Washington State Department of Transportation

Memorandum

February 13, 2007

TO: Douglas B. MacDonald, Secretary of Transportation
MS 47316

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SUBJECT: Technical Review Memo – Assessment of City of Seattle's Proposed Surface/Tunnel Hybrid Concept as an Alaskan Way Viaduct Replacement Option

Conclusion

At the request of the Governor and the chairs and ranking members of the Senate and House Transportation Committees, the Washington State Department of Transportation (WSDOT) has completed its review of the City of Seattle's surface/tunnel hybrid proposal that will be placed on the March 13 ballot measure for Seattle voters. In the best professional judgment of the authors of this memo, WSDOT cannot recommend to the Governor, chairs, or ranking members' approval of this proposal as an acceptable viaduct replacement option because of serious safety and operational problems found during our technical review. We recommend that this proposal not be advanced or studied further.

Background

WSDOT, along with the City of Seattle and the Federal Highway Administration (FHWA), have been working on developing a replacement project for the seismically-vulnerable and aging Alaskan Way Viaduct since 2001. (Viaduct feasibility studies began in the late 1980s.) The State, in partnership with the City, developed over 70 concepts that were analyzed, and screened to five alternatives that were fully evaluated in the project's Draft Environmental Impact Statement (Draft EIS) released in March 2004. After review of thousands of public comments and attending hundreds of public presentations, two options emerged as viable projects: A six-lane stacked cut-and-cover tunnel and a six-lane elevated structure. Each option has unique strengths and weaknesses, but both fully meet the intended transportation goals and objectives for the

project. These two options were further analyzed in a Supplemental Draft EIS released in July 2006.

Between June and December 2006, WSDOT worked with an Expert Review Panel made up of transportation, construction, and environmental experts from around the country to review the implementation plans, cost estimates, and finance plans for the two viaduct replacement options. WSDOT updated the project costs estimates in conformance with recommendations from the Expert Review Panel and released those estimates in mid-September 2006. Based on this updated, the six-lane stacked tunnel was most likely to cost $4.6 billion and the six-lane elevated structure was not likely to cost $2.8 billion. The Expert Review Panel concluded that WSDOT's implementation plans and cost estimates were reasonable.

In accordance with legislation (ESHB 2871), the Governor reviewed the recommendations of the Expert Review Panel and concluded, in a set of Findings (attached) that the cost estimates and finance plan for the elevated structure were reasonable and sufficient. The Governor found that the finance plan for the six-lane stacked tunnel was not sufficient. The Governor also found that the project was politically gridlocked, and that the voters of Seattle should be asked whether they would support the tunnel option knowing that they would have to bear the additional costs, and any cost overruns associated with the tunnel.

On January 5, 2007 City staff approached WSDOT staff about the feasibility of a four-lane tunnel. The four-lane tunnel had no shoulders, two feet of "shy distance" between the traveled lanes and the walls of the tunnel. (The notion of a four-lane tunnel was first suggested by a top City official to WSDOT staff in the late fall of 2006. At that time, it was agreed that such a significant change could not be contemplated at this point in the process. However, the concept of reasonably "narrowing" the tunnel section could be reviewed in later design as a value engineering proposal if the tunnel was selected as the project's preferred alternative.)

The proposal also included several other significant scope changes: aligning SR 99 over Elliott and Western avenues instead of under; deferring fire, life and safety improvements to the Battery Street Tunnel; and significantly accelerating construction to reduce inflation costs. The City asked WSDOT to have the project team do a quick review of the four-lane tunnel to see if it warranted further analysis. From January 8 to January 12, 2007, WSDOT made project team resources available to the City, including project consultant staff and members of the Expert Review Panel, to further develop this concept. By the end of Monday January 8, it became clear that the four-lane tunnel was not adequate to meet the transportation needs in the corridor, or the project's National Environmental Policy Act purpose and need statement as agreed to by the City, WSDOT and the FHWA.

