DATE: December 29, 2008

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SUBJECT: SR 99 Deep Bored Tunnel

BACKGROUND

In response to your request for additional information on a deep bored tunnel under downtown Seattle as a replacement for the Alaskan Way Viaduct, the program team has prepared this briefing paper. Based on the preliminary analysis to date, the team believes that a single bored tunnel is likely the more effective tunnel option from both a cost and schedule perspective (as compared to a twin bored tunnel), and thus was the main focus of this review. More investigation of the cost and constructability trade-offs of both the single and twin bore options is required to confirm this preliminary finding. The briefing paper covers the following topics:

1) Transportation function provided by a four-lane deep bored tunnel
2) Cost estimate for a deep single-bored tunnel
3) Schedule for opening a deep bored tunnel to traffic
4) Potential options for funding a deep bored tunnel

CONCLUSIONS

- Constructing a deep bored tunnel will maintain capacity for trips through downtown Seattle and provide room for growth in those vehicle trips expected to occur by 2030.
- A deep bored tunnel could be open to traffic by early 2017 if a decision is made to proceed in early January 2009. The existing viaduct can be taken down by 2012 as currently planned or remain in place to provide capacity during construction.
- Preliminary cost estimates for a single bored tunnel shows the possibility of achieving cost savings compared to a twin bored tunnel. More work is needed in early 2009 to confirm this finding.

DISCUSSION

Proposed deep bored tunnel. A deep single bore tunnel would connect to the new south mile of SR 99 (from Holgate Street to King Street). It would connect to Aurora Avenue north of the

Battery Street Tunnel, in the vicinity of Harrison Street. The alignment of the tunnel would be primarily under First Avenue at a depth necessary to avoid other existing tunnels (bus, rail, sewer, water) under downtown Seattle.

The tunnel would be approximately 9,000 feet in length and would be a single bore that is currently approximately 54 feet in diameter. The tunnel would accommodate four lanes of traffic (two lanes in each direction) plus shoulders and tunnel systems (ventilation, emergency access).

In the current location of the viaduct, a four-lane surface street would be constructed with a surface street connection to Elliott and Western Avenues, replacing an essential link to the Ballard, Interbay and Magnolia areas of northwest Seattle. This summary assumes that the seawall replacement, utilities relocation, and investments in I-5, transit, city streets, and demand management strategies will be implemented independently by other programs or agencies. Previously these other improvements have been specifically included as part of the project planning, and their removal will need to be explained through the continued planning process.

Through traffic on SR 99 would be on a limited access roadway from Denny Way to Spokane Street. Traffic from Ballard, Interbay, and Magnolia that use the existing viaduct via the Elliott/Western ramps would no longer have that option. Those drivers would either take Alaskan Way to travel through downtown, access the deep bored tunnel via Mercer Street (east to southbound direction only), or use I-5. Access from the south into downtown Seattle would be served by the new King Street ramps in the vicinity of the sports stadiums (removal of the mid-town ramps at Columbia and Seneca have been assumed in all scenarios evaluated to date).

Transportation performance of a bored tunnel. Public safety would be improved compared to the existing viaduct.

- The Battery Street Tunnel, which has limited sight distance, short ramps, narrow lanes, and no shoulders, would no longer serve high volumes of traffic as it's sole function would be to provide enhanced local grid connectivity.
- The existing viaduct also has narrow lanes and shoulders. The deep bored tunnel would have lane and shoulder widths that meet today's safety standards.
- Generally grades in and out of the tunnel would be six percent or less, which would meet state and federal design guidelines while being conducive to freight movement.
- The tunnel would be designed with modern safety features that comply with national fire protection safety standards.

Capacity for trips through downtown Seattle would be maintained and their travel times would increase by up to two minutes due to population growth expected by 2030.

- Approximately 65 percent of traffic using the viaduct today is through trips (trips that do not begin or end inside the downtown area). The bored tunnel would carry a higher percentage of through trips (75 percent) when open to traffic.
- Trips that use the viaduct today to travel through downtown Seattle take between five and a half and seven minutes between Aloha Street and Spokane Street during peak travel times. In a deep bored tunnel, these trips would take between five and six minutes at year of opening.

