Columbia River Crossing
Greenhouse Gas Emission Analysis
Expert Review Panel Report

January 8, 2009

Review conducted November 20, 2008

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Executive Summary

Columbia River Crossing (CRC) is a multi-modal transportation project for Interstate 5 between Portland, Oregon, and Vancouver, Washington. The project formed a panel of independent experts to review and evaluate the greenhouse gas emissions analysis presented in the Draft Environmental Impact Statement (EIS) prior to developing a Final EIS. This review was requested by two of the local sponsor agencies during the selection process for a locally preferred alternative (LPA).

The primary purpose of CRC's greenhouse gas emissions analysis was to compare alternatives. CRC considered both short-term construction related effects and long-term effects from operations of the highway and the transit system. The methodology used to calculate greenhouse gas emissions is based on energy consumed during these activities. Emissions were modeled for diesel and gasoline used during construction and highway operations, and for coal and natural gas combustion associated with electricity generation. Model inputs for highway and transit operations included the number of vehicles traveling, types of vehicle, length of the roadway or track, and vehicle speed.

The Greenhouse Gas Emissions Expert Review Panel (Panel) finds the CRC analysis and findings to be reasonable and commends the efforts of staff to conduct a greenhouse gas emissions analysis for a single project. The Panel agrees with the CRC finding that the locally preferred alternative would generate lower greenhouse gas emissions than the no build alternative. The Panel also recommends that the project team refine the model for the Final EIS, primarily to provide a more comprehensive understanding of traffic-related emissions. The panelists do not expect implementation of their recommendations to change the relative comparison of alternatives.

The specific findings are:

Question 1: Were the methods for modeling greenhouse gas emissions in the Draft EIS reasonable?

We find that the methodology used by the CRC project to model greenhouse gas emissions to be both reasonable and appropriate.

Additionally, we find the use of the traffic modeling software VISSIM to calculate the inputs for the greenhouse gas emissions estimate to be an excellent approach.

We also find that refinements could be made to the methodology used to measure the highway-related emissions and compare the alternatives, as outlined below and under Question 3.

Question 2: Were the findings in the Draft EIS regarding greenhouse gas emissions reasonable?

We conclude that the findings in the Draft EIS regarding greenhouse gas emissions are reasonable. We also find that they likely underestimate the potential for the LPA to reduce greenhouse gas emissions relative to the no build alternative.

In addition, we find that changes to the text and summary tables in the Draft EIS would help clarify the analysis and the transit service differences between alternatives for the reader.

Question 3: Is the proposed approach for estimating greenhouse gas emissions in the Final EIS reasonable?

We find the proposed approach for the Final EIS to be reasonable, and we recommend that this approach include the changes proposed by the CRC project team and by this Panel. The approach for the Final EIS includes recommendations to: separate the transit system emissions estimates from the highway system for reporting and comparison; expand the breadth of the highway system analysis; add analysis of the effects of an electronic-only tolling system by non-residents who may have to exit the highway to pay the toll and contribute to traffic delays; and add an analysis of GHG emissions reductions that would result from removing bridge lifts and reducing crashes. We recognize that a quantitative analysis for some of the additional inputs may not be feasible given data and forecasting/modeling limitations.

Additionally, we find the use of the traffic modeling software VISSIM to calculate the inputs for the greenhouse gas emissions estimate to be excellent and recommend that it continue to be used for the Final EIS.

Question 4: Are there specific and realistic opportunities for the project to further reduce greenhouse gas emissions that should be considered in the Final EIS?

It is the Panel's belief that because there are no thresholds for greenhouse gas emissions under state and federal regulations at this time and because the project has lower emissions than the no build alternative, that mitigation measures are not needed. To the extent the measures are incorporated into the project, the Panel commends the project team.

We find that the strategies suggested by CRC to further reduce greenhouse gas emissions should be considered as part of state and regional policy.

Introduction

The Columbia River Crossing project (CRC or project) is a multi-modal transportation project for Interstate 5 between Portland, Oregon, and Vancouver, Washington. CRC will replace the I-5 bridge over the Columbia River, extend Portland's light rail system to Vancouver, improve seven interchanges, and enhance the pedestrian and bicycle pathway.

