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Hidden challenges of Highway 99 tunnel

For the past year, "overruns" has been a buzzword in Seattle politics because of worries about the cost of the tunnel to replace the Highway 99 viaduct. Worldwide, tunneling projects routinely come in about a third over estimates. Will Seattle's? The answers mostly wait underground.

By Mike Lindblom Seattle Times transportation reporter

Gov. Chris Gregoire couldn't have been more adamant: "We have no cost overruns in this project at all, zero" — and none are expected, she declared last month about the planned Highway 99 tunnel under Seattle.

That was her answer to Mayor Mike McGinn, the pre-eminent tunnel detractor, who has told the public to brace for runaway spending of up to \$1.2 billion over budget.

For the past year, "overruns" has been a buzzword in Seattle politics. That's because of a clause in state legislation that says cost increases will be paid by "Seattle property owners who benefit" from a replacement of the worn 1953 Alaskan Way Viaduct by a buried, double-deck highway.

Gregoire and others say not to worry, that the state can't force Seattle to pay for any overruns.

Worldwide, tunneling projects routinely come in about one-third more than estimates. Will Seattle's? There's no way to tell — at least not yet. The answers mostly wait underground, where obstacles are harder to see and equipment breakdowns are harder to fix.

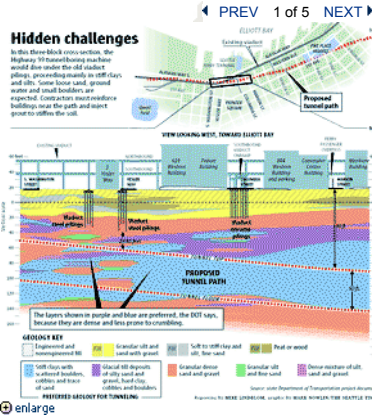
Transportation engineers and tunnel miners would be testing their skill below office towers and through wet soils. The world's largest rotary cutting head, 56 feet across, will bore 1.7 miles from Sodo to South Lake Union.

Two international teams will bid in October for the six-year contract. A third team, led by Kiewit Pacific, said Monday it's dropped out of the bid process.

The tunnel, plus smaller contracts for approaches, will cost up to \$1.1 billion. The entire tunnel budget, including design, is estimated at \$2 billion.

Supporters take comfort in documents showing that the budget includes a \$415 million cushion for risk, contingencies and inflation. However, the state Department of Transportation (DOT) likely will not have that big a rainy-day fund. It turns out the budget also will have to cover the cost of roughly \$200 million in road connections at the north and south tunnel entrances and the street grid near Seattle Center. Unless bids are low, some of that cushion the state is counting on will be spent — before any emergencies.

Ron Paananen, the Highway 99 program administrator, told the City Council Monday that on huge projects, DOT has kept spending within 2 or 3 percent over bid prices.



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Still, the downtown tunnel poses three major risks that could break the bank: a tunneling-machine breakdown; downtown buildings being damaged by sinkholes or soil settlement; and change orders, delays and other claims that grow unchecked.

#### Tunnel machine stalls

Transportation Secretary Paula Hammond last year asked her consultants, what is the worst-case scenario?

Their answer: the tunnel-boring machine stalls halfway, near the Pike Place Market.

About a dozen miles northeast, one of the boring machines is still stuck at the Brightwater sewer project. It was scoured by highly abrasive clay soils, which also predominate downtown.

If that were to happen downtown, DOT conjectures, it would cost an extra \$467 million and up to 2 ½ years to get the machine digging again. Part of that cost would be a \$100 million vertical shaft dug from a downtown lot to retrieve the machine.

This kind of catastrophe in theory wouldn't cause overruns, because it would be covered by \$500 million in surety bonds, a DOT study says. Those bonds are similar to an insurance policy; large financial firms pledge to provide a cash infusion or hire a replacement team if the contractor goes broke or fails.

But there still is risk.

Instead of bonding for the entire \$1.1 billion, lawmakers allowed a lower target of \$500 million.

Councilmember Mike O'Brien, another foe of the project, says the state capitulated by lowering the surety amount to less than the full project value.

Paananen said the DOT did so to enable more bidding teams to get bonds and compete in a tight surety market. Also, taxpayers are protected because the state gradually will release money to contractors as the tunnel advances, so DOT never relinquishes the whole \$1.1 billion until the end.

There is risk of a legal impasse, if the surety sides with contractors and resists paying DOT. A contractor might argue, for instance, it was misled about soil conditions.

In the case of the Brightwater tunnel, the surety hasn't paid up and it remains unclear who will absorb a possible \$200 million cost overrun. King County has replaced the contractor and is suing the surety and former contractor.

