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Originally published June 22, 2010 at 8:28 PM | Page modified June 23, 2010 at 3:29 PM

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**Drilling a Highway 99 tunnel thrills industry pros**

While many in Seattle worry about costs and risks of the world's widest bored tunnel beneath downtown, industry legend Martin Herrenknecht can hardly contain his desire to drill.

By Mike Lindblom  
Seattle Times transportation reporter

While many in Seattle worry about costs and risks of attempting the world's widest bored tunnel beneath downtown, industry legend Martin Herrenknecht can hardly contain his desire to drill.



In the industry, Martin Herrenknecht's a legend.

"If the ground conditions accept it, Seattle will be No. 1 in tunneling. I think we have to fight quite strongly [for the project]; I hope we will get a chance," he said at an after-hours reception for members of the Underground Construction Association, meeting in Portland this week.

The most crucial technical challenge will be advancing through 1.7 miles of varying soils, groundwater and small boulders in a 13-month mission, without causing the earth above to sink. At 56 feet across, the machine needed to dig the planned Highway 99 tunnel would exceed the 50-1/2-foot crossing beneath the Yangtze River in Shanghai and a 50-foot tunnel in Madrid, Spain, drilled with Herrenknecht machines.

Modern tunnel-boring machines, like those built by Herrenknecht, are long cylinders led by a slowly rotating face, where cutting heads are embedded to grind the soil. The spoils typically are removed by conveyor belt out the back end, and eventually trucked off site.

A tunneling machine for Highway 99 is thought to cost \$60 million to \$80 million, out of a \$1.1 billion tunnel contract, according to the state Department of Transportation (DOT). With contingencies and design costs, the tunnel is \$1.96 billion, of a total \$3.1 billion highway-corridor price that includes surface and elevated roads and ramps.

The DOT has a target date of November 2016 at the latest for the tunnel to be ready to replace the aging Alaskan Way Viaduct. Bid proposals are due in late October.

Herrenknecht's staffers say they've contacted all three contractors bidding on the Highway 99 project. "We have quite a bit of interest to build over there, in difficult ground conditions," their boss said.

Herrenknecht's enthusiasm "is good news," said Linea Laird, the DOT's tunnel-segment manager.

But that doesn't guarantee he'll win the contract to supply a Seattle contracting team with the world's largest-diameter boring machine. Mitsubishi also is capable of building such a wide machine, while Robbins Co., a competing firm based partly in Kent, could perhaps partner with another boring-machine firm, Laird said. Mitsubishi supplied a 50-foot machine in Madrid, and Robbins a 47-1/2-foot drill at Niagara Falls, Canada.

Herrenknecht founded his German firm in 1978 with two employees. Now age 65, his company has more than 2,000 employees, including a regional headquarters in Sumner.

More than Asia and Europe, North America is now in the "champions league" of taking on tunnel-engineering challenges, he said. These include a port tunnel in Miami, a drinking-water tunnel beneath 900 feet of unstable rock outside Los Angeles, and a drinking-water tunnel from a lake near Las Vegas, under 13 times atmospheric pressure. And, of course, Seattle.

The challenges of tunneling here are spelled out in an updated geotechnical report the DOT released last week. Clays within much of the route are sticky enough to potentially clog a machine, and there are patches of gravels and quartz sand that are abrasive.

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machine happens to be stuck. That machine was shut down a year ago. The contractor has been replaced in the meantime.

Asked what lessons this offers for Highway 99, Herrenknecht gave no specifics but said his firm has been investigating the Seattle soils. They're manageable "if you have the correct machine and the correct system," he said Monday. "I see it positively."

In a presentation, he described new cutter heads that can work as pincers to crush boulders, expected to be less than 8 feet wide in Seattle. Aaron Shanahan, an engineer from Robbins Co., said his firm is developing sensors that can detect temperatures and

strains on the cutter heads, to help miners read the soils just ahead.

Sound Transit's narrower Beacon Hill Tunnel, drilled by a Japanese-led consortium, left voids in the soil, one of which nearly ruined a house because of errors in supervising the rate of soil removal. The state DOT cites that incident in its specifications, and it demands a precise monitoring plan from bidders.

On the favorable side, most of the Highway 99 tunnel route has been compressed by ancient glaciers, making the soil relatively stable, Steven Kramer, a University of Washington civil-engineering professor and seismic expert, said in an interview. Highly unstable fill soils predominate around the south portal, at Pioneer Square, where some nearby building foundations (or soil beneath) will require support.

DOT engineer David Sowers, who reviewed the soils report, said Seattle soils work well with the latest boring machines.

The state has drilled 110 vertical shafts to test soil samples along the route, and can draw on past experience dating to the downtown Great Northern railroad tunnel a century ago.

On average, tunnels and bridges overrun their estimates 34 percent, according to a 2002 study by Danish scholar Bent Flyvbjerg that blamed over-optimism and even lying for the worldwide trend.

Trying to prevent this, the state DOT has retained nationally respected specialists in soils, risks and contracts. Laird managed the 2007 Tacoma Narrows Bridge within budget and only three months late.

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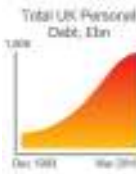


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