CRC released a Draft Environmental Impact Statement (EIS) in May 2008 which described the potential environmental and community effects of five alternatives, including a "no build" alternative. A locally preferred alternative of "replacement I-5 bridge with light rail" was selected in July 2008. The Draft EIS contains a section describing cumulative environmental effects. Within this section, the project's effect on climate change from greenhouse gas emissions is discussed. In November 2008, CRC formed a panel of three independent experts to review and evaluate the greenhouse gas analysis in preparation to develop the Final EIS.

The project is led by the Washington State Department of Transportation and Oregon Department of Transportation in partnership with the U.S. Department of Transportation, and local governments and transit agencies (City of Vancouver, City of Portland, Southwest Washington Regional Transportation Council, Metro, C-TRAN and TriMet).

Panel Purpose

As the Greenhouse Gas Expert Review Panel (Panel), we were tasked with reviewing and evaluating the methodology and findings of greenhouse gas emissions related to the CRC project. This review was requested by the Metro Council, the Portland City Council and the project's advisory Task Force in summer 2008, as part of the selection of a locally preferred alternative for the project. Resolutions adopted by these entities made the following recommendations related to a review of the CRC greenhouse gas analysis, travel demand modeling, and induced growth analysis:

> Further analysis is required of the greenhouse gas and induced automobile demand forecasts for this project. The results of the analysis must be prominently displayed in the Final Environmental Impact Statement. The analysis should include comparisons related to the purpose and function of the so-called "auxiliary" lanes. A reduction in vehicle miles traveled should be pursued to support stated greenhouse gas reduction targets as expressed by legislation in Oregon and Washington and by the Governors. (Metro Council, Resolution 08-3960B, July 17, 2008)
>
> The CRC project shall contract for an independent analysis of the greenhouse gas and induced automobile travel demand forecasts for the project. (City of Portland Council, Resolution 36618, Exhibit A, July 9, 2008)
>
> [The Task Force supports] (i)ndependent validation of the greenhouse gas and climate change analysis conducted in the Draft Environmental Impact Statement to

> determine the project's effects on air quality, carbon emissions and vehicle miles traveled per capita (CRC Task Force, Resolution Recommendations, June 24, 2008)
>
> [The Task Force supports] (t)he inclusion of strategies aimed at reducing greenhouse gases and reducing vehicle miles traveled per capita. The Oregon Global Warming Commission or the Washington Climate Action Team should advise the CRC project on project related aspects that will help achieve both states greenhouse gas reduction goals set for 2020 and 2050. (CRC Task Force, Resolution Recommendations, June 24, 2008).

The above resolutions related to travel demand modeling and induced growth were reviewed and addressed by a separate expert review panel on October 13-14, 2008. The "Travel Demand Model Review Panel" concluded that the CRC's Draft EIS approach to evaluating induced growth was useful and appropriate, and that the overall evaluation of induced growth impacts was rigorous. The panel agreed with the conclusion of the CRC Draft EIS that the transit and highway improvements combined with a new highway toll would promote higher-density transit-oriented development, would concentrate more development in the I-5 corridor, and would likely have little of the sprawl-inducing effects that can result from some new highway corridor projects.

Questions for Consideration

We were asked by the CRC to address the following questions in order to address the related conditions in the locally preferred alternative resolutions:

1. Were the methods for modeling greenhouse gas emissions in the Draft EIS reasonable?
2. Were the findings in the Draft EIS regarding greenhouse gas emissions reasonable?
3. Is the proposed approach for estimating greenhouse gas emissions in the Final EIS reasonable?
4. Are there specific and realistic opportunities for this project to further reduce greenhouse gas emissions that should be considered in the Final EIS?

We reviewed technical memoranda and background materials, reviewed some of the greenhouse gas-related comments received on the project, heard presentations by, and asked questions of, technical staff before developing our findings and making recommendations.

