Review of the Columbia River Crossing DEIS

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On May 2, 2008, a consortium of eight government agencies—the Federal Highway Administration, Federal Transit Administration, Washington Department of Transportation (WSDOT), Oregon Department of Transportation (ODOT), Southwest Washington Regional Transportation Council, Metro, Clark County Public Transportation (C-TRAN), and Tri-County Metropolitan Transportation District (TriMet)—released a draft environmental impact statement (DEIS) for a new bridge across the Columbia River to replace or supplement the existing Interstate 5 bridge. Adoption of a plan requires a consensus among all eight agencies.

The various alternatives in the DEIS propose to spend anywhere from $3.1 to $4.1 billion on either a replacement bridge or a supplemental bridge. In all cases, the replacement or supplement would include room for dedicated transit service, either bus-rapid transit or light rail.

Flaws in the DEIS

The purpose of a draft environmental impact statement is to consider a wide range of alternatives and disclose to the public a comparative evaluation of the impacts of those alternatives. This should make it possible to design an optimal preferred alternative that accomplishes the plan's goals with the least impacts.

The draft EIS for the Columbia River Crossing fails to meet this goal. Instead, it is carefully contrived to obfuscate just what is being proposed and to avoid considering alternatives that could accomplish the same goals at a lower environmental and financial cost.

The DEIS actually proposes three separate projects that are not significantly dependent upon one another. The most obvious, but not the most expensive, project is a new or supplemental highway bridge across the Columbia River. As proposed in the DEIS, this project would cost $1.0 to $1.4 billion (exhibit 4.2-5), with most of the alternatives being around $1.2 billion. This cost is comparable to the cost, per lane mile, of the new Tacoma Narrows Bridge. That bridge, which cost about $850 million, is longer than the I-5 bridge but does not have as many lanes as the proposed new bridges.

The second project is a so-called high-capacity transit line from the existing MAX station at the Expo Center into Vancouver. The DEIS projects that this 2.07- to 4.22-mile project, including a bridge across the Columbia would cost $600 million to $1.1 billion.

The third project is construction of new auxiliary freeway lanes from Main/39th Street in Vancouver to Interstate Avenue in Oregon, along with new highway interchanges at SR 500, Mill Plain, SR 14, Hayden Island, and Marine Drive. These new lanes and interchanges are projected to cost about $1.4 to $1.5 billion.

The alternatives make it appear that these projects are inseparable, but they are not. A replacement or supplemental highway bridge does not need either the transit line or the new auxiliary lanes and interchanges. Yet all of the alternatives (except the no-build alternative) take it for granted that both the transit line and the auxiliary lanes and interchanges will be built. This makes the project far more expensive than necessary.

Prior to the DEIS, the Columbia Crossing Project published a preliminary list of twelve alternatives, two of which did build new or supplemental bridges without dedicated light rail or bus-rapid transit lanes. These were not evaluated in the DEIS. The DEIS only says that, "evaluation of these 12 alternative packages revealed that multimodal packages performed best" and that "highway-only" alternatives "were not recommended to be carried into the DEIS." Since there are many ways of determining "best performance," the public has a right to know why those alternatives were not included. The best way to inform the public is to include a full range of alternatives in the DEIS, which the Columbia Crossing Project has failed to do.

There are other ways in which the DEIS obscures, rather than discloses, alternatives and their costs. For example, both new-bridge alternatives (2 & 3) use one toll rate, while both supplemental bridge alternatives (4 & 5) use a higher toll rate. This makes it impossible to tell how much of the differences in outcomes between these alternatives are due to different tolls and how much to the different bridge proposals.

As another example, the energy technical report observes that alternatives 2 and 3 use the least energy for three reasons: first, "reduced travel demand"; second, "diversion of personal vehicle trips to public transit with the provision of high-capacity transit"; and third, "higher operating speeds across the I-5 and I-205 bridge crossings, which results in improved fuel efficiency." Carefully constructed alternatives would reveal just how much each of these three factors contributed to the reduced energy consumption, but this is impossible to guess based on the alternatives in the DEIS.

