WASHINGTON POLICY CENTER

POLICY BRIEF

Light Rail on I-90 Will Do Little to Reduce CO_2

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October 2007

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1. Introduction

No discussion about regional transportation is complete these days without some reference to the impact on greenhouse gases. This is understandable because CO_2 emissions from cars represent 47 percent of greenhouse gas (GHG) emissions in Washington.[1] Light rail is frequently mentioned as a sure fire way to reduce CO_2 since it runs on electricity. In King and Pierce counties, electricity is generated primarily using non-CO_2 emitting sources including hydroelectric, nuclear and wind power.[2] Given that King County light rail will emit very little CO_2, it seems an obvious policy option for reducing transportation-related greenhouse gases.

A number of policymakers agree with that logic. Elected officials and interest groups have made a range of claims about the importance of light rail to reduce transportation-related greenhouse gases. On Seattle Mayor Greg Nickels' "Mayors for Climate Protection" web page, he notes that "cities are implementing a host of climate-control strategies, adding bike paths and bus routes or light rail…"[3] The Sierra Club agrees, saying "We need to offer commuters more buses and light rail choices…"[4] The organization promoting the Roads and Transit Proposition 1 notes on their web page under the heading "More transportation choices means a cleaner environment," and that "Building an additional 50 miles of light rail … will take cars off the road and provide better mobility options."[5]

Only Emory Bundy has questioned whether light rail will actually reduce CO_2 over the course of its lifetime. He cites the high level of CO_2 emissions during construction, indicating that light rail will probably not save enough CO_2 on a day-to-day basis to catch up to the amount of emissions emitted during construction.[6]

One assumption that is consistent, however, is that on a day-to-day basis, light rail reduces CO_2. Interestingly, no studies have actually been done to test that hypothesis here in Washington. When attempting to find the source for this assumption, no agency we spoke with had begun this

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[1] Washington State Climate Advisory Team, "Greenhouse Gas Inventory and Reference Case Projections, 1990-2020," July 19, 2007, http://www.ecy.wa.gov/climatechange/CATdocs/71907DraftWACATGHGReport.pdf (Accessed September 19, 2007)
[2] Approximately 95 percent of Seattle's electricity, for example, is non-CO2 emitting. See Seattle City Light, "Seattle City Light Fingertip Facts | 2007 Guide," http://www.seattle.gov/light/aboutus/customerguide/#PowSup (Accessed September 26, 2007)
[3] Mayors for Climate Protection, "Mayor of City of Seattle," http://www.coolmayors.com/common/directory/mayor_profile.cfm?QID=28426&ClientID=11061&ThisPage=2 (Accessed September 19, 2007)
[4] Sierra Club Cascade Chapter, "Sierra Club Releases Vision of RTID Highway Building Plan," May 14, 2007, http://cascade.sierraclub.org/node/1329 (Accessed September 19, 2007)
[5] Keep Washington Rolling, "Why Vote Yes," http://www.yesonroadsandtransit.org/about/why_vote_yes.html (Accessed September 19, 2007)
[6] Emory Bundy, "The carbon cost of building and operating light rail," July 25, 2007, Crosscut Seattle, http://www.crosscut.com/sound-transit/5555/The+carbon+cost+of+building+and+operating+light+rail/ (Accessed September 18, 2007)

type of analysis, although all claimed that it was in their future. The Washington State Department of Transportation, Metro, Sound Transit, the Puget Sound Regional Council and the Puget Sound Clean Air Agency all indicated to us that they have not yet done any significant research on this issue. This is not surprising, as this is a fairly new area of analysis.

Testing that hypothesis is, however, very important prior to making major transportation planning decisions. The key issue is that rights-of-way are limited in King County so most plans for light rail involve tunneling or turning highway lanes into light rail. The combination of a reduction in traffic rights-of-way and increasing population seems likely to increase traffic congestion, thus increasing the amount of CO_2 emitted by vehicles as they sit in traffic. Proponents of light rail argue, on the other hand, that the increase in passengers riding light rail would more than offset that increase. No research, however, had been done to test the balance of greenhouse gas emissions from this tradeoff.

Despite that, politicians and activists all assumed that light rail would have the clear effect of reducing CO_2, at least on an operational basis, if not over the course of the lifetime of light rail.

To test this hypothesis, we chose the proposed Eastlink light rail project across I-90 which presents just the tradeoff described above. Using a model provided by the California Air Resources Board (CARB), we tested the CO_2 emissions of both the light rail proposal and the "no action" alternative which would leave the current I-90 configuration.

Using traffic and transit data provided by the WA Department of Transportation, Sound Transit and the Department of Ecology, we estimated the per-passenger CO_2 emissions across I-90 in 2030. We found three interesting results.