- Predicted population growth is expected to increase traffic by up to 11 percent between 2015 and 2030. This could add up to two minutes to travel times for through trips during the peak periods.
- Today there are approximately 91,000 vehicles each day on the viaduct (measured north of Seneca Street); a deep bored tunnel will carry approximately 80,000 to 85,000 vehicles at the same location. The lower volumes are due to the removal of the Elliott/Western ramps.
- However, with a daily volume of 80,000 to 85,000, the new bored tunnel would carry more traffic than the existing Battery Street Tunnel, which currently serves about 63,000 vehicles per day.
- The bored tunnel would provide an important redundancy to I-5 for the north to south link through downtown Seattle.

Trips from Ballard, Magnolia, and Interbay would no longer have direct access to SR 99 with a deep bored tunnel; this would lengthen the time it takes to make trips from those neighborhoods through downtown Seattle.

- Trips from northwest Seattle neighborhoods (Ballard, Interbay, Magnolia) that would no longer have direct access to SR 99 would experience longer trip times.
- Those trips take between two and three minutes today; they would take between seven and eight minutes in 2015 if they took a four-lane surface street on the waterfront. Trip times could increase by up to another three minutes by 2030 due to population growth beyond 2015.

Trips from West Seattle would experience longer travel times to downtown Seattle, due to the combination of growth and the removal of the mid-town ramps at Columbia and Seneca (assumed in all scenarios evaluated). Travel times for West Seattle trips through downtown to the north would likely be slightly shorter than today.

The travel demand modeling results for the deep bored tunnel assumed minimal investments in I-5 and city streets, and a baseline level of demand management strategies and transit service enhancements. These investments have little effect on through trips that would choose to stay on SR 99 if it is maintained as a deep bored tunnel. Therefore if those investments are not made there is expected to be little effect on the transportation performance of the bored tunnel.

Building a deep bored tunnel. Completion of an environmental impact statement (EIS) is required before construction of a deep bored tunnel can begin. Work on the environmental review process began in July 2008 with the issuance of a notice of intent and purpose and need statement. Scoping comments have already been solicited from the public and agencies

We believe this earlier work can be used as the initiation of the environmental review of a deep bored tunnel. Under this bored tunnel proposal, the next step would be to revise the purpose and need statement and issue a new notice of intent. This provides an opportunity to focus on SR 99 replacement and explain why seawall replacement, surface streets, and transit improvements have independent utility and will be implemented separately. With a narrowed focus the status of co-lead (Seattle and King County) and cooperating (Federal Transit Administration and Corps of Engineers) agencies can be re-visited. As required by the National Environmental Policy Act, all reasonable alternatives must be evaluated in the EIS. Based on the outcomes of the last year

of scoping-level analysis, it seems likely that a new independent elevated structure and a surface and transit option would be carried as additional alternatives. Other options evaluated, such as a cut and cover tunnel, could be dropped from further consideration based on future transportation performance and construction impacts. In addition, it is unclear whether the surface and transit option meets the 2030 transportation needs, which could potentially result in it being dropped upon further evaluation. The integrated elevated scenario evaluated in 2008 carries significant concerns due to Section 4(f) impacts and public safety issues, and could also be dropped.

If work begins in early January on the environmental review of a bored tunnel, then the draft EIS could be published in December 2009 for public review; a final EIS released in September 2010; and a federal Record of Decision signed in December 2010. There is an opportunity to shorten this schedule if a decision is made to not apply current federal funding and not solicit new federal funding to the central waterfront replacement of the viaduct. This would create a situation where the State Environmental Policy Act would guide the environmental review process.

A single bored tunnel could be open to traffic by early 2017 assuming an aggressive schedule and funds being available when needed. No assumption has been made about the existing viaduct. It could be removed by 2012 as currently planned, or remain standing until the bored tunnel is open, in order to maintain traffic in the SR 99 corridor. Maintaining traffic on SR 99 during construction would create higher construction risks at the portal locations and may cause slight increases to the cost estimates below.