When asked why they did not calculate how much each factor contributes to saving energy, the Columbia River Crossing project responded that they are "interdependent" and that calculating them "would require a substantial effort." But that is the point of a draft environmental impact statement: to determine the relative importance of various alternatives in saving energy and reducing other environmental effects.

Finally, the DEIS fails to reveal important data relating to the various alternatives. Most notably, the preparers of the DEIS made no effort to calculate the number of vehicle hours of delay that each alternative would impose on I-5 travelers. Instead, they merely estimated the number of hours of each day that bridge traffic would slow below 30 miles per hour.

Vehicle hours of delay is a standard measure of traffic congestion and perhaps the most important measure of the bridge's impact on the quality of life of people who use it. Both Portland's Metro and the Southwest Washington Regional Transportation Council have transportation models that can calculate vehicle hours of delay for their long-range transportation plans. Failing to calculate vehicle hours of delay is like writing an annual report for a corporation and leaving out any statements about the company's profits.

Planners also appear to have made a mistake in their calculations of energy savings, pollution, and greenhouse gas emissions. It appears that the transportation models they used presume that future automobiles will be just as energy efficient and just as polluting as autos are today. This is unrealistic. Thanks in part to high fuel prices and in part to federal standards, autos today are about 40 percent more fuel efficient and 90 percent less polluting than autos of 1970, and both of these trends are expected to continue.

The Energy Independence and Security Act of 2007 requires that average fuel economy of new cars increase from 27.5 miles per gallon today to 35 miles per gallon by 2020. As the nation's auto fleet turns over, the average number of BTUs per passenger mile consumed by the nation's auto fleet are expected to decline by about one third between now and 2030. Lower fuel consumption means less air pollution and proportionately less greenhouse gas emissions. By failing to take this improvement in efficiency into account, the DEIS exaggerates the environmental benefits of the transit portions of the plan.

Flaws in the DEIS Alternatives

Alternative 3 appears likely to become the basis for the preferred alternative. The federal government wants a new bridge that will allow ships to pass without opening a drawbridge. The supplemental bridge alternatives, 4 and 5, leave the existing drawbridges in place that will result in continued delays to northbound I-5 traffic. Those alternatives are projected to cost less than 10 percent less than the replacement bridge alternatives, which is not enough of a savings to justify leaving the drawbridges.

Meanwhile, having wasted hundreds of millions of taxpayer dollars by building a light-rail line to the Expo Center, TriMet is committed to using the light-rail technology in alternative 3 rather than the bus-rapid transit technology in alternative 2. Since TriMet is one of the eight agencies that have veto power over the selection of the final alternative, it will insist on light rail.

Alternative 3 has many problems, all of which are shared with at least some of the other alternatives. First, alternatives 2 and 3 propose a twelve-lane highway bridge, including six through lanes and six auxiliary lanes. This is overkill, as no more than 8 lanes are needed immediately and no more than 10 will be needed in the foreseeable future, when it is possible that ODOT and WSDOT may eventually expand I-5 to 4 lanes in each direction. As shown in exhibit 2.3-5, one of the southbound auxiliary lanes abruptly disappears south of the Hayden Island exit and one of the northbound auxiliary lanes abruptly disappears north of the SR 500 exit. These abrupt merges are likely to cause as much or more congestion than the added lanes will relieve.

A second problem that alternative 3 shares with alternative 5 is the choice of the high-cost light-rail technology. Contrary to the claim in the DEIS, light rail is not "high-capacity transit." The capacity of an exclusive busway greatly exceeds the capacity of Portland's light-rail lines, which are limited (due to the short blocks in downtown Portland) to no more than two cars in each train (see appendix one).

While light-rail cars hold more passengers than buses, they cannot, for safety reasons, operate as frequently as buses. As a result, an exclusive bus lane can move 17 to 25 times as many people as a light-rail line.

Light rail is also slow: the yellow line that connects the Expo Center to downtown Portland travels an average speed of just 20 miles per hour to the Steel Bridge, and is even slower when it crosses into downtown Portland. If the region's transit officials really believe they need high-capacity transit across the Columbia River, light rail is a poor choice.