1) Light rail will reduce CO_2 emissions by about 6 percent during the peak hours assuming that 30 percent of passengers crossing I-90 ride light rail as is projected by Sound Transit. If the percentage of passengers crossing I-90 falls to 22.5 percent, that daily savings disappears.
2) Most of the greenhouse gas emissions reductions are achieved eastbound where the impact of removing two lanes of traffic will have the least impact on congestion. Westbound, where the impact on congestion is the greatest due to the changes, there are small improvements or actually a negative effect.
3) The CO_2 reductions achieved from light rail can very easily be matched by a small increase in fuel efficiency.

These results indicate that transit options that increase congestion will actually see a limited or negative effect on CO_2 emissions.

Finally, while the data show a slight reduction in day-to-day emissions of CO_2, it is probably not reasonable to make light rail the centerpiece of any strategy to reduce greenhouse gases. Our focus in this study is on the day-to-day emissions and does not account for the greenhouse gases emitted during the construction process from the many tons of concrete, steel and other elements of the construction process. An average daily reduction of six percent is likely to take an exceedingly long time to offset the CO_2 emitted during construction.

All of this leads to the conclusion that elected officials and planners should see any reduction of greenhouse gases from light rail or other options that reduce rights-of-way as a pleasant side effect rather than a justification for the strategy. Indeed, decreases in CO_2 can quickly turn into increases if planners attempt to use congestion as a way to promote transit.

2. Projecting Traffic and Transit Ridership in 2030

Any effort to project the future relies on good data and a sound, tested model. For our study we relied on data provided by local transit agencies and a model already in use by the California Air Resources Board. We limited the instances where we adjusted numbers to a minimum and asked local experts for their input on our approach.

First, we looked for credible data on future traffic and transit riders across I-90. Despite the number of agencies and organizations working on future traffic planning in King County, we found it remarkably difficult to get reliable traffic and transit data. In one case we found that one agency responsible for planning was having difficulty getting data from another agency responsible for running transit.

As a side note, getting reliable traffic and transit data was the most frustrating part of this project. It seems surprising that given the importance of transportation in our political discourse and local government there would be some level of cooperation among the agencies and clarity and consistency of data. In my experience, that is not the case and more than one person I spoke with sympathized with my frustration.

Ultimately, rather than attempting to synchronize the data of the various organizations or make projections, we relied on the projections from the Department of Transportation and Sound Transit.

All traffic data is taken from the Department of Transportation "Interstate 90 Center Roadway Study"[7] published last year. They modeled the impact in 2030 of replacing the two reversible center lanes on I-90 with light rail against the traffic under a "No Action" alternative which simply left I-90 in its current configuration. Their model does assume improvements to 520, which are still under discussion, and does not examine the impact of tolls on either or both bridges.

The transit data was provided by Sound Transit. They projected that light rail would carry 3,000 riders in the peak direction and 2,000 in the off-peak direction in 2030. Transit would continue to carry only about 300 passengers in the peak direction and 100 in the off-peak direction.[8]

We used these numbers to project the number of transit riders in the no-action alternative. Sound Transit estimates that 75 percent of those riding light rail will come from buses. The other 25 percent will be new riders. Using that data, we estimated that the number of transit riders in the no action alternative would be 2,550 in the peak direction and 1,600 in the off-peak direction (i.e. 75 percent of the light rail riders plus the remaining transit riders). To estimate the number of buses needed to carry those people, we assumed a load factor of 40 passengers per bus. Thus, we estimated

[7] Washington State Department of Transportation and DKS Associates, "Interstate-90 Center Roadway Study," July 2006, http://www.wsdot.wa.gov/NR/rdonlyres/2D30E991-6159-4F2A-A84B-284622643B79/0/I90CenterRoadwayStudy.pdf (Accessed September 20, 2007)

[8] Conversation with Sound Transit, August 6, 2007

that the no action alternative would see 64 buses in the peak direction per hour and 40 in the off-peak direction. We applied the same logic to the light rail scenario, which gave us 8 buses in the peak direction per hour and 3 in the off-peak direction.

This method slightly improves the CO_2 reduction of the light rail alternative. Sound Transit indicated that it believed it would see between 15 and 30 buses in the off-peak direction per hour.[9] If we used this assumption, the amount of CO_2 emitted in the light rail scenario would increase due to the emissions of those extra buses while carrying the same number of passengers and increasing per-passenger emissions. Ultimately, however, the emissions of the 7 or 12 extra buses per hour would create only a small impact on CO_2, reducing the advantage of light rail over the no action alternative by one half of one percent.

It is true that Sound Transit's light rail ridership projections are controversial and much of the debate about Sound Transit revolves around the accuracy of those numbers. We take no position on that issue. Our goal is simply to see, given the projections currently being used by planners, what impact there will be on greenhouse gases and how sensitive the emissions are to light rail ridership. If these numbers are high, then the CO_2 reduction we found will probably go away. If these numbers are low, then the amount of CO_2 reduced will climb. Our goal was to provide a baseline against which to judge potential savings.

