

Tunnel Talk

A publication of the
 Cascadia Center for Regional Development
 Discovery Institute
 Seattle, Washington



SEATTLE (January 13, 2009) – EXCEPT FOR THE ABSENCE OF RAINDROPS, EVERYTHING SEEMED normal for a mid-January day in the Emerald City. Clouds hovered. The air was cool but comfortable. But on the city’s idyllic waterfront, inside Seattle’s World Trade Center, any semblance of normalcy was about to change. Inside, surrounded by reporters, citizens and community leaders, the region’s leaders were about to bring an end to an eight-year stalemate. By late morning, Washington Governor Christine Gregoire, Seattle Mayor Greg Nickels, and King County Executive Ron Sims had announced their decision. In a unified voice of leadership, they said they supported tearing down the aging Alaskan Way Viaduct and replacing it with a technologically advanced deep-bored tunnel, improvements to transit and surface streets. The crowd cheered. And Seattle would never be the same.

**Testimony to Washington State Senate Transportation Committee
February 10, 2009**

“[A deep-bored tunnel] offers a clear strategic advantage over the other replacement options....Minimizing disruption is crucial to maintaining through capacity in the State Route 99-Interstate 5 corridor, which is essential to sustaining the regional economy.”

Dave Gering,
Manufacturing Industrial Council

“It is quite clear to me that they would prefer a tunnel for all of its significant economic benefits and the promise of a restored waterfront. Even in these difficult economic times we must search for the right answer, not the cheapest.”

Dan Evans,
Former Washington governor

“[The tunnel] provides some of the fastest travel times, has the fewest construction impacts and can be built for the most part while the existing viaduct continues to move traffic.... the project is expected to maintain and create 10,000 jobs each year over the course of the project.”

Maud Daudon,
SNW Securities Corp.

“Our trucks use the Alaskan Way Viaduct to make their way through Seattle and we believe replacing the viaduct with a deep bore tunnel is vital to our operations.”

Bob Donegan,
Ivar’s

Source for document Q/A: Greater Seattle Chamber of Commerce (Items marked with an asterisk* are from the WSDOT presentation to the State Senate Transportation Committee on January 26, 2009)

TUNNELS ARE BEING built around the world, at a faster pace, at less cost and disruption, and using highly advanced technology.

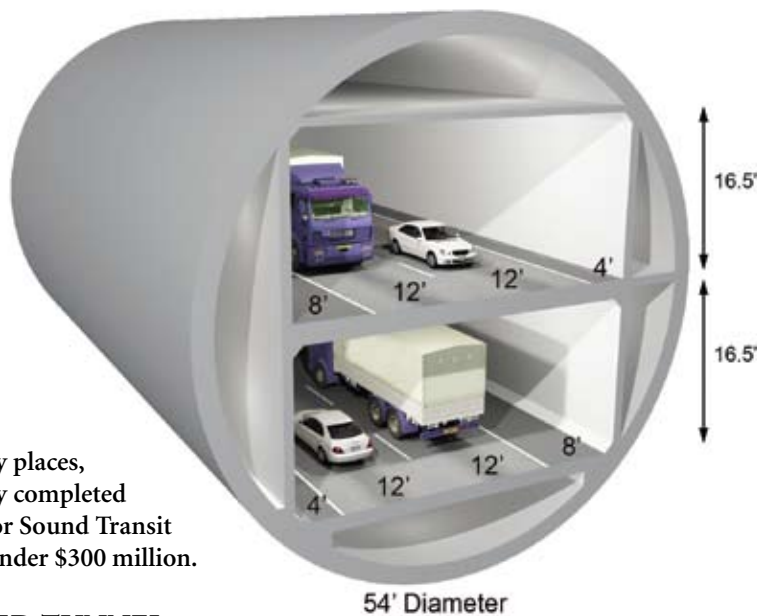
TUNNELS LAST 100-150 years. The Great Northern Tunnel under Seattle was built at the turn of the 20th century, and it is used by more than 40 trains a day.

THE TUNNEL ALLOWS commerce and commuting to continue during construction.

THE DEEP-BORED TUNNEL allows for the seamless integration into a system-wide approach to the region’s throughput needs.

SEATTLE USES TUNNELS in many places, including the recently completed Beacon Hill tunnel for Sound Transit which was built for under \$300 million.

THE DEEP-BORED TUNNEL is an environmentally responsible option: fewer surface impacts, no run-off, and particulates are scrubbed by ventilation systems.



What is the Bored Tunnel Hybrid Alternative?

The Bored Tunnel Hybrid Alternative combines the best elements of the surface street options with a bored tunnel. It accomplishes what other hybrid scenarios cannot. It preserves throughput, reduces construction and operating impacts to businesses and residents, increases transit service, creates jobs, provides a long-term return on investment at a reasonably affordable price, has low environmental impacts, and maximizes new open-space on the waterfront.

How Will the Bored Tunnel Hybrid Alternative Benefit the Environment?