Alternatives 2 and 4 in the DEIS considered a busway as an alternative to light rail. But they assumed that all buses using the busway from Vancouver would terminate at the Expo Center and force their riders to transfer to light rail or local buses (transit technical report p. 5-38). The DEIS admitted that such transfers were "onerous" and were the main reason why the busway was projected to attract fewer riders than light rail (transit technical report appendix E, attachment 3).

Curiously, all alternatives assumed that C-TRAN would continue running express buses from Vancouver to downtown Portland on the highway bridge—not the transit bridge—and that in the afternoon rush hour those express buses could make the journey as fast or faster than light rail (transit technical report exhibit 53). These buses would carry twice as many passengers across the bridge as the exclusive bus-rapid transit lanes. If they had run all buses to downtown Portland, instead of forcing transfers to light rail at the Expo Center, the bus alternatives might have attracted as many riders as the rail alternatives.

A third problem that alternative 3 shares with all the build alternatives is the assumption that transit deserves its own exclusive right of way. Transit buses work very well in a shared right of way, and it is unlikely that demand for transit use across the Columbia River would ever be sufficient to require an exclusive busway. As shown in appendix one, a highway lane in which just one out of twelve vehicles are buses can move considerably more people than the proposed light-rail line.

Fourth, the tolling system proposed for all four build alternatives is obsolete. The plans call for one toll rate during a four-hour period in the morning and a four-hour period in the afternoon, and lower rates during other periods of the day. But travel demand can vary every few minutes, not just every four hours. Exhibit 4-10 of the traffic technical reports projects that, despite tolling, traffic on the bridge will slow to less than 30 miles per hour for up to 5.5 hours each day.

Varying tolls more frequently can prevent these slowdowns. Toll lanes in California's state route 91 use tolls that vary every hour in order to make sure that the lanes never become congested. Rates vary from as low as $1.20 in the off-peak periods to $4.20 in the morning peak periods to $10.00 in the afternoon peaks.[1] This has successfully prevented the lanes from becoming congested.

An even more modern system was applied to I-15 in San Diego in 1998. There, sensors in the road detect the amount of traffic and computers dynamically adjust the tolls every six minutes to insure the lanes never become congested. In fact, motorists are given refunds of their tolls if the lanes become congested. Such dynamic tolling can prevent any congestion from ever forcing traffic to slow below normal speeds of 55 to 65 miles per hour.

Observations show that freeway lanes moving at 15 miles per hour can move only about two-thirds as many vehicles per hour as lanes moving at 50 miles per hour.[2] By preventing such slowdowns, true congestion tolling can actually increase the number of vehicles crossing the bridge, as well as reduce the delay to those vehicles, during peak periods.

There is as yet little evidence about whether predictable, fixed-hourly rate changes or dynamic tolling will work better in situations like the Columbia River Crossing. The SR91 and I-15 toll lanes supplement pre-existing free lanes, so people can make a choice as they approach the toll lanes about which lanes to use. Since there are no convenient alternatives for people approaching the I-5 bridge (I-205 being many miles away), the main choice people will have will be to alter their travel times. Predictable, fixed-hourly or half-hourly rate changes will allow people to make travel plans in this way.

Such fixed hourly changes have been used on entire highways as well as on HOT lanes, while dynamic tolling has not yet been applied to entire highways. Bridge managers should initially plan to use fixed-hourly tolling on the bridge and apply dynamic tolling to any high-occupancy/toll (HOT) lanes that might eventually be built in the I-5 corridor. However, if experience elsewhere reveals that dynamic tolling might work better, Columbia River bridge tolls can easily be made dynamic at little cost.

Finally, as previously indicated, alternative 3 shares with all the other alternatives except 1 the assumption that new auxiliary lanes and highway interchanges costing around $1.5 billion must be built between Main/39th Street in Vancouver and Interstate Avenue in Oregon. While these improvements may ease congestion somewhat, they are not required for a new Columbia River Crossing, and the plan makes no attempt to show that they will be as cost effective in relieving congestion as the bridge itself. These improvements should be considered separate projects that are strictly optional dependent upon whether planners can show they are cost effective—that is, that they will cost no more per hour of reduced delay than replacing the bridge itself.