Panelist Biographies

Each panel member has experience and/or advanced knowledge in methods for estimating greenhouse gas emissions associated with transportation infrastructure. In addition, because we meet the following criteria, we fulfill the requirement that panel members be independent of CRC:

- Not working for project sponsors, lead agencies or interested agencies
- Not working for, or a member of, any entity that has commented on the CRC Draft EIS or CRC project
- Not working for a private sector company that has, or could in the future, be eligible to pursue project contracts
- No expressed or perceived interest (for, against, or otherwise) in the CRC project
- Not living or working in the Portland/Vancouver metropolitan region

Kelly McGourty, Chair
Kelly McGourty is a Principal Planner in the Transportation Planning Department of the Puget Sound Regional Council (PSRC), the metropolitan planning organization (MPO) for the Seattle/Central Puget Sound region. She is the lead staff member on air quality and climate change issues, and works closely with the region's federal, state and local air quality partner agencies. She also works on the region's Transportation Improvement Program (TIP), including the project selection process for distributing PSRC's federal funds. Prior to joining PSRC in 1999, McGourty was with the MPO in Spokane, Washington, where she performed transportation and air quality modeling and analyses. Her background also includes performing environmental assessments and inspections for both a consulting firm and an urban renewal agency. McGourty has an undergraduate degree in Environmental Policy and Assessment from Western Washington University and a graduate degree in Environmental Science from the University of Texas at San Antonio.

Dr. Ed Beimborn
Ed Beimborn is professor emeritus from the University of Wisconsin. Beimborn has worked with local, regional, state and federal agencies on projects including: the design of transportation facilities, the planning and operation of mass transit systems, analysis of the impacts of transportation systems on the environment, evaluation of transportation systems, and improvement in methodologies for transportation planning. He is past chair of the Transportation Planning section of the Institute of Transportation Engineers (ITE) and is currently secretary of the Transit Planning and Development Committee of the Transportation Research Board (TRB). He is the former Director of the Center for Urban Transportation Studies at UW-Milwaukee, served on the Governor of Wisconsin's Climate Change and Transportation Task Force, and served on an expert panel advising on analysis methods for the St. Croix River bridge project. Beimborn received his B.S. degree in Civil Engineering from the University of Wisconsin-Madison and M. S. and Ph.D. degrees in Civil Engineering (Transportation) from Northwestern University. He has been a visiting fellow at Oxford University in England and a visiting professor at the Technion in Israel.

Kelly Dunlap
Kelly Dunlap leads the California Department of Transportation Environmental Management Office in Sacramento. She serves as the NEPA and climate change analysis lead for the department. She has over 10 years environmental project development

experience, including scoping, environmental document preparation, permitting, and compliance during construction. Current responsibilities include developing and improving statewide environmental policies and procedures related to CEQA and NEPA compliance. Dunlap has a B.A. in Geography from the University of California at Los Angeles, and a J.D. from Loyola Law School.

Project Background

Overview

We understand the following about the project from the materials provided.

The Columbia River Crossing project is a bridge, transit and highway project aimed at improving travel efficiency and safety on I-5 for drivers, freight haulers, transit riders, bicyclists and pedestrians. The project area is a five-mile section of I-5 between State Route 500 in Vancouver and Columbia Boulevard in Portland, and includes the Interstate Bridge over the Columbia River.

The Interstate Bridge is composed of two side-by-side bridges that provide three lanes for travel in each direction. This facility has a lift-span for marine traffic which causes highway traffic to stop on average once a day.

The project area has six significant transportation problems that are being addressed by the CRC:

> **Congestion**: Travel demand exceeds capacity which leads to four to six hours of congestion a day. Congested conditions are predicted to grow to 15 hours a day by 2030.
>
> **Public transit**: Service is limited by congestion and travel times are expected to double by 2030.
>
> **Freight**: Mobility through the project area is impaired. Truck can be 20 percent of traffic volumes during certain hours because of the presence of two international marine ports and industrial areas near the project area.
>
> **Safety**: Crash rates are high due to seven closely-spaced interchanges, sub-standard highway design features and bridge lifts. The area has the highest crash rate for I-5 in Oregon. Collisions are expected to increase by up to 75 percent by 2030.
>
> **Pedestrians and bicyclists**: Facilities and connections are inadequate with a bridge pathway so narrow that two bicyclists cannot pass each other without one dismounting.
>
> **Earthquake safety**: The two structures of the I-5 bridge do not meet current seismic standards and are vulnerable to collapse during a major earthquake.

