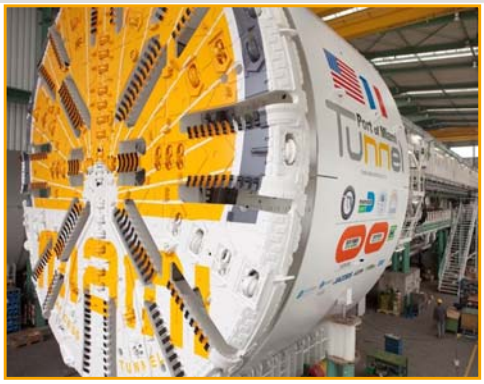
Port of Miami Tunnel

A public-private partnership project by

TUNNEL BORING MACHINE (TBM) & TUNNELING FACT SHEET

OVERVIEW

MAT Concessionaire's design-build contractor, Bouygues Civil Works Florida (BCWF), excavated twin tunnels, connecting Watson Island and Dodge Island in the City of Miami, using a Tunnel Boring Machine (TBM) specifically designed for the Port of Miami Tunnel's geology. The TBM was built by Herrenknecht in Germany. The construction of the Port of Miami Tunnel project broke ground in May 2010 and is scheduled to be completed in May 2014.



TBM PRODUCTION:

Production of the TBM parts ran from March through October 2010. Assembly commenced in October 2010 and was completed in April 2011.

TBM TESTING/COMMISSIONING IN GERMANY:

Fully assembled, the TBM's testing and commissioning was successfully completed on April 15, 2011.

SHIPMENT:

Disassembly and packaging of the fully commissioned TBM pieces ran between April and May 2011. The packaged TBM was driven on special trucks from the Herrenkencht plant to the Port of Kehl in Germany. Cranes lifted the TBM pieces onto river barges bound for Port Rotterdam in Holland, where it was loaded onto the Combi Dock I. The ocean carrier's self-contained cranes lifted the TBM's 19 heavy haul pieces onboard and the ship commenced its transatlantic voyage to Miami on June 8, 2011.

TBM ARRIVAL IN THE USA:

The Combi Dock I ship arrived at PortMiami on June 23, 2011. The TBM arrived in pieces (75 regular cargo, 20 containers and 19 heavy haul pieces). The regular cargo and container pieces were delivered via trucks from PortMiami to the median of the MacArthur Causeway on Watson Island. The 19 heavy haul pieces were lifted by the ship's cranes onto barges. The barges delivered the pieces to Watson Island. From the barges, each piece was loaded onto a special roll-on/roll-off vehicle that delivered the pieces one by one to the MacArthur Causeway median during a very successful five-night rolling stop operation.

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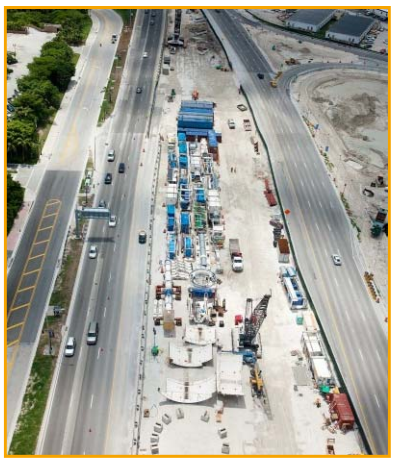
PRE-ASSEMBLY:

The pre-assembly of some of the TBM pieces (such as the cutterhead and tailskin) began the week of July 5, 2011, after all of its pieces were at the staging site in the median.



FULLY ASSEMBLED:

The TBM consists of a cutter head with an outside diameter of ***42.3 feet*** (as high as a 4 story building) and a ***361 foot*** long trailing support gear made up of 6 gantries. The total length of the TBM is ***428.5 feet*** long (more than a football field).

REASSEMBLY OF THE TBM IN THE LAUNCHING PIT:

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The launching pit for the TBM is approximately 400 feet long, 100 feet wide and 40 feet deep. Assembly of the TBM began on August 10, 2011, when the first piece was lowered into the pit from the staging area in the median. That was one of the six pieces of the TBM shield. Piece by piece, one per day, the head of the TBM began to take shape inside the launching pit, while the TBM's six gantries (tail) were also assembled in the work zone. On September 1, 2011, the cutter head of the TBM was lowered into the pit.

TBM LAUNCH:

Harriet launched from her home in the Watson Island pit on November 11, 2011, boring the first tunnel towards Dodge Island.

