From: Chris Smith
To: Draft EIS Feedback;
CC:
Subject: CRC DEIS Comments
Date: Sunday, June 29, 2008 4:20:33 PM
Attachments: CRC_DEIS_comments_Chris_Smith.pdf

P-0506-001 Enclosed please find my comments on the DEIS.

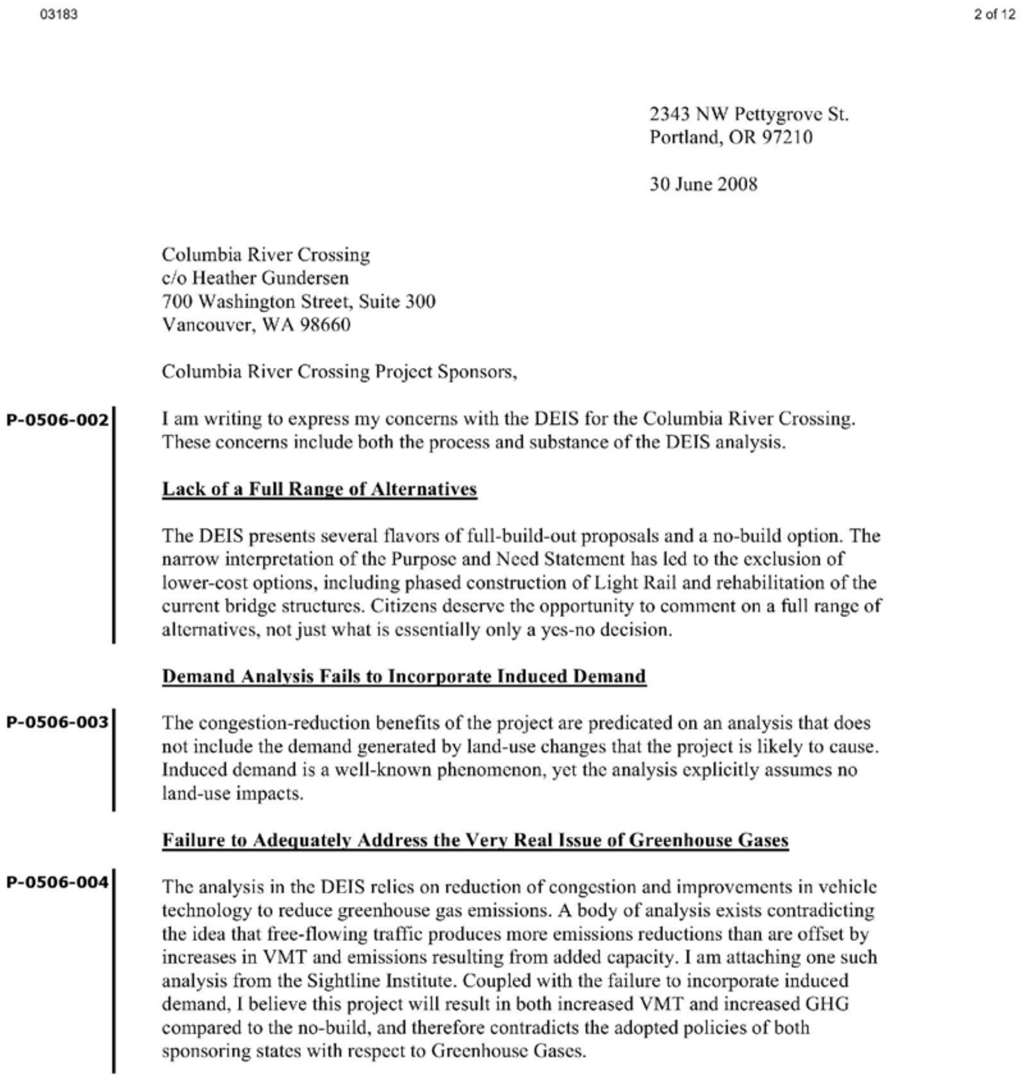
Thank you.

Chris Smith

*** eSafe scanned this email for malicious content ***
*** IMPORTANT: Do not open attachments from unrecognized senders ***

P-0506-001

Thank you for taking the time to submit your comments on the I-5 CRC DEIS.



2343 NW Pettygrove St.
Portland, OR 97210

30 June 2008

Columbia River Crossing
c/o Heather Gundersen
700 Washington Street, Suite 300
Vancouver, WA 98660

Columbia River Crossing Project Sponsors,

P-0506-002 I am writing to express my concerns with the DEIS for the Columbia River Crossing. These concerns include both the process and substance of the DEIS analysis.

<u>**Lack of a Full Range of Alternatives**</u>

The DEIS presents several flavors of full-build-out proposals and a no-build option. The narrow interpretation of the Purpose and Need Statement has led to the exclusion of lower-cost options, including phased construction of Light Rail and rehabilitation of the current bridge structures. Citizens deserve the opportunity to comment on a full range of alternatives, not just what is essentially only a yes-no decision.

Demand Analysis Fails to Incorporate Induced Demand

P-0506-003 The congestion-reduction benefits of the project are predicated on an analysis that does not include the demand generated by land-use changes that the project is likely to cause. Induced demand is a well-known phenomenon, yet the analysis explicitly assumes no land-use impacts.