The Bored Tunnel Hybrid Alternative will provide a world class open-space that is a welcoming place for pedestrians, bicycles, transit and vehicles. It will eliminate noise, shadowing and view blockage, reduce surface-water runoff, and provide a memorable place for people to live, work and play. The project plan also includes a 25% increase in transit (a million more hours of transit per year) that will provide more transportation choices to a broader segment of the region’s population. The tunnel allows surface water and air emissions to be collected and treated before release into the environment.

How Does the Bored Tunnel Hybrid Alternative Differ From the Cut-and-Cover Tunnel Seattle Voters Rejected in a 2007 Advisory Election?

The two tunnels could not be more different. The bored tunnel will be stacked with two lanes in each direction and will be constructed under First Avenue at a depth of 30 to 200 feet below the surface, two blocks from the water. The previous cut-and-cover tunnel was stacked with three lanes in each direction and would have been constructed along the waterfront at a depth of 10 feet below the surface, in the tidal zone.

Bored tunnel construction will take 4 ½ years and the viaduct can stay open to traffic while it is being built, thus limiting the impact to adjacent businesses and residents.

In contrast, the previous cut-and-cover tunnel would have taken at least 7 years to build, and would have put the viaduct out of commission for at least 3 ½ years, causing major impacts to the waterfront and surrounding area.*

How Did the Bored Tunnel Hybrid Alternative Emerge as a Viable Solution?

The deep-bored option was not the one that was recommended to the stakeholders by the government planning team as the stakeholders came to the final hour of their deliberations. It was a recommended option that emerged instead from the stakeholders themselves based on their judgments regarding the data, including costs and benefits, and the different perspectives each stakeholder brought to the table. In the end, not everyone agreed, but remarkably most stakeholders reached something that has not been achieved during the eight years since the viaduct was shaken by the Nisqually quake — a broad-based consensus about a positive path forward.

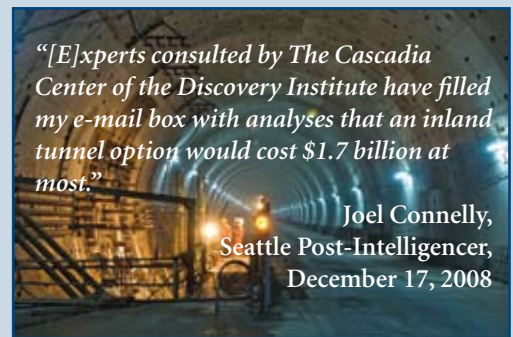
“Our plan would consider both I-5 reconstruction and added capacity and replacement of the central section of the Alaskan Way Viaduct, within the context of region wide tolling... A deep-bored tunnel through downtown to replace the viaduct... would segregate local traffic from through traffic, and would avoid the construction disruptions on the central waterfront that threaten businesses.” Bruce Agnew, Cascadia Center Policy Director, *Puget Sound Business Journal* op-ed, “Viaduct Bypass, I-5 Expansion Should be Linked”

THE LAST CHAPTER? How Seattle Turned To A Tunnel

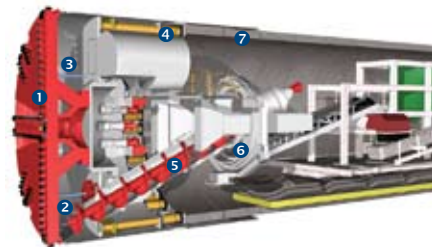
BY EARLY DECEMBER 2008 A STATE, county and city project team had moved forward with its choices for replacing the aging Alaskan Way Viaduct: either an elevated replacement or a surface street option.

In reaction, almost immediately, the Stakeholder Advisory Committee, made up of local and community civic and business leaders who had studied replacement options carefully for nearly one year, said they wanted to take a closer look at the deep-bored tunnel. The deep-bored option was not the one that was recommended to the stakeholders by the government planning team as the stakeholders came to the final hour of their deliberations. It was a recommended option that emerged instead from the stakeholders themselves based on their judgments regarding the data, including costs and benefits, and the different perspectives each stakeholder brought to the table. The stakeholders had spent the better part of a year learning about the options, including countless interactions with Cascadia Center with regard to a deep-bored tunnel. In the end, not everyone agreed, but remarkably most stakeholders reached something that has not been achieved during the eight years since the viaduct was shaken by the Nisqually quake—a broad-based consensus about a positive path forward.

It was then that Cascadia Center and Arup, along with other tunneling experts, were brought in again and asked to share further information about tunneling technology and how it could be used to replace the viaduct. On December 16, in a critical workshop, Cascadia’s experts helped share information about tunneling, emphasizing that tunnel costs really were an “apples to apples” comparison and that the cost could be under \$2 billion and completed in five years or fewer. Following that workshop, Governor Gregoire led the way, deciding to postpone the decision about the viaduct replacement to allow for several more weeks of study and consideration. Several short weeks later, on January 13, Governor Gregoire, County Executive Sims and Mayor Nickels announced their historic decision.



