Alaskan Way Viaduct
REPLACEMENT
PROGRAM

January 2013

Tunneling toward a new SR 99 corridor

It's not rocket science, but it might be just as impressive: a custom-built, tube-shaped machine that bores its way through the earth, building a tunnel behind it as it goes. Industry folks call it a tunnel boring machine. We call it our ride to a new SR 99 corridor.

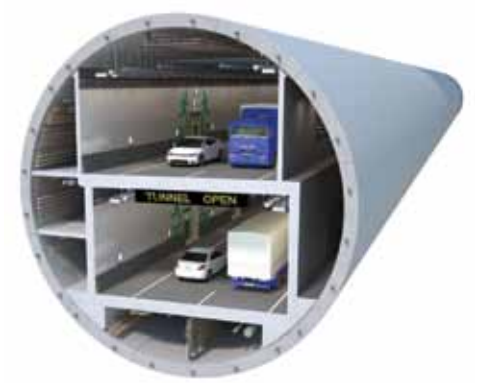
Tunneling beneath Seattle allows us to replace the SR 99 Alaskan Way Viaduct while minimizing closures of the highway during construction. When the tunnel opens in late 2015, a two-mile stretch of SR 99 will move underground, allowing us to remove the viaduct and open up nine acres of new public space along Seattle's downtown waterfront.

At 57.5 feet in diameter – roughly as tall as a five-story building – our tunnel boring machine is the world's largest. After testing is completed in Japan, the machine will be taken apart and shipped to Seattle in more than 40 pieces that will be reassembled in an 80-foot-deep pit to the west of Seattle's stadiums. The machine will arrive this spring, and tunneling is scheduled to start this summer.

Work continues on the 80-foot-deep pit where the tunnel boring machine will begin its journey beneath downtown.

The machine's trailing gear will house the various support systems that crews need to keep it operating smoothly.

Testing of the SR 99 tunneling machine is underway now in Japan.



A rendering of the SR 99 tunnel, which will open to traffic in late 2015.

Better than a shovel

How does a tunnel boring machine work? The answer, as you might expect, is complicated. Our custom-built machine was built specifically for the ground conditions beneath Seattle. The graphic below illustrates a few of its more notable parts.

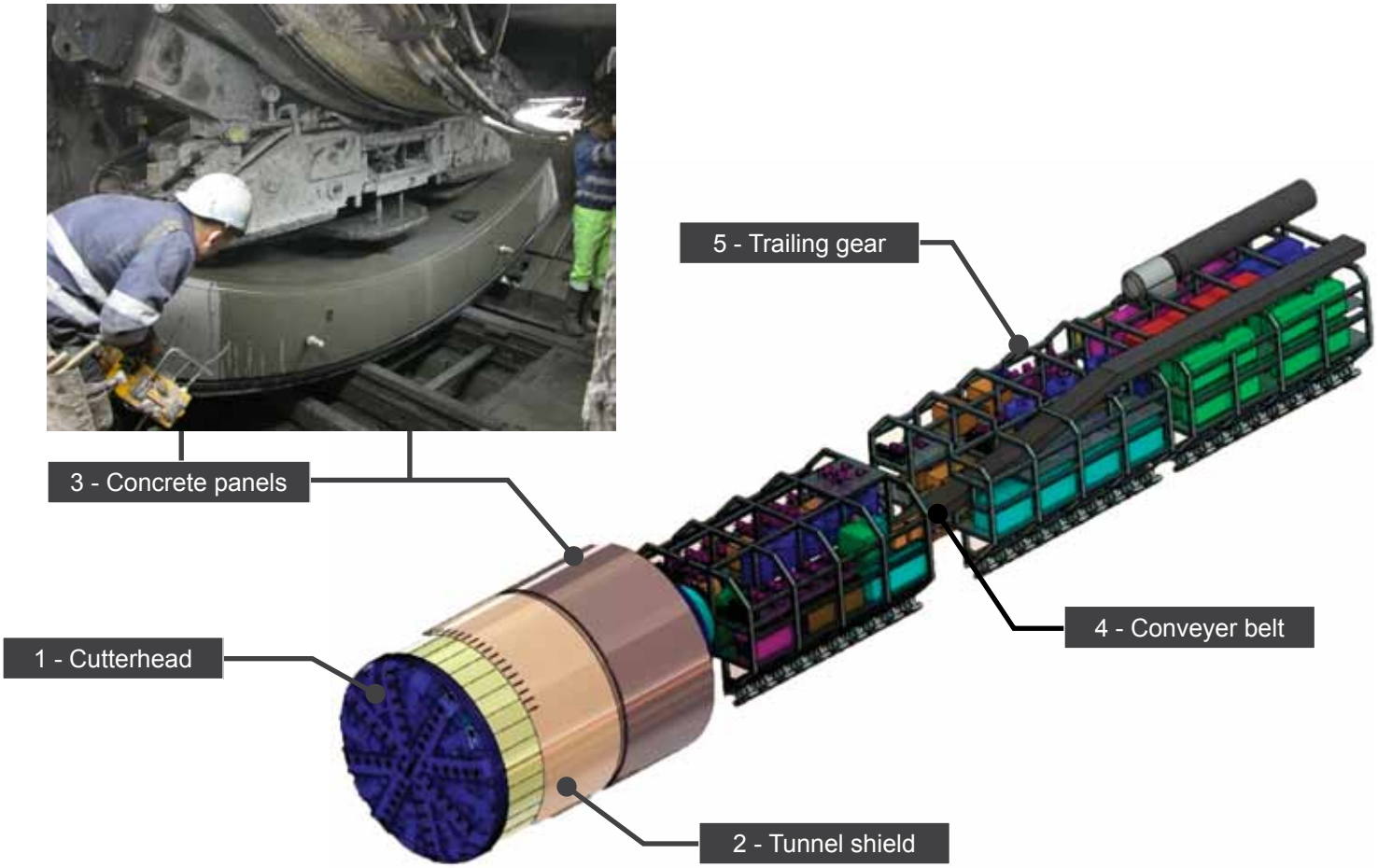
1. **Cutterhead:** The machine's front end is known as the cutterhead for good reason – it has dozens of teeth that chip away the ground as it rotates. The machine will dig an average of 35 feet per day. At the end of its journey, the cutterhead will have rotated the equivalent of 2,300 miles – enough to roll from Seattle to New York.

