Columbia River CROSSING

Memorandum

June 6, 2007

TO: Councilor Robert Liberty, Metro

FROM: Doug Ficco, John Osborn, and Kris Strickler

COPIES: Richard Brandman, Metro

SUBJECT: Questions Pertaining to the Columbia River Crossing Project

We were pleased to meet with you and Amelia Porterfield on February 6, 2007 to discuss your questions and concerns about the Columbia River Crossing (CRC) project. We very much appreciate your interest in the project. At our meeting, we discussed a list of questions you provided. There were a number of questions that required a follow-up response. We provided further information in a memo to the CRC Task Force on February 20, 2007 that included answers to some questions you raised and another letter to Metro Council on February 26, 2007 further reviewing the project process. However, we felt that there were still outstanding questions that required a follow-up. For clarity, each of your questions is repeated in this memorandum, along with our responses, which typically provide more detail than we were able to give during our meeting.

Costs

1. What is the estimated cost of the proposed new I-5 bridge (the recommended alternative)?

Our preliminary, concept-level estimate for building a new I-5 bridge is between $900 million and $1.2 billion in year 2007 dollars. Detailed construction costs for the project will be prepared as part of the Draft Environmental Impact Statement (DEIS). Very preliminary concept-level estimates, including possible risks of the total project capital costs of either complete Replacement Bridge alternative are in the $2 billion to $6 billion range. These total capital costs include a new bridge, removal of existing bridges, new interchanges, and high capacity transit costs.

The DEIS will include evaluation of structural alternatives and costs for all of the major elements of the project, including the river crossing. As an example, the substructure costs will be affected by the deep, unconsolidated soils in the river bed.

In addition, operating and maintenance costs will also be estimated as part of the DEIS work effort. Preliminary estimates are that a replacement bridge would cost about $600,000 annually for maintenance, while maintaining the two existing I-5 bridges costs $3,900,000 per year and maintaining one of the existing bridges would be about $1,800,000 per year. These O and M estimates do not include the operating costs of transit, which would likely benefit from a bridge that does not include a lift-span.

2. What is the estimated cost of the alternatives that the staff has recommended not be continued for further study?

There were 23 river crossing options and 14 transit options that arose from our public scoping process. We evaluated each of them against the project Purpose and Need and also in relation to the Evaluation Criteria adopted by the Task Force. The best performing concepts were carried forward as elements of 12 project alternatives. Capital or operation and maintenance cost estimates were not prepared individually for the 12 alternatives. However, all of the 12 (except the No-Build, TDM, and arterial options) would be expected to have capital costs in the $2 billion to $6 billion range.

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Congestion

1. What is the PM peak hour congestion in 2030 (or whatever year was used for the study) under the no action alternative?

Average weekday traffic volumes crossing the river are about 130,000 vehicles per day now, and are expected to grow to over 180,000 by 2030. Today and in the future, travel demands exceed capacity for multiple hours each day; therefore we focus on the duration of the peak period rather than conditions in the peak hour. Current traffic volumes result in about four hours per weekday of congestion (defined as a level of service “F” with freeway speeds less than 30 miles per hour as established in the *Highway Capacity Manual* published by the Transportation Research Board) in the northbound direction during the PM peak period. Weekday PM congestion (again, level of service “F”) is projected to grow to nearly eight hours in the 2030 No-Build northbound forecasts and by 2030, congestion will emerge for traffic traveling in the southbound direction during the PM peak.

2. What is the PM peak hour congestion in 2030 (or the study year) if the recommended alternative is built?

The Replacement Bridge alternatives are projected to result in up to two hours of congestion for PM peak direction travel—about six hours less than the almost eight hours of congestion projected for the No-Build alternative.

What is the number of hours of delay per person?

The project has not estimated number of hours of delay per person. We have estimated vehicle hours of delay in the I-5 Bridge Influence Area (BIA) during the four-hour AM and four-hour PM peak periods. By 2030, with no improvements to I-5 within the BIA or the expansion of high capacity transit into Vancouver, peak period vehicle hours of delay would increase by over 300% compared to existing conditions. If one of the Replacement Bridge alternatives is built, peak period vehicle hours of delay would be reduced by about 60% compared to 2030 No-Build conditions.

Describe “hours of congestion” levels (F is crawling/stop & go?)

As noted above, hours of congestion are estimated based on projected travel speeds. When a highway’s volume-to-capacity ratio approaches 1.0, travel speeds start to drop below 30 mph and the freeway is considered to have reached saturation and be congested (again, this is based on the *Highway Capacity Manual*).

3. What model or assumptions were used regarding latent demand (aka induced demand, triple convergence) in determining congestion relief with the recommended alternative?

