

HRBT EXPANSION Magazine

IN THIS ISSUE

3

Machine
Commissioning

6

Ready,
Set, Dig —
Tunneling
Begins

9

Staff
Spotlight

10

Landing on
Improvements



TABLE OF CONTENTS

- Project Updates **3**
- Equipment Highlight **4-5**
- Tunneling Update **6-8**
- Staff Spotlight **9**
- Construction Update **10-11**
- Project Milestones **12**
- SWaM/DBE Milestone **13**
- Adjacent Project HREL **14-15**



District Engineer Message

Christopher G. Hall, PE

Exciting times in Hampton Roads with all of the significant interstate improvement projects. In collaboration with our local partner, Hampton Roads Transportation Accountability Commission (HRTAC) we continue to deliver much needed improvements to our regional interstate network. In addition to the HRBT Expansion Project, VDOT has started construction on the Hampton Roads Express Lanes (HREL) network. This 46-mile network will offer travel choices and travel time reliability for motorists. We are working to keep Virginia moving.

We recognize the inconvenience of construction and thank you for your patience as our operations team works hard every day to help clear incidents and keep our roadways safe. But we need your help by being a good neighbor. Please obey all posted speed limits, drive distraction-free and stay alert to new traffic patterns. As you drive through our work zones, please be mindful of the construction crews who are working hard, and let's make sure they make it home to their families each night.



Project Director Message

Ryan Banas, PE

Since joining the project earlier this year, I have been blown away by the work the project has accomplished. We have made significant progress on a number of fronts throughout the project corridor including opening the new Bay Avenue ramp in Norfolk, bridge deck placements across the Hampton Roads Harbor, and most notably launching Mary, our TBM, in April on her journey to construct VDOT's first bored tunnel. I am excited and honored to help lead one of the most talented collections of construction and engineering professionals tasked with this monumental undertaking.

As a Hampton Roads resident for more than 12 years, I personally appreciate the positive impact this project will have on our community. As we continue on this journey we appreciate your patience while we're performing construction throughout the corridor. Please know, we are working diligently to minimize our impact on your daily commute and bring this meaningful infrastructure to completion as quickly as we can. While much has been accomplished to date, I look forward to the opportunity to share with you the many more major milestones we will achieve along the way in delivering VDOT's largest-ever project.



PROJECT UPDATES

Blessings and Bon Voyage

In April 2023, the HRBT Expansion project team participated in two traditional ceremonies to celebrate the completion of the reassembly of the tunnel boring machine (TBM) and slurry treatment plant (STP). The blessing and christening ceremonies marked the start of tunneling, a major project milestone.

Before a TBM starts boring, a traditional ceremony is held. The Saint Barbara blessing calls upon the patron saint of military engineers and miners to protect underground crews as they work to construct the new twin tunnels. Father Oswaldo Saul Anleu Sandoval of Our Lady of Mt. Carmel Catholic Church performed the blessing of the TBM and crew on April 15.

The christening ceremony is an age-old tradition in maritime culture for good luck and safe travels. Similar to ships before their maiden voyage, the TBM and STP were christened on April 17. This ceremony celebrates the launch of the machines as they start their journey to build the first new tunnel.

Commissioning



[ABOVE]: From left to right - VDOT District Engineer Christopher Hall, PE, HRTAC Executive Director Kevin Page, and VDOT Commissioner Stephen Brich, PE, attend the christening ceremony on April 17, 2023. [BELOW]: The HRBT Expansion Project team celebrates the christening of the STP on April 17, 2023.



A very big facility supports a very big tunnel boring machine.

Mary, the Tunnel Boring Machine (TBM) has launched and is making her way from the South Island to the North Island as she constructs the first of two tunnels. Mary would not be able to tunnel without her partner, Katherine, the Slurry Treatment Plant (STP).

The name “Katherine” was selected in honor of Katherine Johnson who was a mathematician and “human computer” at NASA Langley Research Center. The project team hopes to pull from Mary and Katherine’s history as first of their kind, as it constructs VDOT’s first-ever bored tunnel.

[LEFT] **1** All tunnel spoils pass under a magnet (yellow suspended device) to remove metals prior to disposal. [BELOW] **2** An aerial view of the slurry treatment plant which takes up the entire northwest corner of the South Island. [RIGHT] **3** The trommel is a rotating drum which breaks apart clay and dirt to separate material excavated by the TBM. **4** A view from the top of the STP overlooking the many silos used to hold water and slurry.