Refer to EIS what objectives + goals are

go back + compare

compare to present

vote cost to deal w/ political gridlock I was thwarted what did leg. say? terms of vote text of vote

who are people city staff

tampered w/ purpose + need to change scope nature EIS is based upon

3 days later of proj.

project has to meet the NEPA purpose and need statement

As an alternative concept, a four-lane tunnel that utilized roadway shoulders for peak-hour traffic use was discussed. During off-peak hours, the 12-foot right lane would become a shoulder. SDOT and the project team produced a ballpark cost estimate by reducing the base cost of the fully developed six-lane, stacked tunnel alternative, quickly changing the risk register to try to reflect reduced risk with a side-by-side tunnel and prorating the overall risk and escalation factors previously developed. That produced a rough $3.4 billion estimate. No full CEVP or cost re-evaluation work was done on this proposal. WSDOT was unable to validate either the operational parameters associated with this proposal or the cost estimate itself before work stopped on January 12, 2007. The project team documented the work for project records and characterized the results as inconclusive. This alternative was later identified by the City of Seattle as the surface/tunnel hybrid proposal.

The Seattle City Council decided on January 19 to place before the voters of Seattle two questions on a March 13, 2007 ballot. First, whether they supported an elevated structure to replace the Alaskan Way Viaduct at cost of $2.8 billion, and second whether they supported a surface/tunnel hybrid at a cost of $3.4 billion.

On January 25, 2007, the City of Seattle made a presentation to the Senate Transportation Committee suggesting that the surface/tunnel hybrid was functionally equivalent, cheaper, and a better option than the six-lane stacked tunnel option ($4.6 billion) included in the project's Supplemental Draft EIS. Further, the City argued that the finance plan the Governor had rejected for the six-lane stacked tunnel was more than adequate to cover both initial costs and potential overruns for the surface/tunnel hybrid. WSDOT testified that it had not been able to validate the cost estimates and raised several concerns about key assumptions underlying the City's proposal.

On January 30, 2007, the Governor, along with the chairs and ranking minority members of the transportation committees in the House and Senate, sent a letter to Secretary MacDonald seeking answers to numerous questions about the City's proposed surface/tunnel hybrid option (attached).

Between January 31 and February 12, 2007, WSDOT conducted the best technical review of the City's proposal as possible given the time constraints of the review. Our technical review was conducted in a two-step process. First, the concept of operating the SR 99 corridor, including the central waterfront tunnel section, in a "flexible" manner that utilizes the shoulder for peak-hour traffic operations and then converts to a shoulder the rest of the day was reviewed. Second, the roadway and shoulder widths proposed for the corridor by the City was further assessed based in a large part on the outcome of our first review.

The surface/tunnel hybrid proposal included a 'side-by-side' configuration of a cut-and-cover tunnel rather than a 'stacked' cut-and-cover tunnel. This idea has been considered in the past and continues to have potential benefits and risks:

- Benefit: Reduced depth of tunnel minimizes potential risks during extensive soil excavation
- Benefit: Reduced depth of tunnel may lessen the amount of structure (i.e., thickness of walls) needed
- Risk: Roadway width and curve standards may require encroachment in Elliott Bay, which will require additional mitigation
- Risk: Width of tunnel requires deviations from spacing and depth standards for public utilities

Specific responses to questions contained in the January 30, 2007 letter follow:

Question 1.

What is the likelihood that the federal government will approve the necessary variances to allow the shoulders to be used as lanes during the peak period? How long will it take the federal government to make that decision? Has the state of Washington ever successfully requested a similar federal waiver on a transportation project? If so, what results have we experienced on those projects?

Departures from roadway design standards for non-interstate highways that are part of the National Highway System are evaluated based on a design stewardship agreement between WSDOT and FHWA. This agreement calls for a two-stage approval based on WSDOT's design manual as the controlling document for decisions. The American Association of State Highway and Transportation Officials' guidance may be used to justify a departure when safety and operational concerns can be satisfied. WSDOT is responsible for ensuring these issues are carefully considered and assessed as part of its requests to FHWA. In its evaluation, WSDOT assesses the proposed variances based on the classification, geometric and operational characteristics. FHWA makes an independent assessment and may deny, ask for additional mitigation, or approve the departure based on the authority of their oversight.

Highway tunnels are special and challenging environments. Because tunnels are more confined than open roadways, near misses or minor fender benders on the open roadway can become life threatening, possibly even catastrophic events, if the highway tunnel is not designed, operated, and maintained properly.