The Draft EIS was released in May 2008 and described the potential environmental and community effects of the “no build” alternative and four “build” alternatives. The five alternatives were:

1. No build
2. Replacement I-5 bridge with bus rapid transit

3. Replacement I-5 bridge with light rail
4. Supplemental I-5 bridge with bus rapid transit
5. Supplemental I-5 bridge with light rail

All of the build alternatives included interchange, freight and pedestrian/bicycle improvements in the project area.

Alternative 3 was selected in July 2008 as the locally preferred alternative.

The analysis of the replacement bridge alternatives in the Draft EIS assumed a 12-lane bridge structure with three general purpose (or "through") lanes in each direction and three auxiliary lanes in each direction. The analysis also assumed a tolling system with no toll booths and the use of electronic tolling where drivers would use transponders to automatically pay the toll. Drivers without transponders would need to pay in a different way, possibly by exiting the highway or through the use of license plate readers.

Greenhouse Gas Emissions Analysis Overview

We reviewed the Energy Technical Report, the section on climate change from Chapter 3 of the Draft EIS and a summary of national research on induced growth. Our findings and recommendations are based on the following understanding:

The greenhouse gas emissions analysis was conducted to consider both short-term construction related effects and long-term effects from operations of the highway and the transit system. For all three areas of the analysis, greenhouse gas emissions were a function of energy consumed. The equation was presented as:

$$EM = FC \times EF \times CDE$$

Where:

EM	=	Emissions of carbon dioxide (expressed as lbs of carbon dioxide equivalents)
FC	=	Fuel (energy) consumed during construction or operations (gallons or KWh)
EF	=	Emission conversion factor by fuel type (19.4 lbs CO_2/gal gas; 22.2 lbs CO_2/gal diesel; 2.095 lbs CO_2/kWh coal; 1.321 lbs CO_2/kWh natural gas)
CDE	=	Carbon dioxide equivalents (100/95)

(CO_2 emissions account for 94 to 95 percent of greenhouse gases emitted by the transportation sector. As a result, the U.S. Environmental Protection Agency uses CO_2 emission estimates as a representative indicator of all greenhouse gas emissions.)

The fuel consumed (FC) during construction or operations was calculated with the following equations.

Construction Energy Consumption

CRC estimated the consumption of construction-related energy with methodology developed by the California Department of Transportation (CalTrans). Energy (Btu) consumed is a function of the cost of a construction activity multiplied by an energy factor that reflects the number of Btus expended for each dollar of construction value. The equation was presented as:

$$E = C \times EF \times DC$$

Where:

E	=	Energy consumed (Btu)
C	=	Cost of a construction activity in 2007 dollars
EF	=	CalTrans energy factor in 1973 dollars (Btu/1973$)
DC	=	Conversion to 2007 dollars (1973$/2007$)

The data needs for these estimates include project cost per construction activity (e.g. installing light rail tracks, constructing a bridge), dollar conversion factor, energy sources, emission factors for each energy source and composition of energy sources to generate electricity.

Of the total energy used for construction, 70 percent was assumed to come from diesel and 30 percent from gasoline. This breakdown of energy sources was used to estimate the gallons of diesel and gasoline needed to construct the project. The result was then used to estimate carbon dioxide equivalent (CO_2e) emissions.

Highway Operations Energy Consumption

CRC estimated the consumption of energy from highway operations using methodology published in the Oregon Department of Transportation Energy Manual. Energy consumed (in Btus) is a function of the daily volume of traffic, the length of the roadway and the gallons of fuel consumed per mile based on traffic speed and vehicle type. The equation was presented as:

$$E = V \times L \times FCR \times CF$$

Where:

E	=	Energy consumed (Btu)
V	=	Daily volume of traffic
L	=	Length of the roadway (0.9 mile)
FCR	=	Fuel consumption rate based on vehicle type and speed (gallon/mile)
CF	=	Fuel conversion factor (Btu/gallon of gasoline or diesel)

The data needs for these estimates include composition of the types of vehicles in the traffic stream, fuel economies for each type of vehicle over a range of speeds, temporal changes and emission factors for each type of fuel used.

