Second Avenue Subway has a breakthrough moment; several billion more are all the M.T.A. wants

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It was hot and sticky in the 63rd Street F-train station at 10 a.m. yesterday, and there were enough police officers and men in hardhats and orange vests to imply there had been some sort of major accident.

The crew stands before the T.B.M.'s point of entry. **Photos courtesy M.T.A.**

They were there because the Second Avenue Subway, which has technically been ongoing for decades, was about to reach a milestone: The tunnel for the first phase of the project was going to be finished.

What that meant practically, and the reason members of the press had convened in front of the station-agent booth, is that the enormous Tunnel Boring Machine (T.B.M.) was about to break through a wall between the tunnel it has been carving down Second Avenue and an existing spur 80 feet under the surface of Lexington Avenue that comes off the 63rd Street F tunnel.

The F train station at 63rd Street and Lexington is not one of Manhattan's most appealing. It's claustrophobically deep, with escalators long enough to induce doubt about things like what is up and what is down, tunneling through shiny, bright red-orange tiled passages.

To get to the place where the T.B.M. was scheduled to break through yesterday morning required descending several of these and walking to the end of the F platform, where visitors were issued hardhats and orange vests, made to sign a form confirming they were about to enter the tunnel, and then led down a flight of steps further down into a dark cavern, where it was cooler but also more damp.

The Second Avenue subway line is most famous for two things: that it was first conceived approximately 80 years ago—after the Third Avenue elevated line was torn down in the mid-1950s—and that it has drastically disrupted businesses and residents along Second Avenue since ground was broken in 2007.

Both these things are true. Another thing that is true is that it is the largest and most complicated engineering project the New York City public transportation system has undertaken in decades.

The tunnel-boring machine is itself an engineering feat, a two-part machine that weighs in total roughly 450 tons. It has made its way, slowly and through bedrock, tens of feet below the surface, from its launching box at 92nd Street to 63rd Street since it began its journey in May of 2010.

Both of those things are also why what was happening on Sept. 22 was such a big deal. It's finally under construction because, for the first time, the city, using an initial appropriation of $1.3 billion from the federal government, has made it a long-term funding commitment. In the past, short-term commitments of money have been suspended during periods of economic downturn: First in the late 1930s, then in the mid-1970s.

So the completion of the tunnel for the first phase, which will not actually be moving any passengers until at least 2016, is a very big deal, at least in some circles.

The new line will be designated the "T" line, and the color assigned to the circle around the letter is teal.

While the T tunnel broke through at this spur off the 63rd Street Station tunnel, the 63rd Street Station will not itself serve the T but rather the Q.

When trains first start running along the Second Avenue Line, the Q, which presently has its terminus at 57th Street and 7th Avenue at some times, and at others in Astoria where it follows other yellow-coded train the N, will be rerouted. It will follow the F tracks from 57th to 63rd Street, and then turn into the T tunnel and climb uptown on the same tracks to a new terminus at 125th Street.

The T will only run between stations at 96th and 72nd in the new tunnel, until phase 3 (which extends the tunnel south to Houston Street), and phase 4, (which will extend it to Hanover square) are completed.

The plan for phase 2 is to run the T from 96th Street north to 125th, alongside the Q.

The T.B.M. moves in two parts. The first, 75-feet long and 210 tons, bores through six feet of earth, and then the second part, at 350 feet, moves to meet it.

There is a cab in the machine, in which a Sandhog, as members of the union that does most of the excavation for underground projects in New York are called, runs the machine. "Grippers" hold the walls up around the machine while a hydraulic pump pushes the first part of the T.B.M. forward into the rock; the second catches up and the process begins again.

In the best boring conditions the T.B.M. manages to move about 100 feet in a day; but depending on the rock might progress as few as five in the same time on another day.

Most of the subway lines constructed in the history of the city, all before 1970, have been into parts of the five boroughs not previously served by the M.T.A. The Second Avenue subway is essentially an infill project; it is intended to relieve pressure on the 4,5,6 line, currently the most crowded line in the system, and to provide more convenient transportation for residents on the far East Side, who, if they live on 86th Street and East End Avenue, travel five avenue blocks to the nearest station, an approximately 15-minute walk (in many places uphill).

To watch the breakthrough of the T.B.M. was to witness two things: One, the sense of triumph among M.T.A. officials and employees, as well as contractors who were involved; and second, an extraordinary engineering event that rattled eardrums and covered more than 100 attendees in dust.

It did not happen immediately after the journalists descended, however. For more than an hour, we stood behind dividers several hundred feet away from a wall of rock and waited. There was a banner reading "Second Avenue Subway, It's Coming!"

Anticipation was thick, as was increasing dread on my part, beginning when I asked a man next to me, older and dressed in the style of those who had worked on the tunnel, whether I should also have a dust mask.

"There's going to be a big poof, and a rush of water," he said.