TBM NAME:

The South Florida Girl Scouts Troops named our TBM ***"Harriet"***, after the American History Icon Harriet Tubman. Born a slave, this African-American abolitionist and humanitarian escaped slavery and led several rescue missions through a network of secret passages and safe houses known as *The Underground Railroad*. At its height during the 1850s-1860s, the *Underground Railroad Movement* freed more than 100,000 slaves and became a staple of America's history. With our TBM going underground to make history for South Florida, Harriet is a fitting name for this Florida mining marvel.

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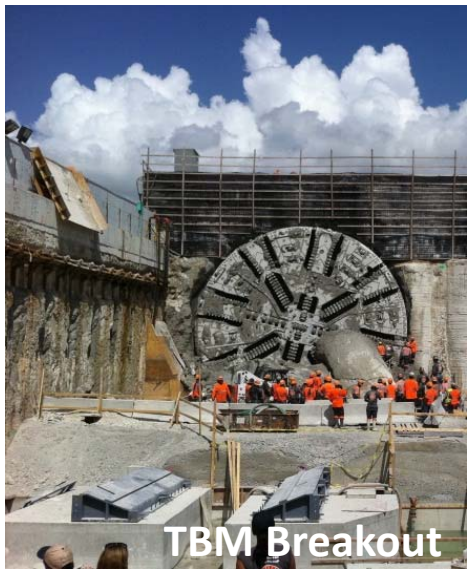
TBM BREAKOUT – EASTBOUND TUNNNEL & TURN AROUND:

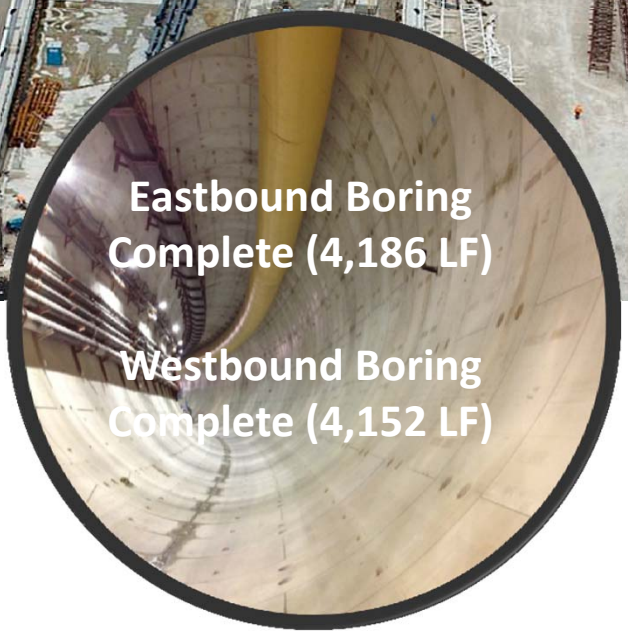
Harriet emerged on Dodge Island on July 31, 2012. She was then disassembled, turned around and reassembled. The westbound tunnel mining began on October 29, 2012, and was completed on May 6, 2013.


TBM Breakout


TBM on Turnaround Table


TBM in Receiving Pit


TBM Rotation


Eastbound Boring Complete (4,186 LF)

Westbound Boring Complete (4,152 LF)


TBM Placement for Westbound Boring

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TUNNELING PROCESS:

Tunneling occurs when the cutter head rotates as a cutting wheel boring out the underground area, while the trailing gear contains the electrical, mechanical, guidance systems and additional support equipment. Excavated material is carried back through the trailing gear on an enclosed conveyor belt or pumped through pipes and deposited outside the tunnel entrance, or portal. It is moved off-site to be used as fill material and is disposed in a manner consistent with applicable environmental rules and regulations. As the TBM moves forward it also erects precast concrete liners (known as segments) that become the finished wall of the tunnel. Once the liners are in place, grout is pumped into the space between it and the excavated area to fill any voids or gaps. The TBM then pushes off from the finished ring to move forward and the process begins again.

FEEDING THE TBM:

It took a total of approximately 12,000 segments to create the lining of the two tunnels. The segments were made at the Cemex concrete plant in Sweetwater specifically for this project. Each segment weighed 12.2 metric tons; 5'7" wide; 14'6" long; and 2' thick. The segments were placed on special trucks and were rolled directly into the tunnel. It took 8 segments to construct each ring and the TBM constructed approximately 3-6 rings per day. It took approximately 1500 rings to line both tunnels. Each ring installation took approximately 60 to 75 minutes to put in place.

TUNNELING OPERATIONS:

During the tunneling operations, there were approximately 12 to 16 persons working in the TBM, as well as 12 to 14 persons on the surface of the machine. The TBM worked 24 hours per day; 20 hours alternating between excavating and ring installation and 4 hours stopped for maintenance.

FOR MORE INFORMATION CONTACT:

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