December 3, 2008

Governor Christine Gregoire
Office of the Governor
P.O. Box 40002
Olympia, WA 98504-0002

Mayor Greg Nickels
Seattle City Hall
600 Fourth Avenue, 7th Floor
Seattle, WA 98104

King County Executive Ron Sims
King County Executive's Office
701 Fifth Avenue, Suite 3210
Seattle, WA 98104

Re: Maintaining Sub-Surface Options to Replace the Alaskan Way Viaduct

Dear Governor Gregoire, Mayor Nickels and King County Executive Sims:

We concur with the jointly signed letter you received this week from the Greater Seattle Chamber of Commerce, the Downtown Seattle Association, and the King County Labor Council: Sub-surface options should continue to be included for consideration to replace the Alaskan Way Viaduct. As you know, the December 31, 2008 deadline for a decision on the Viaduct is fast approaching. We applaud the efforts of the Viaduct Stakeholders Advisory Committee during the last year and thank you in advance for your thoughtful consideration of sub-surface options.

As expressed by the Chamber, the DSA and the Labor Council, "we see no reason to exclude sub-surface options." That said, based on our analyses of alternatives over the last several years (including an attached recent cost comparison study which we hope you will review) the Cascadia Center of Discovery Institute would take this sentiment one step further. Of the sub-surface options, **a deep-bored bypass tunnel, combined with surface transit improvements, represents the best alternative** for the replacement of the Alaskan Way Viaduct. We have long supported surface transit options, including bus rapid transit, streetcars and passenger ferries. Surface transit options can be a part of a short-term solution. But lasting, long-term solutions can best be found in sub-surface scenarios. Importantly, as the Chamber, DSA and Labor Council have shared, sub-surface options "match up well against the Guiding Principles."

The letter signed by the Chamber, the DSA and the Labor Council points to the clear economic benefits of a sub-surface option, including regional economist Glenn Pascall's 2006 study that "identified up to $2.7B in regional economic benefits." Those benefits are realized in part from increased economic activity and higher property values downtown as a result of a tunneled structure. Mr. Pascall articulated further benefits for a bored tunnel in the attached March 16, 2007 op-ed in the *Puget Sound Business Journal* titled, "Bored By All Those Viaduct Choices? Think Again." We encourage you to review his op-ed.

RATIONALE

Cascadia Center has conducted our analysis of deep-bored tunnels because of our interest in assuring that the monumental decision about replacing the Viaduct is made with full consideration of our community's long-range challenges and opportunities. These include economic impacts, opportunities to build toward a fully functioning and interconnected transportation system, and the full life cycle costs of the investment. Over the last several years, Cascadia has convened a panel of international tunneling experts in Seattle and commissioned a series of independent studies from ARUP, a global engineering and consulting firm. We have sought to compare the relative costs (and review remarkable advancements in technology) of deep-bored tunnels around the world. Attached is our latest communication to the Viaduct Stakeholders Advisory Committee highlighting the results of our work.

There are significant disparities between the estimates of the state's technical team and the actual costs of scores of tunnel projects already in place around the world. We encourage you to closely examine **Table 1**, "**Completed large bore tunnels**" from our November 2008 ARUP report, "Large Diameter Soft Ground Bored Tunnel Review." (Note: Table 1 is also extracted and attached to this letter.) Even considering the proposed Port of Miami tunnel (at $677 million per mile the most expensive of the tunnel projects), the data indicates that the tunnel costs for the Viaduct should come in around $1.4 - $1.7 billion. The costs of the tunnels in our survey include full costs: ventilation, portals, entry and exit, life safety and roadways. This cost is significantly less than the current projection made by the state's technical team. (Note: The $3.5 billion cost of Scenario F includes adjustments for risk, inflation, and a construction timetable that is too long. The cost of Scenario C, and the surface option, is at $900 million.) We also note that the construction timetable for the tunnel projects is less than half the 10-year construction period currently under discussion by the committee.

To further refine cost estimates, we recommend funding to engage some of the world's leading tunneling contractors to work with the current project team and independent local consultants to advance the engineering and provide their best estimate of the costs. Considering that over $300 million has been spent on work to date, this would be a bargain for a tunnel that would serve the region for 100-150 years rather than the estimated 50 years of useful life for an elevated structure.