WSDOT is absolutely committed to maintaining critical life and safety standards in tunnel environments on state and interstate highways. During the development of design guidelines for use on the Interstate 90 tunnels in the late 1980s, WSDOT carefully reviewed national and international practices regarding requirements for ventilation, fire

detection and suppression systems, lighting, driver information and warning systems, and roadway geometry. One only has to look at the catastrophic results of the 1982 Caldecott Tunnel fire in Oakland on California State Highway 24 in 1982 to understand what is at risk; in that tunnel fire seven people died and many more were hospitalized because of poor roadway geometrics, inadequate systems and lack of updated communication and fire response plans.

When completed in the early 1990s, the Interstate 90 tunnels in Seattle and Mercer Island incorporated the best practices from around the country and around the world. Recent discussions about the conversion of the I-90 center roadway to full-time light rail transit have revitalized discussions about acceptable systems, practices, and geometry in Washington's highway tunnels. After almost four years of analysis, applications of new detection, communication, and ventilation technologies coupled with maintaining at least one full shoulder for safe emergency egress and emergency vehicle access seem likely in the I-90 tunnels. Application of similar guidelines to the SR 99 tunnel is consistent and critical to maintain the safety of the traveling public.

Summary of Step One Review – WSDOT's review of the corridor being operated with "flexible" shoulders concluded that a flex-shoulder management approach on SR 99 in this location was not reasonable or feasible for the following reasons:

- On and off ramp proximity
- A curve with limited sight distance near the south end
- Steep grades
- High percentages of traffic entering/exiting at Elliott and Western avenues and exiting/entering near the stadiums
- Freight routes using those on/off routes
- Traffic demands on the facility caused by special events on a regular basis throughout the year
- Combined peak periods projected to be 6-7 hours in 2030

These conditions necessitate a full-time auxiliary lane in each direction between Elliott and Western and the stadium exits at South Royal Brougham Way. Thus, the minimum acceptable roadway section is a six-lane section. In this tunnel environment, WSDOT will not approve the use of shoulders as travel lanes because the full time auxiliary lanes are necessary to maintain public safety and mobility compared to a roadway with full-time shoulders.

Summary of Step Two Review – WSDOT then assessed whether a full-time, six-lane facility could work in the roadway section proposed by the City (two-foot shoulder; two 11-foot lanes; one 12-foot lane; one two-foot shoulder). We concluded that a facility without a full-time, usable shoulder is likely to experience the following serious safety and mobility issues:

- Lanes will be blocked by disabled vehicles and accidents
- Response times will be increased for police and emergency response
- Expected increases in the number of crashes into either a bridge rail or tunnel wall
- Obstacles to emergency exits during periods of shoulder use

In addition, the two-foot shy distance from the travel lanes would result in unacceptable sight distances in the tunnel, especially at the "Colman Curve" where speeds in the inside lanes would have to be reduced to approximately 15 miles per hour less than the posted speed limit and would operate with significantly higher accident rates similar to the Battery Street Tunnel.

A roadway configuration for the SR 99 corridor that does not include three lanes and shoulders at all times does not meet the state's safety standards and would not be approved by WSDOT. While a new facility without shoulders may offer some improvements (not validated) over the existing narrow lane, no-shoulder facility, it does not provide the safety and mobility standards expected of a new facility that requires a significant public investment.

The current roadway configuration (one four-foot shoulder; two 11-foot lanes; one 12-foot lane; and one ten-foot shoulder) has received preliminary approval by WSDOT and FHWA[1]. This configuration already represents deviations from WSDOT's design standards, but still provides a reasonable level of safety and mobility. (Full roadway standards would require two 10-foot shoulders and three 12-foot lanes.) WSDOT's approval of the currently approved, deviated roadway sections will require a number of operational strategies to offset the reduction in lane width and reduced shoulders. For reference, the current roadway width that will likely receive final FHWA approval is the result of over four years of design evolution, corridor analysis, and accident studies.

The use of a shoulder as a travel lane on a *new* facility has not been approved by WSDOT or the federal government in Washington State.

[1] The Supplemental Draft EIS tunnel alternative was the same roadway width, but with a slightly different configuration: one two-foot shoulder; three 12-foot lanes; one 10-foot shoulder.