2



The STP has been described as the “Eyes of the TBM.” It’s here crews see the first glimpse into what the TBM is encountering deep under the Hampton Roads harbor. Katherine is performing three critical activities in support of Mary’s work underground.

1. The non-stop slurry loop connecting the TBM and STP.
2. Sorting, separating, and distributing the materials returned from the TBM.
3. Analyzing and testing.

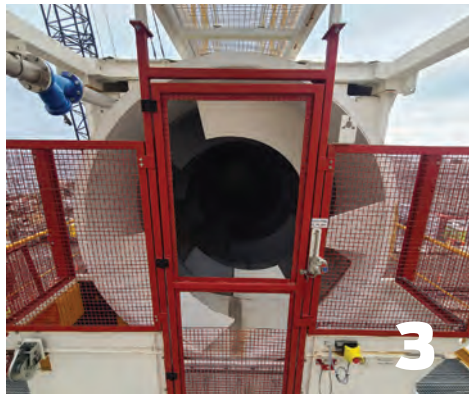
Slurry Loop of Spoils

The Slurry Loop is a system of pipes that first bring a mixture of bentonite clay and water (known as slurry) to the cutter head of the TBM. The slurry provides counter-pressure allowing Mary to excavate and place tunnel segments while minimizing the risk of cave-ins as she advances.

The slurry then returns the material excavated by the cutterhead back to the STP for filtering. The pipes connecting the TBM and STP are 22 inches in diameter. They are capable of transporting 14,000 gallons of slurry a minute, or a fully loaded dump truck every 10 seconds.

Sorting and Separating

The slurry contains debris from tunnel boring, mostly sand and clay but



potentially other materials. All tunnel spoils pass under a magnet to remove any metallic pieces that may have been excavated with the soil. This metallic debris can range from construction materials left over from the facility’s 1957 construction, all the way to Civil War-era cannon balls.

Coarse grade sorting will screen anything larger than .6mm (the size of the tip of a fine ballpoint pen). This material will be sorted via trommel, which is like a large colander or sieve that rotates continuously.

Following the first two steps of spoils reclamation, any remaining fine grade materials not captured in the first separation process are then processed through the on-site hydrocyclone. The hydrocyclone works with gravity in a circular motion, using centrifugal force, separating these tiny particles from the slurry.

Fine grade materials are then moved through a filter press to be compacted under extreme pressure into “cakes” and onto conveyor belts to be removed from the site by barge. If, at any time, the flow of processed material is greater than the ability to carry it



away, there are storage facilities built into the STP. The separated water is stored to be used by the STP. After filtering, much of the slurry mixture can be recycled to the TBM to start the process over again.

Analyzing and Testing

Laboratory technicians at the STP check the characteristic of the excavated spoils at least three times per operation. Teams on-site monitor the materials to detect any geological change, research any anomalies (and what they might mean), as well as measure the progress of the TBM. They also ensure the cutter face’s wear is within acceptable parameters. All systems of the TBM and the STP are constantly monitored and maintained.

Uninterrupted Operations

The STP is as critical to tunnel construction as the TBM. Without the STP, mining cannot occur. As the largest STP in North America, Katherine is built to be 2.5 times larger than what’s needed for Mary’s work. This ensures that when Mary is digging, Katherine will always have the capacity to support her excavation.



[ABOVE] Katherine Johnson, NASA Mathematician, recipient of the Presidential Medal of Freedom

KATHERINE THE STP

Learn more about Katherine, the STP, by listening to a two-part podcast featuring project crew members.



Ready, Set, Dig — Tunneling Begins

A view inside the newly constructed tunnel with temporary steel rings making way for the permanent concrete tunnel rings.





[ABOVE]: **1** The TBM operator monitors all operations from the control room. **2** Multi-service vehicles are used to transport the tunnel segments to the TBM. **3** The segment feeder brings in tunnel segments as the vacuum erector awaits overhead, preparing to move each segment into place. **4** The TBM has 54 hydraulic thrust cylinders that push against the tunnel ring to move the TBM forward.