When the deep-bored tunnel is combined with a range of surface transit enhancements, it has other significant advantages:

- Provides the best capacity, travel time and through-put for the 55-80 percent of traffic on Highway 99 that is by-pass or through traffic;
- Represents ***the least disruption*** to the waterfront and downtown, since construction will occur underground and dirt can be hauled away via rail or barge while the Viaduct is still in use (Hebert's economic impact study in November 2006 estimated the cost of this disruption at $2.2-$3 billion for each year the Viaduct was down without a replacement.);
- Surface water runoff ***and*** air emissions could be captured and treated in a tunnel structure (through new electrostatic precipitator technology) resulting in a cleaner Puget Sound and lower greenhouse gases;
- Alignment could run through the central downtown area rather than the waterfront— eliminating the need to replace the seawall as a part of the Viaduct replacement project;
- Surface transportation enhancements can move ahead immediately while tunneling costs are refined and financing secured;
- A deep-bored tunnel can be planned and built as part of a larger regional system of bridges and tunnels including SR 520, Sound Transit's Link light rail through Beacon and Capitol Hill, and possibly a downtown tunnel in Bellevue with likely project cost-sharing and economies of scale;
- Sale of air rights along corridor could result in financial partnerships to reduce project costs and share risk;
- Offers the best opportunity to reconnect Seattle's waterfront and downtown core, introduce more sunlight, open views and park and recreational opportunities;
- New boring technology provides tunnels with up to 53 feet of diameter, allowing for three highway, transit and/or truck-only levels;
- A "Y-shaped" tunnel configuration could provide access to the third of traffic on SR99 that heads to Ballard or Fremont along the western corridor as well as to Mercer to I-5.

Thank you for your concern about the future viability of the Puget Sound region. We'd be happy to review our data with you and answer any questions you may have.

Sincerely,

Bruce Agnew
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Attachments

CC:
Senate Majority Leader Lisa Brown
KCDOT Director Harold Taniguchi
SDOT Director Grace Crunican
SDOT Project Director Bob Chandler
Secretary of Transportation Paula Hammond
Seattle Deputy Mayor Tim Ceis
Senate Transportation Committee
King County Labor Council
Seattle City Council
Greater Seattle Chamber of Commerce
WSDOT Deputy Secretary David Dye
Speaker of the House Frank Chopp
WSDOT Project Director Ron Paananen
PB Project Manager Mike Rigsby
Independent Project Manager Jim Parsons
House Transportation Committee
Washington Transportation Commission
King County Council
Downtown Seattle Association
Viaduct Stakeholders Advisory Committee

Comparison Charts Extracted from "Large Diameter Soft Ground Bored Tunnel Review," November 2008
Commissioned by Cascadia Center

COMPLETED LARGE BORE TUNNELS – TABLE 1

Completed large diameter highway tunnels						
Name	**Length**	**Dia.**	**Bores**	**Reported cost per *mile* of tunnel ($)**	**Soils**	**Function**
Shanghai River Crossing, China	4.6 mi	50.6 ft	twin	$27m	sand, clay, rubble	Road
Madrid M-30 - north tunnel of the south bypass, Spain	3.65 mi	50 ft	twin	$131m	marly clays of the Madrid Tertiary penuela and gypsum	Road
Serebryany Bor Tunnel	1.5 mi	46.6 ft	twin	*no data*	*no data*	Road/Metro
Lefortovo, Moscow	1.3 mi	46.6 ft	twin	$439m	fine to coarse sand, clay, limestone (medium strength, partially very fissured)	Road
4th Tube of the Elbe Tunnel, Germany	1.6 mi	46.5 ft	single	$303m	sand and mud, rock and pebbles, marly till and mica schist	Road
SMART Tunnel, Kuala Lumpur, Malaysia	1.86 mi	43.3 ft	single	$85m	*no data*	Water/ Road
Wesertunnel, Kleinensiel, Germany	1 mi	38.3 ft	twin	$180m	clay, sand, turf, till, silt	Road
Westerschelde, Terneuzen, Netherlands	4.1 mi	37 ft	twin	$60m	soft, permeable ground	Road
A-86W East Tunnel, Paris France	6.2 mi	34 ft	single	$242m	limestone, sand, clay, marl, chalk	Road

SURVEY OF TUNNEL COSTS – TABLE 2

Tunnel	Year completed	Diameter (ft)	Bores	Alignment length (miles)	Total length of tunnels (miles)	Reported cost ($ million)	Cost per mile of tunnel (million $/mile)
Port of Miami Tunnel	proposed	36	twin	0.7	1.5	1,000	$677
Lefortovo	2005	47	single	1.4	1.4	600	$439
Airport Link Brisbane	2012	41	twin	3.3	6.5	2,206	$338
Groene Hart Tunnel	2006	48	single	1.4	1.4	450	$332
4th Tube of the Elbe	2002	47	single	2.6	2.6	775	$303
I-710 (A3)	proposed	50[1]	triple	4.1	12.4	3,585	$290
I-710 (C3)	proposed	42[1]	triple	4.0	12.0	3,195	$266
A86W	2010	37.9[1]	single	10.9	10.9	2,641	$242
Wesertunnel	2001	38	twin	1.0	2.0	358	$180
Beacon Hill Tunnel	2009	21	twin	0.8	1.6	280	$172
M-30	2008	50	twin	2.2	4.3	570	$131
Dublin Port Tunnel	2006	38	twin	2.8	5.6	530	$94
Pannerdenschkanaal	2003	32	twin	1.0	2.0	173	$86
SMART	2007	43	single	6.0	6.0	515	$85
Wuhan	2008	37	twin	1.7	3.4	288	$85
Nanjing	2013	49	twin	1.9	3.7	245	$66
Westerschelde	2002	37	twin	4.1	8.2	490	$60
Shanghai River Crossing	2008	51	twin	4.6	9.3	245	$27

[1] This scheme contains multiple tunnel diameters. This number presented is the average tunnel diameter.