3. Projecting Greenhouse Gas Emissions

The process of modeling CO_2 emissions is relatively new, so finding a model that allowed us to project the impact of transit options on greenhouse gas emissions was not straightforward. The Environmental Protection Agency does have a model. They, however, discouraged us from using it suggesting a model used by the California Air Resources Board. CARB's model, they said was more user friendly and suited to my project and since California had the most experience with efforts to reduce CO_2, they would be extremely knowledgeable on the topic.

CARB has a model called EMFAC, the EMission FACtors model. The model is available online for anyone to use.[10] The model generates CO_2 emissions data, as well as other emissions data, for a wide range of vehicles and can be adjusted to fit a range of circumstances. The user guide notes that

> "This model reflects the ARB's current understanding of how vehicles travel and how much they pollute. The Emfac2007 model can be used to show how California motor vehicle emissions have changed over time and are projected to change in the future. This information helps ARB weigh prospective control programs and determine the most effective, science-based proposals for protecting the environment."[11]

[9] E-mail to author from Sound Transit, August 16, 2007

[10] The latest version is EMFAC2007, available at http://www.arb.ca.gov/msei/onroad/latest_version.htm

[11] California Air Resources Board, "EMFAC2007/Version 2.30: Calculating emission inventories for vehicles in California," http://www.arb.ca.gov/msei/onroad/downloads/docs/user_guide_emfac2007.pdf (Accessed September 21, 2007)

First, the model calculates the emissions based on the type of vehicles, including motorcycles, cars, light trucks, freight trucks, buses and other types of vehicles. Within each category, it also breaks the type of vehicles down into other groups, including vehicles that use gasoline, diesel, hybrids or zero-emissions vehicles (ZEVs).

The model also can be adjusted to fit a range of other characteristics, including average daytime temperature, humidity and the projected year. For our purposes we projected data for 2030. The model estimates the percentage of vehicles from each model year based on typical percentages of cars sold in each year. Although the model can project emissions for 2030, it is conservative in this area, assuming no technology improvements beyond 2010. For instance, the model caps the number of electric cars (ZEVs) at 2.4 percent. This is a limitation to be sure, but it is no less unreasonable than attempting to pick percentages for 2030. Consider, for instance, that hybrids have been on the market barely a decade, so making projections about available technology for 23 years into the future is perilous.

The result of that assumption is that light rail looks better than it might otherwise. As the level of CO_2 emissions for vehicles declines, the advantage that light rail has over vehicles also declines. Thus, if we assume a higher level of vehicle emissions than is probable, it slightly favors light rail. It should be noted, however, that the difference is slight, amounting to fractions of a percentage point when comparing the no action alternative to light rail.

The model also approximates actual vehicle travel. Rather than simply assuming a constant speed, the model builds in starts and stops which add to CO_2 emissions. Although the model produces estimated emissions by average speed, it assumes that the speed is average, not constant. Anyone who has crossed I-90 at peak hour understands that the brake and the gas pedal are equally important. EMFAC knows that too and makes estimates of that starting and stopping.

	Car	**Light Duty Truck**	**Medium Duty Truck**	**Heavy Duty Truck**	**Bus**	**Motorcycle**	**ALL**
5.000	923.902	1180.693	1703.937	3188.379	2486.245	266.261	1263.026
10.000	698.157	892.319	1257.331	2643.219	2206.939	221.962	967.977
15.000	547.565	699.949	970.068	2207.869	2042	190.651	767.443
20.000	445.733	569.866	781.353	1898.199	1941.571	168.686	631.465
25.000	376.591	481.541	656.098	1784.114	1879.156	153.753	546.305
30.000	330.232	422.322	573.594	1692.152	1840.271	144.423	488.31
35.000	300.555	384.412	521.523	1619.835	1816.872	139.9	450.34
40.000	283.912	363.152	492.724	1565.804	1804.557	139.889	428.167
45.000	278.355	356.052	483.462	1529.392	1801.156	144.561	419.548
50.000	283.248	362.303	492.586	1510.421	1806.093	154.603	423.77
55.000	299.151	382.618	521.275	1509.15	1820.209	171.362	441.506
60.000	327.92	419.369	573.309	1526.353	1846.013	197.138	474.951
65.000	373.079	477.056	655.945	1563.549	1888.437	235.705	528.276

EMFAC Model Output – Grams of CO2 per mile by Speed and Vehicle Type – 2030

In first using the model, we asked CARB to run the data we needed. They obliged, using the temperature, humidity and year data we provided. Using their results, we created the initial estimate and then produced our own data using the model, adjusting the variables to test the sensitivity of the model to a range of factors. This is important because while modelers and others can debate about the appropriate numbers to put into the model, if those changes make little difference to the outcome, such debates do not affect the overall conclusions of the model. Given the inherent margin of error in predicting emissions in 2030, minor changes to the model can be a bit like debating about the number of angels that can dance on the head of a pin.

