV lane in each direction), with 4-foot-wide inside shoulders and 10-foot-wide outside shoulders across the floating bridge. The typical roadway cross-section across the floating bridge would be approximately 116 feet wide, compared to the existing width of 60 feet. In response to community interests expressed during public review of the January 2010 SDEIS, the SR 520 corridor between I-5 and the Montlake interchange would operate as a boulevard or parkway with a posted speed limit of 45 miles per hour and median planting across the Portage Bay Bridge. To support the boulevard concept, the width of the inside shoulders in this section of SR 520 would be narrowed from 4 feet to 2 feet, and the width of the outside shoulders would be reduced from 10 feet to 8 feet. Exhibit 1 highlights the major components of the Preferred Alternative.

The Preferred Alternative would include the following elements:

- An enhanced bicycle/pedestrian crossing adjacent to the East Roanoke Street bridge over I-5
- Reversible transit/HOV ramp to the I-5 express lanes, southbound in the morning and northbound in the evening
- New undercrossings and an integrated lid at 10th Avenue East and Delmar Drive East
- A six-lane Portage Bay Bridge with a 14-foot-wide westbound managed shoulder that would be used as an auxiliary lane during peak commute hours
- An improved urban interchange at Montlake Boulevard integrated with a 1,400-foot-long lid configured for transit, pedestrian, and community connectivity





- A new bascule bridge across the Montlake Cut that provides additional capacity for transit/HOV, bicycles, and pedestrians
- Improved bridge clearance over Foster Island and the Arboretum Waterfront Trail
- A new west approach bridge configured to be compatible with future high-capacity transit (including light rail)
- A new floating bridge with two general-purpose lanes, and one HOV lane in each direction
- A new 14-foot-wide bicycle/pedestrian path with scenic pull-outs along the north side of the new Evergreen Point Bridge (west approach, floating span, and east approach), connecting regional trails on both sides of Lake Washington
- A new bridge maintenance facility and dock located underneath the east approach of the Evergreen Point Bridge
- Re-striped and reconfigured roadway between the east approach and 92nd Avenue NE, tying in to improvements made by the SR 520, Medina to SR 202: Eastside Transit and HOV Project
- Design features that would also provide noise reduction including reduced speed limit on Portage Bay Bridge, 4-foot concrete traffic barriers, and noise absorptive materials applied to the inside of the 4-foot traffic barriers and lid portals. Quieter concrete pavement would also be used for the new SR 520 main line, and noise walls where recommended by the noise analysis and approved by affected property owners would be included in the design
- Basic and enhanced stormwater treatment facilities

Exhibit 2 summarizes the Preferred Alternative design compared to the existing corridor elements, and compares the Preferred Alternative to design options A, K, and L as described in the SDEIS. For a more detailed description of the Preferred Alternative, see the Description of Alternatives Discipline Report Addendum (WSDOT 2011a).

When will the project be built?

Construction for the SR 520, I-5 to Medina project is planned to begin in 2012, after project permits and approvals are received. To maintain traffic flow in the corridor, the project would be built in stages. Major construction in the corridor is expected to be complete in 2018. The most vulnerable structures (the Evergreen Point Bridge including the west and east approaches, and Portage Bay Bridge) would be built in the first stages of construction, followed by the less vulnerable components (Montlake and I-5 interchanges). Exhibit 3 provides an overview of the anticipated construction stages and durations identified for the SR 520, I-5 to Medina project.



Exhibit 2. Preferred Alternative and Comparison to SDEIS Options

Geographic Area	Preferred Alternative	Comparison to SDEIS Options A, K, and L
I-5/Roanoke Area	The SR 520 and I-5 interchange ramps would be reconstructed with generally the same ramp configuration as the ramps for the existing interchange. A new reversible transit/HOV ramp would connect with the I-5 express lanes.	Similar to all options presented in the SDEIS. Instead of a lid over I-5 at Roanoke Street, the Preferred Alternative would include an enhanced bicycle/pedestrian path adjacent to the existing Roanoke Street Bridge.
Portage Bay Area	The Portage Bay Bridge would be replaced with a wider and, in some locations, higher structure with six travel lanes and a 14-foot-wide westbound managed shoulder.	Similar in width to Options K and L, similar in operation to Option A. Shoulders are narrower than described in SDEIS (2-foot-wide inside shoulders, 8-foot-wide outside shoulder on eastbound lanes), posted speed would be reduced to 45 mph, and median plantings would be provided to create a boulevard-like design.
Montlake Area	The Montlake interchange would remain in a similar location as today. A new bascule bridge would be constructed over the Montlake Cut. A 1,400-foot-long lid would be constructed between Montlake Boulevard and the Lake Washington shoreline. The bridge would include direct-access ramps to and from the Eastside. Access would be provided to Lake Washington Boulevard via a new intersection at 24th Avenue East.	Interchange location similar to Option A. Lid would be approximately 75 feet longer than previously described for Option A, and would be a complete lid over top of the SR 520 main line, which would require ventilation and other fire, life, and safety systems. Transit connections would be provided on the lid to facilitate access between neighborhoods and the Eastside. Montlake Boulevard would be restriped for two general-purpose lanes and one HOV lane in each direction between SR 520 and the Montlake Cut.
West Approach Area	The west approach bridge would be replaced with wider and higher structures, maintaining a constant profile rising from the shoreline at Montlake out to the west transition span. Bridge structures would be compatible with potential future light rail through the corridor.	Bridge profile most similar to Option L, and slightly steeper; structure types similar to Options A and L. The gap between the eastbound and westbound structures would be wider than previously described to accommodate light rail in the future.
Floating Bridge Area	A new floating span would be located approximately 190 feet north of the existing bridge at the west end and 160 feet north of the existing bridge at the east end. The floating bridge would be approximately 20 feet above the water surface at the midspan (about 10 to 12 feet higher than the existing bridge deck).	Similar to design described in the SDEIS. The bridge would be approximately 10 feet lower than described in the SDEIS, and most of the roadway deck support would be constructed of steel trusses instead of concrete columns.
Eastside Transition Area	A new east approach to the floating bridge, and a new SR 520 roadway would be constructed between the floating bridge and Evergreen Point Road.	Same as described in the SDEIS.



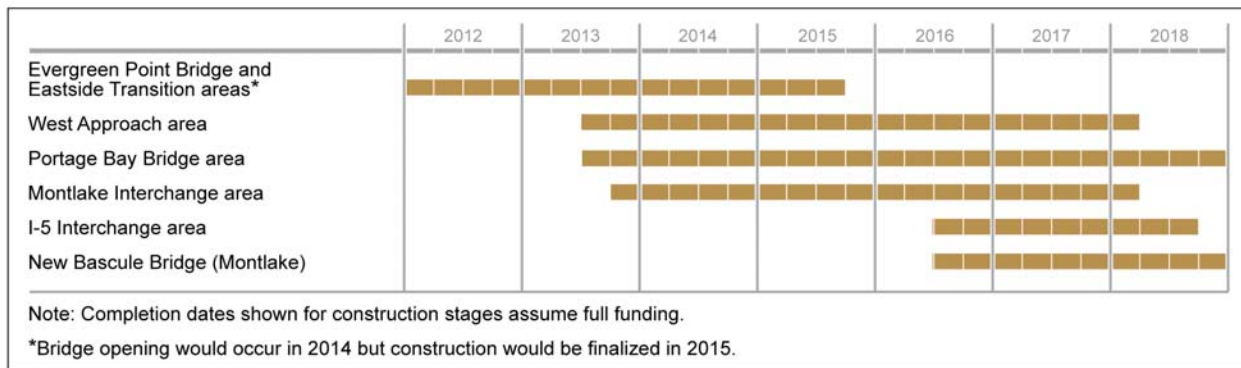


Exhibit 3. Preferred Alternative Construction Stages and Durations

A Phased Implementation scenario was discussed in the SDEIS as a possible delivery strategy to complete the SR 520, I-5 to Medina project in phases over an extended period. FHWA and WSDOT continue to evaluate the possibility of phased construction of the corridor should full project funding not be available by 2012. Current committed funding is sufficient to construct the floating portion of the Evergreen Point Bridge, as well as the new east approach and a connection to the existing west approach. The Final EIS discusses the potential for the floating bridge and these east and west “landings” to be built as the first phase of the SR 520, I-5 to Medina project. This differs from the SDEIS Phased Implementation scenario, which included the west approach and the Portage Bay Bridge in the first construction phase. Chapters 5.15 and 6.16 of the Final EIS summarize the effects for this construction phase. Therefore, this discipline report addendum addresses only the effects anticipated as a result of the updated construction schedule.

Are pontoons being constructed as part of this project?

WSDOT has completed planning and permitting for a new facility that will build and store the 33 pontoons needed to replace the existing capacity of the floating portion of the Evergreen Point Bridge in the event of a catastrophic failure. If the bridge does not fail before its planned replacement, WSDOT would use the 33 pontoons constructed and stored as part of the SR 520 Pontoon Construction Project in the SR 520, I-5 to Medina project. An additional 44 pontoons would be needed to complete the new 6-lane floating bridge planned for the SR 520, I-5 to Medina project. The additional pontoons would be constructed at Concrete Technology Corporation in the Port of Tacoma, and if available, at the new pontoon construction facility located on the shores of Grays Harbor in Aberdeen, Washington. Final pontoon construction locations will be identified at the discretion of the contractor. For additional information about project construction schedules and pontoon construction, launch, and transport, please see the Construction Techniques and Activities Discipline Report Addendum and Errata (WSDOT 2011b).