Time passed. One woman had her picture taken in front of the stone wall. A procession of men in suits arrived wearing hard hats that looked as if they had never been worn before and printed with AECOM, one of the contracting companies. A number of other of other men arrived with their children; a girl who looked about 11 and a boy who looked about 6.

We were still waiting, with the machine alternately roaring and quiet, when someone behind me said, "Jay's about 10 minutes out," referring Jay Walder, outgoing chairman and C.E.O. of the M.T.A.

The woman he was speaking to said, "That's what we've been waiting for."

A man in charge told another to take down the ribbon that separated most of the people from the 20 or so that could stand in front.

"People are going to rush and they're going to get hurt," he said.

Phase 1 of the project is Phase 1 not because it's the most simple, in terms of engineering. Michael Horodniceanu, president of the M.T.A. Capital Construction Company, told me, after the boring machine had emerged through the rock, that all of the phases are challenging; and according to Robert Paaswell, a professor of engineering at the City University of New York and the head of the University Transportation Research Center, it is Phase 1 because it will attract the most riders initially, and it will connect to both the Q and F lines.

Jay Walder did arrive, but it was still an hour or so before the machine broke through. In the meantime, there were many false celebrations. Several observers would raise their cellphone or cameras to document the event, and then, when nothing happened, they would, one by one, drop down.

This happened at least a dozen times. It smelled like sweat, rock and mold.

At the beginning of the operation, engineers had to move or remove and replace sewers, gas lines, electrical lines, and water mains in order to make a hole through which the T.B.M. could be lowered.

The difficulties presented by layers of underground infrastructure below New York City streets varies with the depth of the boring project. Infrastructure isn't as much of a problem at this point in the work, according to Horodniceanu, because the boring is now proceeding deep enough that it's below most of that stuff.

But engineers are still hollowing out ground below streets and buildings, which means that there is a risk that buildings can settle, or even collapse. Though the project has been severely disturbing to residents—there is the noise, the loss of foot-traffic for small businesses, some temporary relocations—there have been no calamities, which is not exactly a miracle but it says something about the caution with which engineers have approached the Second Avenue Subway.

In the world of civil engineering, it's an unprecedented challenge.

"For civil engineers like us, it's great," Paaswell said. "I mean everything hard in civil engineering is great—not great for the community—but it's a beautiful piece of engineering."

"They've been very careful, it's a pain in the neck if you're in the community, but," he said, "it's the old French saying: 'you can't make an omelet without breaking eggs.' You really don't want to disrupt people or their lives, but the long-term payoff for the city is going to be an incredible new subway line."

When the boring machine finally did break through, there was applause, and then dust.

The clouds of it moved slowly, but when they arrived they were white and thick. Someone was handing out dust masks, until there weren't any more. I couldn't see anything, which made the whole exercise of being there seem somewhat pointless. A man next to me said, "Just imagine it. It's a big hole."

The dust was a problem in part because of the shape of the boring machine, which is conical, as opposed to flat, like the one used to dig the 7 train extension. In fact, the celebration

was considered finished before the machine made it all the way through the rock because the dust would have been too much for the assembled audience to handle.

“As soon as we are out of here we’ll do that,” Horodniceanu said after the main event. “They turn the machine on—it will take another hour, and a lot of dust. They stopped it because of the dust—we almost choked.”

While the dust was still settling, there was some disagreement over whether anything was happening next, and there were some departures.

But after about half an hour, it thinned out, and someone announced that the air quality was back to normal; Sandhogs had been hosing down the front of the machine and the tunnel walls in an effort to settle the dust down. Walder, along with Horodniceanu and several other men in suits, proceeded past the ribbon that had held even the dignitaries back and stood in front of the boring machine and its hole to be photographed. The machine has a name, as the boring machines all do for specific projects.

This will be one of Walder's last great accomplishments before he leaves to take over the Hong Kong metropolitan transportation system; but the boring machine is named Adi, for Horodniceanu's granddaughter, and it is a victory for him, too, even though by the time the press was led away from the scene the machine itself had shown only its head, which looked like the end of an elaborate screwdriver, or a conceptual sculpture made of steel.

Now that the T.B.M. has come through at 63rd Street, it will go back to its owner—the contractor—for now. It’s going to be transported by rail back to the launching box at 92nd Street, where it will be dismantled and lifted out by crane. It is not going on to phase 2 of the Second Avenue Subway because there is not yet any commitment of funds.

“We need another $22 billion dollars to do the rest,” Horodniceanu said.

Read more:

The Launchbox: An obsessive and obsessively absorbing blog about the digging of the Second Avenue Subway tunnel.
Wikipedia: Second Avenue Subway: A particularly lovingly detailed compendium of information about the history, engineering, and future of the new line.
M.T.A. Capital Construction: Second Avenue Subway: Documentation, maps, details, history.