A comparison of the surface/tunnel hybrid proposal with the preliminarily approved configuration of the six-lane stacked tunnel is made in the table below.

Six-Lane Stacked Tunnel December 2006	**Surface/Tunnel Hybrid January 2007**
Stacked tunnel along central waterfront	Side by side tunnel on central waterfront
4 feet /11 feet /11 feet /12 feet/10 feet roadway (48 feet total roadway width)	2 feet /11 feet /11 feet /12 feet /2 feet roadway configuration (38 feet total roadway width)
3 lanes of travel plus shoulder 24/7 each direction	Third lane in each direction only used 7 hours per day.
SR 99 under Elliott and Western Avenues	SR 99 over Elliott and Western Avenues
Lid adjacent to Victor Steinbrueck Park	No lid; walkway over SR 99 to waterfront
Fire and life safety improvements in Battery Street Tunnel included	No work in Battery Street Tunnel
9 years total construction duration – 39 months total closure of SR 99	6 year total construction duration – 33 months total closure of SR 99

Also, WSDOT believes that fire and life safety improvements to the Battery Street Tunnel must be included in the project because they put in place systems that meet today's standards for protection of public safety. This project has been identified as necessary for over five years and has been consistently included in this project when requesting state funding.

Question 2.

What are some examples of operational measures that would be necessary to offset the loss of shoulders during peak periods? How much would those kinds of measures cost?

Operational measures alone will not offset the loss of full-time shoulders in the tunnel. The approved section by WSDOT includes one full-time shoulder.

Do first responders have concerns regarding access issues and the use of shoulders as lanes during the peak periods?

The Seattle Police Department and Seattle Fire Department have indicated that the roadway configuration in the surface/tunnel hybrid proposal provides adequate access for emergency response (see attached letters). The Washington State Patrol disagrees and notes the importance of roadway shoulders in a tunnel environment (see attached letter).

Question 3.

What are the schedule assumptions for the surface/tunnel hybrid proposal and the elevated alternative, and what are the cost implications related to those assumptions?

The schedule assumptions that are common to both the surface/tunnel hybrid and elevated structure options are:

- 18 months for initial utility relocation before the start of major construction
- 12 months for surface restoration and final utility relocations
- Two 10-hour shifts per day with estimates adjusted for added labor costs

The construction schedule assumptions for the surface/tunnel hybrid and elevated structure take opposing strategies. The construction plans for the surface/tunnel hybrid option are intended to complete construction as quickly as possible, which requires closing SR 99 and Alaskan Way to have a continuous 33 month complete closure The construction plans for the elevated structure are designed to keep SR 99 and Alaskan Way open to traffic as much as possible during construction and result in 3 months of complete closure of SR 99 and Alaskan Way is always open with lane reductions and/or other traffic management restrictions.

In order to hold down cost, the hybrid tunnel proposal assumes an aggressive construction approach that will have intense impacts on traffic and businesses. The schedule depends on closing SR 99 and Alaskan Way for 33 months, during which some $2 billion of tunnel, bridge and road work will have to be accomplished. This unprecedented level of activity risks cost increases due to reduced competition and strains on supplies of labor and materials.

The cost implications related to these assumptions are fairly straight forward: Closing SR 99 sooner and for an extended period of time advances significant construction expenditures and saves literally hundreds of millions of dollars in inflation costs; keeping SR 99 as open to traffic as much as possible delays construction expenditures and increases construction costs by hundreds of millions of dollars. Either way, significant impacts to businesses, residents and the traveling public will be felt, although the intensity of those impacts will generally be more severe over a shorter period for a full closure than for the more open option, but the effects will continue over a longer period of time in the latter.

Are schedules and impacts to waterfront businesses consistently evaluated across the various options?

The schedules and impacts to waterfront businesses are consistently evaluated for both the City's surface/tunnel hybrid proposal and the elevated structure alternative; however, the degree of impacts will be significantly different. The full 33 month closure for the surface/tunnel hybrid assumes complete closure of both SR 99 and the Alaskan Way surface street. Access to waterfront businesses will be across Alaskan Way and through the construction work. The elevated structure construction assumes a 3 month complete closure of SR 99 and allows continuous north-south access along the Alaskan Way surface street. It is important to note that although there are more opportunities for access, the construction duration is 37 months longer.