This model is geared toward California traffic patterns and used California data to verify the model's projections. Applying it to Washington, therefore, is not perfect. This is mostly unavoidable. As mentioned above, California has done more work in the area of CO_2 emissions than other states, so there is a tradeoff between using a model from the state that is farthest ahead in this analysis or using a model that fits Washington. EPA does have a model that might be appropriate, but both the EPA and CARB indicated that the EMFAC model would be suitable for this project while recognizing its limitations.

We also adjusted the data, using local data on the types of vehicles in King County provided by the Department of Ecology and the Puget Sound Clean Air Agency.[12] King County vehicle distribution is skewed more toward larger cars and fewer motorcycles than Alameda County, which we believed would be a relatively close comparison for a variety of reasons. The result of these changes, however, changed the outcome only by about 0.2 percent.

Finally, we estimated that light rail would emit no CO_2 since it uses electricity which, in King County, is produced largely from non-CO_2 emitting sources. Given that we currently produce more than 90 percent of our electricity from hydro, nuclear and wind, it is not unreasonable to assume that by 2030 the level of CO_2 emissions from electrical generation for King County will be very close to zero. Of course there will always be some CO_2 emitted to run and maintain light rail. The levels, however, are negligible enough that they also represent a margin of error so small that it is unlikely to change the outcome of the analysis.

4. Comparing Alternatives

Using the data provided by the various agencies and the model provided by CARB, we compared the emissions from an alternative that uses the two middle lanes of I-90 for light rail against an alternative that continues to use the current I-90 configuration. As noted above, we used data from the Department of Transportation to estimate the impact on traffic for the two scenarios.

In the light rail alternative, the two lanes being removed would be replaced with an additional lane in each direction on I-90. This, however, is not a perfect replacement. Currently, depending on the time of day, there are five lanes in one direction and three in the other. The reversible lanes are used to ease congestion in the peak direction. Thus, in a scenario where there are four lanes in each direction, there is a reduction in the peak-direction lanes and an increase in the off-peak direction. This is the reason that peak-direction commute times increase in the light rail scenario.

Since transit options are targeted toward peak hours, we limited our analysis to those times of day. Transit is not designed to help people travel more quickly at noon or midnight. It is focused on

[12] E-mail to the author from the Puget Sound Clean Air Agency, September 17, 2007

8am and 5pm. It would simply be unfair, in our opinion, to judge the impact of transit for trips that are ancillary to its purpose.

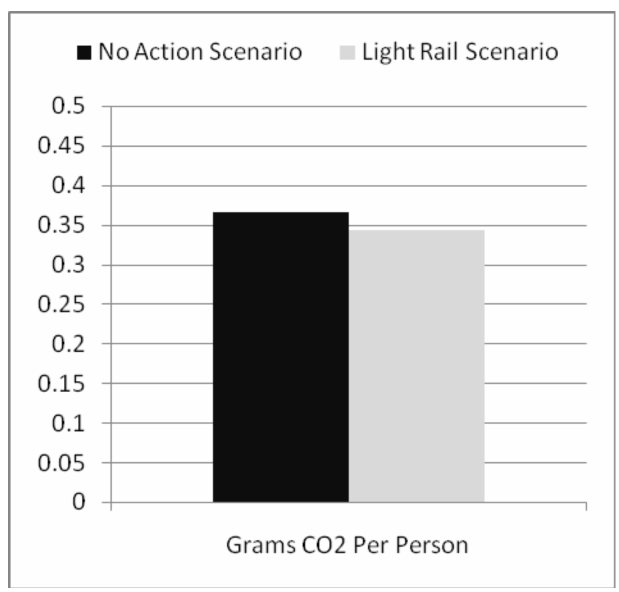
Thus, we modeled the average CO_2 emissions for one hour of AM peak traffic in both directions and one hour of PM peak traffic in both directions. We then totaled the CO_2 emissions for these four hours and divided the total by the estimated number of passengers in cars, buses and on light rail to create an estimate of CO_2 per person.