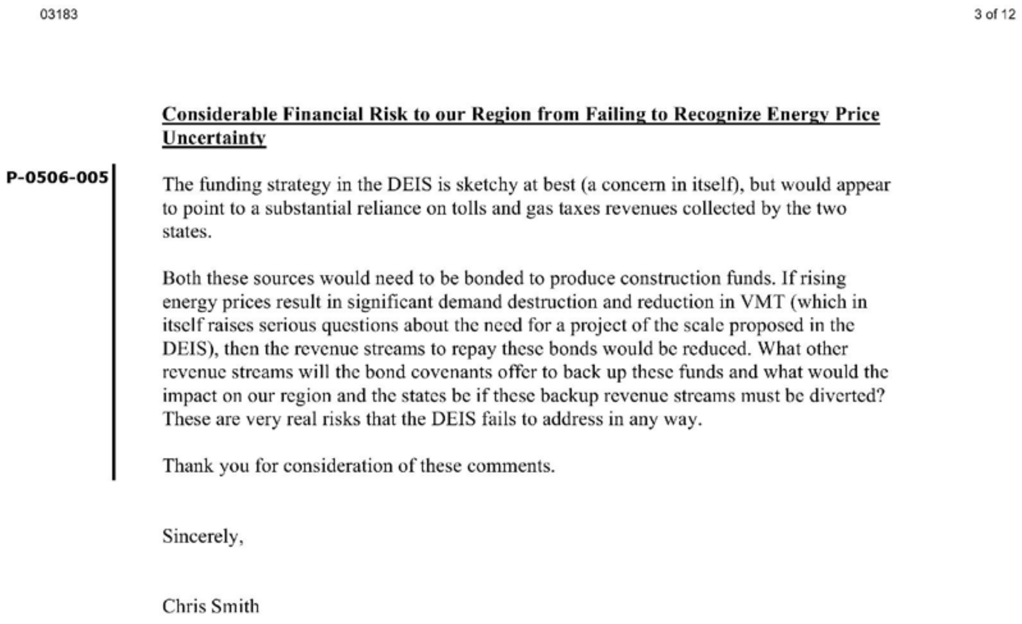
Failure to Adequately Address the Very Real Issue of Greenhouse Gases

P-0506-004 The analysis in the DEIS relies on reduction of congestion and improvements in vehicle technology to reduce greenhouse gas emissions. A body of analysis exists contradicting the idea that free-flowing traffic produces more emissions reductions than are offset by increases in VMT and emissions resulting from added capacity. I am attaching one such analysis from the Sightline Institute. Coupled with the failure to incorporate induced demand, I believe this project will result in both increased VMT and increased GHG compared to the no-build, and therefore contradicts the adopted policies of both sponsoring states with respect to Greenhouse Gases.

P-0506-002

The evaluation of the five alternatives in the DEIS was preceded by the screening of a wide array of possible solutions to the CRC project's Purpose and Need. Chapter 2 (Section 2.5) of the DEIS explains how the project's Sponsoring Agencies solicited the public, stakeholders, other agencies, tribes and other experts for ideas on how to meet the Purpose and Need. This effort produced a long list of potential solutions, such as new transportation corridors across the Columbia River, various transit modes, tolling, other demand management measures, and techniques for operating the existing highway system more efficiently. After identifying this wide array of options, the project evaluated whether and how they met the project's Purpose and Need, and found that alternatives that do not include improvements to the existing I-5 facility generally do little or nothing to address some of the identified needs, including reducing traffic congestion, improving the safety problems and reducing crashes on I-5. Traffic modeling showed that even significant investment in improving transit options in the I-5 corridor or building a third highway corridor, would not substantially reduce future traffic demand or address identified safety hazards. It is important to note that components were not eliminated simply because they did not expand highway capacity. Components that helped reduce travel demand without increasing capacity were also advanced for further evaluation. For example, bus rapid transit, light rail transit and tolling all help to decrease auto demand without expanding highway capacity. See Appendix C of the DEIS for an explanation and the results from early screening processes.

Regarding retaining the existing bridges, the CRC Task Force - composed of 39 leaders from a broad cross section of Washington and Oregon communities – was tasked with advising the CRC project team and providing guidance and recommendations at key decision points over the course of nearly 3 ½ years. Public agencies, businesses, civic organizations, neighborhoods and freight, commuter and environmental



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Considerable Financial Risk to our Region from Failing to Recognize Energy Price Uncertainty

P-0506-005

The funding strategy in the DEIS is sketchy at best (a concern in itself), but would appear to point to a substantial reliance on tolls and gas taxes revenues collected by the two states.

Both these sources would need to be bonded to produce construction funds. If rising energy prices result in significant demand destruction and reduction in VMT (which in itself raises serious questions about the need for a project of the scale proposed in the DEIS), then the revenue streams to repay these bonds would be reduced. What other revenue streams will the bond covenants offer to back up these funds and what would the impact on our region and the states be if these backup revenue streams must be diverted? These are very real risks that the DEIS fails to address in any way.

Thank you for consideration of these comments.