Affected Environment

What were the updates to the affected environment?

Other than the addition of the sub-regional study area, there were no updates to the affected environment for energy and GHGs since preparation of the SDEIS analysis. The Energy Discipline Report describes the affected environment for energy effects (pages 15 through 18, WSDOT 2009a). In addition, the Energy Discipline Report provides a background discussion for GHG effects (pages 31 through 34, WSDOT 2009a).

Potential Effects

The Energy Discipline Report provides a detailed discussion of effects of the No Build Alternative and SDEIS options (WSDOT 2009a, pages 19 through 28). This addendum provides an updated analysis of the No Build Alternative because there are updated assumptions about the baseline transportation network. The discussion below supplements the 2009 Energy Discipline Report and compares the effects of the Preferred Alternative with the effects of the No Build Alternative and SDEIS options using new text and new or updated exhibits where appropriate.

What were the methods used to evaluate the potential effects and how have they changed since publication of the SDEIS?

Construction Analysis

Energy

The analysis of energy consumption associated with construction of the Preferred Alternative project used the same methodology as described in the Energy Discipline Report (WSDOT 2009a, pages 19 through 21).

Greenhouse Gas Emissions

Greenhouse gas emissions associated with project construction were calculated for the Preferred Alternative and the updated No Build Alternative using the methodology described in the Energy Discipline Report (WSDOT 2009a, pages 34 through 35). Since the GHG emissions are calculated from the energy use, the construction GHG emissions also include embodied emissions. The methodology included direct emissions (fuel burned onsite) and indirect emissions (energy used offsite resulting in emissions, such as fuel burned during the manufacture of concrete).



Operations Analysis

Energy

The methodology for the energy analysis is the same as described in the Energy Discipline Report (WSDOT 2009a, pages 21 through 22), except that it incorporated the same revised transportation network assumptions used for the Final EIS transportation analysis. Some of the major changes described in the Final Transportation Discipline Report (WSDOT 2011c) were:

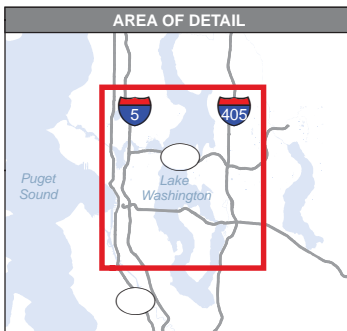
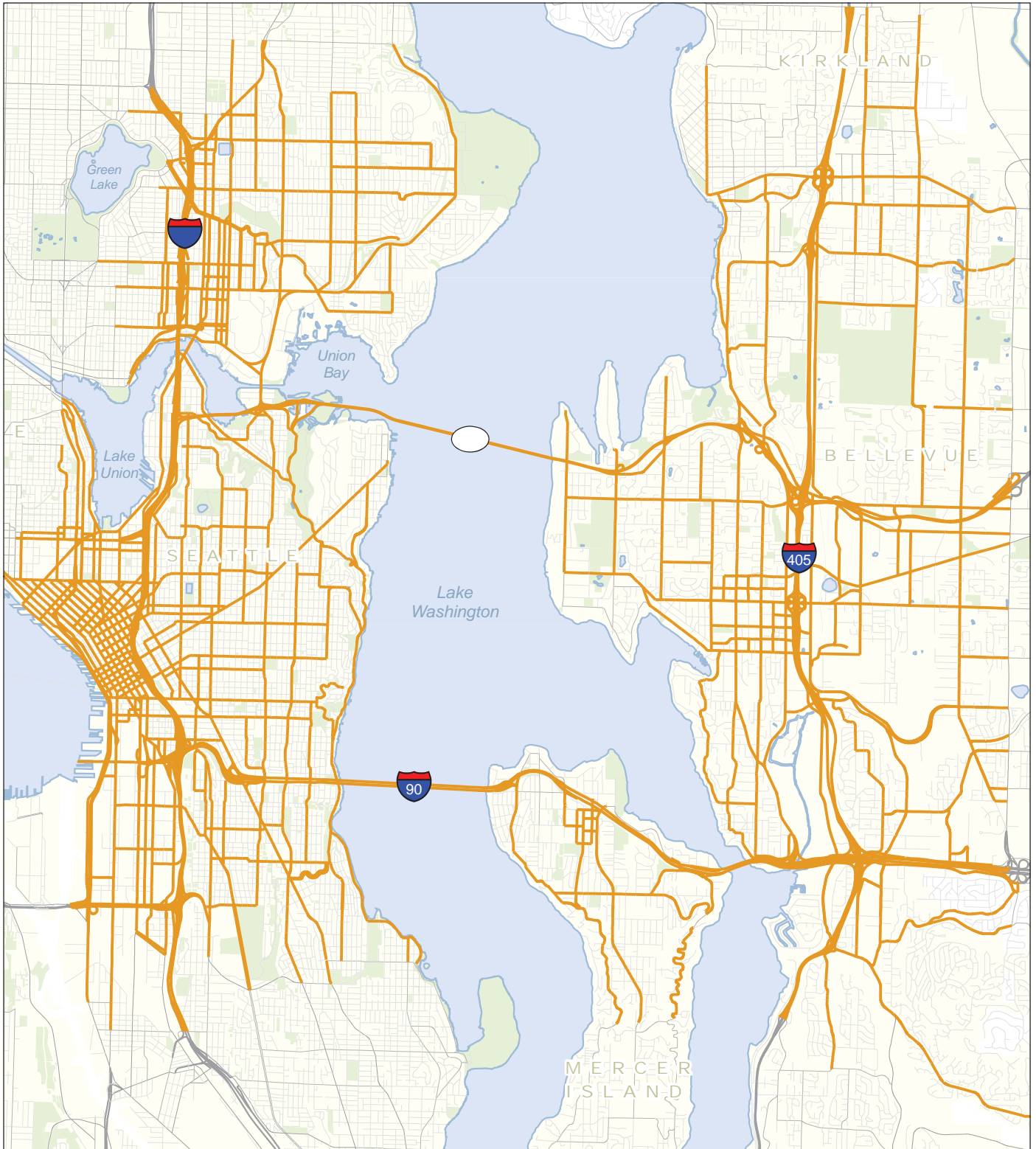
- Tolling was assumed to be single-point, rather than the segmental tolling assumed in the SDEIS analysis. As with the SDEIS analysis, 3+ HOV would be exempt from the toll.
- The complete East Link light rail line was assumed to be in operation in 2030. The East Link line includes light rail across the I-90 bridges.
- As with the SDEIS analysis, the University Link light rail project was assumed to be in operation in 2030.

Greenhouse Gas Emissions

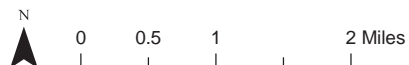
Operational greenhouse gas emissions in the project study area were calculated using the same methodology described in the Energy Discipline Report (WSDOT 2009a, pages 36 through 37). This analysis considered how changes in traffic on the SR 520 corridor would affect GHG emissions and compared the findings of the Preferred Alternative to those for the SDEIS options and the No Build Alternative. The analysis of the Preferred Alternative and updated No Build Alternative is based on the same updated transportation network assumptions described for the energy operations analysis above.

In addition to the GHG analyses conducted for the SDEIS options, a second evaluation was conducted to better understand the effects of the project on GHG emissions. This second study was based on an area referred to as the sub-regional study area. Exhibit 4 shows the roadways evaluated for this second analysis. The intent of analyzing operational effects for the sub-regional study area is to capture the effects of trips on other roadways that would be affected by the project, such as potential trips diverted to I-90, I-5, I-405, or local routes because of tolling.





- Major Street Network in the Study Area
- Park



Source: King County (2008) GIS Data (Streams, Streets, Water Bodies), CH2M HILL (2008) GIS Data (Parks). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 4. Sub-Regional Study Area Map for Greenhouse Gas Emissions

I-5 to Medina: Bridge Replacement and HOV Project

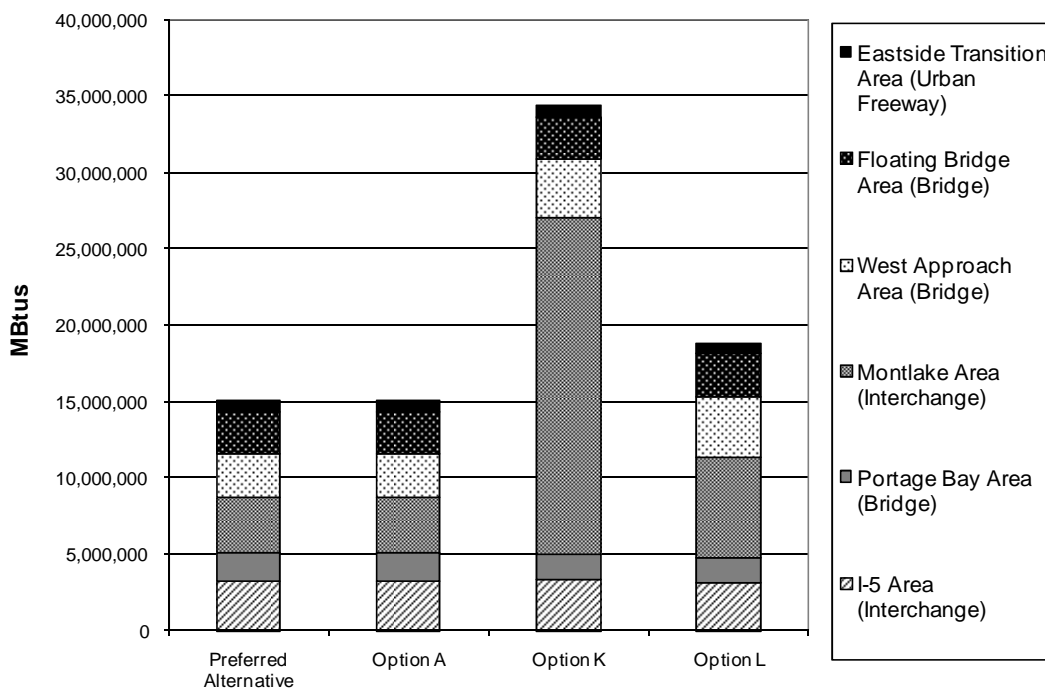
How would construction of the Preferred Alternative affect energy and greenhouse gas emissions?