The Affordable Alternative

It is possible to design a new alternative that will remedy all of these weaknesses in alternative 3 and the other alternatives in the DEIS. This is the *Affordable Alternative* because it costs far less than the DEIS alternatives and requires no tax dollars for any part of the project (other than early planning stages). Yet it relieves congestion, provides opportunities for true high-capacity transit, and is more energy efficient and environmentally friendly than any of the alternatives in the DEIS.

The Affordable Alternative would construct a 10-lane bridge across the Columbia River, with additional space for pedestrians and cyclists. Initially, the bridge will be striped for only 8 lanes: six through lanes and two auxiliary lanes. The other lanes will be opened as funds become available to expand I-5 to four lanes north and south of the bridge entrances. They could also be used as exclusive busways, bikeways, or even light-rail lines if demand for those uses ever increased enough to justify using the lanes for something other than autos and trucks. Since the DEIS estimates that a 12-lane bridge will cost $1.2 billion, it is likely that this 10-lane bridge will cost about $1.0 billion.

The new bridge will have tolls varying frequently enough to avoid congestion—either dynamically or at least hourly according to predetermined schedules. Since hourly or dynamic tolling will prevent the 5.5 hours of congestion projected for the 12-lane span in alternative 3, the Affordable Alternative will actually allow more cars to cross the bridge during peak periods, when people are willing to pay the most to cross. Variable tolls may start at $1 or even 50 cents during off-peak periods and reach several dollars during peak periods (which may only be a few minutes of each morning and evening). Trucks would pay higher tolls that are at least proportional to their number of axles.

Tolls will be collected electronically. Most people will obtain transponders that will allow them to pay tolls through prepaid or charge accounts. Toll collectors can photograph the license plates of vehicles without transponders and send them a bill with a surcharge to account for billing cost. The surcharge should be big enough to encourage regular users to obtain a transponder but small enough to not seem punitive to travelers who rarely cross the bridge.

Since the bridge will rarely become congested, C-TRAN and Tri-Met will be able to operate buses across the bridge at any time of the day without fear of delay. This could allow buses to connect downtown Vancouver with downtown Portland faster than light rail even during rush hour. This eliminates any need for exclusive bus lanes or a light-rail bridge.

One way to pay for and build the bridge would be for the Oregon and Washington legislatures to jointly create an Interstate Toll Authority that can sell bonds, build bridges and roads in the I-5 corridor in and between Portland and Vancouver, toll those bridges and roads, and use the tolls to repay the bonds. No taxpayer funds will be needed. As shown in the appendix, if bonds are sold at 5 percent interest, tolls averaging $1.65 per crossing will pay for a $1 billion bridge in 30 years, while tolls averaging $2 will pay for the bridge in 20 years.

Since tolls will be set to prevent congestion, not pay for the bridge, it is likely that revenues will exceed this amount. Any excess revenues can be used to make other roadway improvements in the I-5 corridor. For example, the toll authority could add the auxiliary lanes or rebuild the interchanges described in the DEIS if those improvements proved cost effective. Or it may decide to add high-occupancy toll lanes to I-5 in Vancouver and Portland, thus giving drivers a congestion-free alternative through the north-south length of the urban area. All toll revenues will be retained by the toll authority, an independent entity, and it will be free to spend the tolls in ways it thinks are most appropriate to relieve congestion and improve regional mobility.

Even if the Oregon and Washington legislatures fail to create such an interstate toll authority, the Oregon and Washington departments of transportation could still jointly build and toll the bridge. If TriMet remains committed to low-capacity light-rail transit, it is likely that the state departments would have to act without TriMet’s support.

Effects of the Affordable Alternative

Though it costs far less than any of the build alternatives, the Affordable Alternative will have more positive effects on the region’s transportation network and lower impacts on the environment. Even without running the transportation models used by the writers of the DEIS, this paper can show that the Affordable Alternative is superior to the others in almost every respect.

