December 22, 2008

Mr. David Dye
WSDOT
PO Box 47300
Olympia, WA 98504-7300

Dear Mr. Dye:

This letter responds to your request that we provide you our best thinking about deep bore tunnel costs. We would like to thank you for meeting with members of our team and for sharing information among colleagues. Much of our thinking has been presented in our previous letters and in last week's discussions with the stakeholder committee. The main conclusions are:

1. A bored tunnel option provides replacement through capacity while reducing construction and longer term community impacts. Agree.
2. Highway tunnels in these conditions are feasible and there is a large body of experience from within and outside the US. We agree, generally. It is likely that a bored tunnel is technically feasible. However, either the single or twin bores would be larger than any project completed in the United States to date. The bored tunnels under discussion for Seattle would be complex and challenging and would be near the state of the practice. Underground projects necessarily entail significant geotechnical risks and so far very limited information has been gathered. While we believe the bored tunnel is technically feasible, it is not without significant risk.
3. Based on a survey of other tunnel projects both in the US and internationally the reported AWV replacement cost is higher than might be expected. It is very difficult to obtain detailed cost information from other projects in order to make a true apples-to-apples comparison. Each bored tunnel is unique in its size, length, location, environmental conditions, geotechnical conditions, labor rates, etc. Some reported costs represent preliminary cost estimates, others are bid prices, others are construction in place. Some do not include agency costs for design and construction management. Some do not include escalation. Wage and labor rates and currency values can vary widely.Each tunnel project is unique Keep in mind that this project is still at a very conceptual state and it is prudent to have a conservative set of assumptions regarding cost.
4. The 9.5 year construction schedule also appears long when compared with other projects. 9.5 years was the construction schedule for the entire scenario which included environmental and permitting, design, and other related improvements to surface streets. It was not the construction schedule for the bored tunnel which was a component of that scenario. At a conceptual level, we estimate the the bored tunnel itself including both portals and all internal finishes could be constructed in about 6 years. This does not include the time required to procure and install the tunnel boring machine (1.5 years) or the time to complete the environmental process (2 years).

We appreciate the opportunity to attend and present at the Stakeholders meeting last week, and thank you for providing a copy of your presentations. While we have not received a detailed breakdown of your estimate or schedule we have carried out an initial assessment of the figures provided and have compared these figures with those from other similar highway tunnels. Based on this analysis we continue to believe that the project cost estimates for the tunnel options are significantly higher than those of similar recent tunneling projects, and we explain some of the reasons we believe this to be the case below:

- **Cost comparison and Savings**

  While we do not have your detailed cost breakdown, based on the information provided we have the following broad comments which are based on the twin bored option, although several hold true for the single bore:

  It appears that the AWV Construction Estimate of $1.2bn (which includes 25% design contingency and contractor mobilization, overhead and profit) is in line with consortia's construction bid prices for PPP projects of a similar nature. These hard bids were prepared on the basis of a preliminary design and include design and construction risk and contingency.

Based on this analysis we would expect a construction estimate of between $1.2 and $1.4bn including risk and much of the contingency that has been included as separate line items in the estimate presented. We agree, generally, on the expected construction bid price. At this early stage in project development, it is prudent to carry an additional amount in the estimate to account for risk and contingency. Currently our estimates include 12% for Risk and 28% for contingencies. There are many known risks with underground construction and the project still faces many unknowns.

The design fee of 15.75% and the construction administration figure of 15.5% appear high in our experience. We would anticipate them to be of the order of 10% and 6% respectively. The numbers you recommend are typical of what might be paid to consultants for design and construction management. The higher figures we are using are also aimed at capturing the costs to the agencies (State, County, and City) who will be reguired to manage and supervise the desing and construction. We would also not expect the uplift for risk, contingency and escalation to be applied to these items, or the uplift for risk to be applied to contingency.Risk and contingency are discussed above. It is prudent to include them at this point in the project. It is also prudent and standard WSDOT policy to include escalation for any costs that will occur in the future to account for th time value of money

Based on these observations we believe that the project can be competed for less than $2Bn including the Right of Way costs. Our current "most likely" cost estimates for the twin bored tunnel is $2.8B and for the single bore, $2.1B. It appears we are not that far apart and that :below the line" factors account for most of the difference.

As a comparison against a bid project, these figures assume that the project proceeds largely to the anticipated schedule and do not include the impacts of any substantial project delays or other extreme events. It is prudent at this stage in the project to make some allowances for events that could delay or disrupt the schedule.