Energy

Construction Effects on Energy Use

Effects of the Preferred Alternative would be similar to those described for Option A in the Energy Discipline Report (WSDOT 2009a, pages 23 through 25). Exhibit 5 summarizes the total energy consumption during construction of the Preferred Alternative and the SDEIS options.

Exhibit 5. Total Energy Consumption during Construction of the Preferred Alternative and the SDEIS Options (Update to Exhibit 14 of the 2009 Discipline Report)



Pontoon Transport from Moorage Locations to Project Site

Effects of pontoon transport would be the same as described in the 2009 Energy Discipline Report, as shown in Exhibit 6 (Exhibit 15 of the 2009 Discipline Report). A total of 112,000 million British thermal units (MBtu) would be needed for pontoon transport from the Grays Harbor and Concrete Technology Corporation, Inc. (CTC) pontoon construction facility sites to the project site.

Summary of Construction Effects

Exhibit 7 summarizes construction energy consumption. The amount of energy used during project construction would be roughly proportional to the cost of the project. The Preferred Alternative is expected to have the same construction costs as Option A; therefore, the Preferred Alternative’s energy effects are the same as Option A and less than Options K and L.



Exhibit 6. Estimated Diesel Fuel Consumption and Energy Use during Transport of Pontoons (Exhibit 15 of the 2009 Discipline Report)

Route	Number of Trips	Est. Miles per Trip	Est. Total Miles	Est. Avg. mph	Est. Operating Hours	Diesel Fuel Consumption ^a (gallons)	MBtu ^b
Grays Harbor to SR 520	56	254	14,224	3	4741	711,150	99,000
Puget Sound to SR 520	21	35	735	3	245	36,750	5,000
Additional Tug for Locks	77	10	770	2	385	57,750	8,000
Total	154		15,729		5,371	805,650	112,000

a Fuel consumption of 150 gallons per hour based on delivery tow estimate for SR 520 pontoon tow (WSDOT 2005).

b Conversion rate: One gallon of diesel = 139,000 Btu.

Exhibit 7. Summary of Construction Energy Effects (Update to Exhibit 16 of the 2009 Discipline Report)

Option	Energy Expended (MBtu)		
	Construction Activities	Pontoon Transport	Total Construction
Preferred Alternative	15,006,000 ^a	112,000 ^b	15,118,000
Option A	15,006,000 ^a	112,000 ^b	15,118,000
Option K	34,299,000 ^a	112,000 ^b	34,411,000
Option L	18,781,000 ^a	112,000 ^b	18,893,000

a A 60 percent risk cost was used to estimate construction energy consumption.

b Conversion rate: one gallon of diesel = 139,000 Btu.

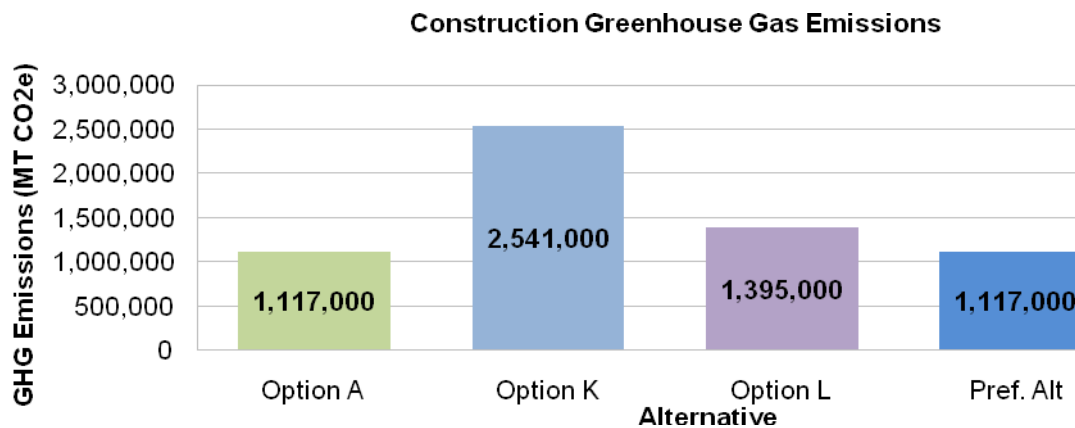
Greenhouse Gas Emissions

Construction Emissions

Exhibit 8 shows the estimated construction GHG emissions for the Preferred Alternative and the SDEIS options, including pontoon transport to the project site.



Exhibit 8. Preferred Alternative and the SDEIS Options Construction GHG Emission Comparison (Update to Exhibit 22 of the 2009 Discipline Report)



The project would result in indirect GHG emissions, which are not released by the project but are nonetheless caused by the project. Greenhouse gases would be emitted during the production and disposal of materials used for project-related construction. For example, emissions would be released during the production of the concrete used in construction, and in the manufacture of the equipment used during construction. Indirect emissions are also categorized as embodied and lifecycle emissions.

At this time, there is no consistent and standardized method to calculate specifically the embodied and lifecycle emissions for transportation projects. There are no tools currently available for discerning clearly and meaningfully which emissions are attributable to a specific project and which emissions would have occurred without the project. Nonetheless, the construction emission levels reported here do include embodied emissions because the factors used to calculate construction energy use include embodied energy use. In addition, as with all environmental disciplines, vendors that produce equipment and materials used in project construction are subject to regulation at their facilities.

Embodied emissions are the emissions generated in producing the materials that are used in the construction process and include emissions from sourcing the raw materials from the earth and their conversion into a usable form, including the energy used in processing. Embodied emissions can be thought of as “cradle to site” emissions. For example, the emissions released while mining the coal used to manufacture the steel girders for a bridge would be considered embodied emissions.

Lifecycle emissions include emissions released during material production (embodied) and emissions released throughout a facility’s lifetime, including demolition and disposal. Unlike embodied emissions, lifecycle emissions account for the durability of a product. Lifecycle emissions are often referred to as “cradle to grave” emissions

Pontoon Transport

Emissions associated with pontoon transport are unchanged from the SDEIS.



How do the construction effects on energy and greenhouse gas emissions compare to the SDEIS Options?

Exhibit 9 summarizes the construction effects of the Preferred Alternative and the SDEIS options on energy use and GHG emissions. Exhibit 10 lists the quantifiable effects, that is, those effects that could be estimated as measurable quantities, such as gallons and percents.

Exhibit 9. Summary Comparison of Construction Effects of the Preferred Alternative and the SDEIS Options (Update to Table 6.16-1 in the SDEIS)

Effect	Preferred Alternative	Option A	Option K	Option L
Source of GHG emissions	During construction, the primary source of GHG emissions would be fuel combustion. GHG emissions are proportional to the amount of energy used. The analysis assumes diesel fuel only (no electricity or gasoline) to be conservative and is intended to show relative differences between the options.			
Relative level of GHG emissions	Same as Option A.	Option A would have the lowest level of construction GHG emissions.	Option K has the highest GHG emissions potential at roughly double that of Option A.	Option L would produce approximately 20 percent more emissions than Option A, but less than Option K.

Exhibit 10. Project Construction Effects – Quantitative Impacts Summary (Update to Table 6.16-2 in the SDEIS)

Type of Effect	Preferred Alternative	Construction Effects		
		Option A	Option K	Option L
Onsite construction energy requirement (MBtu)	Same as Option A	15,006,000	34,299,000	18,780,000
Pontoon Transport energy requirement (MBtu)	Same as Option A	108,000	108,000	108,000
GHG Emissions (MT CO ₂ e, in millions)	Same as Option A	1,116,000	2,541,000	1,395,000

MT = metric tons

CO₂e = carbon dioxide emissions

How would operation of the project affect energy and greenhouse gas emissions?

Energy

Project Area Effects

No Build Alternative

Effects of the No Build Alternative are similar to those described in the Energy Discipline Report (WSDOT 2009a, page 27). The annual VMT for the study area is forecasted to increase and average



speeds are expected to decrease when compared to existing conditions (2006). In 2030, the annual VMT under the No Build Alternative would be approximately 609 million miles (Exhibits 11 and 12). Like the SDEIS options, the annual VMT for the Preferred Alternative is expected to be lower than the No Build Alternative, because no tolls would be in effect in 2030 under the No Build Alternative conditions. Tolls are assumed to be in effect starting in 2011 under all options. However, they are assumed no longer to be in effect by 2030 if construction of the project does not occur. Vehicles operating in the study area under the No Build Alternative would consume about 4.1 MBtu of energy, which is equivalent to 32.8 million gallons of fuel per year (Exhibit 12).