Triple convergence refers to the response of transportation system users to changes in facilities or service. A change in the system (say increased highway capacity or transit service) will prompt users to change route, time of day, or mode choice until equilibrium is reached (generally when alternative routes, times of day, or modes become equally attractive). Travel demand forecasts for CRC use Metro’s regional travel forecast model. It responds to potential changes in transportation facilities or transit services with predictions of changes of trip-making patterns such as route (i.e., shifting from I-205 to I-5) and mode (i.e., shifting from single occupant vehicle to high occupancy vehicle or transit). The model forecasting process uses iterative runs that continuously revise route and mode choices until system equilibrium is reached.

Metro’s regional model does not directly address the potential shifting of travel times (the third element of the triple convergence theory). However, at a corridor level (i.e., after we receive the regional model outputs) we use analytical tools that calculate the difference between demand and available capacity, and if the demand exceeds capacity our corridor-level models assume that it is delayed until it can be accommodated. Further, the Metro travel forecast model result is consistent with the triple convergence conclusion—that the number of hours of congestion may be reduced, but can't be totally eliminated.

4. What is the best performance in peak hour congestion relief among the alternatives not recommended for further study?

The 12 alternatives considered in late 2006 included a No-Build, TDM/TSM, an arterial crossing, four supplemental bridge alternatives, and five replacement bridge alternatives. The supplemental and replacement bridge alternatives performed best in terms of transportation performance. The supplemental bridge options were not recommended for further study because they performed less well on other criteria, such as land use impacts, natural resource impacts, and marine navigation, to name a few. The worst in terms of transportation performance were the No-Build, TDM/TSM, and arterial alternatives.

What are the congestion effects if you only do ramps and not bridge? What do these individual parts cost, and how much congestion relief would that buy?

There would be very little transportation benefit to improving the ramps and not the bridge. This is because most of the current congestion in the corridor is caused by a combination of the ramp configurations and the lack of capacity <u>on</u> the existing bridges. For example, to "fix" the northbound congestion caused by travel on the northbound Marine Drive and Hayden Island ramps, an auxiliary lane across the Columbia River would be needed to permit entering vehicles to get up to speed before mixing with freeway traffic. It is not feasible to cost-effectively add travel lanes to the existing bridges, since an auxiliary lane requires a new structure to carry additional travel lanes across the river.

Based on our experience with past projects and the potentially wide range of design options, the cost of individual interchange improvements can range from tens to hundreds of millions of dollars, depending on the nature of the problem that needs to be addressed and the potential solutions.