In the peak directions there is a significant reduction in the number of single-occupancy vehicles crossing I-90 in the light rail scenario. The DOT study assumes that 520 will see improvements in the coming years and that increased congestion on I-90 will cause a shift in traffic patterns away from I-90 toward 520. For instance, during the morning peak hour on I-90 in the westbound direction, there are more than 1,000 fewer single-occupancy vehicles in the light rail scenario than under the no action alternative. Many of those cars are simply moving to 520. Thus, emissions are not being reduced for those vehicles, it is simply being moved from I-90 to 520. To account for this, we added back the CO_2 emissions from half of those vehicles. We assume that some of those missing cars result from their drivers climbing on light rail. Sound Transit's estimates are that there will be 750 light rail riders per hour who did simply switch from bus to light rail. It seems reasonable that some, but not all, of those 750 passengers came from cars. Thus, we split the number of diverted vehicles in half between those that diverted to 520 and those who are now riding light rail.

Finally, it should be noted that we made efforts to check the validity of our approach by speaking with agencies that are expert in this area. It should be clear that all of the work is ours, but we made an effort to check the validity of our approach and model.

5. The Results – Small Reductions in CO_2 Emissions

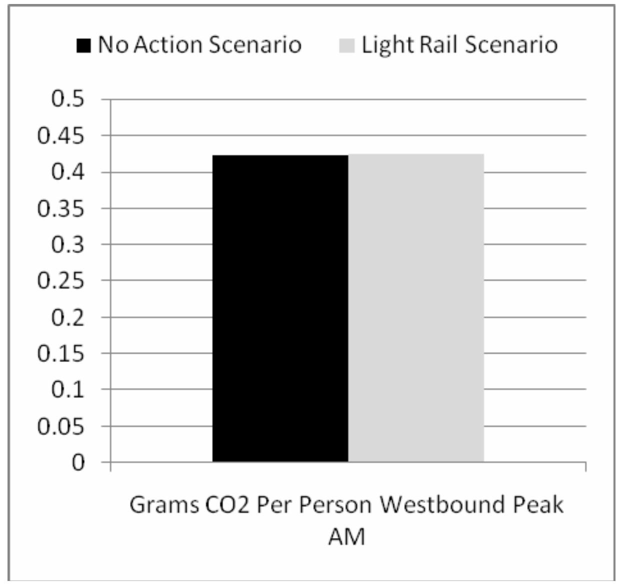
After running the data through the EMFAC model and applying the results to DOT's I-90 data, the results show a small reduction in the amount of CO_2 per passenger crossing I-90. For the peak hours in both directions, the average passenger crossing I-90 under the no action alternative emits about 0.366 grams of CO_2. In the light rail scenario the average passenger crossing I-90 emits 0.344 grams of CO_2, or about 94 percent of the amount emitted on average in the no action alternative.



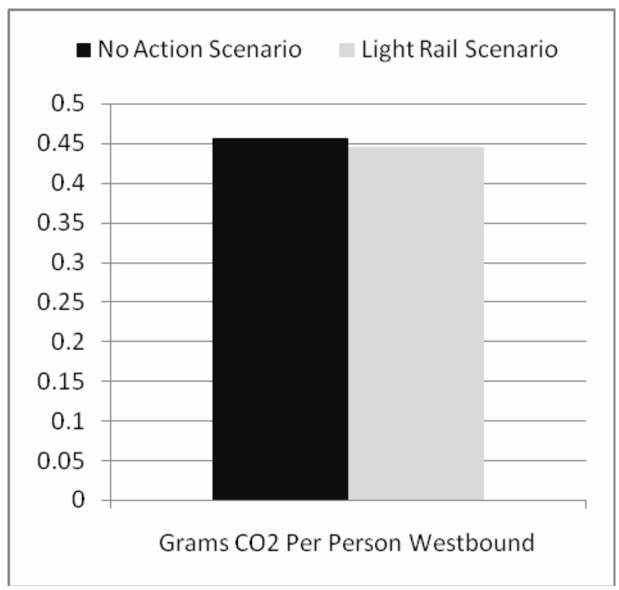
A closer look at the data shows where these savings come from.

For the morning commute, passengers in the off-peak (eastbound) direction emit about ten percent less CO_2 per person than in the peak (westbound) direction. In the westbound direction, however, the CO_2 per person is actually higher in the light rail alternative than in the no action alternative. In other words, the increased congestion caused by removing the two middle lanes more than offsets the reduction in

CO_2 from passengers riding emissions-free light rail. All of the CO_2 savings come from the direction where traffic is flowing freely.



The same pattern emerges in the evening commute. The average passenger traveling in the peak direction (eastbound) in the light rail scenario emits about 14 percent less CO_2 than in the no action alternative. Due to a variety of factors, the DOT model notes that removing the middle two lanes for light rail has a greater impact on westbound traffic than eastbound traffic. This reduction in CO_2 results from the increased number of passengers traveling in the peak direction. The total number of vehicles is virtually the same under both scenarios in the evening off-peak direction. Thus, the total amount of CO_2 emitted is basically identical. Due to the higher number of passengers in the light rail scenario, however, the per-passenger CO_2 is lower. This improvement, therefore, depends entirely on the projections of off-peak light rail passengers.