The cost estimates provided below are preliminary and have not been through a Cost Estimate Validation Process (CEVP), which is a standard procedure for all large projects managed by WSDOT. The methodology for preparing these estimates has generally followed the methodology of CEVP by establishing a base estimate for construction costs and adding factors for risks, contingency, and inflation that are likely to occur. These numbers are also based on conceptual designs; additional preliminary design and a complete CEVP are needed to confirm these costs.

Essential Elements – SR 99 Single Bored Tunnel	**Planning Level Estimate**
Construction Costs	$850 to $961 million
Contract and Construction Management; Final Design	$162 to $300 million
Contingency and Risk	$325 to $547 million
Inflation	$208 to $281 million
Right-of-Way Costs	$40 million
Total Tunnel Costs	**$1,585 to 2,130 million**
Viaduct Demolition and	
Alaskan Way Restoration (Four-Lane Surface Street)	$98 to $125 million
Total Program Costs	**$1,683 to $2,255 million**

These costs *do not* include the costs of the following items:

Other Elements	**Planning Level Estimate**
Seawall Replacement	$189 to $256 million
Waterfront Utility Relocation	$41 to $56 million
Waterfront Streetcar	$9 to $12 million
City Street Work	$49 to $66 million
Other	$83 to $112 million
Other Costs	**$503 to $682 million**

Paying for a Deep Bored Tunnel. The state has committed $2.8 billion to pay for a viaduct replacement. Currently $1.1 billion has been committed or spent for the Moving Forward Projects, which replace or repair over half of the viaduct. This leaves approximately $1.7 billion in state investment. Given that some portions of the Moving Forward Program would either not be required or require less investment under a bored tunnel option, there is potential for savings that could be transferred to help pay for the bored tunnel. This would involve decisions regarding the latter phase of Battery Street Tunnel retrofit work, retrofitting the existing viaduct between Lenora Street and the Battery Street Tunnel, and the scope and cost of the northern transition section of the Holgate to King viaduct replacement project. Current estimates would indicate between $100 million and $150 million could be available, further work would be required to confirm a more specific estimate.

Charging tolls to drivers in a four-lane bored tunnel through downtown Seattle would support up to $410 million in additional project funding between 2014 and 2018. Tolling the existing viaduct during construction could raise up to another $140 million in pay-as-you go project funding, for a total SR 99 tolling contribution of approximately $550 million.

Tolling SR 99 during and after construction would increase the total possible state funding available for a deep bored tunnel to $2.25 billion. Tolling is expected to divert some trips to other routes such as the downtown street grid or I-5. Preliminary studies have indicated the diversion rate could be from 35 to 40 percent, which is assumed within the above tolling assessment.

At this point in time there are no proposals for additional federal funds within the program, though there are ongoing questions related to stimulus package opportunities. As previously mentioned, there is some schedule advantage to pursuing the central waterfront environmental planning work based solely on state funding.

Other potential funding sources have been discussed, including a local improvement district for property owners who would benefit from new open space on the central waterfront; local public utilities paying for utility relocation; open space funds; and Port of Seattle funding. The amount and likelihood of these funding sources have not been explored related to the current bored tunnel proposal, although the Port of Seattle has expressed interest in discussing the funding plan for a capacity replacement.

NEXT STEPS

If a decision is made to pursue a deep bored tunnel as a replacement option for the Alaskan Way Viaduct, we recommend the following steps be taken by the program team:

- Convene an early January work shop to further review the base estimates, findings of the recent independent estimate review, and the program mark-ups that have come into question. It is assumed we would engage a variety of independent tunnel experts in order to ensure findings that have broad industry support.
- Complete a two to three month tunnel feasibility study to confirm preliminary findings about the cost, schedule and alignment of a single bored tunnel as compared to a dual bored tunnel.
- Continue the environmental review process.

ATTACHMENTS

1. Single bored tunnel alignment and profile