Congestion: The traffic technical report projects that the build alternatives will result in 5 to 10 hours of congested traffic on the I-5 bridge each day by 2030 (exhibits 4-10 and 4-11). The use of true congestion tolling in the Affordable Alternative will eliminate this congestion, mainly by encouraging people who travel times are discretionary to drive when tolls are lower due to less traffic. The Affordable Alternative may also provide funding, in the form of surplus bridge tolls, to reduce congestion in other parts of the I-5 corridor.

Transit: The DEIS predicts that light rail would carry a slightly higher percentage of travelers across the Columbia than bus-rapid transit: 19 percent vs. 17 percent (DEIS errata sheet, page 14). However, it is likely that the Affordable Alternative's reliance on virtual busways could equal or exceed light rail numbers. Bus can run faster, more frequently, and to more destinations that light rail.

Energy: Evaluations of energy use must consider both the energy required for construction and the energy required for operations. The energy technical report projects that alternatives 4 and 5 will use about 400 million more BTUs of energy in daily operations than alternatives 2 and 3 (exhibit 1-2). Even though alternatives 2 and 3 project more automobile bridge crossings per day than 4 and 4, the former are projected to use the least amount of gasoline each day due to the lower congestion. This shows that congestion is a major component of wasted energy. However, alternatives 2 and 3 will require about 1.2 trillion more BTUs of energy during construction (exhibit 1-4).

The Affordable Alternative will use the least energy in construction because it does not require a supplemental transit bridge and does not include six auxiliary lanes on the highway bridge. By avoiding congestion, it will also use the least amount of energy and the least amount of petroleum-based energy in operations. The 5 to 10 hours of congestion projected for the build alternatives translate to thousands of gallons of wasted energy each year that would be avoided by the Affordable Alternative.

The energy technical report also indicates that light rail saves negligible amounts of energy over bus-rapid transit: about 5.8 million BTUs per day. But light-rail construction requires 223 billion more BTUs than bus-rapid transit, which means it would take more than 100 years of savings to make up for this cost. Because the Affordable Alternative relies on buses, it would save the energy cost of constructing light rail.

Pollution: Automobiles produce least in congestion-free traffic, so alternatives that do the most to reduce congestion will result in the greatest reductions in air pollution. In contrast, the choice of transit system has only a tiny effect on air pollution.

The air quality technical report indicates that a replacement bridge with bus-rapid transit produces 0.5 percent less air pollution than the same alternative with light rail (exhibit 5-8). Much larger reductions are produced through tolling: in the vicinity of the bridge, the "standard toll" (maximum of $2.00) results in 25 percent less pollution than no toll, while the "high toll" (maximum of $2.50) results in another 5 percent less pollution. By raising tolls high enough to avoid congestion, the Affordable Alternative should produce significantly less air pollution than the alternatives considered in the DEIS.

Greenhouse gases: According to the energy technical report, light rail actually produces more greenhouse gases than bus-rapid transit during both construction and operations (exhibits 1-3 and 1-5). By avoiding construction of a dedicated transit span and light-rail line, the Affordable Alternative should result in lower greenhouse gas emissions than any of the alternatives in the DEIS. The Affordable Alternative should also produce less greenhouse gas emissions in daily operations as it will avoid the congestion that leads to wasteful burning of fossil fuels.

Land use: One bi-directional light-rail line uses as much land as two highway lanes. Yet Portland's light-rail lines carry less than 40 percent as many people, per route mile, as the average mile of freeway lane in the Portland area.[3] That means that light rail is five times as land intensive as highways. By relying on buses rather than light rail, the Affordable Alternative is more land efficient.

Economic effects: The economics technical report estimates the number of businesses that would be displaced by a replacement or supplemental bridge. But if fails to account for businesses that would be harmed during construction. Construction of light-rail lines in Vancouver streets will limit customer access to the businesses on those streets. Light-rail construction in Phoenix reduced some businesses' sales by more than 60 percent.[4] Even after construction is complete, the presence of light rail will probably limit on-street parking. The light-rail alternatives are thus likely to have serious effects on Vancouver businesses.