CRC estimated greenhouse gas emissions from vehicles based on the daily volume of traffic and average speeds for the 0.9 mile river crossings at I-5 and I-205. This method does not provide a comprehensive tally of all CO_2 emissions, but it does provide a relatively precise estimate for comparing the relative difference between alternatives. The daily traffic volumes were developed based on regional travel demand modeling completed by the local metropolitan planning organizations (Metro and RTC). These volumes were then processed through an operational traffic analysis model to provide greater precision to speed and congestion estimates.

Transit Operations Energy Consumption

CRC estimated the consumption of energy from buses and light rail vehicles using a similar methodology as used for highway operations. However, the size of the systems for both transit types was larger. Data were available on transit vehicle volume and average speed for the entire regional transit system under the no build and build alternatives. As a result, the alternatives were evaluated based on both nominal and relative differences.

The energy consumption estimate for buses was calculated using the same equation as used for highway operations. For light rail energy consumption, CRC estimated the CO_2 emissions associated with the creation of electricity from a combination of hydropower, nuclear, biomass, coal and natural gas combustion. The light rail operations equation was modified slightly to:

$$E = V \text{ x } L \text{ x } FCR \text{ x } CF$$

Where:

E	=	Energy consumed (Btu)
V	=	Daily volume of light rail cars
L	=	Length of rail segment (miles)
FCR	=	Fuel consumption rate based on average operating speed (kWh/mile)
CF	=	Fuel conversion factor (Btu/KWh)

Methodology proposed for the Final EIS

We further understand that the CRC team proposes to use the same basic methodology for the Final EIS with the following modifications:

- Use of updated construction cost estimates for LPA
- Inclusion of energy use associated with bridge and highway maintenance
- Expansion of study area to five miles of I-5 and I-205, if data are available
- Inclusion of bridge lift congestion and idling
- Inclusion of congestion effects from vehicle collisions
- Added level of detail from travel demand model

Panel Findings

Question 1: Were the methods for modeling greenhouse gas emissions in the Draft EIS reasonable?

Findings

We find that the methodology used by the CRC project to model greenhouse gas emissions to be both reasonable and appropriate.

Additionally, we find the use of the traffic modeling software VISSIM to calculate the inputs for the greenhouse gas emissions estimate to be an excellent approach.

We also find that refinements could be made to the methodology used to measure the highway-related emissions and compare the alternatives, as outlined below and under Question 3.

Discussion

This is one of the first transportation infrastructure projects that analyzed greenhouse gas emissions quantitatively for reporting under the National Environmental Policy Act. Similar types of analytic efforts have been conducted on a regional or statewide basis, but have rarely been done at the project level. The CRC project is doing more to calculate and reduce greenhouse gas emissions than most other transportation projects. As such, it should be recognized as a pioneering effort.

Currently, there is no industry-wide standard for estimating greenhouse gas emissions at the individual project level. The CRC project based its greenhouse gas emission estimates on long-term energy consumption rates and the carbon dioxide equivalent by-product from that consumption using data from Oregon and other state agencies. This approach differs from other greenhouse gas estimating models currently being tested in other states. Other efforts have used existing air quality models that estimate carbon monoxide and other air toxics. For example, the MOVES model developed by the U.S. Environmental Protection Agency (still in draft form) is an air quality model that is being used and tested to estimate greenhouse gas emissions.

We believe that the use of an energy analysis is an appropriate course of direction to compare project alternatives because emissions from vehicles associated with speed or lack of speed (i.e. congestion) can be captured. Two considerations may affect the use and continued development of the energy-based model: Currently, the CO_2 emissions per gallon of fuel are held constant. However, changes in the fuel mix may require a change to this factor. Second, the air quality-based models more readily allow carbon emissions to be measured for local streets, which is more difficult with the energy-based approach that uses traffic operations output from VISSIM modeling. However, some of the air quality type models show limitations in other factors such as their sensitivity to speed changes across the various vehicle classes.