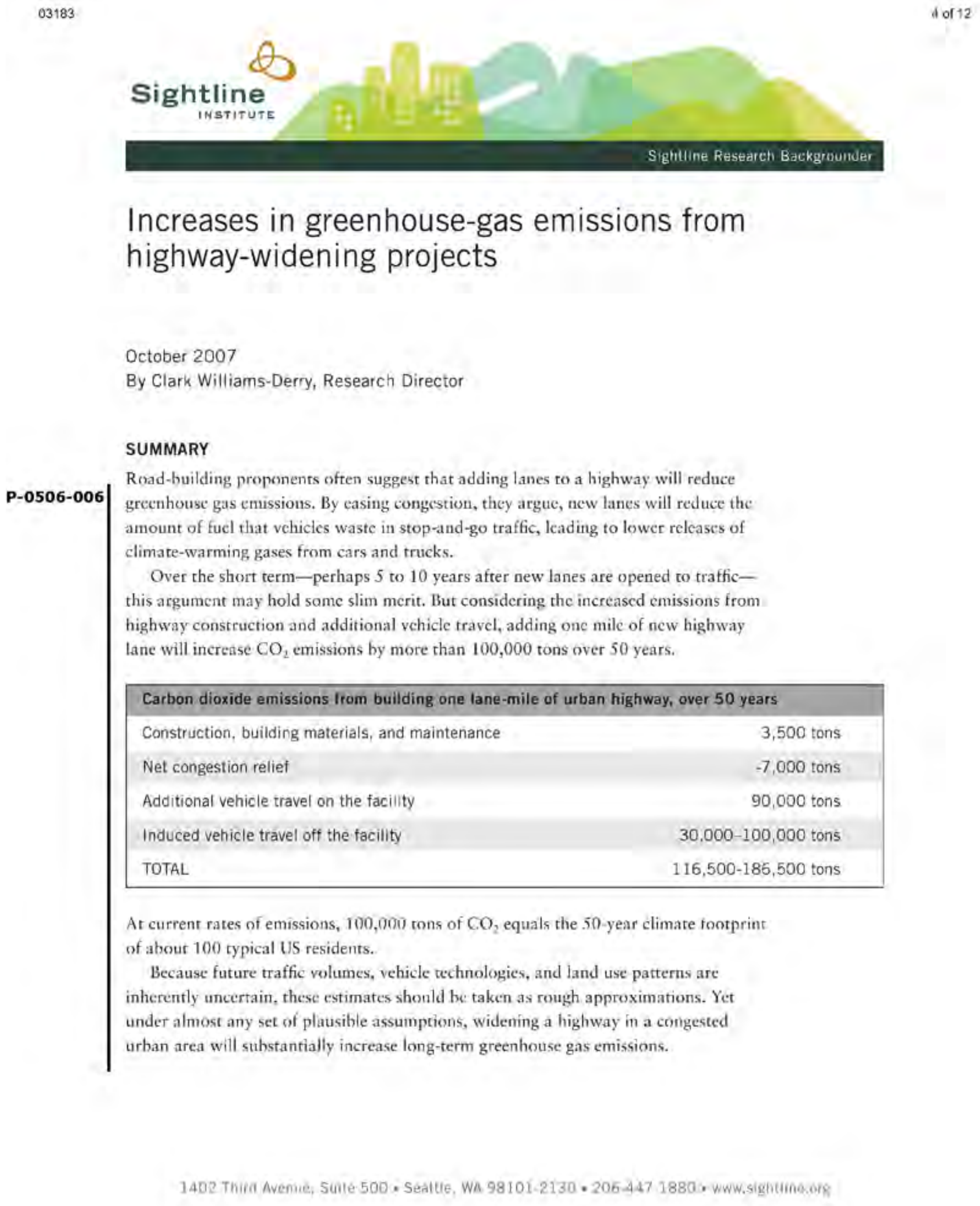
Sincerely,

Chris Smith

groups were all represented on the Task Force. The Task Force voted to develop a supplemental bridge alternative, in an attempt to find an alternative to total bridge replacement that would still meet the project's Purpose and Need but at lower cost and with greater reliance on managing demand with higher tolls and more transit service. The two most promising supplemental alternatives were considered in the DEIS. Based on the detailed analysis that followed, the Task Force recommended, and all project sponsors agreed, that the replacement bridge with light rail was the locally preferred alternative.

P-0506-003

As described in Chapter 3 (Section 3.4) of the DEIS and FEIS, and in the Indirect Effects Technical Report, highway capacity improvements and access improvements can induce development in suburban and rural areas that were not previously served, or were greatly underserved, by highway access. The DEIS outlines a comprehensive analysis of the potential induced growth effects that could be expected from the CRC project. A review of national research on induced growth indicates that there are six factors that tend to be associated with highway projects that induce sprawl. These are discussed in the Indirect Effects Technical Report. Based on the CRC project team’s comparison of those national research findings to CRC’s travel demand modeling, Metro’s 2001 land use / transportation modeling, and a review of Clark County, City of Vancouver, City of Portland and Metro land use planning and growth management regulations, the DEIS and the FEIS conclude that the likelihood of substantial induced sprawl from the CRC project is very low. In fact, the CRC project, because of its location in an already urbanized area, the inclusion of new tolls that manage demand, the inclusion of new light rail, and the active regulation of growth management in the region, the CRC project will likely reinforce the region’s goals of concentrating development in regional centers, reinforcing existing corridors, and promoting transit and pedestrian friendly development and development patterns.



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Sightline INSTITUTE

Sightline Research Backgrounder

Increases in greenhouse-gas emissions from highway-widening projects

October 2007
By Clark Williams-Derry, Research Director

SUMMARY

P-0506-006 Road-building proponents often suggest that adding lanes to a highway will reduce greenhouse gas emissions. By easing congestion, they argue, new lanes will reduce the amount of fuel that vehicles waste in stop-and-go traffic, leading to lower releases of climate-warming gases from cars and trucks.

