Repairing the SR 99 tunneling machine

In summer 2013, Bertha, the world’s largest tunneling machine, began digging the SR 99 tunnel beneath downtown Seattle. In December 2013, Seattle Tunnel Partners, the contracting team hired to design and build the tunnel, stopped excavation approximately 1,000 feet into the dig after measuring increased temperatures in the machine. While investigating the cause of the high temperatures, STP discovered damage to the machine’s seal system and contamination within the main bearing.

STP is working to resume tunneling by the end of March 2015. Crews are building a 120-foot-deep circular pit to access the machine. Their work plan includes four major repair and enhancement elements:

- Replacing the damaged seal system with a more robust system
- Replacing the main bearing
- Installing enhanced monitoring systems
- Adding steel to strengthen the machine and accommodate the new seal system
Building a better Bertha

In addition to making planned repairs to the seal system and replacing the main bearing, STP is making major enhancements to the machine based on information gathered during the first 1,000 feet of tunneling, including:

- Widening the openings at the center of the cutterhead
- Improving the soil conditioning injection system
- Installing bit- and wear-resistant steel on the cutterhead
- Extending the length of the agitator arms in the mixing chamber

STP will provide WSDOT with additional supporting information about rebuilding the machine in the coming months, in accordance with the design-build contract, to demonstrate how the repairs will meet the contract’s performance and technical requirements, including:

- An analysis demonstrating that the machine’s structure can withstand all loads from the surrounding ground and its own operation
- Seal design details and background calculations
- Design of revised conditioner injection systems and cutterhead openings
- Updated operations plan including enhanced instrumentation and monitoring for key machine components
- Complete testing program for all modified machine components prior to restart of mining

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Significant work continues elsewhere along the SR 99 corridor, including at the future north end of the SR 99 tunnel, where Bertha will emerge at the end of her journey beneath downtown.

### Schedule and cost

STP submitted an updated construction schedule in April 2014 that delays tunnel boring by up to 16 months. STP hopes to recover as much as five months of schedule to meet the November 2016 tunnel opening date WSDOT established in the project’s 2010 request for proposals. STP had proposed opening the tunnel in late 2015, 11 months earlier than WSDOT's original requirement. Additional costs and time associated with this delay will be addressed in accordance with the SR 99 tunnel contract.

#### 2014

**Seattle Tunnel Partners’ repair plan - May 2014**

- **May**: Late May: Underground wall construction begins
- **June**: June 16: STP/Hitachi announce repair plan
- **July**: Late July: Access pit excavation begins
- **Oct.**: STP begins repairs to seal system and replacement of main bearing
- **Nov.**: STP provides WSDOT with a full list of repairs

#### 2015

- **Feb.**: Testing of machine begins
- **March**: Tunneling resumes

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
Follow @BerthaDigsSR99

Send a letter to:
Alaskan Way Viaduct Replacement Program
Washington State Department of Transportation
999 Third Ave., Suite 2200
Seattle, WA 98104

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