When conducting its analysis, the CRC project used the same general equation to estimate emissions from operation of the highway and transit systems. More extensive travel forecasts were available for the transit system than for the highway system. Relatively precise forecasts of light rail, bus rapid transit (BRT) and other transit vehicle trips and speeds were available region-wide. However, precise forecasts of highway traffic speeds by vehicle classification and roadway link were much more limited. Thus, the Draft EIS restricted its quantification of the greenhouse gas emissions from the highway to the portion of the highway where such data were available, namely the river crossings themselves (approximately a one-mile segment of I-5 and of I-205). This is a reasonable method for comparing highway alternatives, as long as highway volumes and speeds outside this segment have a similar, ordinal relationship among the alternatives as those same metrics within the measured segment. Based on the traffic analysis results we reviewed, this appears to be true for the CRC alternatives, and therefore we would expect that including more of the highway in the analysis would not change the basic conclusions in the Draft EIS about the relative emissions for each alternative.

In the Draft EIS, the tons of carbon emitted from both the transit system and the highway system were presented as a simple total for alternative comparison purposes. Whereas in the Energy Technical Report, more detailed analysis, charts and graphs were presented on the emissions estimates from each transit option and from each highway option. We find the summation of the transit and highway results to be potentially misleading: The physical area for the analysis of the transit emissions and the highway emissions were not the same. The highway analysis did not include emissions from adjacent highways, while the transit analysis included the emissions effects of all light rail trains and buses in the region. Thus, the analysis of the transit elements and the analysis of highway elements did not use a consistent geographic scope and therefore should not be shown as a combined total.

We also note that the Draft EIS indicates that the transit-related emissions are larger than the highway emissions. The presentation of the data and the reason for this difference could have been strengthened by clearly indicating that the transit-related emissions were for the entire regional transit system and the highway emissions were solely for the I-5 and I-205 bridge crossings, as further discussed in Question 3.

Question 2: Were the findings in the Draft EIS regarding greenhouse gas emissions reasonable?

Findings

We conclude that the findings in the Draft EIS regarding greenhouse gas emissions are reasonable and likely underestimate the potential for the LPA to reduce greenhouse gas emissions relative to the no build alternative.

In addition, we find that changes to the text and summary tables in the Draft EIS would help clarify the analysis and the transit service differences between alternatives for the reader.

Discussion

The greenhouse gas emission estimates reported in the Draft EIS are based on an approach that likely understates the potential to reduce greenhouse gas emissions relative to the no build alternative. The method underestimated emissions from the no build alternative because it did not include two primary sources of congestion associated with the no build alternative as well as existing conditions: bridge lifts and collisions. As a result, the potential for the build alternatives to reduce greenhouse gas emissions also was underestimated, in particular those emissions that stem from vehicles idling on the highway following crashes, incidents and bridge lifts. We expect that the build scenarios, especially those that eliminate the bridge lifts and reduce crash-related congestion, will further reduce carbon emissions, but these reductions are not reflected in the quantitative Draft EIS estimates. The Panel also discussed that the construction emissions from the project are likely overestimated given that they are based on a Caltrans model that uses an older and less efficient fleet of construction vehicles.

Our second finding relates to the communication of the difference in level of transit service between alternatives 2 and 3 (named "efficient" operations in the Draft EIS) and alternatives 4 and 5 (named "increased" operations in the Draft EIS). It is not immediately clear how many more regular buses and high capacity transit vehicles would be operating in the "increased" operations. However, we are concerned that the emissions estimates for the alternatives with "increased" operations are greater than the emissions for the no build alternative. The summary table on page S-31 and chart on page 3-435 highlight these results. This is counter-intuitive and needs explanation.

We would suppose that by not adding much highway capacity with alternatives 4 and 5, many transit vehicles remain stuck in congestion, which could discourage ridership. Further, the addition of many more diesel powered buses and electric light rail trains would increase greenhouse gas emissions. It may be that the forecasted transit demand associated with light rail or BRT would be largely served with the level of transit frequency provided in the "efficient" operations, such that in spite of adding significantly higher frequency of trains or BRT vehicles, it does not attract substantially more new transit riders or a proportional decrease in auto trips. All of these factors provide a reasonable explanation but they are not clearly explained in the Draft EIS. We encourage CRC to simply – yet fully – clarify the transit service differences and the resulting differences in transit mode split and greenhouse gas emissions. The project may also consider adding a calculation of greenhouse gas emissions per vehicle (or per person) trip to provide another way to compare modes and compare transit service operations.