What is the assumed cost regarding construction mitigation for waterfront businesses?

Costs for construction mitigation along the central area (including hard costs and risk costs) range from $100 million for the open corridor option to $160 million for the closed corridor option. This includes measures such as maintaining access to businesses on Alaskan Way, noise control, air quality maintenance, and temporary bridges to the piers. These measures not only benefit the waterfront businesses, they will benefit the surrounding downtown businesses and residents.

In the event reasonable access to the waterfront businesses cannot be maintained, cost estimates include a risk of either renting or purchasing the piers and helping to relocate businesses.

Question 4.

Based on your analysis, does the surface/tunnel hybrid proposal maintain vehicle capacity needs in 2030?

The surface/tunnel hybrid does not maintain vehicle capacity needs in 2030 because of the effects of having no roadway shoulders. The lack of shoulders will increase congestion during accidents or vehicle breakdowns (over that of the accepted roadway width) and will thus not meet operational reliability requirements, even with increased incident management. The narrower section proposed also has less theoretical vehicle carrying capacity (a few percent or so) than the approved section.

Limited traffic modeling has been completed due to the short time period allowed for review. Theoretically, it is possible to argue that the proposal meets capacity requirements by "flexing" to six lanes during peak periods. Practically, however, the lack of full-time shoulders, the required merging and diverging of traffic (including trucks), and the inherent increase in delay due to blocking incidents imply that capacity is reduced

in the City's proposal. More detailed analysis would be needed to quantify the extent of this reduction. However, an indication of the difference can be made by comparing SR 520 to I-90. As part of the SR 520 Bridge Replacement Project, we completed the analysis and estimated that the addition of shoulders would reduce congestion due to blocking incidents by 44 percent.

Is there any diversion to I-5? If so, are there ways to mitigate or avoid this diversion? If design changes are necessary, how much will those changes cost and will they affect the sequencing of construction?

The decreased reliability of operations due to increased durations of blocking incidents with no shoulders in the peak hours will likely lead to some diversion of trips to other parts of the network, most likely the city street grid. However, there is some potential for shifting of trips to I-5. More detailed analysis would be needed to quantify these impacts. This effect would be most likely occur south of downtown where trips to/from West Seattle would utilize the more direct connection to I-5 from Spokane Street.

Does this proposal require a Supplemental Draft Environmental Impact Statement?

Based on our current understanding of the City's surface/hybrid tunnel proposal, it does not appear that a Supplemental Draft EIS would be required. Further analysis would be required to make a final determination. The design of the surface/tunnel hybrid would need to be advanced to a screening level to determine if it still meets the NEPA purpose and need statement and to increase that new significant impacts not already introduced in the environmental process. This may take three to six months.

Question 5.

Have the utility companies agreed to significantly deviate from their current spacing, depth and cover requirements that enable the side-by-side configuration?

In the past, a side-by-side tunnel configuration has not been agreed to by the utility companies because of the limited right-of-way for the placement of utilities. In a letter to WSDOT on February 5, 2007, Seattle City Light wrote "Based on our preliminary review, we do not believe there are any technical barriers associated with relocating City Light's transmission and related electric facilities in a side-by-side configuration." In a letter to WSDOT on February 6, 2007, Seattle Public Utilities wrote they "...will be flexible around standard separation and depth requirements related to design and construction for the Hybrid Tunnel Option, while ensuring quality customer service, protection of public health, safety, the environment, both during and after construction of SPU assets."

While we have received these indications of their willingness we have not yet received sufficient information to allow us to answer this question. However, many of the

solutions to space constraints for utilities are in practice in other urban areas in the United States where space is a premium. It is possible that some of the necessary changes will increase the initial capital costs of utility relocation.

How are utilities relocation costs addressed in the other Alaskan Way Viaduct project alternatives and how does this approach compare to other transportation projects?

The state could pay to relocate utilities that have a property right in the right-of-way in which they are located. In the case of replacing the Alaskan Way Viaduct, the City of Seattle owns the right-of-way on which SR 99 is located. The state cannot pay to relocate any utility that is on a franchise or has no property right. The private utilities in the project corridor are a franchise and do not have a property right in the right-of-way.