Over the short term—perhaps 5 to 10 years after new lanes are opened to traffic—this argument may hold some slim merit. But considering the increased emissions from highway construction and additional vehicle travel, adding one mile of new highway lane will increase CO_2 emissions by more than 100,000 tons over 50 years.

Carbon dioxide emissions from building one lane-mile of urban highway, over 50 years	
Construction, building materials, and maintenance	3,500 tons
Net congestion relief	-7,000 tons
Additional vehicle travel on the facility	90,000 tons
Induced vehicle travel off the facility	30,000–100,000 tons
TOTAL	116,500-185,500 tons

At current rates of emissions, 100,000 tons of CO_2 equals the 50-year climate footprint of about 100 typical US residents.

Because future traffic volumes, vehicle technologies, and land use patterns are inherently uncertain, these estimates should be taken as rough approximations. Yet under almost any set of plausible assumptions, widening a highway in a congested urban area will substantially increase long-term greenhouse gas emissions.

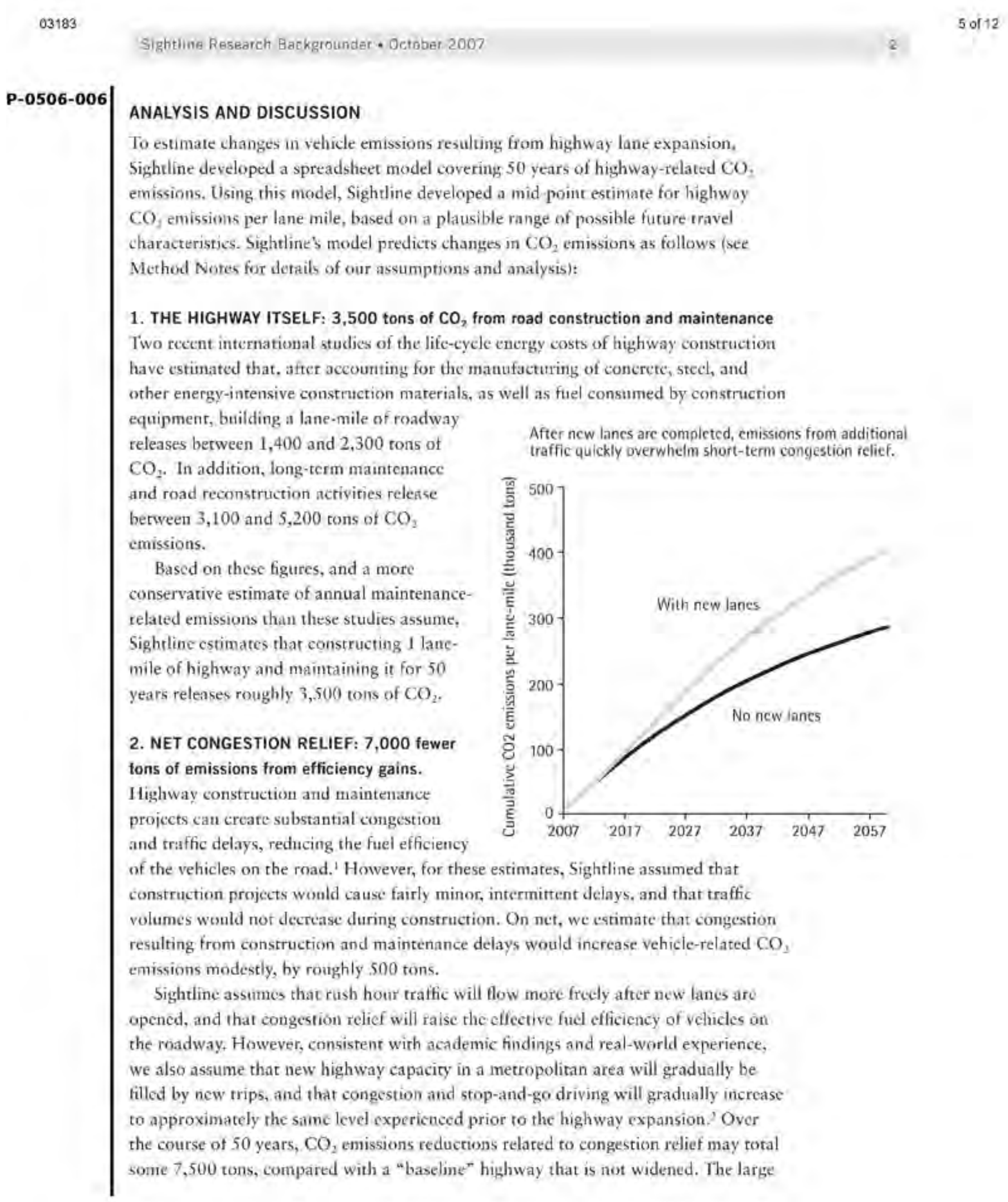
1402 Third Avenue, Suite 500 • Seattle, WA 98101-2130 • 206-447 1880 • www.sightline.org

In October, 2008, the project convened a panel of national experts to review the travel demand model methodology and conclusions, including a land use evaluation. The panel unanimously concluded that CRC's methods and the conclusions were valid and reasonable. Specifically, the panel noted that CRC would "have a low impact to induce growth…because the project is located in a mature urban area," and that it would "contribute to a better jobs housing balance in Clark County…a positive outcome of the project". These results are summarizes in the "Columbia River Crossing Travel Demand Model Review Report" (November 25, 2008).