Question 3: Is the proposed approach for estimating greenhouse gas emissions in the Final EIS reasonable?

Findings

We find the proposed approach for the Final EIS to be reasonable, and we recommend that this approach include the changes proposed by the CRC project team and by this Panel.

Additionally, we find the use of the traffic modeling software VISSIM to calculate the inputs for the greenhouse gas emissions estimate to be excellent and recommend that it continue to be used for the Final EIS.

Discussion

We base our findings that the proposed approach for the Final EIS is reasonable on our earlier conclusion that the methodology used for the Draft EIS was reasonable and appropriate. We understand from our discussions with, and presentations from, the CRC staff that additional inputs and a broader scope of highway emissions analysis are planned for the Final EIS. We recommend CRC implement those changes and to implement our recommendations related to the Draft EIS methodology when conducting the greenhouse gas emissions analysis for the Final EIS.

Specifically, the following changes, which include some proposed by the CRC staff and some recommended by the Panel, should offer a more precise estimate of emissions under the no build and the locally preferred alternative scenarios:

- Separate the transit system emissions estimates from the highway system for reporting and comparison. The Draft EIS provided combined estimates. The estimates should remain separate unless their geographic scope can be modified to be equivalent.
- Include traffic-related emissions for a greater length of I-5 and I-205 in the estimates.
- Include analysis of the adjacent highway emission effects (i.e. Highway 99E, SR 14, SR 500 and I-205).
- Include analysis of the effects of congestion associated with bridge lifts.
- Incorporate the effects of congestion associated with collisions or traffic incidents.
- Add analysis of the effects of a reduction in traffic idling, and in particular, diesel trucks.
- Add analysis of the effects of an electronic-only tolling system by non-residents who may have to exit the highway to pay the toll and contribute to traffic delays.

We recognize that a quantitative analysis for some of these new inputs may not be feasible given data and forecasting/modeling limitations. In some cases, it may be possible to define a "usual" or average scenario and estimate emissions quantitatively based on it. In cases where quantitative data cannot be reasonably obtained, then a qualitative analysis should be included to recognize that there is an effect to greenhouse gas emissions. For example, we understand that precise emissions from off-mainline highway emissions are more difficult to estimate than mainline conditions. However, if practicable, we recommend that the project include the adjacent highway impacts in the assessment. If they cannot be quantified with the same level of precision as the river crossing, then they should at least be generally estimated or addressed qualitatively in the analysis.

Again, it does not appear that this, or any of the other refinements listed above, would change the basic conclusions about the LPA and the no build alternatives in the Draft EIS, but they will provide a more comprehensive and precise estimate of the effects on greenhouse gas emissions for the Final EIS.

Recommendations for documentation for Final EIS:

In our review of the greenhouse gas analysis and subsequent discussions with CRC staff, we learned that many of our questions from reading the Draft EIS were, indeed, considered in the analysis. However, we found that the documentation of the analysis could be more thorough and compelling. We recommend the following to improve the presentation of the greenhouse gas analysis in the Final EIS:

- Provide a clear explanation between the baseline in 2007 and no build in 2030. Greenhouse gas emissions will be greater in 2030 with or without the CRC project, if CRC does not move forward given the region's predicted population and employment growth.
- Ensure the conclusions related to greenhouse gas emissions are supported by a description of, or a reference to, the analysis that was conducted. Specifically, the conclusion paragraphs on p. 3-435 of the Draft EIS should be connected to a deeper description of the analysis.
- The CRC project is multi-modal with many benefits. Provide an effective, clearly-worded summary of the climate change benefits beyond the numbers given in the summary tables.
- Revisit the methodology used to estimate transit emissions. Once completed, include a detailed explanation of the methodology and the results and avoid use of a quick bullet point conclusion.
- Use separate entries for the transit and highway emissions in the executive summary table of CRC's community and environmental effects for the Final EIS and not combined as they are in the Draft EIS on p. S-31.
- Describe in more detail the actual impacts from tolling on mode shift, trip reduction and trip diversion.
- More clearly describe the effects to I-5 with less congested conditions by:
    - Providing a connection to the traffic analysis or repeat the information from the traffic analysis in the greenhouse gas analysis section.
    - Describing how many trips might be induced because traffic flow would improve. For example, discretionary trips may increase with better travel conditions. At the same time, the highway toll would decrease such trips, and the jobs-housing balance may improve with the project. The result could reduce regional vehicle miles traveled and counteract and added discretionary trips.