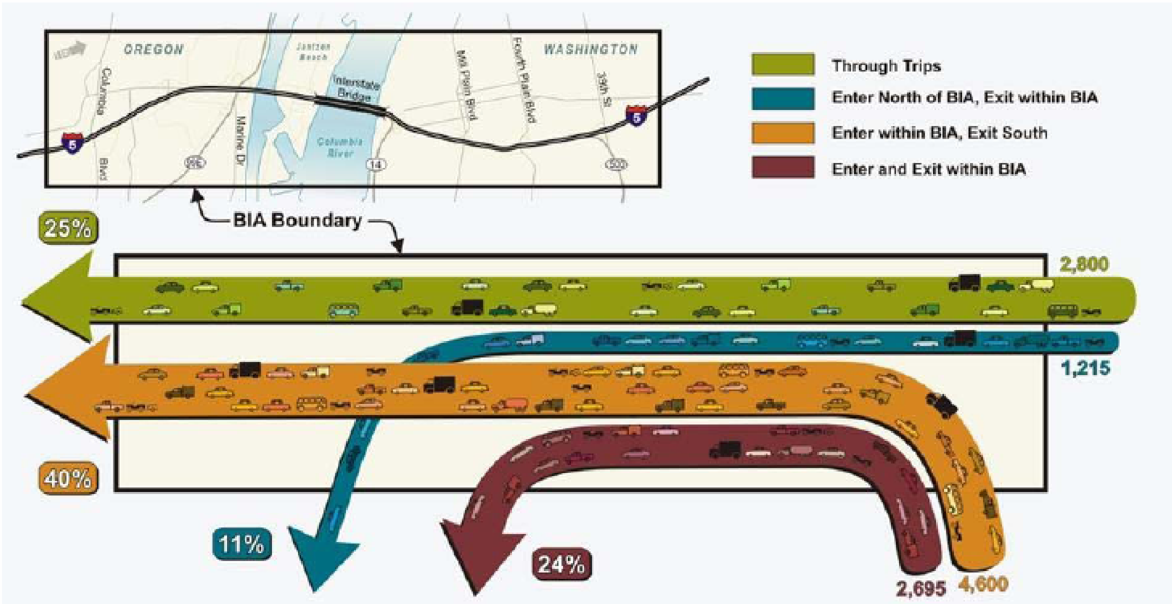
<u>Travel Patterns</u>

1. What percentage of southbound AM peak trips have destinations in the city of Portland?

- 25% of southbound traffic using the bridge goes all the way through the five-mile range;
- 11% enters north of the BIA and exits at one of the ramps within the BIA south of the river;
- about 40% enters the freeway in the Vancouver portion of the BIA; and
- about 24% enters the BIA in Vancouver and then exits the freeway at the Hayden Island, Marine Drive, or Victory exit ramps.

These data are based on our most recent analysis of travel patterns was conducted in the fall of 2005, when we recorded license plates of all vehicles getting on or off the freeway in the BIA (see figure below).

Southbound I-5 Vehicle-Trip Patterns in the Bridge Influence Area, for Trips Across the Interstate Bridge (205)



The survey did not identify the ultimate destinations of the vehicles after they left the BIA. However, results from the regional travel demand model indicate that the average vehicle trip crossing the river is about 19 miles, which means that most trips are traveling a significant distance before and/or after their portion of the trip on I-5.

From earlier work done for the I-5 Transportation and Trade Partnership Strategic Plan (2002), model results indicated that about 80% of the peak period trips crossing the river have destinations within the city of Portland.

2. **What percentage of southbound AM peak trips have destinations in the Portland Central City (Downtown, Lloyd District, South Waterfront, Pearl, Central Eastside)?**

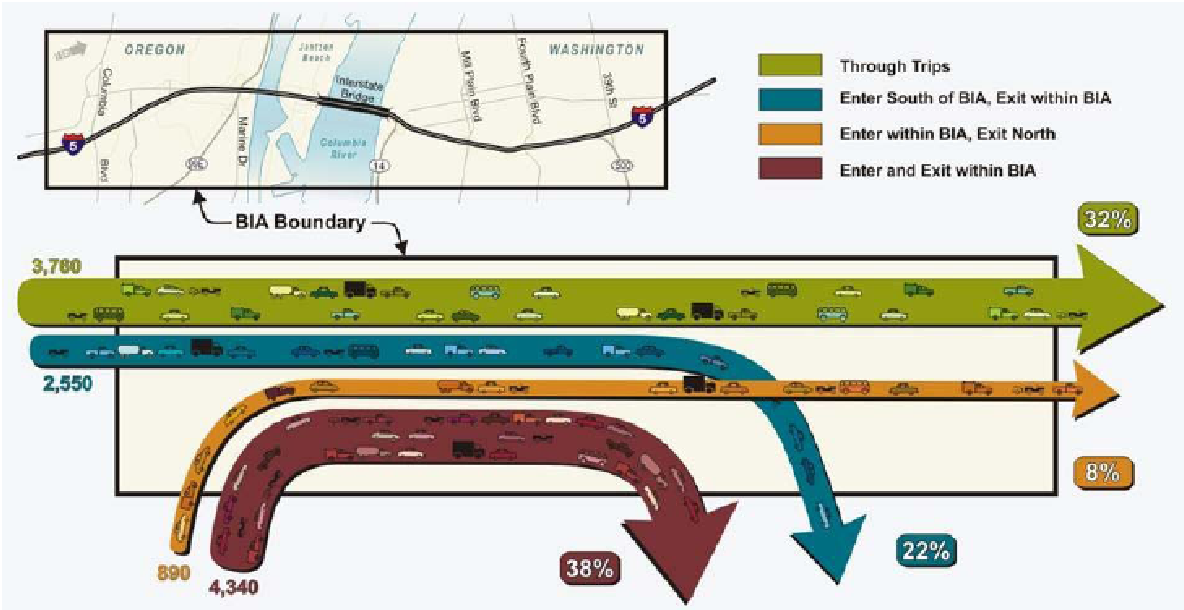
   Estimates from the Partnership work are that approximately 20% to 25% of peak period trips are destined for the Portland Central City. We have not re-visited those analyses to date as part of the CRC studies, but will be updating them as part of the DEIS

3. **What percentage of northbound PM peak trips have destinations outside the city of Vancouver?**

   From the license plate study noted above, northbound PM peak period trips break out as follows:

   - 32% are through trips (staying on I-5 all the way through the BIA);
   - 22% enter the BIA on I-5, and after crossing the river exit in the Vancouver portion of the BIA;
   - 8% enter on one of the I-5 on-ramps in the Portland portion of the BIA, and stay on I-5 to a location north of the BIA; and
   - 38% enter within the BIA, cross the river, and then exit while still within the BIA.