In 2010, Metro ran the MetroScope model (an integrated land use and transportation model) to forecast growth associated with transportation improvements of a 12-lane river crossing and light rail to Clark College. Even with a 12-lane river crossing, the model showed only minimal changes in employment location and housing demand compared to the No-Build Alternative.

For a more detailed discussion regarding potential indirect land use changes as a result of the CRC project, including the likely land use changes associated with the introduction of light rail, please see Chapter 3 (Section 3.4) of the FEIS.

P-0506-004
The Sightline report refers to a hypothetical highway improvement (adding one general purpose lane, no toll, no high capacity transit, unspecified land use, unspecified real estate markets, and unspecified land use controls). The CRC project-specific analysis of GHG emissions is a much better representation of likely GHG emissions from the CRC project.In addition, the Sightline report (http://www.sightline.org/research/energy/res_pubs/analysis-ghg-roads) inserted a fixed assumption into its spreadsheet model regarding



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ANALYSIS AND DISCUSSION

To estimate changes in vehicle emissions resulting from highway lane expansion, Sightline developed a spreadsheet model covering 50 years of highway-related CO_2 emissions. Using this model, Sightline developed a mid-point estimate for highway CO_2 emissions per lane mile, based on a plausible range of possible future travel characteristics. Sightline's model predicts changes in CO_2 emissions as follows (see Method Notes for details of our assumptions and analysis):

1. THE HIGHWAY ITSELF: 3,500 tons of CO_2 from road construction and maintenance

Two recent international studies of the life-cycle energy costs of highway construction have estimated that, after accounting for the manufacturing of concrete, steel, and other energy-intensive construction materials, as well as fuel consumed by construction equipment, building a lane-mile of roadway releases between 1,400 and 2,300 tons of CO_2. In addition, long-term maintenance and road reconstruction activities release between 3,100 and 5,200 tons of CO_2 emissions.

Based on these figures, and a more conservative estimate of annual maintenance-related emissions than these studies assume, Sightline estimates that constructing 1 lane-mile of highway and maintaining it for 50 years releases roughly 3,500 tons of CO_2.

After new lanes are completed, emissions from additional traffic quickly overwhelm short-term congestion relief.

2. NET CONGESTION RELIEF: 7,000 fewer tons of emissions from efficiency gains.

Highway construction and maintenance projects can create substantial congestion and traffic delays, reducing the fuel efficiency of the vehicles on the road.[1] However, for these estimates, Sightline assumed that construction projects would cause fairly minor, intermittent delays, and that traffic volumes would not decrease during construction. On net, we estimate that congestion resulting from construction and maintenance delays would increase vehicle-related CO_2 emissions modestly, by roughly 500 tons.

Sightline assumes that rush hour traffic will flow more freely after new lanes are opened, and that congestion relief will raise the effective fuel efficiency of vehicles on the roadway. However, consistent with academic findings and real-world experience, we also assume that new highway capacity in a metropolitan area will gradually be filled by new trips, and that congestion and stop-and-go driving will gradually increase to approximately the same level experienced prior to the highway expansion.[2] Over the course of 50 years, CO_2 emissions reductions related to congestion relief may total some 7,500 tons, compared with a "baseline" highway that is not widened. The large

induced growth. They made an underlying assumption that about 85 percent of the traffic using a new highway lane over the estimation period would be trips that would not have occurred if not for that additional capacity. Sophisticated modeling conducted by Metro for the CRC project, as well as the Method Notes for the Sightline report itself, suggest that this may be an extreme over-estimate. The Sightline report appears to have assumed that diverted trips were induced trips in their assumption regarding induced growth. For example, traffic modeling for the CRC project indicates that with improved capacity and reliability on the I-5 crossing (and assuming no toll), the number of auto trips using the I-5 crossing would increase compared to No-build (with a toll the number of trips would decrease). However, most of these "induced" trips are actually "diverted" trips that, under No-build, would have used I-205 instead to avoid the severe congestion and unreliability of the existing I-5 route. These are not new trips, they are diverted trips. Furthermore, this diversion would actually slightly reduce GHG emissions because many of those trips would have a shorter route (resulting in lower VMT) and experience less congestion (resulting in higher fuel efficiency) than if they used the I-205 crossing under a No-build scenario.

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Please refer to Chapter 4 of the FEIS for a description of the current plans for funding construction and operation of the LPA. This discussion provides an updated assessment of likely funding sources for this project, though it is not common practice to receive funding commitments until the alternative selection process is complete. As described in the FEIS, project funding is expected to come from a variety of local, state, and federal sources, with federal funding and tolls providing substantial revenue for the construction. As Oregon and Washington businesses and residents will benefit from the project's multi-modal improvements, both states have been identified as contributors to the project.

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majority of these emissions reductions occur within the first decade in which a new lane is open to traffic.

On net, then, we expect that changes in congestion associated with highway expansion (including both congestion created by construction and maintenance, and congestion relieved after construction) will reduce emissions by about 7,000 tons.

3. NEW TRAFFIC: 90,000 tons of emissions from additional travel on the highway.

It is well documented that highway expansion can result in an increase in the number of vehicle trips on a roadway, particularly in congested urban areas. Indeed, accommodating additional trips is typically the point of adding new lanes to a highway. Still, the speed at which additional traffic floods new lanes often comes as a surprise. One recent California study estimated that more than roughly 90 percent of new lane capacity in congested urban areas is filled within five years after a project is completed. Other studies have found similar "induced traffic" effects from adding lanes to congested roads.