2. **Tunnel shield:** As the name implies, the shield is the protective barrier between the ground and the workers and equipment inside the machine.

3. **Concrete panels**: Curved concrete panels are installed behind the shield to form "rings" that serve as the tunnel's exterior walls. Ring by ring, the machine pushes forward while the tunnel takes shape in its wake.

4. **Conveyer belt:** A massive conveyer belt will move excavated soil from the front of the machine out of the tunnel to barges waiting at nearby Terminal 46. The belt will get longer as the machine progresses, eventually reaching 9,000 feet in length.

5. **Trailing gear:** More than 300 feet of support gear will trail behind the machine. It includes everything the machine and its crew needs, from supplies like grout and grease to amenities like restrooms and a kitchen. About 25 crew members will be working in the machine at any given time.



The SR 99 Tunnel Project is being designed and built by Seattle Tunnel Partners, a joint venture of Dragados USA and Tutor Perini Corp.

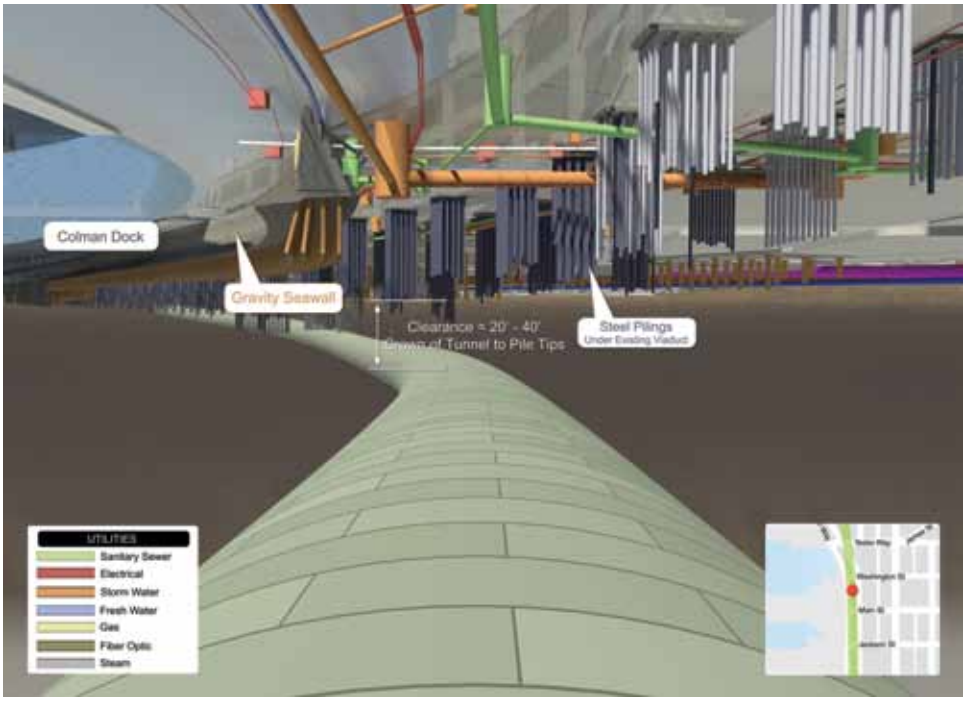
Both firms have extensive backgrounds in delivering successful megaprojects, including similar tunnels, around the world. The tunnel boring machine is being manafactured by Japanese firm Hitachi Zosen Corporation.

Real-time monitoring

There's a lot to keep track of when you're tunneling beneath a bustling city. Steering, for instance. And of course the soil in front of the machine. The important thing to know about soil is that not all of it is the same. In fact, there are eight different types of soils along our tunnel route. In general, the looser the soil, the more likely it is to move as you tunnel through it. Sand, for example, is harder to control than clay. Other things workers might encounter underground: boulders, gravel, logs and various man-made objects.