READY

After years of preparation, the HRBT Expansion Project began boring the first of two new tunnels in April 2023. This milestone comes after the completion of the launch pit and headwall, the re-assembly of Mary the Tunnel Boring Machine (TBM) and Katherine, the Slurry Treatment Plant (STP).

SET

Twenty-two nautical miles away in Cape Charles, the segments that will be assembled to form the new tunnel are being constructed using reinforced concrete. Each concrete ring of the new tunnel is comprised of nine unique tunnel segments. It will take 2,388 rings to form the two new tunnels. A barge loaded with 180 tunnel segments journeyed down the Chesapeake Bay to the South Island of the HRBT in March 2023.

A gantry crane lifted the segments, three at a time, from the barge into the launch pit where they were moved onto the segment feeder, ready to be placed by the TBM.

DIG

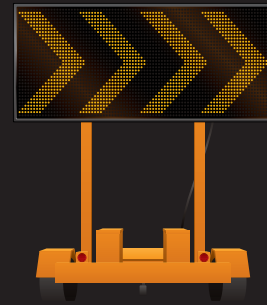
With a 46-foot cutterhead rotating at a rate of up to 1.5 revolutions per minute, Mary utilizes 198 scrapers and 26 disc cutters to excavate soil, making room for the new tunnel. To assist with excavation, Mary uses slurry, a mixture of bentonite clay and water, to balance soil and water pressure in front of the cutterhead. This helps to prevent the soft soils from collapsing in before the tunnel segments are placed. The excavated soil and slurry mixture are then pumped out to the STP for processing. Soil is separated from slurry to be barged away to pre-approved disposal sites. The slurry is then recycled and pumped back into the TBM.

Once Mary has advanced approximately six and a half feet, accounting for 350 cubic yards of excavated tunnel spoils, she can build her next ring. Mary's vacuum erector picks up each segment weighing as much as 12 tons and puts them into position with precision and accuracy.

Mary's erector bridge allows the vacuum erector to rotate 360 degrees for placement of each of the nine segments to form one ring. Mary's thrusters then pin the segment in place where it is then bolted to the previous ring. Additional segments are placed and bolted to one another to form one complete ring of the tunnel. Once the last segment is placed, Mary uses her thrusters to push off the newly formed ring and continue excavation.

View behind-the-scenes photos and videos of the TBM





Monitoring Progress

Given the complexity of working underground with no visibility to what is in front of the TBM, the team relies on data to monitor progress. Mary provides over 2,500 data points, including face pressure, muck balance, tail void and cutterhead torque. The ring summary report pulls directly from the TBM system to track data from the installation of each ring, from the length of time it took for Mary to advance to the condition of the installed segments. Each tunnel segment is equipped with an RFID chip that is scanned at every step of the process, following the segment from creation to placement. Data is collected and stored in a database, where the team tracks every detail of that specific segment, including concrete mix, arrival time to the South Island and ultimate placement in the tunnel.



Extending Results

Trailing behind Mary are the electrical lines and pipes needed to power and support operations and connect Mary to her counterpart Katherine. For every 30 feet Mary advances, the lines and pipes must be extended to accommodate her movements.



5 The TBM erector bridge controls the placement of the tunnel segments. **6** A look from the back of the TBM over the completed rings to the opening of the tunnel. **7** Crews prepare a new section of 22 inch diameter slurry pipe.

STAFF SPOTLIGHT



YVONNICK RESCAMPS

Tunnel Construction Manager

Yvonnick Recamps is Hampton Roads Connector Partners' Tunnel Construction Manager, overseeing all aspects of the new twin tunnels for the HRBT Expansion Project. From his first internship at the start of his career, Yvonnick knew he wanted to specialize in underground construction. His career has spanned the globe from France, Italy and Qatar, to Russia and the United States.

Yvonnick chose the HRBT Expansion Project, because he was excited about new tunnel boring machine (TBM) technology. With more than 30 years of tunneling experience, Yvonnick is no stranger to TBMs. He has worked on 14 TBMs throughout his career, including earth pressure balance, slurry and micro TBMs. The HRBT's Mary is Yvonnick's first variable density TBM. The variable density TBM was invented as an evolution of the slurry TBM. In the past, Yvonnick had to manually adjust slurry TBMs to accommodate the variation in density using a bypass valve. With the variable density TBM, the machine can manage the variation in density automatically.