Edward Gallagher, vice president of the Surety & Fidelity Association of America, said jobs typically resume. "No construction project ever got cheaper by stopping," he said. "What sureties would rather do is defer all the claims, and keep the work continuing."

Boston's Big Dig was completed under surety funding, even after major contractor Modern Continental went bankrupt.

#### Sinking downtown buildings?

If too much soil is removed, or groundwater leaks uncontrollably, that might create sinkholes above the tunnel, perhaps undiscovered for months or years.

Voids above Sound Transit's Beacon Hill Tunnel nearly ruined a house because of errors in monitoring the rate of soil excavation; over-excavation in one of the Brightwater tunnels caused a sinkhole.

Some projects have gone far worse. Water leaks from tunneling were suspected of causing the archives building in Cologne, Germany, to fall into a sinkhole last year, killing two people. In Amsterdam, buildings buckled due to trenching of cut-and-cover transit stations — in ground comparable to Seattle's Pioneer Square area, where the south tunnel entry begins in a former tidal flat blanketed by unstable fill and wood debris.

Damage would be covered by an insurance policy. Or, tunnelers would buy out damaged properties, Paananen said.

State managers have made a route change to try to reduce risks. The tunnel portal at First Avenue South in Sodo was shifted west to Alaskan Way South, reducing the proximity to historic buildings on shallow foundations in Pioneer Square.

Soil conditions improve once the machine descends into downtown, reaching depths up to 214 feet below



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the hillside.

"It's very good, in most places," said Steven Kramer, a University of Washington civil-engineering professor and seismic expert. This is because ancient glaciers once covered the area under 2,500 feet of ice. "The weight of that ice compacted the soil, made it very still, very cohesive, very strong," he said. "These are good characteristics."

The soils are familiar after a century of digging, sluicing and probing under downtown Seattle, dating to the Great Northern Railway tunnel more than a century ago.

"My personal expectation is it's going to go well and they're going to get it done on budget and on time," Kramer said.

Much of the soil under downtown is highly abrasive clay. Miners also are expected to hit pockets of sand and water, posing a challenge to maintain alignment and excavation rates.

Concrete grout will be injected before the boring, and squirted from the machine itself, to strengthen the soil.

The tunneling crew will be required to bury extensometers, probes that measure soil settlement, said Monique Nykamp, geotechnical engineer for consulting firm Shannon & Wilson. Vibration monitors will be at the surface, about one every block, she said.

Every building near the tunnel path will be outfitted with at least four highly sensitive tiltmeters, capable of measuring any change. And other devices on the old viaduct will indicate whether existing cracks widen.

In a May 27 news conference, Paananen insisted the odds of settlement are extremely low. "Risk is inherent in any construction project. Are we willing to say, we're not going to accept any risk?"

#### Controlling costs

Even assuming the soil cooperates, tunnel managers must tame the general threat of cost overruns from delays, inflation and change orders.

Sound Transit estimated its Beacon Hill Tunnel contract at \$240 million. It awarded the job to sole bidder Obayashi Corp. for \$280 million, and has paid out \$312 million, with scores of unsettled claims remaining.

The DOT's tunnel managers hope to avoid nasty surprises by having the builders handle the final engineering. This is supposed to shift responsibility to tunnel teams and reduce the chances that they will file multimillion-dollar claims.

In a 2002 study, professor Bent Flyvbjerg, now at Oxford, found that 90 percent of worldwide megaprojects exceeded their original budgets, and that tunnels and bridges were worse than most, averaging costs 33 percent over budget.

He said Washington state's \$415 million risk cushion is better than average. "That's a good sign, a sign of responsible management," Flyvbjerg said.

He also warned against declaring with certainty that there will be no cost overruns. "That's something you cannot say."

Told that some contingency funds likely will be drawn down, Flyvbjerg said Monday he's not close enough to the project to judge whether the DOT will keep enough of the \$415 million contingency. But it's not unusual, he said, to use some of those funds at this stage.

Already, reality is squeezing the DOT's schedule. The two remaining bidders are being allowed to work past Gregoire's earlier 2015 deadline by up to a year, in order to keep bids low, Hammond said.

Barry LePatner, a noted New York construction attorney, said taxpayers should assume the whole contingency will be tapped, based on builders' proclivity to seek extra dollars after winning a contract. McGinn is wise to doubt state assurances, said LePatner, currently writing a book on bridges and other public works. "He should have a ton of very smart lawyers and construction people at hand, to protect the public."

The political timeline is added cause for scrutiny. The January 2009 decision by Gregoire, former Mayor Greg Nickels and others to go forward with the bored tunnel came before much public debate or study over the cost of that option.

"You just decided you could do the tunnel for exactly the budget you have. That sounds suspicious," O'Brien said.

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