It is not clear from the figures provided where the demolition of the existing viaduct is included in the estimate. We assume that this is not included in the tunnel costs. Demolition of the Viaduct was not included in the tunnel estimates we presented on December 16, 2008. Cost for the demolition of the existing Viaduct is estimated at about $40M.

- **Tightening the Estimated Construction Schedule.**
  While the overall construction period is reported at 9.5 years we understand from your presentation that the tunnel construction will be of the order of 7.5 years (twin tunnel) and 6.5 years (single large tunnel). Our assessment is that construction of the tunnel (including portals, tunnel and highway) could reasonably be reduced to a maximum of 5 years for either option. A 5-year construction period is consistent with the Port of Miami tunnel proposal which also included the final design phase. In addition to reducing construction impacts this would have some reducing effect on construction cost (contractor's fixed costs and escalation) and construction impacts. As stated above, each tunnel project is unique. The Port of Miami tunnel is much shorter, in different soil conditions, and construction on that tunnel has not yet begun. If the project develops further, it may be possible to find ways to shorten the construction duration.

- **Mitigation costs**
  While we have not been provided with details of the cost estimates for the other options we anticipate that mitigation costs for the bored tunnel would be comparatively low. The other options have impacts that will be extremely difficult to mitigate and these costs, we believe, are not included in the budget projections. Recent economic studies performed by the Waterfront Coalition suggest negative impacts to businesses would be lowered with the deep bore tunnel option, thereby reducing potential migration costs. We agree that the bored tunnel would likely involve less construction disruption to the waterfront businesses than other alternatives. Even the bored tunnel would, however, involve construction impacts at the north and south portals.

- **Holistic Costing**

As discussed in our presentation we would recommend that the whole life cost of the various alternatives be assessed. This would include annualized operations, maintenance and replacement costs, as well as the wider costs and benefits to the community including the cost of disruption during construction, the cost of additional travel time associated with the surface option and the increase in property values and potential for increased amenity as a result of removing traffic from the waterfront. Wider costs and benefits were evaluated separately as part of the economics analysis.

- **Alaskan Way / Western Avenue Couplet**

  The Option F Scenario included for upgrading of Alaskan Way and Western Avenue to a 6 lane north-south route at a cost of $190 million. The couplet does not appear as part of the elevated viaduct scenario and it is not clear why it is part of bored tunnel scenario, given that the bored tunnel provides similar throughput. The 8 scenarios were developed to evaluate a wide variety of system-wide improvements that could be made to SR 99, the surface streets, I-5, transit, and other policy changes. In part, the couplet was paired with the bored tunnel to test the performance of the Elliott & Western connections which are not included in the bored tunnel. As the hybrid process moves forward, the lessons learned will be incorporated in the final recommended scenario. It is easily possible to separate out the costs that each building block contribute to the overall scenario.

- **Continue Tunnel Hybrid Analysis in Environmental Impact Statement**

  The Stakeholder Group and the community have come together to recommend the deep bore tunnel option be carried forward for further analysis in the EIS. In our considered opinion it would be beneficial to construct a deep bore tunnel before the current elevated structure is demolished, sustaining throughput, lessening the traffic impacts of demolition and lessening the impacts on local businesses.

  In fact, if a deep bore tunnel were selected as a preferred alternative, the EIS process could be reduced significantly. Unlike the elevated alternative and the surface plus transit, the deep bore, has impacts limited to the portals and any shafts and may even be managed as a supplemental assessment to the original AWV EIS. The EIS will be required to disclose the impacts of all reasonable alternatives and not just the preferred alternative. It is too early to tell what alternatives will be evaluated in the EIS.

To this point we have not had the data, time or resources to complete a detailed line by line comparison of the cost estimate or schedule. The above conclusions are based on our experience of tunnels and highway projects both in Seattle and further afield and on comparisons with other projects. With full access to the technical project data so far collected by the independent project team, we estimate we could develop such a comparison cost estimate in 5 weeks.

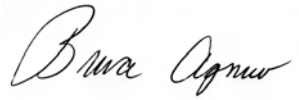
We understand the importance of moving forward on a decision for AWV. We also fully understand the need to adequately address the full costs of a project, including potential risk. In light of these concerns, we respectfully offer the following recommendations:

- Proceed to include Deep Bore Hybrid in next phase of the environmental analysis
- Fully develop a tunnel cost estimate to the same level that the currently selected hybrids will be, and include for mitigation costs.
- Concurrently pursue a "dual" design
- Issue a request for proposals

Such an approach would allow the industry to weigh in on costs, risks, inflation, etc. Their informed self-interest will provide the State and our region with actionable information that could provide a solution that really works for our city, our economy and regional mobility.

Respectfully,

Richard Prust
Associate Principal, Arup



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