Earth Pressure Balance Machine



Using EPB (Earth Pressure Balance) machines, the soil is excavated by the tools on the rotating cutting wheel ① at the tunnel face and passes through the openings in the cutting wheel into the excavation chamber ②. There, it mixes with the other plastic soil. The force from the thrust cylinders ④ is transmitted via the pressure bulkhead ③ to the soil to support the tunnel face and control the entry of material into the excavation chamber. The excavated material is removed by the screw conveyor ⑤ from the excavation chamber which is under pressure and into the tunnel which is under atmospheric pressure. With the help of an erector ⑥ the tunnel lining segments ⑦ are built directly behind the shield.

How Does the Tunnel Help me get to Ballard or Magnolia?

Less than one percent of the project is designed, so there is plenty of time to develop a good solution for access to Magnolia, Ballard, Fremont and North Bay. About 33,000 vehicles now on the viaduct come from or head to Northwest Seattle, so the project team is looking at solutions on Elliott, Western, along the waterfront, and across Mercer to the north portal of the tunnel.

“A brighter future for Seattle’s waterfront took a dramatic step forward this week, as three key leaders endorsed a plan to use a deep-bore tunnel to replace the crippled Alaskan Way Viaduct.”

Alwyn Scott,
Puget Sound Business Journal

What Now?

The viaduct replacement package is now before the Washington State Legislature, where the Senate approved it 43-6, but it is facing some opposition in the House, especially from those who thought an elevated replacement was favorable. The full package for the replacement is just over \$4 billion, but the cost of the deep-bored tunnel represents about half of that, or \$1.9 billion.

This is a critically important transportation and sustainability issue for the region, one that will have an impact on the Puget Sound region for decades to come. For citizens (individuals and businesses) who have views about next steps, we encourage you to reach out to your state legislators. www.leg.wa.gov/legislature

How Does the Bored Tunnel Hybrid Alternative Differ From the 'Big Dig' in Boston?

The Big Dig was one of the largest engineering projects in world history and has next to nothing in common with this project. As Governor Gregoire said: "They tried to move the world...we're trying to keep the world in place." The Big Dig included a very disruptive cut-and-cover tunnel through the central city under an existing roadway and two subway lines, a new cable-stayed bridge over the Charles River, and two sets of immersed tubes under the harbor to the airport in very challenging soil conditions.* Nearly a third of the project costs went to extensive traffic management and construction mitigation. Moreover, the initial cost estimate did not include inflation, risk or escalation and there was significant growth in the scope of work from what was originally envisioned.

In contrast, the Bored Tunnel Hybrid Alternative will have minimal impacts on existing traffic, downtown and the waterfront, and WSDOT will strongly assert itself as the project owner using state-of-the-art cost estimates that account for risk, contingency and escalation. Also, it's important to remember that over 150 tunnels have been built in Seattle since 1890, mostly in glacial soils. Unquestionably, we have the tools and expertise to do this project. The machines that dug the English Channel Tunnel were built in Kent, Wash.

Value / investment

Data from OpEd in Tunnels and Tunneling magazine indicating economic impact of various project alternatives

Urban street



Elevated urban highway Local access road



Urban street with traffic calming measures Urban highway tunnel



As part of its presentation at the December 16, 2008, tunneling workshop, Arup discussed the above image (originally used in an article in the magazine Tunnels and Tunneling). The description above right describes the significance of the graphic.

For most urban streets, there is a real estate premium placed on major street front properties with the traffic and pedestrian activity driving commercial and retail vitality. A seminal 1981 study looked at the quality of life on three San Francisco streets where there was low, medium and high traffic. The study concluded that high levels of traffic on a particular street reduces amenity and creates a barrier within a community, while lower volumes result in more attractive streetscapes and increased usage making them more attractive locations to work and for retail purposes.

Elevated highways do not provide much in the way of amenity to the adjacent properties along the highway and instead can act as a barrier dividing communities in two. Urban blight results in the form of depressed rental rates and property values as we have seen with the nature of the properties directly to the east of the Alaskan Way.

Removing high-volume through traffic into a bypass tunnel results in the best of both worlds. Throughput is maintained, sustaining the regional economy, while the level of traffic at the urban street level encourages vibrant, commercially active communities. When the Embarcadero Freeway was torn down, nearby property values are quoted as increasing by 300 percent and entire new neighborhoods were created along the waterfront.

Samples of Reported Cost Per Mile of Completed Large Diameter Highway Tunnels*

- **MADRID, SPAIN:** M-30 – north tunnel of the south bypass, \$131 million/mile
- **KUALA LUMPUR, MALAYSIA:** SMART Tunnel, \$85 million/mile
- **PARIS, FRANCE:** A-86W East Tunnel, \$242 million/mile

*Information extracted from Arup's December 2008 report "Large Diameter Soft Ground Bored Tunnel Review." Arup (www.arup.com) is a global firm of planners, designers, engineers and business consultants, and their tunneling report continues to serve as an important educational tool. It is available online at www.cascadiaproject.org.

*Everything you did—by force of will
mostly—to keep the tunnel on the table
made the difference, thank you!*

Kate Joncas,
President of the Downtown Seattle
Association in a note to Cascadia Center



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