



HRBT EXPANSION VDOT HRTAC HAMPTON ROADS

Mary

HRBT EXPANSION PROJECT BREAKTHROUGH CEREMONY

★ SEPTEMBER 2025 ★



Beneath the busy waters of the Chesapeake Bay, one of the most powerful excavation machines ever used for a U.S. transportation project has completed her mission in the Hampton Roads Bridge-Tunnel (HRBT) Expansion, quietly rewriting local engineering history...one ring at a time. Mary, the HRBT Expansion Project's record-setting tunnel boring machine (TBM), has carved a new path that will reshape transportation in Hampton Roads for generations to come.

Fabricating Mary

Mary is a highly specialized, custom-built, variable density TBM. At 46.1 feet in diameter, Mary is the second largest TBM used in North American history. She has been powered by 16 electric motors that together generate 7,510 horsepower, consuming the equivalent amount of electricity used by 6,000 homes each day.

Once fabricated by German company Herrenknecht, Mary was shipped from Europe to the U.S. as 173 parts, pieces, and shipping containers. She arrived at Portsmouth Marine terminal in December 2021 where she was then transported to South Island and her reassembly began.

Breaking New Ground

Unlike previous tunnels in Hampton Roads built using immersed tube methods, Mary is the first TBM to complete a bored roadway tunnel in Virginia and only the third in the United States. With a 46-foot cutterhead spinning up to 2 revolutions per minute, Mary excavated soil at depths as low as 173 feet, with the new twin tunnels sitting beneath the bay bottom. She used 198 scrapers and 26 disc cutters, aided by a pressurized slurry mixture of bentonite clay and water, which stabilized the ground in front of the cutterhead and also served as the medium for transporting excavated material back to the surface.

Trailing behind Mary are the electrical lines and slurry pipes that powered her systems and connected her to Katherine, the slurry treatment plant named in honor of NASA mathematician Katherine Johnson. Katherine is the largest slurry treatment plant in North America. The plant was at the center of the slurry loop, providing clean slurry to the machine and separating



spoils from the slurry returned to the machine after being mixed with soil at the cutterhead.

From Cape Charles to the Depths

The concrete segments forming the tunnel's lining were produced in Cape Charles, Virginia. Thousands of high-strength precast segments were fabricated using 10,000 PSI concrete under tightly controlled conditions to ensure durability and precision.

Once cured, 20 rings (180 segments) at a time were carefully transported by barge across the Chesapeake Bay to the



South Island, where they were staged. Specialized vehicles delivered the segments to the tunnel boring machine, where they were fed onto a segment feeder beneath Mary and installed ring by ring.

Forging the Tunnel

As Mary advanced, she moved forward 6 feet, 6 inches at a time, cutting away nearly 600 tons of material with each push. Behind the cutterhead, she immediately began building the permanent tunnel lining.

Using a vacuum erector mounted on her erector bridge, she lifted and rotated nine massive precast concrete segments—some as large as 16 feet wide, 6 feet 6 inches long, 18 inches thick, and weighing 10 tons—into precise position. Thrust cylinders held the pieces steady so they could be bolted together, forming a complete ring.

Once a ring was finished, Mary advanced by pushing off the newly installed ring. By the end of excavation, she had installed 2,385 rings, totaling 21,465 segments, creating the twin bored tunnels' final lining.

The First Tunnel

Mary launched on her inaugural journey on April 24, 2023. After 51 weeks of tunneling beneath the Hampton Roads harbor, Mary completed her first trip between the islands on April 17, 2024, becoming VDOT's first ever bored tunnel. During her time underground, Mary traveled 7,940 feet and installed 1,191 rings.

Following her first breakthrough, Mary was put through a rigorous inspection process prior to crews performing repairs, replacements, and modifications. Cutting tools were replaced and testing, cleaning, and commissioning of her mission-critical systems were completed.

The Turnaround

After completing the first tunnel, Mary had to be turned 180 degrees inside the HRBT North Island receiving pit to begin her return trip to South Island. At 430 feet in length and 4,700 tons, even partially disassembled, she was far too massive for a standard crane lift.

Instead, crews set to complete another historical effort by separating Mary's shield and cutterhead from her gantries and rotating her using nitrogen table technology. The friction-reducing, innovative technology allowed a 180-degree rotation of the 2,350 ton, 46-foot shield in just 11 hours with 35 crew members assisting.

This set a world record for both diameter and weight for the rotation of a TBM using this technology.



The Second Tunnel

Exactly 6 months to the day from her first breakthrough, Mary started her return trip to South Island by starting excavation of HRBT's second tunnel on Oct. 17, 2024. During her return trip, Mary excavated 7,960 feet and installed 1,194 rings. Following breakthrough, Mary will install her last 6 rings, marking the end of her incredible journey.

In her time serving the HRBT Expansion, Mary tunneled exactly 3 miles. Additionally, she has set many records given her sheer size as the second largest TBM in North America, as well as her productivity installing 440 feet of tunnel in a single week—believed to be a world record for her class of TBM. While she may no longer be needed at the HRBT, she will long live on in the history of Virginia and the story of Hampton Roads.



FUN FACTS

- ★ Mary is longer than a football field. She measures 430 feet in length.
- ★ She weighs more than 4,700 tons. That's roughly the weight of 10 fully loaded Boeing 747 airplanes.
- ★ Mary's best week occurred in June 2025 where she installed 66 rings in just 5 working days.
- ★ Mary bored 15,900 feet or exactly 3 miles for both tunnels.
- ★ Mary moved more than 1 million cubic yards of soil. Enough dirt to fill over 300 Olympic-size swimming pools.