PUGET SOUND Business Journal
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Friday, March 16, 2007

Bored By All Those Viaduct Choices? Think Again

by Glenn R. Pascall

This week's voter rejection of both Alaskan Way Viaduct replacement options on the ballot in Seattle reflects the fact that each has serious drawbacks that prevent it from being the clear choice. The surface-street option, the default winner in the election, has its own challenge: gridlock or a massive shift in commuter behavior.

A viaduct rebuild sacrifices the rare opportunity to remove an urban eyesore and reconnect Seattle's downtown with the waterfront, while a cut-and-cover tunnel involves high costs and/or design compromises. Both options risk severe construction disruption. Moreover, the route is located in highly unstable ground conditions, with poorly placed fill and soft marine deposits.

The question is whether there is a way to liberate the part of the city that has been violated by the viaduct, while maintaining essential transport capacity, holding construction disruption to an absolute minimum, and financing the project's dollar cost in the very low billions.

There may be an answer: the Bored Tunnel Alternative. Truth in packaging: I've been working as an adviser to a group that has been examining alternatives over the past few months and has focused on this one as the most promising.

Members of the dialogue include Bruce Agnew, director of the Cascadia Center; John Wilson, a principal at the Gallatin Group; and Gary Lawrence, a principal at Arup consultants. As of this writing, they are poised to put forth the case for such an approach soon.

Bored tunnels have been built around the world for decades, but the technology of boring machines (called "moles") has advanced by leaps and bounds in recent years. This has enabled larger diameters (up to 51 feet), increased productivity and greater control of ground movements in a wide variety of conditions.

Recent bored roadway tunnels include the M30 tunnel in Madrid, the SMART tunnel in Malaysia, the 4th Elbe Crossing in Germany, and the A86 West Tunnel in Paris. This type of technology is being used in Seattle by Sound Transit on its Beacon Hill tunnel, and is proposed for the University Link Extension and for King County's Brightwater project.

Several years ago, state transportation engineers evaluated a 2.5-mile bored tunnel and ruled out this option because of high estimated costs. However, cost data for recent bored tunnel projects around the world indicate huge gains in economy of construction. Projected or actual costs of $270 million or less per mile are a small fraction of the original Washington state Department of Transportation estimate, and far below costs for an elevated structure or a cute-and-cover tunnel.

A combination of factors makes bored tunnels in this country more expensive than elsewhere. Cost estimates for projects on Interstate 710 in California and at the Port of Miami run up to $860 million per mile. However, these projects would accommodate port-related heavy truck traffic that would not be allowed either on a new elevated structure or a tunnel here.

Even so, using this top end conservative baseline for Seattle translates into $1.5 billion for a single-bore, 1.75-mile tunnel, or $3 billion for a double bore that would carry six lanes. The compact length of the bored tunnel is due to more direct routing through downtown.

Another advantage: When the bore is deep enough that the surface area above the tunnel is not disturbed, construction disruption for a bored tunnel is minimal. This means no open excavations, no utilities diversions (other than those associated with demolishing the viaduct) and no trucks through downtown streets. The vast majority of the visible work would be focused at the portals.

Many possibilities exist for locating a single or twin bored tunnel configuration. All options have a common theme: They would be located in firm ground, away from the very poor fill material and soft marine clays along the waterfront. The alignment would likely run from near the stadiums to the south of downtown and follow downtown avenues before connecting to State Route 99 in the vicinity of Denny Way or Mercer Street.

The tunnels would run at least 40 feet below ground and would pass below the existing freight rail tunnel. They would also bypass the existing viaduct, which would be kept open during construction, thus avoiding the large economic costs of disruption related to proposed alternatives.

The completed portals would represent valuable pieces of real estate. The portal structure can be designed to carry high-rise building loads that would allow future development of the site, adding to residential property values near downtown and stimulating new development in the surrounding area.

The options that have been put forth suffer from shortcomings related to cost, capacity, and design impacts. If this were not the case, the protracted debate would have long since ended and agreement reached on a preferred alternative. But the debate continues because all parties find themselves defending deeply flawed approaches.

The bored tunnel alternative is a proven technology that could break the deadlock among advocates. It combines capacity with minimal disruption, at an affordable price, and offers the bonus of reconnecting the waterfront and downtown.

Glenn Pascall's column appears regularly in the Puget Sound Business Journal. Pascall is an economist who has taught and done research for the Evans School of Public Affairs at the University of Washington. He has directed economic impact studies for the aerospace and wood-product industries, among others, and developed strategies for state economic vitality and affordable housing.