Utility relocation costs have been addressed using the same approach and assumptions for the four options. The cost estimates include relocating publicly-owned utilities and have been estimated in the same manner as all other state transportation projects. The cost of moving private utilities within the project area has not been included in any of the cost estimates. To relocate City-owned utilities, the estimated cost is up to $500 million.

The City of Seattle has committed publicly to fund the relocation of City-owned utilities should a tunnel project be built. The City has also stated that it would not fund the relocation of City-owned facilities if a new elevated structure is built.

In the event WSDOT pays the relocation costs of the City's utilities, motor vehicle funds can only be used to supply in-kind systems with code upgrades. Any system "betterment," such as increased capacity, is the responsibility of the City.

WSDOT has paid relocation costs for public utilities. However, we have found no examples with the magnitude and complexity of the relocations required by replacement of the Alaskan Way Viaduct.

Question 6.

How does the surface/tunnel hybrid proposal impact the safe and efficient movement of freight to and through the project corridor?

The City's surface tunnel hybrid affects freight movement in several ways. Without the auxiliary lane, trucks would be forced to merge into higher speed traffic in the through lanes during non-peak periods. This merge-diverge causes increased potential for accidents.

The increased length and grades when SR 99 goes over Elliott and Western avenues from a waterfront tunnel would consist of a seven percent grade for approximately 1,700 feet

and a four percent grade for an additional 400 feet. These grades fall within WSDOT design standards, but are longer than in the Supplemental Draft EIS stacked tunnel alternative and will cause more slowing of heavy freight vehicles, causing increased delays and speed differentials between travel lanes.

Question 7.

How does the surface/tunnel hybrid proposal impact the safe and efficient movement of transit to and through the project corridor?

For the surface/tunnel hybrid, existing or planned transit is not expected to use the new tunnel because access into downtown Seattle (the only destination of transit on SR 99) is to the north and south of the tunnel entrances.

[From Question 4] Does the capacity analysis assume new transit investments? If so, are those transit investments reflected in the current cost estimate?

The two alternatives described in the Supplemental Draft EIS and the surface/tunnel hybrid proposal include the same assumptions about future transit investments as previously described in the Supplemental Draft EIS. The capacity analysis assumes the following major transit improvements to be in place by 2030:

- Sound Transit LINK light rail between Sea-Tac International Airport and the University of Washington
- Revised King County METRO routing to serve LINK light rail stations
- Currently planned and funded expansion of Sound Transit commuter rail service to Tacoma and Everett
- Additional bus services provided by King County METRO's six-year plan and Transit Now service proposals based on current information

Funding for these transit investments or any additional investments has not been included in the cost estimates for the six-lane stacked tunnel or six-lane elevated structure.

What are the assumptions for transit in the surface/tunnel hybrid proposal and how do those assumptions compare to the use of transit in the elevated structure option?

The Supplemental Draft EIS alternatives and the City's surface/tunnel hybrid proposal assume transit plays a significant role in meeting demand for trips otherwise expected to be met in the SR 99 corridor. The assumptions include that one of every three trips added above today's trip level to or through central Seattle will be provided by transit and nearly every commute period trip to downtown will be served by transit. This will require

significant new investments in transit capital and operating needs, none of which are included in the projected costs of replacing the viaduct.

The surface/tunnel hybrid proposal refers to additional permanent transit service in the corridor but does not provide for funding in the cost estimate as far as we know. Both the surface/tunnel hybrid and the elevated structure alternative anticipate additional transit service during construction to help offset travel impacts, and costs are included in the project estimate.

What are the funding assumptions regarding transit in the surface/tunnel hybrid proposal and the elevated structure option?

No expansion of transit service is included in the funding assumptions for any of the options except during the construction period.

Response to Other Questions in Letter

What is the real cost difference between the surface/tunnel hybrid and the elevated alternative? The City has identified some cost savings that could be also applied to the elevated option. Please make a cost comparison of the elevated option and hybrid tunnel using common scheduling and cost savings assumptions.

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The letter asked the Expert Review Panel to conduct the review to answer the above questions. WSDOT was unable, in the time allowed, to develop a base cost estimate and risk assessment for the surface/tunnel hybrid.

SA