In the off-peak direction (westbound) during the evening commute, the light rail scenario sees CO_2 emissions only four percent lower than the no action alternative. Thus, where light rail increases congestion, the reductions in CO_2 emissions are almost eliminated. In the westbound direction, there is a less than three percent improvement in the amount of CO_2 emitted.

The impact of congestion is rather dramatic. Even with a scenario where approximately 30 percent of people crossing I-90 are emitting no CO_2 (i.e. light rail riders), the benefits of those savings are almost offset by the congestion created by removing two lanes. This is important because many of the proposed efforts to move people out of cars rely on the effect increased congestion will have on drivers. These proposals assume that as traffic increases, people will begin to choose transit. Unless large numbers of people make the switch to a zero-emissions alternative, the model demonstrates that congestion will most likely overwhelm any CO_2 reductions.

One final note on the amount of CO_2 emissions is necessary. This analysis looks only at the day-to-day impact on CO_2 emissions of the light rail project. Most analyses of greenhouse gas emissions use a life-cycle analysis that examines not only the day-to-day results of an action, but the energy used to create that scenario. A strategy, therefore, that relies on pouring many tons of concrete and steel must see day-to-day CO_2 reductions that are greater over the lifetime of the project than the CO_2 emitted during construction. Construction of light rail is projected to take many years and many tons of concrete will be used to build the project.

However, we were unable to obtain reliable data on the amount of concrete and steel Sound Transit believes it will use during the construction of the Eastlink light rail project. Given the small amount of daily savings of CO_2, however, it does not seem unreasonable to believe that it will take a long time to catch up to the amount of CO_2 emitted during construction, if the project ever, in fact, does catch up. Further, even if light rail can eventually see a reduction in lifetime CO_2 emissions, there is a temporal problem. Reducing one ton of CO_2 today is more valuable in terms of lowering total greenhouse gases in the atmosphere than one ton of CO_2 in 2100. Thus, emitting CO_2 today in the hopes that we will reduce CO_2 tomorrow is problematic.

6. Potential Responses to These Results

There are a number of potential critiques about the data produced by this model. Many involve our use of the model and the data we used to make the projections. Our assumptions are explained above and many of these limitations are acknowledged. Our goal is not to produce an absolute amount of CO_2 emitted by the various alternatives, but to create a comparative baseline for the two alternatives. While the specific traffic patterns of Washington and I-90 may be different than those assumed in the EMFAC model, the ratio of CO_2 emitted in each scenario is unlikely to change significantly. During this process we looked for variables that would have a significant impact on the results. For instance, when we received more accurate data about the types of vehicles on the road in King County, we substituted it for those from Alameda County. As mentioned above, despite an increase in the number of SUVs and a reduction in motorcycles, the impact was very slight, increasing the advantage that light rail had over the no action alternative by only 0.2 percent. This was a consistent pattern. Whenever we modified the inputs, the outputs changed, but only slightly, leaving the overall pattern the same.

One change that would have a significant impact on the amount of CO_2 per person is the projection of light rail ridership. If light rail ridership, projected for 3,000 passengers per hour in the peak direction and 2,000 per hour off-peak, is reduced by 25 percent, the no action alternative becomes the better alternative for reducing CO_2. As noted above, I do not take a position on the validity of Sound Transit's projections. During this process they noted that their projections must meet standards set by the U.S. government in order to qualify for federal funding. For that reason, they say, ridership numbers are not simply projections based on political expediency as some claim. Others look at ridership projections on the Sounder, which have fallen short, as an indication that Sound Transit is unlikely to meet their ridership levels.

One issue I will address is a statistic that has been repeated to me a number of times, namely that the total ridership on transit for all trips is currently only three percent, making a 30 percent ridership unlikely. I do not believe that is an accurate comparison in this case. The three percent statistic refers to all trips, including trips people take to the store and which are very unlikely to use transit. Light rail, on the other hand, is built to serve a specific, known pattern of travel for a large number of people, namely commuters. For this specific route, therefore, the percentage of commuters using light rail across I-90 is likely to be significantly larger than three percent. That does not indicate whether the total will be higher or lower than thirty percent, but it does indicate that the use of the three percent statistic is inappropriate.

Another potential objection would be that even though the CO_2 emissions are fairly low, they are real and therefore worth the effort. Of course, this assumes that the light rail ridership projections are correct and will not fall below expectations or that the removal of the middle lanes will not have a greater-than-projected impact on congestion. If either of these things occur, there would be a net increase in per-passenger CO_2 under the light rail scenario. That is also independent of the CO_2 emitted during construction.