When he's not focused on his very technical job, Yvonnick likes to express his creative side through photography, designing champagne cork art, and restoring vintage furniture.



SCOTT McHENRY

Chief Tunnel Inspector

VDOT's lead for the tunnel inspection team is Scott McHenry and his "office" is 100 feet underground. As the HRBT Expansion Project's Chief Tunnel Inspector, Scott brings 25 years of experience in safety and inspection of major infrastructure projects along the east coast. After his first tunnel project in Atlanta, Scott caught the tunneling bug and has been hooked since. His experience includes projects from Connecticut, Washington DC, all the way to Georgia.

On the HRBT Expansion Project, Scott's role is to oversee a team of tunnel inspectors who monitor all tunneling activities. Scott and his team work closely with the contractor, HRCP, to ensure that their work is in compliance with the technical requirements of the contract. While Scott is no stranger to tunnel boring machines, HRBT's Mary is the largest TBM he has encountered.



Landing on Improvements



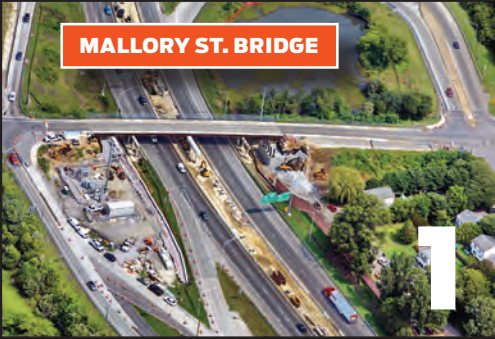
While the tunnels have received the most attention, the most visible progress on the HRBT Expansion Project happens on the landside. Interstate 64 will be widened to accommodate two additional lanes in each direction from Settlers Landing Road in Hampton to Patrol Road in Norfolk. Visible along the entire corridor, crews have cleared the median to accommodate the new lanes.

The complex landside operations of the HRBT Expansion Project aren't restricted to just roadway work as the name implies. Landside operations include the complete replacement of the Mallory Street Bridge along with the widening of 23 additional bridges and overpasses, including Willoughby Bay Bridge, Mason Creek Bridge, and Oastes Creek Bridge.

- 1 The southside of the Mallory Street Bridge has been demolished and crews are working to build the new bridge. The replacement of the Mallory Street Bridge is necessary in order to widen I-64 below to accommodate the additional travel lanes.
- 2 Crews have installed all the piles, a total of 245, to widen the Willoughby Bay Bridge for eastbound traffic. Additionally, nearly all girders have been placed and crews have been working to pour the new bridge decks. In July, crews started pile driving activities for the westbound bridge.
- 3 The Mason Creek Bridge widening is nearly complete for the eastbound lanes. Crews are working on pouring the last segments of the bridge deck. Once completed in 2024, traffic will shift to the new portion of the bridge so that crews can start working to widen the westbound lanes in the median.
- 4 The new on-ramp from W. Bay Avenue to I-64 east has been completed. This work was necessary to provide crews with access to I-64 to widen the eastbound lanes between the existing bridge and the newly constructed on-ramp.

I-64 WIDENING





MALLORY ST. BRIDGE



MASON CREEK BRIDGE



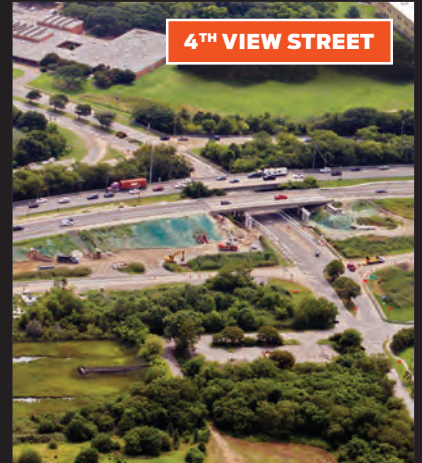
SOUND WALLS



W. BAY AVENUE



1ST VIEW STREET



4TH VIEW STREET



WILLOUGHBY BAY BRIDGE

Throughout the project, sound walls will be constructed in many locations adjacent to the widened interstate. The new sound walls being installed in Norfolk pay homage to the U.S. Navy with the medallion featuring a frigate. Some of the work by the landside team that is not visible but is critical to the community

happens underground. Stormwater management systems have been installed throughout the project, which will ensure proper drainage along the newly constructed corridor.