- Include an explanation of the construction emissions analysis in the climate change section in the Final EIS and state that it likely overestimates CO_2 emissions.
    - As part of this exercise, revisit the numbers and assumptions obtained from the California Department of Transportation methodology of 1973 to ensure reasonableness in 2008.
    - In addition, explain why the CalTrans methodology was used, given that it is 35 years old. Since then, the construction vehicle fleet has become much more efficient and cleaner. The result of using this methodology is that the analysis gives a high estimate of carbon emissions.
- Include summary tables of the induced growth analysis in the climate change section of the Final EIS. Based on our cursory review of the induced growth analysis, we find the methods to be robust and the findings reasonable, and recommend that it be summarized in the climate change section as it makes a compelling case for how the project's indirect effects would likely further reduce greenhouse gas emissions.

Question 4: Are there specific and realistic opportunities for the project to further reduce greenhouse gas emissions that should be considered in the Final EIS?

Findings

It is the Panel's belief that mitigation measures are not needed because the project has lower emissions than the no build alternative and because there are no thresholds under state and federal regulations at this time. To the extent the measures are incorporated into the project, the Panel commends the project team.

We find that the strategies suggested by CRC to further reduce greenhouse gas emissions should be considered as part of state and regional policy.

Discussion

We commend CRC for looking at additional measures to reduce greenhouse gas emissions beyond providing alternatives to driving and implementing bridge tolls. With CRC's multi-modal approach, greenhouse gas emissions are expected to be less with the project than under the no build scenario. As a result, mitigation is not required.

However, we do support CRC's suggested strategies and recommend they be pursued at the regional or state level. These include:

- planting trees to offset carbon emissions
- improving pedestrian and bicycle access to light rail stations
- requiring construction contractors to use alternative fuels
- using the right-of-way to generate green energy
- providing opportunities to recharge electric vehicles at park and rides
- increasing ride-share and commute choice programs
- operating the facility on green energy

Specific to the CRC project area, CRC should consider how it will collect tolls from vehicles that do not have transponders, and qualitatively evaluate whether this would result in any additional delays or congestion on or off the I-5 mainline. In addition, the staging of the transit improvements should be examined as possible mitigation for construction-related highway impacts. Long-term, a high-level, aggressive incident management system and traffic operations system should be developed both as a way to reduce greenhouse gas emissions and to benefit highway operations.

Other considerations related to climate change adaptation

We wish to acknowledge that reducing the transportation system's effect on global climate change is not the only climate change consideration for large transportation projects. Transportation planners, engineers and managers also must recognize and investigate the potential of climate change to affect transportation projects. For example, river flows can increase as can the potential for fires, floods, soil compaction and settling. We recognize CRC's efforts to consider how I-5 bridge design may need to reflect the potential for a climate-change induced rise in the high water levels of the Columbia River.

Conclusion

It is the conclusion of this Panel that the CRC project's methodology to estimate and compare greenhouse gas emissions from the alternatives presented in the Draft EIS was both reasonable and appropriate. Given the lack of consistent methodology nation-wide for this type of analysis, other transportation projects should consider the CRC energy consumption approach as a viable option. We believe the use of the traffic modeling software VISSIM to calculate inputs to the model strengthens its validity.

We agree with the CRC finding that the locally preferred alternative would reduce greenhouse gas emissions compared to the no build alternative. Improvements to the model are suggested to refine the analysis for the Final EIS. If these recommendations are implemented for the Draft EIS, we do not believe that the CRC relative comparison of alternatives would change.

Because greenhouse gas emissions will not increase with construction of the project and no emissions thresholds exist under state and federal law, mitigation measures are not necessary. We commend the CRC's consideration of additional strategies to further reduce greenhouse gas emissions.