Additionally, given the huge cost of the project, there are numerous ways to reduce CO_2 more cheaply than by creating light rail. For instance, the City of Seattle plans to spend just over $100 million during the next six years to reduce CO_2 emissions in Seattle to the levels required by the Kyoto Protocol. Whether they can meet the targets for that cost remains to be seen, but compared to the many billions it will take to build light rail, it is a relative bargain. We have noted before that even Seattle's plan is up to ten times as expensive per ton of CO_2 reduced than other available methods.[13] Thus, under any set of assumptions, the percentage of the light rail project that can reasonably be considered to be part of efforts to reduce CO_2 is extremely small.

7. Conclusion: Lessons and Alternatives

Despite the assumptions being made by elected officials, activists and policymakers, building light rail is not an effective way to reduce greenhouse gases. This does not mean that there is no reason to support light rail. It does mean that light rail's value should be judged based on its impact on transportation, not CO_2. Policymakers should take several lessons from this data.

First, policymakers should avoid making policy based on untested assumptions about CO_2 reductions. On the assumption that moving people from cars to transit has a dramatic impact on emissions, some have treated congestion as an opportunity, not a cost. As the data shows, however, that is a dangerous assumption that can quickly become counterproductive.

Second, using congestion to encourage people to move out of their cars is risky. Even in the above scenario, where the CO_2 emissions from 30 percent of riders were eliminated, the net reduction of greenhouse gases is small. In the case of the westbound commute, where the creation of light rail creates the most congestion, the light rail scenario has per-passenger CO_2 emissions only about three percent lower than the no action alternative. While the data does not exist to test the impact, this would seem to indicate that the proposed strategy to remove the Alaskan Way viaduct in Seattle, replacing the capacity only with transit, would actually increase CO_2 emissions despite the fact that reducing greenhouse gases is the putative reason for that strategy.

This conclusion is confirmed by a study done by the University of California Riverside Center for Environmental Research and Technology.[14] Using GPS transmitters in cars in the Los Angeles area, UCR studied travel patterns of vehicles and measured CO_2 emissions. They found that increases of traffic speed, up to 45 mph, decreased emissions per mile. In a PowerPoint presentation, they concluded that "traffic congestion has a significant impact on CO_2 emissions."[15] They indicated

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[13] Todd Myers, "Seattle Climate Policy is Heavy on Dollars and Light on Change," September 2006, Washington Policy Center *Environmental Watch*,
http://www.washingtonpolicy.org/EnvironmentalWatch/September%202006%20Environmental%20Watch.pdf (Accessed September 21, 2007)

[14] The presentation was based on Barth, M. and K. Boriboonsomsin (2007) "Real-World CO2 Impacts of Traffic Congestion", submitted to the Transportation Research Board 87th Annual Meeting, Washington D.C., January 2008.

[15] Ibid

that strategies that “reduce severe congestion” and smooth the flow of traffic to “reduce the number of acceleration and deceleration events” could each reduce CO_2 by 5 to 12 percent.

Third, policymakers need to be smart about their approaches to reducing CO_2. As a percentage of the overall cost of light rail, CO_2 reductions account for a tiny fraction of the amount. There are many ways to reduce CO_2 more efficiently and in the near term than building light rail. Improving traffic flow, as proposed by the above strategy, is one option.

Improving fuel efficiency is also likely to be a less expensive way to achieve the same result. From 1980 to 2000, fuel efficiency of the average car improved by 37 percent according to the Bureau of Transportation Statistics.[16] President Bush has announced his intention to increase CAFE standards by 20 percent by 2020. The EMFAC model does not allow us to directly test the reductions that would result from this increase in efficiency, but there is no question that a twenty percent improvement in fuel efficiency is likely to significantly reduce CO_2 emissions. This also reduces the benefit that light rail enjoys over vehicles. As vehicles move closer to zero emissions, the advantage that light rail has in CO_2 emissions disappears. Thus, if vehicle efficiency improves beyond 2010, which is almost certain, the gap between the no action alternative and light rail will diminish.

As CO_2 models improve and the push to reduce CO_2 increases, we will have a better sense of the costs and benefits of the various transportation proposals. Based on the analysis of the I-90 Eastlink light rail project it seems clear that policymakers should avoid strategies that have the effect of increasing congestion.

If policymakers want to address transportation emissions, the data from this analysis indicates that decisions must be based on good analysis and smart use of taxpayer dollars. Our work is the first step in providing that data. Until we can more completely analyze the impacts of various transportation plans, claims about environmental benefits risk being costly and counterproductive.