Exhibit 11. Annual VMT (millions) by Alternative (Update to Exhibit 11 of the 2009 Discipline Report)

Alternative/Option	Passenger Vehicle VMT ^a	Heavy-Duty Truck VMT	Transit Bus VMT	Total VMT ^b
Existing Conditions (2006) SDEIS	541	17	4	562
2030 No Build Alternative SDEIS	776	24	6	806
2030 Option A SDEIS	710	22	6	738
2030 Option K/L SDEIS	727	23	6	756
Existing Conditions (2006)	525	16	4	546
2030 No Build Alternative	585	18	5	609
2030 Preferred Alternative	562	18	5	584

^a Passenger vehicles include cars, light trucks, and motorcycles.

^b The sum of the columns may not equal the total due to rounding.

Source: WSDOT 2009b

Exhibit 12. Annual Fuel Consumption during Operation (2030) (Update to Exhibit 18 of the 2009 Discipline Report)

Alternative/Option	Annual VMT (millions)	MBtu	Gallons of Fuel ^a (millions)	% Change from 2030 No Build Alternative
Existing Conditions (2006) SDEIS	562	3,818,000	30.3	NA
2030 No Build Alternative SDEIS	806	5,474,000	43.4	NA
2030 Option A SDEIS	738	5,012,000	39.8	-8%
2030 Option K/L SDEIS	756	5,134,000	40.7	-6%
Existing Conditions (2006)	546	3,707,000	29.4	NA
2030 No Build Alternative	609	4,132,000	32.8	NA
2030 Preferred Alternative	584	3,967,000	31.5	-4 %

^a Fuel includes both diesel and gasoline.

NA = not applicable

Sources: WSDOT 2009b, DOE 2008



Preferred Alternative

Exhibit 12 presents estimates of annual fuel consumption during operation for the Preferred Alternative. Exhibit 1-2 in Attachment 2 provides detailed calculations of energy consumption during operation for the No Build Alternative and the Preferred Alternative. The Preferred Alternative in 2030 is estimated to consume 4 percent less energy than the 2030 No Build Alternative. The reduction in energy use under the Preferred Alternative is attributable to three factors:

- A reduction in VMT because of tolling for single occupancy vehicles in the SR 520 corridor, which might cause commuters to shift transportation modes or find alternative routes across Lake Washington
- The addition of HOV lanes, which would improve traffic flow for buses and carpools
- More people using transit and carpooling rather than driving alone, resulting in improved mobility in the general-purpose lanes

This analysis does not take into account the improved vehicle speed that is anticipated under the Preferred Alternative, nor does it account for changes in fuel efficiency standards for future vehicles. The analysis focuses on the changes in VMT and uses year 2007 vehicle energy consumption factors to estimate both existing (2006) and 2030 energy consumption during operations. Incorporating expected improvements in vehicle speed under each of the Preferred Alternative options would likely lead to a greater decrease in the fuel consumed by the Preferred Alternative options as compared to the No Build Alternative than shown in Exhibit 12.

Greenhouse Gas Emissions

Operational Emissions

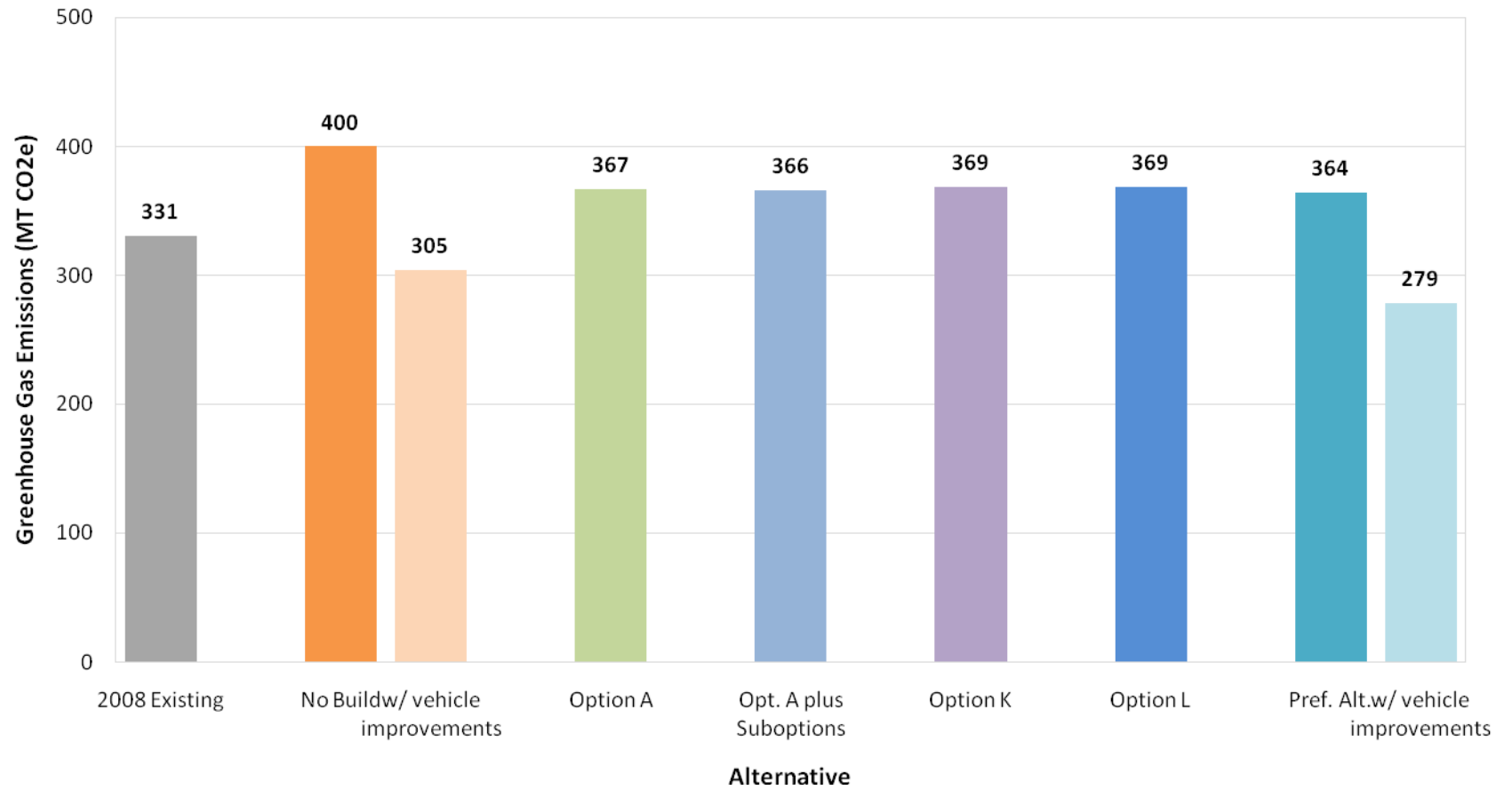
Corridor Analysis

Exhibit 13 displays the estimated GHG emissions on the SR 520 corridor. Existing conditions, Options A, Option A plus sub-options, Option K, and Option L are the same as in the SDEIS. The Preferred and No Build alternatives have been updated to reflect current travel assumptions. The Preferred Alternative's operational emissions are comparable to the emissions from the SDEIS options.

Since the SDEIS was prepared, modeling tools have been updated to include the CAFE standards currently in law (light-duty fuel economy improvements between 2011 and 2016). To understand the emissions associated with this project better, the revised No Build Alternative and the Preferred Alternative were analyzed both with and without the updated vehicle standards. Therefore, Exhibit 13 shows two columns for both the No Build and Preferred Alternatives.



Exhibit 13. Weekday Peak-Period Operational GHG Emissions (2030) (Update to Exhibit 23 of the 2009 Discipline Report)



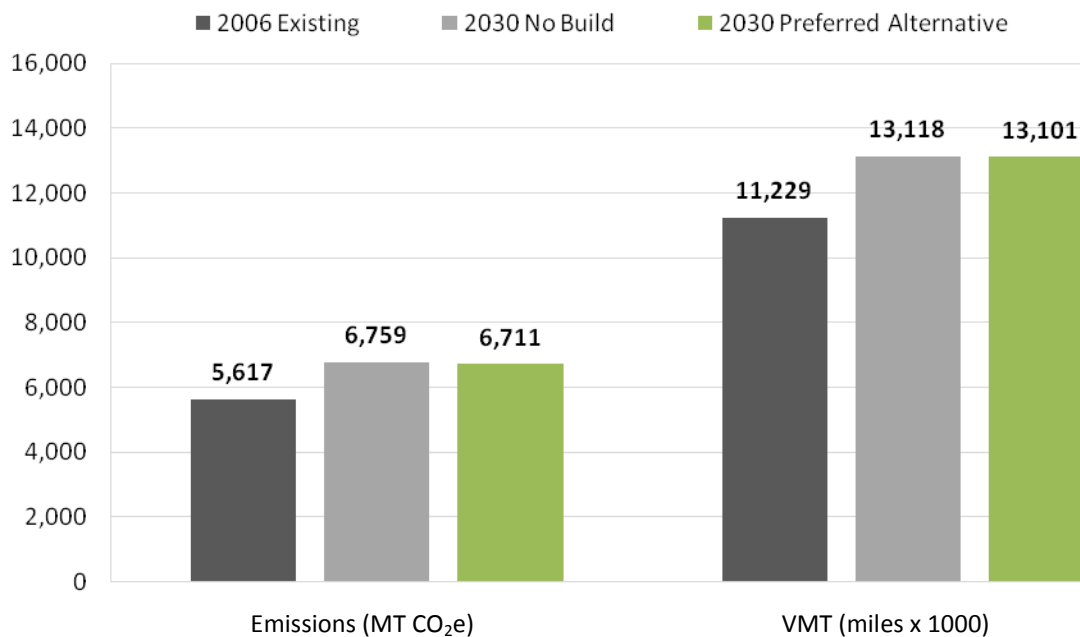
Sub-Regional Analysis

In addition to the corridor analysis performed for the SDEIS, a sub-regional analysis was undertaken for the Final EIS to consider the changes in emissions caused by this project more fully. The emissions in this analysis include improvements in the vehicle fleet required under current law (existing CAFE standards); as travelers upgrade vehicles over the next 20 years, the vehicle fleet as a whole will become more efficient. The data for this analysis came from the PSRC regional model as modified to evaluate this project. The base year available for this model is 2006 instead of 2008 as used for the other analyses in this addendum.