However, not all of the additional traffic on new lanes represents genuinely new travel. Very shortly after a new road or lane opens, for example, some trips that had been taken on other streets and roads shift to the new facility. To account for this effect, Sightline assumes that for the two years after new lanes are opened, none of the additional trips taken on a new facility are genuinely new, but were simply rerouted from nearby roads onto the new facility.

The greenhouse gas impacts of future travel will be affected by changes in vehicle technology and fuel efficiency. Yet even assuming that average vehicle fuel economy improves by 2.5 percent a year (an optimistic assumption, given that the average fuel economy of passenger vehicles has stagnated for decades), Sightline estimates that new vehicle travel on each lane-mile of new highway will release 83,000 tons of CO_2 over the next 50 years. Adding in energy associated with vehicle manufacture and maintenance, this total rises to approximately 90,000 additional tons of CO_2 per lane mile associated with new vehicle trips on an expanded facility.[3]

4. INDIRECT FUEL CONSUMPTION: 30,000-100,000 tons of CO_2 from induced travel off the highway itself.

Travel patterns off the expanded highway are the most difficult to project, since they involve the greatest uncertainties.

Cars that travel on a new highway lane will need to travel on other streets and roads to get to and from the highway; this will result in some additional vehicle mileage beyond the driving that takes place on the highway itself. As a conservative value, Sightline estimated that for each 10-mile trip on a highway, the vehicle is driven a total of 1 mile to and from the highway on- and off-ramps.

In addition, adding lanes—particularly on roads leading to low-density suburbs and undeveloped land on the urban fringe—tends to accelerate low-density sprawling development. Many studies have linked lower-density land use patterns with increased driving. In a sprawling suburb, virtually every trip must be taken by car, and everyday

Projections for VMT suggest that it will rise considerably through 2030. Though per capita VMT may fall, the addition of one million new residents to the region will bring continued growth in trips.

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Please see response above to comment P-0506-004.

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trips can require many miles of travel. In contrast, residents of more compact suburbs and urban neighborhoods typically drive less, and can walk or use transit for many trips, which reduces the carbon emissions from their daily transportation. Accordingly, low-density development is associated with increased vehicle fuel consumption.[4]

Sightline estimates that if as little as one-tenth of new highway trips represent a net shift to lower-density land use patterns (i.e., new sprawling suburban development with modestly higher per-household driving than in compact suburbs), then greenhouse gas emissions from additional off-facility driving could rival or exceed the increases from driving on the facility itself. Regardless of the precise figures, the impacts of off-facility driving enabled by highway expansion are likely to be significant, long-lasting, and far larger than the modest reductions in emissions resulting from congestion relief.

CONCLUSIONS

Our estimates suggest that, over the course of five decades, adding new highway lanes will lead to substantial increases in vehicle travel and CO_2 emissions from cars and trucks. Claims about fuel savings from congestion relief may hold slim merit over horizons of a decade or less. But over the long term, new traffic will fill the added road space, leading to long-term increases in vehicle emissions totaling tens of thousands of tons per lane-mile.

Future refinements in Sightline's emissions model, and the data that it relies on, may affect the specifics of these estimates. Yet under most plausible assumptions for future travel patterns and vehicle efficiencies, Sightline's model predicts that added emissions from new traffic will overwhelm the modest greenhouse gas reductions from congestion relief.

METHOD NOTES

To estimate changes in vehicle emissions resulting from highway lane expansion, Sightline developed a spreadsheet model covering 50 years of highway-related CO_2 emissions. This model relied on the following assumptions and inputs:

Number of lanes: Sightline's model considers an existing metro-area highway with two lanes in each direction that is widened to three lanes in each direction.[5]

Per-mile fuel consumption: Given today's vehicle and fuel technologies, Sightline estimates that the average passenger vehicle creates 1.1 pounds of CO_2 emissions per mile. This covers emissions throughout the "well-to wheels" emissions of the vehicle fuel, including drilling, transporting, and refining petroleum, as well as the end-use consumption of gasoline in passenger vehicles.[6]

- Improvements in vehicle efficiency: Sightline assumes that, over 50 years, average vehicle CO_2 emissions per mile will decline to less than one-third of today's levels, through a combination of improved vehicle efficiency and lower-carbon fuels.[7]
- Congestion-related efficiency losses: When vehicles are operating on a

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congested highway, Sightline estimated that emissions per mile increase by about one-third—comparable the difference between "city" and "highway" miles-per-gallon ratings.[8] Note, however, that even for highways that experience rush-hour congestion, fewer than half of all trips take place during peak travel hours.[9]

- Emissions from vehicle manufacturing: Roughly 9 tons of CO_2 are released during the manufacture a passenger vehicle.10 Sightline assumes that today's cars and light trucks average 180,000 miles of travel over their usable life spans,[11] and that vehicle manufacturing emissions will decline in the future by 1 percent per year.
- Emissions from road construction and maintenance: Sightline used recent peer-reviewed studies to estimate CO_2 emissions from road construction and maintenance.[12]
- Traffic volumes: Sightline assumed that daily traffic volumes on existing lanes would start at between 15,000 and 20,000 daily vehicle trips per lane, rising to a steady state somewhere between 18,000 and 24,000 vehicles per lane over time. Once new lanes are open to traffic, Sightline estimated that 10 percent of any remaining highway capacity would be filled with traffic each year.[13]
- Off-highway driving: For every highway trip, vehicles must travel some distance to and from the highway. In addition, new highway construction can promote scattered, low-density residential and commercial development, which in turn requires residents to drive more miles.[14] Because of the high degree of uncertainty for both effects, Sightline makes conservative estimates for off-highway driving. For new trips resulting from increased capacity, Sightline assumes that vehicles travel one-tenth of a mile of off-highway driving for every mile of on-highway driving. Sightline's low-end estimate of emissions from land use effects assumes that only 5 percent of new trips represent new low-density households, and that these households drive 15 percent more than their higher-density counterparts.

