VandenBerghe, Alissa (Consultant)

From: Bob Donegan [bobd@keepclam.com]
Sent: Wednesday, December 17, 2008 6:42 AM
To: Jim Seaver
Subject: Viaduct Avalanche Begins #1 of a Series on Wednesday

It was 16 degrees below zero when I left Milwaukee yesterday, and snowing with quarter mile visibility when we connected in Kansas City, but it was steaming hot here in Seattle regarding all things viaduct. Two big developments:

Monday the Port of Seattle Commission voted unanimously to ask the Governor, Exec, and Mayor to keep the Deep Bore Tunnel on the study list.
Tuesday the Manufacturing Industrial Council Executive Board voted unanimously to reject the surface and elevated hybrids and investigate the Deep Bore tunnel option.

Last night was the long awaiting meeting among the Project Team and its Tunnel Experts and the outside tunnel experts, largely coordinated by Cascadia. In front of 10 stakeholders (Coney, Binder, Vogel, Oustamovitch, Odland, McCumber, O'Halloran, Tayloe, Sexton and Ranf and two dozen others (including Drago from the city and Constantine from County) we finally got to the core of the differences between the cost and construction timing estimates.

The Boring Stuff

Harvey Parker (retired President of the Intl Tunnel assn) did a quick review of tunneling history, advantages, disadvantages. His biggest suggesting was that the tunnel's advantages would be more apparent if Life Cycle benefits were to be considered as a part of the project. He said the Burlington Northern Tunnel is now in its 106th year, and we could expect an elevated viaduct to have to be replaced two or three times in the time a tunnel would work. He also reminded all that tunnels are the safest in earthquakes, a single bored of 54 feet was pushing the state of the art, but achievable, and this tunnel would be 160-170 feet deep at its deepest point. Later in questioning he said four or five tunnel firms would likely bid on Seattle's project. He cautioned that little site investigation had been completed, and said it would equivalent of a thimble full of investigation compared to a barrel full of dirt.

Then John Reilly, a consultant to the project, summarized cost estimating techniques. He compared five large tunnel projects whose cost per km varied from $37.2M to $375M, with an average of $232M per MILE. He focused on analysis by a Swedish scientist, Flyvbjerg (no spelling mistake) who looked at 258 International Construction projects between 1910 and 2000 and concluded that they underestimated project costs by 40%, ranging from 25% for highways to 44% for tunnels. He encouraged focus on the state's CEVP process for evaluating costs, and then showed the inflation patterns of major projects under construction since 2006
Most interesting to me, there was no CEVP process done on the tunnel, nor the elevated nor surface hybrids. In questioning, he admitted that the highest cost example he cited (the London Jubilee project completed 8.5 years ago) had been overcome by many other projects, and that the Sound Transit Tunnel under Beacon Hill was delivered on budget for the tunnel portion (though station costs are over budget).

Finally, Mike Rigsby from Parsons summarized the project team's cost projection for twin deep tunnels (42 ft diameter) and a single bore tunnel (54 ft).

Twin	Single	Item
$ 20	$ 8	City Streets
110	58	South Entry cut and cover tunnel and connections
430	330	Cost of tunnel bore, including boring machine
50	42	North Entry cut and cover tunnel and connections
$590	$430	Tunnel Costs
50	47	Utilities in tunnel
173	159	Tunnel systems
$833	$644	All in tunnel costs
$208	161	Inflation, contingency by contractor at 25%
202	157	Contractor overhead and profit at 19.4%
$1243	$961	Contractor price for tunnel
$193	$149	WsDOT management of project 1t 15.5%
$196	$151	Design
$1632	$1261	All in Tunnel Costs before Risk, Inflation , Contingency
12%	12%	Contingency
28%	28%	Risk
15.55%	15.55%	Inflation
$120	$ 40	Acquire right of Way under buildings
$2.823	$2.130	All costs of deep bore tunnels

Common to both tunnels, in addition:

$270	Seawall
$ 56	Utility relocation
$190	Western couplet on surface
$ 70	Street Work
$ 12	Waterfront street car
$ 84	Other

Other costs of a Deep Bore-Surface Hybrid were not available and will be provided. We estimated they would be about $470M, for a total cost of the deep bore hybrid at

$4.605B	$$3.912B
Twin bores	Single bore

Peter Chamley, ARUP, Cascadia

Peter presented a quick summary of project ARUP had worked on and described the spaghetti-like relationship among tunnel experts. For instance, in the 2nd Ave Subway

tunnel in New York, Arup is the project mgr and Parsons is the designer. In the London Jubilee tunnel, ARUP is the designer and PB is the project manager. David Dye said the world's tunnel community could fit in a phone booth.

ARUP will take the project team's numbers and apply its own factors. Peter suggested that the risk-contingency-inflation numbers are too high, since costs of past projects INCLUDES those factors. In his comparative chart, he noted that costs of the Miami tunnel and two tunnels in Brisbane, Australia INCLUDE FINANCING COSTS.

He focused on life cycle benefits, (suggesting all projects be made comparable on a 45-50 year life), increased property values from eliminating view obstruction, noise, through trip capacity, and ease of installing tolling to help pay for the project. He also cautioned not to make this decision now, since many aspects can be phased.

Major Findings

Vlad discovered that none of the hybrids include any money for Business Mitigation. There is $130M in for mitigation, which consists of $100M for transit and a $30M parking garage. Vlad also discovered that 4-5 tunnel builders would likely bid on the project (from Canada, Japan, US and Europe.) In response, Dye said costs of disruption are minimal at $66M a year, quoting Moore economic impact study.

Jim O'Halloran was the star of the night, asking why if WsDOT was world leader with its CEVP process it did not include life cycle benefits in its analysis, and pushing hard for the project team to do so. "Don't let a short term focus on capital costs cause us to select the wrong solution."

The inflation factors, above COMPOUND. That is, every factor takes as its base the INFLATED factors before it, and then grows them

The time to bore each tunnel has been shortened to 12 months. The addition of tunnel systems, portals, and the rest of the hybrid causes the project timetable to be about 5.5 years (if two machines are used in twin bores case).

Seawall replacement is still in both options, now estimated at $270M.

Dye

There is EXCESS space in both tunnels that could be used for a third lane. In single bore, there are 13 foot spaces above and below the roadway. In single bore, there is 17 feet to the sides and 20 feet above and below the roadway. The twin bore has "ladder legs" to join the tunnels every 660 feet, about 120 feet from tunnel to tunnel for emergency escape routes

Next Steps

Distribute all slides

ARUP and Cascadia to vette the costs

Dye: "The Jury is still out" on deep bore hybrid. This is a big change from Thursday last week when "I'm pouring cold water on this hybrid. We're not building a tunnel."