As Exhibit 14 shows, the No Build and Preferred Alternative both produce about 20 percent more emissions than existing conditions. The vehicle miles traveled in the sub-region increase as well, by almost 20 percent. The difference between the Build and No Build alternatives is not discernible for either emissions or VMT.

In conclusion, emissions are expected to increase by about 20 percent at the sub-regional level between now and 2030, both with and without the project because of population growth. At the corridor level, under the No Build Alternative, the emissions are also expected to increase by about 20 percent. However, with the Preferred Alternative in place, the corridor emissions are expected to be about 10 percent less than they would be under the No Build Alternative. While the effects of the project are noticeable at the corridor level, the project does not discernibly affect emission quantities in the surrounding area. In addition, vehicle efficiency improvements are expected to reduce emissions noticeably over the next 20 years.

Exhibit 14. Sub-Regional Daily Emissions and VMT



How do the operation effects on energy and greenhouse gas emissions compare to the SDEIS Options?

Exhibit 15 summarizes in qualitative terms the project operation (permanent) effects of the Preferred Alternative and the SDEIS options on energy and GHG emissions. Exhibit 16 lists the quantifiable effects, that is, those effects that could be estimated as measurable quantities such as gallons and percentages.

Exhibit 15. Summary Comparison of Operation and Permanent Effects of the Preferred Alternative and the SDEIS Options (Update to Table 5.16-1 in the SDEIS)

Effect	Preferred Alternative	Option A	Option K	Option L
Energy Requirement	The SDEIS options and the Preferred Alternative would reduce annual energy consumption between 5 and 10 percent on trips that cross Lake Washington by SR 520.			
Corridor GHG Effects	All build alternatives will produce about 10% less emission than the no build alternative. The differences between the build alternatives are negligible and the build alternatives should all be considered equivalent in this regard.			
Sub-Regional GHG Effects	The project is anticipated to have no measurable effect on emission in the sub-regional area.	Because the traffic effects of the SDEIS options are similar to those of the Preferred Alternative, it is expected that these options also would not affect sub-regional emission quantities.		

Exhibit 16. Project Operation Permanent Effects – Quantitative Impacts Summary (Update to Table 5.16-2 in the SDEIS)

Type of Effect	Existing Conditions	Preferred Alternative	Operation Effects		
			Option A	Option K	Option L
Estimated gallons of fuel (millions) consumed annually during operation (2030)	29.4	31.5	39.8	40.7	40.7
Reduction in GHG emissions of the project over No Build conditions		10% reduction	10% reduction	10% reduction	10% reduction
Percent change in GHG emissions at the sub-regional level as compared to the No Build Alternative		-1%; this difference is not meaningful given the estimation methodology. The alternatives should be considered equivalent.		NA	

NA= this effect does not apply for this option or alternative



Mitigation

What has been done to avoid or minimize negative effects?

The Preferred Alternative minimizes adverse potential energy and GHG effects as described below.

Construction

Building the Preferred Alternative would consume large amounts of energy that would no longer be available for other purposes. Construction practices that minimize roadway congestion and encourage efficient energy use would be implemented. Measures that reduce energy use will also reduce GHG emissions. Possible measures might include:

- Limiting idling equipment
- Encouraging carpooling of construction workers
- Locating staging areas near work sites
- Scheduling the delivery of materials during off-peak hours to allow trucks to travel to the site with less congestion and at fuel-efficient speeds

Operation

WSDOT and its transportation partners are working to reduce energy consumption and GHG emissions from the transportation sector throughout the state, including the SR 520 corridor. Examples of these activities include providing alternatives to driving alone (such as carpooling, vanpooling, and transit); developing transportation facilities that encourage transit, HOV, bike, and pedestrian modes; supporting land use planning and development that encourage such travel modes (such as concentrating growth within urban growth areas); and optimizing system efficiency through measures such as variable speeds. Tolling would also have a positive effect on GHG emissions since a larger proportion of people are forecasted to travel in carpools and on buses under the Preferred Alternative than with No Build Alternative conditions.

What would be done to mitigate negative effects that could not be avoided or minimized?

Construction Mitigation

Energy use during construction activities and the associated GHG emissions would be temporary, and avoidance and minimization measures would be applied during construction to limit effects. No mitigation is required for construction effects related to energy or GHG emissions.



Operation Mitigation

Energy and GHG effects would be lower under the Preferred Alternative when compared to the No Build Alternative. After applying avoidance and minimization measures to project operations, no mitigation would be required for adverse effects related energy or GHG emissions.

What negative effects would remain after mitigation?

There would be no negative effects remaining related to energy or GHG emissions for the Build Alternative.

Did the project consider future conditions related to climate change?

Washington is likely to experience a changing climate over the next 50 years, including:

- Increased temperature (heat waves, poor air quality)
- Changes in volume and timing of precipitation (reduced snow pack, increased erosion, flooding)
- Ecological effects of a changing climate (spread of disease, altered plant and animal habitats, negative effects on human health and well-being)
- Sea level rise, coastal erosion

In response to these anticipated changes, climate change is considered in the design of the new Evergreen Point Bridge, which crosses Lake Washington.

An overview of how the project considered future conditions related to climate change is included in the Energy Discipline Report (WSDOT 2009a). The Indirect and Cumulative Effects Discipline Report (WSDOT 2011d) provides more information on GHG emissions in the region.



References

The following list of references is in addition to those listed in the 2009 Energy Discipline Report.

DOE. 2008. Transportation Energy Data Book, Edition 27. Tables 2.13, 2.16, and 3.6.

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WSDOT. 2011a. *Description of Alternatives Discipline Report Addendum, SR 520, I-5 to Medina: Bridge Replacement and HOV Project.* Prepared for Washington State Department of Transportation, Olympia, WA, and Federal Highway Administration, Washington, DC.

WSDOT. 2011b. *Construction Techniques and Activities Discipline Report Addendum and Errata, SR 520, I-5 to Medina: Bridge Replacement and HOV Project.* Prepared for Washington State Department of Transportation, Olympia, WA, and Federal Highway Administration, Washington, DC.

WSDOT. 2011c. *Final Transportation Discipline Report, SR 520, I-5 to Medina: Bridge Replacement and HOV Project.* Prepared for Washington State Department of Transportation, Olympia, WA, and Federal Highway Administration, Washington, DC.

WSDOT. 2011d. *Indirect and Cumulative Effects Discipline Report, SR 520, I-5 to Medina: Bridge Replacement and HOV Project.* Prepared for Washington State Department of Transportation, Olympia, WA, and Federal Highway Administration, Washington, DC.



Attachment 1

Errata

Attachment 1

Energy Discipline Report Errata

The following table corrects errors and provides clarifications to the Energy Discipline Report (WSDOT 2009). Information contained in this table does not change the results or conclusions of any analyses in the 2009 discipline report.

Page	Current Text	Corrected Text/Clarification
3	<ul style="list-style-type: none"> Usual and accustomed fishing areas of tribal nations that have historically used the area’s aquatic resources and have treaty rights 	<ul style="list-style-type: none"> Usual and accustomed fishing areas <u>of the Muckleshoot Tribe, which has</u> tribal nations that have historically used the area’s aquatic resources and <u>has</u> have treaty rights <u>for their protection and use</u>
22	Exhibit 24. Weekday Peak-Period GHG Emission Comparisons: “Existing (2006)”	Existing year revised to “2008.” Also - Table revised to correct math errors, but percentages and findings do not change.