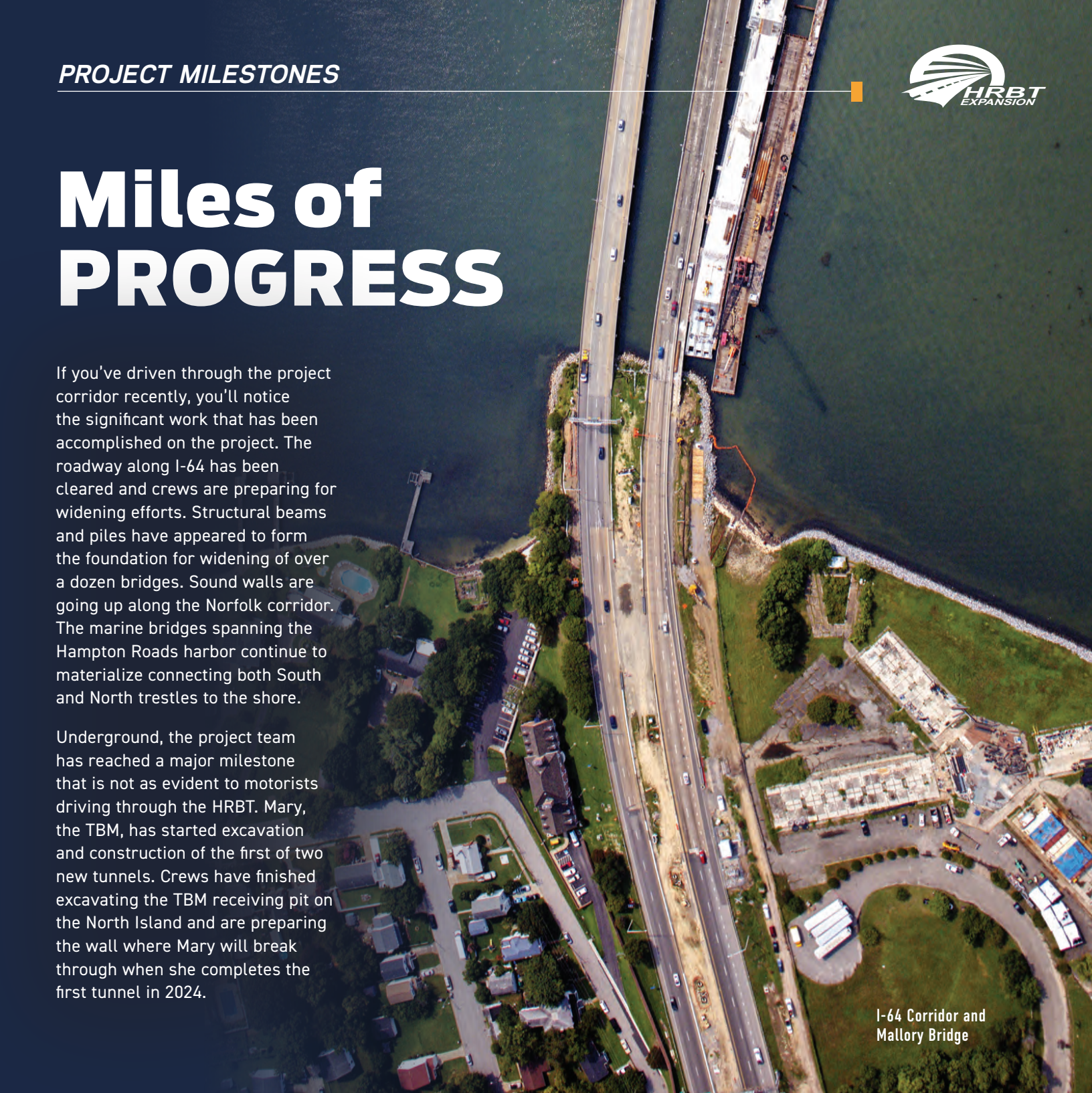
Unlike the crews working on the tunnels, the landside team is working adjacent to live traffic. Work zones have been

established to provide a barrier of protection for these crews. When you drive through the work zone, you are driving through their "office." Please obey all posted speed limits and avoid distracted driving. Just like you, our crews want to make it home safely from the office each day!