Northbound I-5 Vehicle-Trip Patterns in the Bridge Influence Area, for Trips Across the Interstate Bridge (2005)



From the I-5 Transportation and Trade Partnership Strategic Plan, 40% to 50% of the northbound peak period trips are destined for locations within Vancouver. Of the rest, about 40% are destined for other locations within Clark County, and roughly 10% are destined for locations further north.

Land Use Patterns

1. Among the alternatives studied, which alternative delivered the most jobs and housing units to downtown Vancouver? Central City Portland?

NEPA and FTA New Starts processes require that all alternatives be considered using consistent land use assumptions and be based on adopted regional plans. Those assumptions are used for both pre-DEIS and DEIS analyses. For the DEIS we will also consider indirect and cumulative impacts of the build alternatives. This will include a review of potential changes to housing and employment throughout the region.

Seismic Standards

1. What is the seismic standard that the recommended alternative will meet? Is it Phase I or Phase II or something else?

The terms "Phase I" and "Phase II" refer to seismic retrofit programming phases. Here are the definitions for each state:

ODOT Seismic Retrofit

- Phase I: Superstructure retrofit to prevent superstructure pull-off and bearing failure. Typically this consists of installing cable restrainers and/or shear keys to restrict movement of the superstructure.
- Phase II: Retrofit of columns and foundations. Given limited funding, this level of retrofit is uncommon in Oregon.

WSDOT Seismic Retrofit

- Phase I: Superstructure retrofit to prevent superstructure pull-off and bearing failure.
- Phase II: Retrofit of single-column structures.
- Phase III: Retrofit of multiple-column structures.
- No foundation retrofit has been completed.

Criteria for both a new bridge and retrofit of the existing bridges require that the structures meet dual-level seismic performance criteria. The criteria are as follows:

a. Serviceability: After a design event, damage will be limited to “secondary” elements, the bridge will be available for use by emergency vehicles, and any damage can be quickly inspected and repaired, returning the bridge to service. Minor, repairable damage to other elements may also be permitted as long as the damage does not prevent immediate use of the structure.
b. No-Collapse: Significant, even irreparable, damage can result from the design event, but no damage that poses a threat to public safety will occur.

The State bridge engineers for ODOT and WSDOT have jointly agreed to the following design return periods for a new bridge or retrofit of an existing bridge across the Columbia River for the CRC project:

- Retrofit: 1000-year “No-Collapse” and 500-year “Serviceability”
- New Structure: 2500-year “No-Collapse” and 500-year “Serviceability”

These criteria were selected for the Columbia River bridges on I-5 so that in the event of a catastrophic event (in this case the 500-year event) the structures will be able to serve emergency and recovery efforts and the structures will not have to have significant repairs or be replaced. The 2500-year event is applied to the design of new structures to avoid loss of life through collapse of the structures.

2. Do the I-5 overpasses north and south of the proposed new bridge meet the seismic standard proposed for the new Columbia Crossing?

Improvements to all of the interchanges in the BIA are being studied. If those improvements result in new overcrossings, those new structures will be built to current WSDOT or ODOT standards. Currently, most of the overcrossings in Clark County are of relatively recent construction and/or have had some retrofit work completed to meet No-Collapse criteria These retrofits have been completed to standards intended for “normal” structures whereas the Columbia River Crossing bridges are considered “major” or “important” structures and so are held to a higher standard of performance. Through North Portland, the overcrossings typically have not been retrofit to a No-Collapse standard.

3. Does the I-205 bridge (Glenn Jackson Bridge) meet the seismic standard proposed for the new Columbia Crossing?

The Glenn Jackson Bridge was opened to traffic in 1982 and met design criteria in place when designed. However, the 1989 Loma Prieta and the 1994 Northridge earthquakes in California dramatically advanced our understanding of how to engineer bridges in seismically-active zones. A seismic assessment of the I-205 bridge based on the more advanced understanding has not been completed, but it is anticipated that some retrofit would be required to meet the No-Collapse standard. This would not bring it to the same level of performance in seismic events as is expected for the I-5 Columbia River Crossing.

4. Does the I-5 bridge over the Willamette (the Marquam Bridge) meet the seismic standard proposed for the new Columbia Crossing?

ODOT has completed a Phase I and partial Phase II retrofit of the Marquam Bridge. The bridge will meet current seismic design criteria of No-Collapse if the Phase II retrofit is completed.

5. What is the cost of having the existing I-5 bridges over the Columbia meet Phase I and Phase II standards? What engineering firm conducted the study?