Exhibit 24. Weekday Peak-Period GHG Emission Comparisons - Updated

	a.m. Emissions (MT CO ₂ e)	Compared to No Build Alt. (MT CO ₂ e)	% Difference	p.m. Emissions (MT CO ₂ e)	Compared to No Build Alt. (MT CO ₂ e)	% Difference	Total Emissions (MT CO ₂ e)	Compared to No Build Alt. (MT CO ₂ e)	% Difference
(2008)	172	-15	-8%	155	-64	-29%	327	-80	-20%
No Build Alt. (2030)	188			219			407		
A Base (2030)	175	-13	-7%	192	-27	-12%	367	-40	-10%
A Add (2030)	175	-12	-7%	191	-28	-13%	366	-41	-10%
Option K or Option L (2030)	177	-11	-6%	192	-27	-12%	369	-38	-9%



Page	Current Text	Corrected Text/Clarification
28	More people using transit and carpooling rather than driving alone, resulting from improved mobility in the general-purpose lanes.	More people using transit and carpooling rather than driving alone, resulting from <u>in</u> improved mobility in the general-purpose lanes.
28	The analysis does not take into account the improved vehicle speed that is anticipated under the 6-Lane Alternative not does it account for changes in fuel efficiency standards for future vehicles.	The analysis does not takes into account the improved vehicle speed that is anticipated under the 6-Lane Alternative. <u>However, it does</u> not account for changes in fuel efficiency standards for future vehicles.



Attachment 2

Calculations for Estimated Energy Consumption

Attachment 2

Calculations for Estimated Energy Consumption

Mode	Annual VMT (millions)		Energy Consumption (Btu/mile)		Energy Consumed (MBtu)		Btu/ Gallon of Fuel		Gallons of Fuel (millions)
Existing Conditions: Energy Consumption During Operations									
Passenger Vehicle	525	*	6,005	=	3,154,000	/	124,000	=	25.4
Heavy Duty	16	*	23,238	=	381,000	/	139,000	=	2.7
Transit Bus	4	*	39,408	=	172,000	/	139,000	=	1.2
Total	546			=	3,707,000				29.4
No Build 2030: Energy Consumption During Operations									
Passenger Vehicle	585	*	6,005	=	3,516,000	/	124,000	=	28.4
Heavy Duty	18	*	23,238	=	424,000	/	139,000	=	3.1
Transit Bus	5	*	39,408	=	192,000	/	139,000	=	1.4
Total	609			=	4,132,000				32.8
Preferred Alternative 2030: Energy Consumption During Operations									
Passenger Vehicle	562	*	6,005	=	3,376,000	/	124,000	=	27.2
Heavy Duty	18	*	23,238	=	407,000	/	139,000	=	2.9
Transit Bus	5	*	39,408	=	184,000	/	139,000	=	1.3
Total	584			=	3,967,000				31.5

Note: The product, quotient, and summation of numbers in the table may not equal the total due to rounding.
Sources: WSDOT 2009b; DOE 2008; EIA 2007



Sections	Primary Structure	2014 Construction Dollars		Deflation Factor		1977 Construction Dollars		Energy Consumption Factor (Btu)		Conversion to MBtu		Energy Consumption (MBtu)
Preferred Alternative: Construction Costs (2014\$) and Energy Consumption												
I-5	Interchange	\$280,900,000	/	6.20	=	\$45,299,877	*	70,100	/	1,000,000	=	3,176,000
Portage Bay Bridge	Bridge	\$412,800,000	/	6.20	=	\$66,570,983	*	28,100	/	1,000,000	=	1,871,000
Montlake Interchange & Cut	Interchange	\$318,700,000	/	6.20	=	\$51,395,767	*	70,100	/	1,000,000	=	3,603,000
West Approach	Bridge	\$635,600,000	/	6.20	=	\$102,501,253	*	28,100	/	1,000,000	=	2,880,000
Floating Bridge	Bridge	\$613,000,000	/	6.20	=	\$98,856,620	*	28,100	/	1,000,000	=	2,778,000
Eastside Improvements	Urban Freeway	\$157,400,000	/	6.20	=	\$25,383,413	*	27,500	/	1,000,000	=	698,000
Total		\$2,418,400,000										15,006,000
Option A: Construction Costs (2014\$) and Energy Consumption												
I-5	Interchange	\$280,900,000	/	6.20	=	\$45,299,877	*	70,100	/	1,000,000	=	3,176,000
Portage Bay Bridge	Bridge	\$412,800,000	/	6.20	=	\$66,570,983	*	28,100	/	1,000,000	=	1,871,000
Montlake Interchange & Cut	Interchange	\$318,700,000	/	6.20	=	\$51,395,767	*	70,100	/	1,000,000	=	3,603,000
West Approach	Bridge	\$635,600,000	/	6.20	=	\$102,501,253	*	28,100	/	1,000,000	=	2,880,000
Floating Bridge	Bridge	\$613,000,000	/	6.20	=	\$98,856,620	*	28,100	/	1,000,000	=	2,778,000
Eastside Improvements	Urban Freeway	\$157,400,000	/	6.20	=	\$25,383,413	*	27,500	/	1,000,000	=	698,000
Total		\$2,418,400,000										15,006,000
Option K: Construction Costs (2014\$) and Energy Consumption												
I-5	Interchange	\$296,000,000	/	6.20	=	\$47,735,008	*	70,100	/	1,000,000	=	3,346,000
Portage Bay Bridge	Bridge	\$360,400,000	/	6.20	=	\$58,120,597	*	28,100	/	1,000,000	=	1,633,000
Montlake Interchange & Cut	Interchange	\$1,950,600,000	/	6.20	=	\$314,567,249	*	70,100	/	1,000,000	=	22,051,000
West Approach	Bridge	\$837,000,000	/	6.20	=	\$134,980,410	*	28,100	/	1,000,000	=	3,793,000
Floating Bridge	Bridge	\$613,000,000	/	6.20	=	\$98,856,620	*	28,100	/	1,000,000	=	2,778,000



Sections	Primary Structure	2014 Construction Dollars		Deflation Factor		1977 Construction Dollars		Energy Consumption Factor (Btu)		Conversion to MBtu		Energy Consumption (MBtu)
Eastside Improvements	Urban Freeway	\$157,400,000	/	6.20	=	\$25,383,413	*	27,500	/	1,000,000	=	698,000
Total		\$4,214,400,000										34,299,000
Option L: Construction Costs (2014\$) and Energy Consumption												
I-5	Interchange	\$277,300,000	/	6.20	=	\$44,719,316	*	70,100	/	1,000,000	=	3,135,000
Portage Bay Bridge	Bridge	\$361,600,000	/	6.20	=	\$58,314,117	*	28,100	/	1,000,000	=	1,639,000
Montlake Interchange & Cut	Interchange	\$582,100,000	/	6.20	=	\$93,873,473	*	70,100	/	1,000,000	=	6,581,000
West Approach	Bridge	\$871,700,000	/	6.20	=	\$140,576,372	*	28,100	/	1,000,000	=	3,950,000
Floating Bridge	Bridge	\$613,000,000	/	6.20	=	\$98,856,620	*	28,100	/	1,000,000	=	2,778,000
Eastside Improvements	Urban Freeway	\$157,400,000	/	6.20	=	\$25,383,413	*	27,500	/	1,000,000	=	698,000
Total		\$2,863,100,000										18,781,000

Note: The product, quotient, and summation of numbers in the table may not equal the total due to rounding.



Attachment 3

Model Inputs for Greenhouse Gas Emissions Modeling

Attachment 3

Model Inputs for Greenhouse Gas Emissions Modeling

SR 520 2006 General-Purpose Lanes

EPA MOVES RunSpec File Name:

C:\Documents and Settings\landsbk\My Documents\Climate Change\Projects\SR 520\SR 520 FEIS\SR520_Westside\SR520_MOVES\SR520_2006_GP_101130

Description:

SR 520 2006 General-Purpose Lanes
November 2010
Karin Ladnsberg

Domain/Scale: Project

Calculation Type: Inventory

Time Spans:

Aggregate By: Hour
Years:
2006
Months:
March
Days:
Weekdays
Hours:
Begin Hour: 17:00 - 17:59
End Hour: 17:00 - 17:59

Geographic Bounds:

LINK geography
Selection: WASHINGTON - King County

On Road Vehicle Equipment:

Compressed Natural Gas (CNG) - Transit Bus
Diesel Fuel - Intercity Bus
Diesel Fuel - Motor Home
Diesel Fuel - Passenger Car
Diesel Fuel - Passenger Truck
Diesel Fuel - School Bus
Diesel Fuel - Transit Bus
Electricity - Motor Home
Electricity - Passenger Car



Electricity - Passenger Truck
Electricity - School Bus
Electricity - Transit Bus
Gasoline - Motor Home
Gasoline - Motorcycle
Gasoline - Passenger Car
Gasoline - Passenger Truck
Gasoline - School Bus
Gasoline - Transit Bus

Road Types:

Urban Restricted Access
Pollutants And Processes:
Running Exhaust Atmospheric CO2
Running Exhaust CO2 Equivalent
Running Exhaust Methane (CH4)
Running Exhaust Nitrous Oxide (N2O)
Running Exhaust Total Energy Consumption
Running Exhaust Total Gaseous Hydrocarbons

Strategies:

Strategies:

Rate of Progress:

Rate of Progress calculations are disabled

Manage Input Data Sets:

General Output:

Output Database Server Name: [using default]
Output Database Name: SR520_Corr_101102_out

Units:

Mass
Units: Grams
Energy
Units: Joules
Distance
Units: Miles

Activity Outputs:

Distance Traveled
Source Hours
Source Hours Operating



Output Emissions Breakdown:

On Road/Off Road
Road Type
Output Time Step
Hour
Geographic Output Detail
LINK

Advanced Performance Features:

Do Not Execute:
Save Data From:
Do Not Save Generator Data
Saved Data Database Server Name: [using default]
Saved Data Database Name: [using default]
Custom Default Database Server Name: [using default]
Custom Default Database Name: [using default]
Perform Final Aggregation (if necessary)



SR 520 2006 HOV Lanes

EPA MOVES RunSpec File Name:

C:\Documents and Settings\landsbk\My Documents\Climate
Change\Projects\SR 520\SR 520
FEIS\SR520_Westside\SR520_MOVES\SR520_2006_HOV_101130

Description:

SR 520 2006 HOV Lanes
November 2010
Karin Ladnsberg

Domain/Scale: Project

Calculation Type: Inventory

Time Spans:

Aggregate By: Hour
Years:
2006
Months:
March
Days:
Weekdays
Hours:
Begin Hour: 17:00 - 17:59
End Hour: 17:00 - 17:59

Geographic Bounds:

LINK geography
Selection: WASHINGTON - King County

On Road Vehicle Equipment:

Compressed Natural Gas (CNG) - Transit Bus
Diesel Fuel - Intercity Bus
Diesel Fuel - Passenger Car
Diesel Fuel - Passenger Truck
Diesel Fuel - School Bus
Diesel Fuel - Transit Bus
Electricity - Passenger Car
Electricity - Passenger Truck
Electricity - School Bus
Electricity - Transit Bus
Gasoline - Motorcycle
Gasoline - Passenger Car
Gasoline - Passenger Truck
Gasoline - School Bus
Gasoline - Transit Bus



Road Types:

Urban Restricted Access
Pollutants And Processes:
Running Exhaust Atmospheric CO2
Running Exhaust CO2 Equivalent
Running Exhaust Methane (CH4)
Running Exhaust Nitrous Oxide (N2O)
Running Exhaust Total Energy Consumption
Running Exhaust Total Gaseous Hydrocarbons

Strategies:

Strategies:

Rate of Progress:

Rate of Progress calculations are disabled

Manage Input Data Sets:

General Output:

Output Database Server Name: [using default]
Output Database Name: sr520_corr_out

Units:

Mass
Units: Grams
Energy
Units: Joules
Distance
Units: Miles

Activity Outputs:

Distance Traveled
Source Hours

Output Emissions Breakdown:

On Road/Off Road
Road Type
Output Time Step
Hour
Geographic Output Detail
LINK



Advanced Performance Features:

Do Not Execute:

Save Data From:

Do Not Save Generator Data

Saved Data Database Server Name: [using default]

Saved Data Database Name: [using default]

Custom Default Database Server Name: [using default]

Custom Default Database Name: [using default]

Perform Final Aggregation (if necessary)



SR 520 2006 Trucks

EPA MOVES RunSpec File Name:

C:\Documents and Settings\landsbk\My Documents\Climate
Change\Projects\SR 520\SR 520
FEIS\SR520_Westside\SR520_MOVES\SR520_2006_Trucks_101130

Description:

SR 520 2006 Trucks
November 2010
Karin Ladnsberg

Domain/Scale: Project

Calculation Type: Inventory

Time Spans:

Aggregate By: Hour
Years:
2006
Months:
March
Days:
Weekdays
Hours:
Begin Hour: 17:00 - 17:59
End Hour: 17:00 - 17:59

Geographic Bounds:

LINK geography
Selection: WASHINGTON - King County

On Road Vehicle Equipment:

Diesel Fuel - Combination Long-haul Truck
Diesel Fuel - Combination Short-haul Truck
Diesel Fuel - Light Commercial Truck
Diesel Fuel - Refuse Truck
Diesel Fuel - Single Unit Long-haul Truck
Diesel Fuel - Single Unit Short-haul Truck
Electricity - Light Commercial Truck
Electricity - Refuse Truck
Electricity - Single Unit Short-haul Truck
Gasoline - Combination Short-haul Truck
Gasoline - Light Commercial Truck
Gasoline - Refuse Truck
Gasoline - Single Unit Long-haul Truck
Gasoline - Single Unit Short-haul Truck



Road Types:

Urban Restricted Access
Pollutants And Processes:
Running Exhaust Atmospheric CO2
Running Exhaust CO2 Equivalent
Running Exhaust Methane (CH4)
Running Exhaust Nitrous Oxide (N2O)
Running Exhaust Total Energy Consumption
Running Exhaust Total Gaseous Hydrocarbons

Strategies:

Strategies:

Rate of Progress:

Rate of Progress calculations are disabled

Manage Input Data Sets:

General Output:

Output Database Server Name: [using default]
Output Database Name: SR520_Corr_out

Units:

Mass
Units: Grams
Energy
Units: Joules
Distance
Units: Miles

Activity Outputs:

Distance Traveled
Source Hours

Output Emissions Breakdown:

On Road/Off Road
Road Type
Output Time Step
Hour
Geographic Output Detail
LINK



Advanced Performance Features:

Do Not Execute:

Save Data From:

Do Not Save Generator Data

Saved Data Database Server Name: [using default]

Saved Data Database Name: [using default]

Custom Default Database Server Name: [using default]

Custom Default Database Name: [using default]

Perform Final Aggregation (if necessary)



SR 520 2030 General-Purpose Lanes

EPA MOVES RunSpec File Name:

C:\Documents and Settings\landsbk\My Documents\Climate
Change\Projects\SR 520\SR 520
FEIS\SR520_Westside\SR520_MOVES\SR520_2030_GP_101130

Description:

SR 520 2030 GP
November 2010
Karin Ladnsberg

Domain/Scale: Project

Calculation Type: Inventory

Time Spans:

Aggregate By: Hour
Years:
2030
Months:
March
Days:
Weekdays
Hours:
Begin Hour: 17:00 - 17:59
End Hour: 17:00 - 17:59

Geographic Bounds:

LINK geography
Selection: WASHINGTON - King County

On Road Vehicle Equipment:

Compressed Natural Gas (CNG) - Transit Bus
Diesel Fuel - Intercity Bus
Diesel Fuel - Motor Home
Diesel Fuel - Passenger Car
Diesel Fuel - Passenger Truck
Diesel Fuel - School Bus
Diesel Fuel - Transit Bus
Electricity - Motor Home
Electricity - Passenger Car
Electricity - Passenger Truck
Electricity - School Bus
Electricity - Transit Bus
Gasoline - Motor Home
Gasoline - Motorcycle



Gasoline - Passenger Car
Gasoline - Passenger Truck
Gasoline - School Bus
Gasoline - Transit Bus

Road Types:

Urban Restricted Access
Pollutants And Processes:
Running Exhaust Atmospheric CO2
Running Exhaust CO2 Equivalent
Running Exhaust Methane (CH4)
Running Exhaust Nitrous Oxide (N2O)
Running Exhaust Total Energy Consumption
Running Exhaust Total Gaseous Hydrocarbons

Strategies:

Strategies:

Rate of Progress:

Rate of Progress calculations are disabled

Manage Input Data Sets:

General Output:

Output Database Server Name: [using default]
Output Database Name: SR520_Corr_out

Units:

Mass
Units: Grams
Energy
Units: Joules
Distance
Units: Miles

Activity Outputs:

Distance Traveled
Source Hours

Output Emissions Breakdown:

On Road/Off Road
Road Type
Output Time Step
Hour
Geographic Output Detail
LINK



Advanced Performance Features:

Do Not Execute:

Save Data From:

Do Not Save Generator Data

Saved Data Database Server Name: [using default]

Saved Data Database Name: [using default]

Custom Default Database Server Name: [using default]

Custom Default Database Name: [using default]

Perform Final Aggregation (if necessary)



SR 520 2030 HOV

EPA MOVES RunSpec File Name:

C:\Documents and Settings\landsbk\My Documents\Climate
Change\Projects\SR 520\SR 520
FEIS\SR520_Westside\SR520_MOVES\SR520_2030_HOV_101127

Description:

SR 520 2030 HOV
November 2010
Karin Ladnsberg

Domain/Scale: Project

Calculation Type: Inventory

Time Spans:

Aggregate By: Hour
Years:
2030
Months:
March
Days:
Weekdays
Hours:
Begin Hour: 17:00 - 17:59
End Hour: 17:00 - 17:59

Geographic Bounds:

LINK geography
Selection: WASHINGTON - King County

On Road Vehicle Equipment:

Compressed Natural Gas (CNG) - Transit Bus
Diesel Fuel - Intercity Bus
Diesel Fuel - Passenger Car
Diesel Fuel - Passenger Truck
Diesel Fuel - School Bus
Diesel Fuel - Transit Bus
Electricity - Passenger Car
Electricity - Passenger Truck
Electricity - School Bus
Electricity - Transit Bus
Gasoline - Motorcycle
Gasoline - Passenger Car
Gasoline - Passenger Truck
Gasoline - School Bus
Gasoline - Transit Bus



Road Types:

Urban Restricted Access
Pollutants And Processes:
Running Exhaust Atmospheric CO2
Running Exhaust CO2 Equivalent
Running Exhaust Methane (CH4)
Running Exhaust Nitrous Oxide (N2O)
Running Exhaust Total Energy Consumption
Running Exhaust Total Gaseous Hydrocarbons

Strategies:

Strategies:

Rate of Progress:

Rate of Progress calculations are disabled

Manage Input Data Sets:

General Output:

Output Database Server Name: [using default]
Output Database Name: SR520_Corr_out

Units:

Mass
Units: Grams
Energy
Units: Joules
Distance
Units: Miles

Activity Outputs:

Distance Traveled
Source Hours

Output Emissions Breakdown:

On Road/Off Road
Road Type
Output Time Step
Hour
Geographic Output Detail
LINK



Advanced Performance Features:

Do Not Execute:

Save Data From:

Do Not Save Generator Data

Saved Data Database Server Name: [using default]

Saved Data Database Name: [using default]

Custom Default Database Server Name: [using default]

Custom Default Database Name: [using default]

Perform Final Aggregation (if necessary)



SR 520 2030 Trucks

EPA MOVES RunSpec File Name:

C:\Documents and Settings\landsbk\My Documents\Climate
Change\Projects\SR 520\SR 520
FEIS\SR520_Westside\SR520_MOVES\SR520_2030_Trucks_101130

Description:

SR 520 2030 Trucks
November 2010
Karin Landsberg

Domain/Scale: Project

Calculation Type: Inventory

Time Spans:

Aggregate By: Hour
Years:
2030
Months:
March
Days:
Weekdays
Hours:
Begin Hour: 17:00 - 17:59
End Hour: 17:00 - 17:59

Geographic Bounds:

LINK geography
Selection: WASHINGTON - King County

On Road Vehicle Equipment:

Diesel Fuel - Combination Long-haul Truck
Diesel Fuel - Combination Short-haul Truck
Diesel Fuel - Light Commercial Truck
Diesel Fuel - Refuse Truck
Diesel Fuel - Single Unit Long-haul Truck
Diesel Fuel - Single Unit Short-haul Truck
Electricity - Light Commercial Truck
Electricity - Refuse Truck
Electricity - Single Unit Short-haul Truck
Gasoline - Combination Short-haul Truck
Gasoline - Light Commercial Truck
Gasoline - Refuse Truck
Gasoline - Single Unit Long-haul Truck
Gasoline - Single Unit Short-haul Truck



Road Types:

Urban Restricted Access
Pollutants And Processes:
Running Exhaust Atmospheric CO2
Running Exhaust CO2 Equivalent
Running Exhaust Methane (CH4)
Running Exhaust Nitrous Oxide (N2O)
Running Exhaust Total Energy Consumption
Running Exhaust Total Gaseous Hydrocarbons

Strategies:

Strategies:

Rate of Progress:

Rate of Progress calculations are disabled

Manage Input Data Sets:

General Output:

Output Database Server Name: [using default]
Output Database Name: SR520_Corr_out

Units:

Mass
Units: Grams
Energy
Units: Joules
Distance
Units: Miles

Activity Outputs:

Distance Traveled
Source Hours

Output Emissions Breakdown:

On Road/Off Road
Road Type
Output Time Step
Hour
Geographic Output Detail
[LINK](#)



Advanced Performance Features:

Do Not Execute:

Save Data From:

Do Not Save Generator Data

Saved Data Database Server Name: [using default]

Saved Data Database Name: [using default]

Custom Default Database Server Name: [using default]

Custom Default Database Name: [using default]

Perform Final Aggregation (if necessary)



SR 520 Subregional Analysis 2006

EPA MOVES RunSpec File Name:

C:\Documents and Settings\landsbk\My Documents\Climate
Change\Projects\SR 520\SR 520
FEIS\SR520_Westside\SR520_MOVES\SR520_SubR_2006_101123.mrs

Description:

SR 520 Subregional Analysis 2006
November 2010
Karin Ladnsberg

Domain/Scale: Project

Calculation Type: Inventory

Time Spans:

Aggregate By: Hour
Years:
2006
Months:
March
Days:
Weekdays
Hours:
Begin Hour: 17:00 - 17:59
End Hour: 17:00 - 17:59

Geographic Bounds:

LINK geography
Selection: WASHINGTON - King County

On Road Vehicle Equipment:

Compressed Natural Gas (CNG) - Transit Bus
Diesel Fuel - Combination Long-haul Truck
Diesel Fuel - Combination Short-haul Truck
Diesel Fuel - Intercity Bus
Diesel Fuel - Light Commercial Truck
Diesel Fuel - Motor Home
Diesel Fuel - Passenger Car
Diesel Fuel - Passenger Truck
Diesel Fuel - Refuse Truck
Diesel Fuel - School Bus
Diesel Fuel - Single Unit Long-haul Truck
Diesel Fuel - Single Unit Short-haul Truck
Diesel Fuel - Transit Bus
Electricity - Light Commercial Truck
Electricity - Motor Home
Electricity - Passenger Car



Electricity - Passenger Truck
Electricity - Refuse Truck
Electricity - School Bus
Electricity - Single Unit Short-haul Truck
Electricity - Transit Bus
Gasoline - Combination Short-haul Truck
Gasoline - Light Commercial Truck
Gasoline - Motor Home
Gasoline - Motorcycle
Gasoline - Passenger Car
Gasoline - Passenger Truck
Gasoline - Refuse Truck
Gasoline - School Bus
Gasoline - Single Unit Long-haul Truck
Gasoline - Single Unit Short-haul Truck
Gasoline - Transit Bus

Road Types:

Urban Restricted Access
Urban Unrestricted Access
Pollutants And Processes:
Running Exhaust Atmospheric CO2
Running Exhaust CO2 Equivalent
Running Exhaust Methane (CH4)
Running Exhaust Nitrous Oxide (N2O)
Running Exhaust Total Energy Consumption
Running Exhaust Total Gaseous Hydrocarbons

Strategies:

Strategies:

Rate of Progress:

Rate of Progress calculations are disabled

Manage Input Data Sets:

General Output:

Output Database Server Name: [using default]
Output Database Name: SR520_SubR_2006_101123out

Units:

Mass
Units: Grams
Energy
Units: Joules
Distance
Units: Miles



Activity Outputs:

Distance Traveled
Source Hours

Output Emissions Breakdown:

On Road/Off Road
Road Type
Output Time Step
Hour
Geographic Output Detail
LINK

Advanced Performance Features:

Do Not Execute:
Save Data From:
Do Not Save Generator Data
Saved Data Database Server Name: [using default]
Saved Data Database Name: [using default]
Custom Default Database Server Name: [using default]
Custom Default Database Name: [using default]
Perform Final Aggregation (if necessary)



SR 520 Subregional Analysis 2030

EPA MOVES RunSpec File Name:

C:\Documents and Settings\landsbk\My Documents\Climate
Change\Projects\SR 520\SR 520
FEIS\SR520_Westside\SR520_MOVES\SR520_SubR_2030_101123.mrs

Description:

SR 520 Subregional Analysis 2030
November 2010
Karin Ladnsberg

Domain/Scale: Project

Calculation Type: Inventory

Time Spans:

Aggregate By: Hour
Years:
2030
Months:
March
Days:
Weekdays
Hours:
Begin Hour: 17:00 - 17:59
End Hour: 17:00 - 17:59

Geographic Bounds:

LINK geography
Selection: WASHINGTON - King County

On Road Vehicle Equipment:

Compressed Natural Gas (CNG) - Transit Bus
Diesel Fuel - Combination Long-haul Truck
Diesel Fuel - Combination Short-haul Truck
Diesel Fuel - Intercity Bus
Diesel Fuel - Light Commercial Truck
Diesel Fuel - Motor Home
Diesel Fuel - Passenger Car
Diesel Fuel - Passenger Truck
Diesel Fuel - Refuse Truck
Diesel Fuel - School Bus
Diesel Fuel - Single Unit Long-haul Truck
Diesel Fuel - Single Unit Short-haul Truck
Diesel Fuel - Transit Bus
Electricity - Light Commercial Truck
Electricity - Motor Home
Electricity - Passenger Car



Electricity - Passenger Truck
Electricity - Refuse Truck
Electricity - School Bus
Electricity - Single Unit Short-haul Truck
Electricity - Transit Bus
Gasoline - Combination Short-haul Truck
Gasoline - Light Commercial Truck
Gasoline - Motor Home
Gasoline - Motorcycle
Gasoline - Passenger Car
Gasoline - Passenger Truck
Gasoline - Refuse Truck
Gasoline - School Bus
Gasoline - Single Unit Long-haul Truck
Gasoline - Single Unit Short-haul Truck
Gasoline - Transit Bus

Road Types:

Urban Restricted Access
Urban Unrestricted Access
Pollutants And Processes:
Running Exhaust Atmospheric CO2
Running Exhaust CO2 Equivalent
Running Exhaust Methane (CH4)
Running Exhaust Nitrous Oxide (N2O)
Running Exhaust Total Energy Consumption
Running Exhaust Total Gaseous Hydrocarbons

Strategies:

Strategies:

Rate of Progress:

Rate of Progress calculations are disabled

Manage Input Data Sets:

General Output:

Output Database Server Name: [using default]
Output Database Name: SR520_SubR_2030_101123_2_out

Units:

Mass
Units: Grams
Energy
Units: Joules
Distance
Units: Miles



Activity Outputs:

Distance Traveled
Source Hours

Output Emissions Breakdown:

On Road/Off Road
Road Type
Output Time Step
Hour
Geographic Output Detail
LINK

Advanced Performance Features:

Do Not Execute:
Save Data From:
Do Not Save Generator Data
Saved Data Database Server Name: [using default]
Saved Data Database Name: [using default]
Custom Default Database Server Name: [using default]
Custom Default Database Name: [using default]
Perform Final Aggregation (if necessary)