Miles of PROGRESS

If you've driven through the project corridor recently, you'll notice the significant work that has been accomplished on the project. The roadway along I-64 has been cleared and crews are preparing for widening efforts. Structural beams and piles have appeared to form the foundation for widening of over a dozen bridges. Sound walls are going up along the Norfolk corridor. The marine bridges spanning the Hampton Roads harbor continue to materialize connecting both South and North trestles to the shore.

Underground, the project team has reached a major milestone that is not as evident to motorists driving through the HRBT. Mary, the TBM, has started excavation and construction of the first of two new tunnels. Crews have finished excavating the TBM receiving pit on the North Island and are preparing the wall where Mary will break through when she completes the first tunnel in 2024.



I-64 Corridor and Mallory Bridge



North Island and Trestles



South Island



Willoughby Spit



Oastes Creek



Rebecca Gibson, owner of Flyaway Geese, poses with two of her working Border Collies. Flyaway Geese is one of over 340 contracts awarded to small, women, and minority-owned businesses.

\$500 Million Milestone; One Small Business at a Time

The HRBT Expansion project hit another great milestone this summer. More than \$520 million through 340 contracts has been awarded through the federal Disadvantaged Business Enterprise (DBE) program and Virginia's Small, Women-owned, and Minority-owned (SWaM) Business program.

The DBE program and the SWaM program aims to create opportunities for small, minority-, and women-owned businesses on large projects including the HRBT Expansion project.

On projects receiving federal funds, a certain percentage of contracts need to be awarded to DBE and/or SWaM companies. The HRBT Expansion

project currently has a total DBE/SWaM goal of 32% and has reached 23% to-date, well on track to exceeding the goal before the project is completed.

Roughly 80% of the DBE/SWaM firms awarded are based in Virginia and more than half are based in Hampton Roads. Surprisingly, not all these small businesses are construction companies. Contracts have been awarded to moving companies, landscapers, janitorial services as well as technical and administrative firms. Each one of these firms play a pivotal role towards delivering the largest transportation project in Virginia history.



YOUR DRIVE. CHOICE.

Hampton Roads Express Lanes (HREL) are under construction across the region to provide motorists with more travel options and travel time reliability. The Hampton Roads Bridge-Tunnel Expansion project is just one part.

The HREL Construction Projects aim to alleviate congestion and provide motorists with more reliable travel options along I-64 in Newport News, Hampton, Norfolk, and Chesapeake. By introducing additional travel choices, HREL are designed to significantly reduce overall travel times and enhance

predictability. Motorists can expect smoother journeys and improved traffic flow along I-64.

When complete, HREL will be a continuous 46-mile network of Express Lanes on I-64. This network extends from east of Denbigh Boulevard in Newport News to the I-64/I-264/I-664 Bowers Hill interchange in Chesapeake, providing enhanced travel options to accommodate the future transportation needs of the Hampton Roads region.

Express Lanes give you more options to get where you need to be.

The Hampton Roads Express Lanes are designed to help make better use of the highway capacity that we already have and will provide choices for those who want a more reliable travel time, while also relieving congestion in the free general purpose lanes.

The HREL network is being constructed in multiple segments over the next several years, which will include road widening, bridge construction, and the installation of flexible delineators, pavement markings, overhead toll gantries, dynamic message boards, signage, guardrail, and barriers during construction. Construction across all segments of the HREL network is estimated to be complete as early as 2028.

USING THE EXPRESS LANES:

Starting as early as the end of 2023, tolling operations on the Chesapeake and Norfolk Reversible Roadway Express Lanes will be 24 hours a day, 7 days a week. Solo drivers will be able to choose to utilize the Express Lanes by paying a dynamic toll when using their E-ZPass or E-ZPass Flex transponder, or they may choose to use the general purpose lanes that will remain free. For vehicles with two or more passengers, the Express Lanes can be used for free using the E-ZPass Flex transponder switched to "HOV-ON." Before you enter the Hampton Roads Express Lanes, electronic signs display the amount of the variable toll. As you enter, the price you see on the sign is the amount you will be charged. That amount won't change, even if the amount of the toll changes while you are in the lanes.