Sightline found that the model's outputs were most strongly affected by three inputs: trends in vehicle fuel efficiency; the difference between current vs. maximum traffic per lane; and the rate at which new lanes are filled by new traffic. In addition, assumptions about off-highway driving and land-use impacts strongly affected total emissions. However, these latter factors are the most inherently uncertain, since they are dependent on geographic, regulatory, and economic factors that are outside the scope of this analysis.

To avoid the chance of overestimating the CO_2 impacts of lane expansion, Sightline's estimates are conservative in a number of ways, including:

- Slow rate of induced traffic: Sightline's midpoint estimates are based on the assumption that 10 percent of any remaining road capacity will be filled

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per year after a new lane opens—meaning that less than half of added lane capacity is filled within 5 years of completion. In contrast, many recent studies have found that as much as 90 percent of new capacity may be filled within 5 years after a new lane is opened.15 Assuming faster rates of induced travel would reduce estimated benefits of congestion relief, while increasing total emissions from generated traffic.

- Low maintenance-related emissions: Sightline assumes a lower total energy consumption from road maintenance and repair than is assumed by several academic studies.
- Assuming no induced travel on parallel roadways: Sightline's model assumes that all new traffic entering a roadway for the first year and half after new lanes are opened represents trips rerouted from nearby routes, rather than genuinely new travel. In addition, Sightline's model assumes that rerouted traffic represents a *permanent* reduction of travel on parallel roadways—an assumption that is inherently conservative, since traffic on parallel roadways is likely to grow as congestion increases on new lanes *(Text updated and corrected June 26, 2008)*.

ENDNOTES

1 For four highway-widening projects analyzed by the Surface Transportation Policy Project in the late 1990s, the "payback" period—the period after which time savings due to added road capacity equaled time lost during road construction—ranged from 2.75 years to infinity. In the latter case, travelers never recouped the time lost to congestion during construction. See STPP, "Road Work Ahead: Is Construction Worth the Wait?" at *http:www.transact.org/report.asp?id=169*.

2 An excellent of the literature on "induced" or "generated" traffic can be found in Todd Litman, "Generated Traffic and Induced Travel: Implications for Transport Planning" at *http://www.vtpi.org/gentraf.pdf*. See especially pages 7 and 8 for estimates of "generated traffic" from highway expansion. Also see page 4 for a discussion of how a congested roadways tend to reach an equilibrium daily traffic volume.

3 Carbon intensities for future vehicle and fuel technologies are impossible to predict, since they depend on regulatory, economic, technological, and geological factors that are outside the scope of this report. Yet even if effective vehicle fuel economy rises to 100 mpg over 50 years, GHG emissions from new traffic on the lane will still total some 60,000 tons—far more than the relatively modest greenhouse gas benefits from congestion relief.

4 For more on the relationship between urban form and vehicle travel, see:
Frank, Lawrence and Company, Inc. (2005). "Achieving Sustainability Through Healthy Community Design." King County, WA. September 27, 2005.
Golob, Thomas, and David Brownstone (2005). "Impact of Residential Density on Vehicle Usage and Energy Consumption." Institute of Transportation Studies,

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UC-Irvine. *http://www.its.uci.edu/its/publications/papers/ITS/UCI-ITS-WP-05-1.pdf*

Holtzclaw, John (1998). "Curbing Sprawl to Stop Global Warming," Sierra Club. *http://www.sierraclub.org/sprawl/articles/warming.asp*

Holtzclaw, John (2000). "Smart Growth—As Seen From the Air," Air& Waste Management Association Annual Meeting, June 2000. *http://www.sierraclub.org/sprawl/transportation/holtzclaw-awma.pdf*

Holtzclaw, John, et al (2002). "Location Efficiency: Neighborhood and Socio-Economic Characteristics Determine Auto Ownership and Driving; Studies in Chicago, Los Angeles, and San Francisco." Transportation Planning and Technology, March 2002.

Kahn, Matthew. (2000). "The Environmental Impact of Suburbanization." Journal of Policy Management," Vol. 19, No 4, *http://www.environmentalleague.org/Issues/Land/Kahn_2.pdf*

Newman and Kenworthy (1989b). Cities and Automobile Dependence: An International Sourcebook.

Newman and Kenworthy (1999). Sustainability and Cities: Overcoming Automobile Dependence, Washington, DC: Island Press.

U.S. Environmental Protection Agency (2001). "Our Built and Natural Environments: A Technical Review of the Interactions Between Land Use, Transportation, and Environmental Quality." Development, Community, and Environment Division, January 2001. *http://www.epa.gov/dced/pdf/built.pdf*

5 Note that the end results do not depend heavily on these assumptions. Other configurations of highway expansion lead to virtually identical results.