When Portland turned Fifth and Sixth Avenues into bus malls, "city officials swore it would result in the renaissance of downtown," says Portland's *Willamette Week*. Instead, it put many shops out of business, turning the streets into "a dark wasteland of sad store fronts, scrawny trees and lifeless commuters."[5] When TriMet proposed to build a north-south light-rail line on Third and Fourth or other parallel streets, merchants on those streets furiously opposed the plan, saying it would force them to move or go out of business. So TriMet is converting the bus mall into a bus-rail mall, mainly because the merchants who would have objected to that route are already out of business. Ironically, conflicts between buses and rail will actually reduce the capacity of the mall to move transit riders.

Tax burden: Alternatives 2 through 4 all require the use of billions of dollars of federal, state, and/or local taxes—taxes that could be used for other, more productive activities or simply left in taxpayers' pockets. The Affordable Alternative will not require any tax dollars except, perhaps, for some initial planning stages.

Ecosystems, parks, and historic sites: Because the proposed bridge is considerably smaller than the bridges contemplated in alternatives 2 and 3, the Affordable Alternative will be much less likely to disturb ecosytems, parks, or historic sites. While the proposed bridge is slightly larger than the supplemental bridge in alternatives 4 and 5, the Affordable Alternative does not require the large disturbances needed for light rail in alternative 5. Since the taxpayers' alternative does not contemplate immediate construction of auxiliary lanes and new interchanges north and south of the bridge, none of the historic resources disturbed by this construction would be at risk.

Conclusions

The DEIS failed to consider a full range of alternatives, including alternatives with and without a dedicated transit bridge or transit lanes and alternatives with and without auxiliary lanes and reconstructed interchanges north and south of the I-5 bridge. As a result, any readers, whether ordinary citizens or officials on the boards or commissions of the state and regional transportation organizations that published the DEIS, are unable to accurately evaluate the proposed projects.

Based on information in the financial chapter of the DEIS, however, it is clear that replacing the existing highway bridge will cost less than one-third of the total costs contemplated in the DEIS. It is likely that all of this cost can be recovered by bridge tolls, especially if tolls are allowed to frequently vary in response to demand. Moreover, such variable tolls will result in less congestion than any of the DEIS alternatives even if the bridge has less capacity than the twelve-lane structure proposed for alternatives 2 and 3.

Other than the companies that stand to profit from building light rail, the Affordable Alternative is a win-win solution for almost everyone. It relieves traffic congestion, provides potentially better transit than light rail, reduces energy costs, air pollution, and greenhouse gas emissions, protects Vancouver businesses, and saves tax dollars for other useful projects.

To fix these problems, the final environmental impact statement must:

1. Analyze and compare the Affordable Alternative with other alternatives that were in the DEIS

2. Include other alternatives that do not build the auxiliary lanes and five new interchanges north and south of the bridge

3. Revise the bus-rapid transit alternatives so that buses run through to downtown Portland instead of terminating at the Expo Center

4. Revise energy, pollution, and greenhouse gas calculations to account for more fuel-efficient cars in the future

5. Calculate vehicle hours of delay for all alternatives

Appendix One: The Limits of Light-Rail Transit

Buses can move more people faster, safer, and at a far lower cost than light rail. Although buses are smaller than light-rail vehicles, they can move far more people because they can safely be operated far more frequently than light-rail trains.

Most of Portland's light-rail cars have 64 seats and have an "achievable capacity" of 133 people, including standees (exhibit 52 of the transit technical report).[6] Since each car is slightly less than 100 feet long, and downtown Portland blocks are 200 feet long, TriMet cannot run trains of more than two light-rail vehicles at one time. This means that the total capacity of each train is no more than 266 people.

For safety reasons, TriMet does not operate trains more frequently than about every three minutes. That means that a light-rail line can move no more than 5,320 people per hour.

An even bigger bottleneck in Portland's light-rail system is the Steel Bridge, which TriMet plans to use for the yellow, green, blue, and red light-rail lines. Tri-Met is installing signaling systems that it says will allow 30 trains an hour to safely cross the bridge. Under its plans for 2025, TriMet is likely to run ten trains an hour to Gresham, six to eight to Clackamas, and four to the airport, leaving just eight to ten slots an hour for trains to the Expo Center and, possibly, Vancouver.[7] The transit technical report projects eight trains an hour to Vancouver under alternative 3 and ten trains per hour under alternative 5 (exhibit 51). At ten trains a hour to Vancouver, those trains could still move only 2,660 people an hour at 20 miles per hour.