[16] Bureau of Transportation Statistics, “Table 4-23: Average Fuel Efficiency of U.S. Passenger Cars and Light Trucks,” http://www.bts.gov/publications/national_transportation_statistics/html/table_04_23.html (Accessed September 21, 2007)

Appendix – CO_2 Emissions Data Tables

Westbound Peak AM	Minutes	MPH		HOV Minutes	MPH
No Action	32.5	16.8		12.3	44.3902439
Lt. Rail	41.4	13.1884058		11.4	47.89473684
	No Action Riders	**CO2**		**Light Rail Riders**	**CO2**
Lt. Rail	0	0		3,000	0
SOV	5,174	3232833.293		4,131	3162740.17
2 Passenger	1,430	244593.3028		1,562	263417.2071
3 Passenger	769	84838.41871		840	91403.88252
Truck	308	651145.8677		235	569906.1392
Transit	2,550	115572.3795		300	14426.50846
Total	**10,231**	**4328.983262**		**10,590**	**4501.16106**
CO2 Per Rider (metric tons)		**0.42313243**			**0.425054871**
			Diverted	522	399267.15

Eastbound Peak AM	Minutes	MPH		HOV Minutes	MPH
No Action	16.2	33.7037037		16.1	33.9130435
Lt. Rail	15.7	34.77707006		11.7	46.6666667
				Breakeven Scenario	
	No Action Riders	**CO2**		**Light Rail Riders**	**CO2**
Lt. Rail	0	0		2,000	0
SOV	4,619	1752682.731		4,611	1712912.94
2 Passenger	666	125840.3242		736	124739.972
3 Passenger	353	43080.9257		394	43049.3192
Truck	355	585028.8004		393	641516.066
Transit	1,600	73129.12104		100	5412.574
Total	**7,593**	**2579.761902**		**8,238**	**2529.1175**
CO2 Per Rider (metric tons)		**0.339737391**			**0.30701743**
			Diverted	4	1486.62

Westbound Peak PM	Minutes	MPH		HOV Minutes	MPH
No Action	38	14.36842105		18.9	28.8888889
Lt. Rail	38.1	14.33070866		13.9	39.2805755
				Breakeven Scenario	
	No Action Riders	**CO2**		**Light Rail Riders**	**CO2**
Lt. Rail	0	0		2,000	0
SOV	4,040	2907230.535		4,040	2913169.81
2 Passenger	1,170	246346.7857		1,176	176362.24
3 Passenger	679	92222.57994		676	65386.3926
Truck	198	460055.4135		299	695701.209
Transit	1,600	74319.83111		100	5433.28983
Total	**7,687**	**3780.175145**		**8,291**	**3856.05294**
CO2 Per Rider (metric tons)		**0.491768482**			**0.46510022**
			Diverted	**0**	**0**

Eastbound Peak PM	Minutes	MPH		HOV Minutes	MPH
No Action	10.2	53.52941176		11.9	45.8823529
Lt. Rail	12.6	43.33333333		10.5	52
				Breakeven Scenario	
	No Action Riders	**CO2**		**Light Rail Riders**	**CO2**
Lt. Rail	0	0		3,000	0
SOV	5,056	1829386.426		4,553	1564125.26
2 Passenger	2,642	452226.1415		2,564	456029.676
3 Passenger	1,466	161925.4924		1,423	163274.787
Truck	327	496587.1473		265	410825.64
Transit	2,550	115504.1235		300	14535.047
Total	**12,041**	**3055.62933**		**12,356**	**2695.1907**
CO2 Per Rider (metric tons)		**0.253762412**			**0.21812103**
			Diverted	252	86400.29

Total CO2	No Action		
		Westbound	Eastbound
	AM	4328.983262	2579.761902
	PM	3780.175145	3055.62933
		Total	**13744.54964**
	Light Rail		
		Westbound	Eastbound
	AM	4501.16106	2529.117497
	PM	3856.052941	2695.190699
		Total	**13581.5222**
			101.2%

Total Pax	No Action		
		Westbound	Eastbound
	AM	10,231	7,593
	PM	7,687	12,041
		Total	**37552.4**
	Light Rail		
		Westbound	Eastbound
	AM	10,590	8,238
	PM	8,291	12,356
		Total	**39474.5**
			95.1%

	No Action	Lt Rail
Westbound	0.4574505	0.445077548
CO2 Per Person		
0.366009886		
CO2 Per Person		
0.344058118	106.4%	

Total CO2 Per Person	No Action		
		Westbound	Eastbound
	AM	0.42313243	0.339737391
	PM	0.491768482	0.253762412
		Total	**1.508400714**
	Light Rail		
		Westbound	Eastbound
	AM	0.425054871	0.307017432
	PM	0.465100224	0.21812103
		Total	**1.415293557**

About the Author

Todd Myers is Director of WPC's Center for Environmental Policy (CEP). He is the author of several studies on environmental issues. He served as Director of Communications for the Washington State Department of Natural Resources, and was previously Director of Public Relations for the Seattle Super Sonics and Director of Public Affairs for the Seattle Mariners. Mr. Myers holds a Masters Degree in Russian and International Studies.

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