6 Current average passenger vehicle fuel economy is approximately 21 mpg; see *http://www.epa.gov/otaq/fetrends.htm* and *http://www.washingtonpost.com/wp-dyn/content/graphic/2006/07/18/GR2006071800596.html*. This is likely a conservative estimate of highway vehicle emissions, since it represents only passenger vehicles, while ignoring heavy trucks that emit significantly more CO_2 per mile. Life-cycle CO2 emissions per gallon of gas estimated at 25.6 pounds; derived from *http://www.environmentaldefense.org/documents/3986_CAautocarbonburden.pdf*, p. 11.

7 It is possible that future vehicle and fuel technologies may achieve even better results. However, given that US vehicle fuel economy has stagnated for roughly two and a half decades, any improvement in the fuel economy of the vehicle fleet is, at this point, purely a matter of speculation. If carbon emissions from vehicle travel fall more slowly than Sightline assumes, then Sightline's analysis may substantially understate eventual carbon emissions resulting from highway expansion.

8 City vs. highway fuel economy derived from data downloaded from the US Department of Energy, at *http://www.fueleconomy.gov/feg/download.shtml*. Note, however, that hybrid gas-electric engines are actually more efficient in stop-and-go city driving than in free-flowing traffic—suggesting that the fuel-conserving benefits

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of congestion reduction may fall over time as these technologies are used more widely.

9 In a study of 75 US metropolitan areas, just over 40 percent of vehicle travel in 2000 took place at times when major roadways typically experience congestion, and 25.5 percent of all travel took place under congested conditions. See Anthony Downs, Still Stuck in Traffic: Coping With Peak-Hour Traffic Congestion, Washington, DC, Brookings Institution Press, 2004, p. 16. Similarly, data for the Puget Sound region show that roughly 42 percent of total travel on the region's busiest highways in 2005 took place during peak periods (6 to 9 a.m. and 3 to 7 p.m. inclusive); see *http://depts.washington.edu/hov/2005/WkdyVehVol/2005_WkdyVehVol.pdf*. And data from the US Bureau of transportation statistics suggests that 43 percent of all trips nationwide take place during the morning and afternoon peak periods; see *http://www.bts.gov/publications/journal_of_transportation_and_statistics/volume_06_number_01/html/paper_02/table_02_02.html* and *http://www.bts.gov/publications/highlights_of_the_2001_national_household_travel_survey/html/table_a12.html*. Considering both the increases in per-mile emissions caused by congestion, with , Sightline estimates that peak-hour congestion increases fuel-related CO_2 emissions on a roadway by about 15 percent.

10 Sightline's estimates for the carbon intensity of vehicle manufacture are based on a number of published sources, including:

Argonne National Laboratory, F. Stodolsky et al., "Life-Cycle Energy Savings Potential from Aluminum-Intensive Vehicles," at *http://www.transportation.anl.gov/pdfs/TA/106.pdf*.

Environmental Defense, John DeCicco and Kate Larsen, "Automaker Carbon Burdens in California," 2004, available at *http://www.environmentaldefense.org/documents/3986_CAautocarbonburden.pdf*.

Web page, "Life cycle assessment: Toyota's comprehensive analysis of vehicle CO_2 emissions over the life of the vehicle reveals some surprizes [sic]," Automotive Industries, Feb. 2005, at *http://findarticles.com/p/articles/mi_m3012/is_2_185/ai_n12937459*.

Web page, "Automobiles: Electric vs. Gasoline; Seikei University (Tokyo), 2001" Institute for Lifecycle Environmental Analysis, at *http://ilea.org/lcas/tabaraetal2001.html*.

Web page, "Report 5: How Do We Contribute Individually to Global Warming," The Hinkle Charitable Foundation, at *http://www.thehcf.org/emaila5.html*.

Web page, "Car Companies and Climate Change: Measuring the Carbon Intensity of Sales and Profits," World Resources Institute, at *http://earthtrends.wri.org/features/view_feature.php?theme=5&fid=53*.

11 Lifetime mileage per vehicle from National Highway Traffic Safety Administration, "Vehicle Survivability and Travel Mileage Schedules," January 2006, at *http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/Rpts/2006/809952.pdf*. Note that the 180,000 mile per vehicle figure currently applies to light trucks, rather than

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cars, which are typically driven just 152,000 over their lifetimes; to be conservative, applied the higher figure applies to all passenger vehicles.

12 Life-cycle road construction and maintenance emissions estimated from:
Graham J. Treloar et al., "Hybrid Life-Cycle Inventory for Road Construction and Use," Journal of Construction Engineering and Management, Vol. 130, No. 1, January/February 2004, pp. 43-49 , (DOI 10.1061/(ASCE)0733-9364(2004)130:1(43)),
Kwangho Park et al., "Quantitative Assessment of Environmental Impacts on Life Cycle of Highways," Journal of Construction Engineering and Management, Vol 129, January/February 2003, pp 25-31, (DOI: 10.1061/(ASCE)0733-9364(2003)129:1(25)).

13 As noted in the above review, recent studies have found that three-quarters or more of new road capacity will be filled after the first few years of operation, particularly in crowded urban areas with significant "latent" demand. One California study estimated that 90 percent of new road capacity will be filled within five years.
In this context, the estimates used in Sightline's spreadsheet model (i.e., that 10 percent of additional road capacity will be filled per year after a new lane opens) is fairly conservative. See also note 4.

14 See note 4.

15 See note 2.