In contrast, an ordinary 40-foot TriMet bus has 39 seats and room for 17 people standing.[8] Such buses can safely operate at freeway speeds spaced 220 feet apart, allowing one bus every 3 seconds. An exclusive busway can therefore move more than 67,000 people per hour—25 times as many people as a light-rail line running ten trains per hour. Even if the buses carried no standees, they could move 46,800 people per hour—17 times as many people as the yellow line running ten trains jammed with standees each hour.

Since the light-rail lines operate at an average of just 20 miles per hour, a busway can provide faster as well as higher quantities of service. Buses are also more flexible, being able to diverge to many different destinations, while light rail can only go where the rails are, thus requiring many people to drive or ride feeder buses to rail stations. In order to generate more business, rail transit agencies like TriMet end up becoming land-use manipulators, demanding that landowners near rail stations build to higher than marketable densities and quietly supporting such dense developments with various tax subsidies.

The biggest advantage of buses is that they cost far less, partly because they can share road space with cars and trucks. Individual light-rail vehicles cost about ten times as much as a bus, yet can carry only about three times as many people. The tracks needed for light rail typically cost $50 to $60 million per mile, which is enough to build several miles of four-lane freeway or many miles of exclusive busway. The U.S. General Accounting Office estimates that starting a new light-rail line costs 50 times as much as starting a new bus-rapid transit line that runs on existing streets, and the light rail costs more to operate as well.[9]

The DEIS also reveals that the light rail has greater environmental impacts than buses. The air quality technical report projects that the light rail will emit more carbon monoxide and volatile organic compounds than bus-rapid transit (exhibit 5-1). The energy technical report says light rail will emit more greenhouse gases, during both construction and operation, than bus-rapid transit (exhibits 1-3 and 1-5).

As a practical matter, the demand for transit between Portland and Vancouver is not sufficient to require exclusive busways. So buses can share road space, and the cost of that space, with other vehicles. If the region uses congestion tolls or builds a network of high-occupancy toll lanes, the buses can use those lanes as "virtual exclusive busways," thus avoiding congestion and delivering people to their destinations far faster than any light-rail line. Even if buses account for only one out of every 12 vehicles in such lanes, they will be moving far more people than the light-rail line.

Appendix Two: Paying for the Toll Bridge

Exhibit 4-1 of the traffic technical report says that about 134,000 cars per day currently cross the bridge and that daily crossings are growing by about 2,000 cars each year. This analysis assumes that these numbers are weekday averages, and that average monthly crossings are about 25 times weekday crossings. Given an average toll of $1, 1,000 average daily crossings would produce revenues of $25,000 per month or $300,000 per year.

The traffic technical report also projects that tolling will reduce 2030 crossings from 184,000 with no tolls to 178,000 with "standard tolling" and 165,000 with "higher tolling." Dynamic tolling will lead more people to change the times that they cross than it will discourage from crossing at all, so 175,000 crossings in 2030 is probably conservative. Assuming growth of 2,000 daily crossings per year, the number of crossings in 2015, the projected year the bridge would open, will be about 145,000 vehicles per day.

At this number of crossings and a 2,000-daily-crossing per year growth rate, if 100 percent of toll revenues are dedicated to repaying the bonds borrowed at 5 percent interest, the bonds can be repaid in 30 years at average tolls of $1.33. Current interest rates on municipal bonds are slightly less than 5 percent. But even if rates rise to 7 percent interest between now and the time the bonds are sold, tolls would have to average no more than $1.66 to repay the bonds in 30 years. If average tolls exceed these amounts, they can be used to repay bonds faster or make other highway improvements, such as building HOT lanes, in the I-5 corridor.

Table One
Average Tolls Required to Repay $1 Billion in Bonds

	5%	7%
30 years	$1.33	$1.66
25 years	1.46	1.77
20 years	1.66	1.93
15 years	2.04	2.33

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