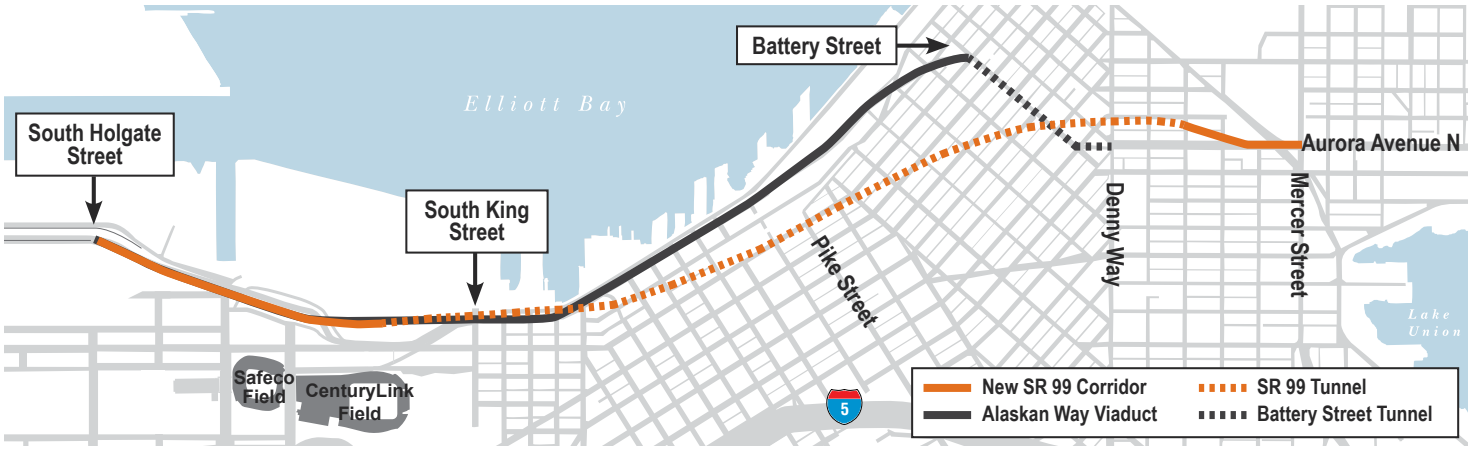
Inside the control room of the tunnel boring machine.

Our machine can handle almost anything, but that doesn't mean our crews won't use extreme caution. They will constantly monitor ground conditions as they drive the machine forward. Safety measures begin before tunneling even starts, when some 160 buildings above the tunnel alignment are examined and fitted with monitoring equipment that allows crews to detect even the slightest movement. Buildings and other structures that are thought to be sensitive are stabilized prior to tunneling. There are a number of ways to do this, including ground improvements and construction of angled walls below the ground that hold the earth in place above the tunnel.



A simulated view of the underground conditions near South Washington Street, along the SR 99 tunnel route.

Project Area



Learn more at Milepost 31

Our tunnel boring machine won't arrive in Seattle until spring, but you don't have to wait until then to check it out. A 10-foot-long, motorized model of the machine is on display now at Milepost 31, our public information center in Seattle's Pioneer Square neighborhood.

In addition to interactive displays and other cool exhibits that tell the story behind our efforts to replace the viaduct, Milepost 31 highlights the people and projects that shaped Pioneer Square. You'll find history, artifacts and interactive exhibits designed to broaden your understanding of the land beneath you. You'll explore the neighborhood's changing landscape, from earth-moving efforts of the past to the massive tunnel project that will soon move SR 99 underground and reconnect Pioneer Square to the waterfront.

A scale model of the SR 99 tunnel boring machine is on display now at Milepost 31, located at 211 First Ave. S., Seattle.

What's in a Name?

Like most ships, tunnel boring machines are typically named after females. Our machine is named Bertha, in honor of Bertha Knight Landes, who was elected mayor of Seattle in 1926 and was the first woman to lead a major American city. A panel of judges that included Gov. Chris Gregoire and Transportation Secretary Paula Hammond selected Bertha from more than 150 submissions to a naming contest among Washington state students. Follow Bertha on Twitter at @BerthaDigsSR99.

Fun facts

- The 57.5-foot-diameter, 326-foot-long machine is the size of some of Washington State Ferries' largest vessels. It weighs nearly 7,000 tons.
- The machine will be delivered to Seattle in 41 pieces. The largest piece will weigh over 900 tons.
- The engine of your average sedan runs at about 200 horsepower. Our tunnel boring machine has about 25,000 horses behind its cutterhead.
- Over the course of tunneling, crews will remove 850,000 cubic yards of soil. If you were to pile all of it on the turf at nearby CenturyLink Field, you'd end up with a mountain of dirt more than 400 feet tall. That's 100 feet taller than the stadium's roof.

For more information

Visit the website at www.AlaskanWayViaduct.org

Call the hotline at 1-888-AWV-LINE

Send an email to viaduct@wsdot.wa.gov

Send a letter to:
Alaskan Way Viaduct Replacement Program
Washington State Department of Transportation
999 Third Ave., Suite 2424
Seattle, WA 98104

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