A conceptual cost estimate was developed as the result of a two-day workshop of seismic experts in August of 2006. The group included the State bridge engineers from Washington and Oregon, the Chairman of the California Seismic Advisory Panel (Dr. Frieder Seible), and bridge and geotechnical engineers with experience in retrofit of major river crossings from Parsons Brinckerhoff and David Evans and Associates.

Prior to the Expert Panel considering retrofit of the structures, limited analysis had been done by David Goodyear and Associates under contract with ODOT in 1995. This analysis identified several significant vulnerabilities. Also, during the summer of 2006 a limited geotechnical investigation of the soils adjacent to the existing I-5 bridges was conducted by WSDOT and ODOT. The results of this study (which included three new borings in the river) concluded that there is a high potential for liquefaction of the soils, even under moderate seismic events.

In developing a conceptual seismic retrofit cost estimate, the Expert Panel considered the previous analyses and past experiences on major structures similar to the I-5 bridges over the Columbia River. The resulting cost estimate is approximately $125 million to $265 million to meet the No-Collapse criteria. This is about $400 to $800 per square foot, which is close to the unit cost of building a new structure.

Design Standards

1. Does the Marquam Bridge meet the standards for (a) roadway width; (b) horizontal curvatures; (c) vertical grades; and (d) exit and entrance ramp geometry, proposed for the recommended alternative?

The I-5 Marquam Bridge was constructed in the mid 1960's and has several design characteristics that would not meet current design standards including lane widths, shoulder widths, vertical and horizontal curves, and sight distance.

2. Does the I-205 bridge meet the standards for (a) roadway width; (b) horizontal curvatures; (c) vertical grades; and (d) exit and entrance ramp geometry, proposed for the recommended alternative?

The I-205 Glenn Jackson Bridge was constructed in the mid 1980's and meets current design standards except for the inside shoulder width.

Bridge Lifts

1. How many peak hour bridge lifts are there per year?

Lifts are currently prohibited during peak traffic hours: from 6:30-9:00 a.m., and from 2:30-6:00 p.m. As travel demands increase with each passing year, the peak travel period is starting earlier and lasting later. For example, lifts often occur a few minutes after 6:00 p.m., which is still a very heavily traveled time of day.

From 1991 to 2005, the average number of monthly bridge lifts have ranged between 30 and 65 per month. The number of lifts depends largely on the river level, which affects clearance as well as the river velocity. River velocity is the principal factor affecting whether towboat captains will use the mid-span openings or will call for a bridge lift.

Changes in the river level are seasonal and are strongly affected by annual precipitation in the greater Columbia River basin.

2. What is the total peak hour congestion caused by annual bridge lifts?

Again, by agreement between the Coast Guard, ODOT, and WSDOT, lifts are prohibited during weekday peak periods. In general, as noted above, we have been averaging about 30 to 65 lifts per month. Each lift stops traffic for 5 to 15 minutes. The resulting effects can take a half hour or more to dissipate, depending on traffic volumes.

3. What is the minimum additional height needed at the center span to avoid all or almost all bridge lifts during peak hour?

A clearance of 90 to 100 feet above low water will pass around 99% of vessels (the only exceptions are a small number of sailboats and construction barges). The current clearance at the "hump" is 72 feet at low water level.

4. What is the relative value of freight movement up and down the river that requires bridge lifts relative to freight movement across the bridges?

We do not have that information.

<u>Transit</u>

1. What is the current transit mode split for transit in Clark County and across the I-5 bridges today?

We do not have the current or projected mode split for trips that stay within Clark County. During the peak period, 6% of people who cross the bridge are on transit.

2. What is the projected transit mode share in Clark County and across the river under the recommended alternative at the end of the study period?

With no highway or transit improvements in the corridor, it is projected that 11% of the peak period trips would be on transit in 2030. Preliminary analysis indicates that the projected share of peak period trips across the river by transit for build alternatives will be between 14% and 20%, depending on the mode, alignment, and other factors. Mode split estimates will be prepared for all DEIS alternatives.

3. What is the potential for commuter rail to serve Clark County using the existing rail system?

There have been two recent studies that concluded that it would not be feasible to use the existing tracks because freight movements and Amtrak service completely use up the capacity of the system. One of the studies was conducted by RTC in the late 1990's. More recently, it was also studied as part of the I-5 Transportation and Trade Partnership Study. Both studies had two key conclusions regarding the freight rail corridor between Vancouver and Portland: 1) there are future capacity constraints for freight and intercity passenger service even without the inclusion of commuter rail; and 2) if new major rail capacity were provided for freight and intercity service, commuter rail could be reconsidered.

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