64 Express Lanes Reversible Roadway:

The 64 Express Lanes Reversible Roadway spans 8.4 miles between I-264 and I-564 in Norfolk. Since the Express Lanes launched in this location in 2018, variable tolling of the 64 Express Lanes takes place on weekdays from 5-9 a.m. westbound and 2-6 p.m. eastbound. Once the HREL Express Lanes Chesapeake Segment comes online as early as late 2023, dynamic tolling operations for both the Chesapeake Segment and the Reversible Roadway Segment in Norfolk will operate 24 hours a day.





The HREL construction project and other major transportation improvements in the Hampton Roads region are made possible through regional leadership and partnership.



UNDER CONSTRUCTION

Hampton Segment (4C)

The HREL Hampton Segment includes the widening and reconfiguration of the three existing east- and westbound general purpose (GP) lanes on I-64 into two Express Lanes and two GP lanes. The project will widen I-64, repave the existing lanes, and add an additional 12-foot-wide travel lane in each direction from west of Mallory Street (exit 268) to LaSalle Avenue (exit 265) for a total of 2.4 miles. This section of interstate includes six mainline bridges and one pedestrian underpass. The two eastbound bridges over the Hampton River will be replaced, and the westbound Hampton River bridge will be widened and rehabilitated.

Chesapeake Segment (2A) – High Rise Bridge

The I-64 Southside Widening and High Rise Bridge Project will add an Express Lane in each direction on I-64 from the I-64/I-264/I-664 Bowers Hill interchange (exit 299) to nearly 1 mile past the I-464 interchange (exit 291), where it will connect with Chesapeake Segment (2B).

Chesapeake Segment (2B)

The second Chesapeake Segment (2B) extends 7.7 miles along I-64 from the I-464 (exit 291) in Chesapeake to I-264 (exit 284) in Norfolk, where the existing HOV lane has been converted into an Express Lane in both directions. The majority of the remaining

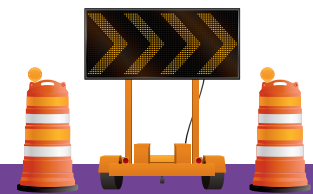
construction activities in this segment include the finalization of new signage and installation of pavement markings and flexible delineators indicating the new Express Lanes.

Hampton Roads Bridge-Tunnel Segment (3)

The Hampton Roads Bridge-Tunnel (HRBT) Expansion Project includes widening the current four-lane segments to six lanes along nearly 10 miles of the I-64 corridor in Norfolk and Hampton, with new twin tunnels across the harbor. Once complete, this corridor will consist of two free general purpose lanes, one Express Lane and one part-time shoulder Express Lane in each direction.

Norfolk Segment (1A)

The HREL Norfolk Segment (1A) is under construction on I-64 in both directions from Tidewater Drive (exit 277) to Patrol Road in Norfolk. In this 2-mile segment, the existing shoulder will be converted to a part-time shoulder Express Lane, operating alongside the three existing general purpose lanes in each direction. This project also includes the widening and rehabilitation of five bridges, as well as the rehabilitation of three additional bridges within the project corridor.



IN DESIGN



HREL Norfolk Segment (1B) The HREL Norfolk Segment (1B) will span approximately 7 miles on I-64 in both directions, from 1 mile east of I-264 (exit 284) to Tidewater Drive (exit 277) in Norfolk. In this segment, the existing inside shoulder will be converted to a part-time shoulder Express Lane, operating alongside the three existing general purpose lanes in each direction. The project also includes the full replacement of two bridges and the rehabilitation of 10 additional existing bridges.

Newport News Segment (4A/4B) The HREL Newport News Segment (4A/4B) will span approximately 13.5 miles on I-64, starting just east of LaSalle Avenue (exit 265) in Hampton and ending 1.2 miles west of Denbigh Boulevard in Newport News. For 10.5 miles of the segment from just west of Jefferson Avenue (exit 255) to I-664 (exit 264), the existing HOV lane in each direction will be converted into an Express Lane, alongside the three general purpose lanes. For the last 1.5 miles of the segment between I-664 and LaSalle Avenue, one general purpose lane will be converted into an Express Lane in each direction, alongside two general purpose lanes. The project also includes the replacement of the east- and westbound bridges over LaSalle Avenue and the rehabilitation of the east- and westbound bridges over Armistead Avenue, Billy Woods Canal and J. Clyde Morris Boulevard.





For more project details visit:

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