

India's biggest TBM to bore bullet train tunnel through 7km under Thane Creek

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By 2028 when India's first bullet train runs from Ahmedabad to Mumbai, it will pass under the ecologically sensitive Thane Creek. Beneath the waters of the creek, a complex engineering creation is set to take shape. Work on India's first undersea tunnel, a 7km stretch of the Mumbai-Ahmedabad bullet train corridor, has entered a decisive phase as the tunnel boring machine (TBM) for the project is expected to be launched by the end of the year. Work on this segment, which is part of a larger 21km tunnel, comes with unique challenges, which include burrowing through complex undersea geological layers.

The Kolkata Metro boasts of the country's first underwater train tunnel passing through Hooghly River, fol-

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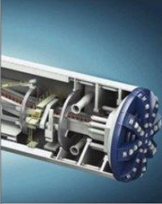
lowed by the Mumbai Metro Rail Corporation's Line 3, which goes under Mithi River linking BKC and Dharavi stations. The upcoming undersea tunnel will be different from those constructed under rivers. "The tunnel will be a single tube structure to accommodate two up and down tracks. To construct this, TBMs with cutter heads of 13.6-metre diameter will be used. Usually, 6-8-metre diameter cutter heads are used for urban tunnels used in the Metro system, as these tunnels accommodate only one track," says a senior official of the National High Speed Rail Corporation Limited (NHSRCL), which is implementing the project.

Excavation is underway at three sites — Ghansoli, Shilphata and Vikhroli. The first TBM is expected to be lowered at the Ghansoli shaft, at a depth of 39 metres, by the end of the year. The TBM will excavate towards the creek from Ghansoli. To

CUTTER HEAD DIAMETER 2X OF THAT USED FOR METRO LINES

The National High Speed Rail Corporation Ltd (NHSRCL) plans to deploy the largest tunnel boring machines (TBMs) to have been ever used in the country. The TBMs will be deployed for the 21km tunnel component of the Mumbai-Ahmedabad bullet train project. Manthan K Mehta reports

MAMMOTH MACHINES



Cutter head diameter of each TBM to be used **13.1 metres**

Comparison: 6 metres
Maximum cutter head diameter of TBMs used in Metro projects

12 metres | Cutter head diameter of TBMs used in the Coastal Road project. This is the current record

THE TUNNEL

21 km Total length | **7 km** Length under sea (Thane Creek)

A FEAT

The bullet train tunnel will be the country's first under-sea rail tunnel

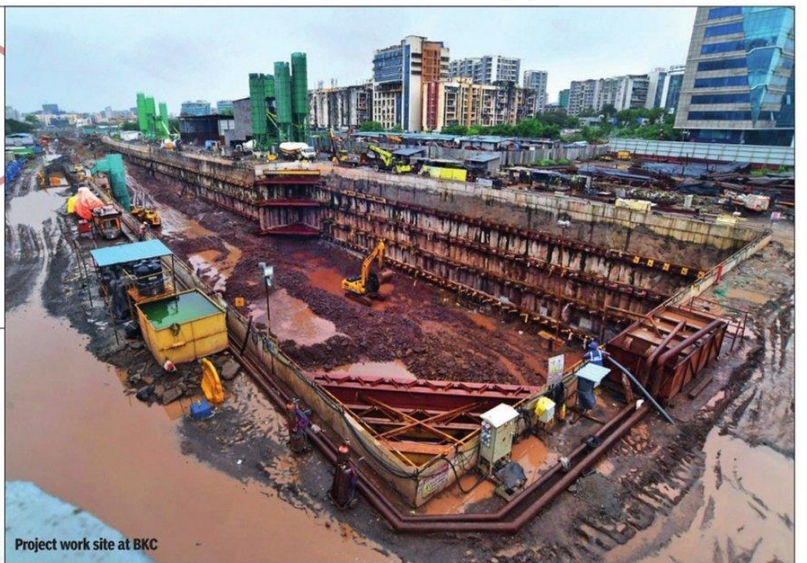


Comparison:

- > The Coastal Road tunnels between Girgaum Chowpatty and Priyadarshini Park are the country's first partially undersea tunnels (road or rail)
- > Kolkata Metro's Hooghly tunnel was the country's first under-river rail tunnel



₹6,397cr
Cost of tunnelling



CHALLENGES

- > The tunnelling project presents a significant challenge as part of it will be under-sea
- > Also, the alignment between BKC and Vikhroli passes through a densely populated urban area, with underlying utilities, making boring tricky
- > The excavation of shafts is anticipated to be demanding, given that the depths may exceed 50 metres

DEPTH

The tunnel will span a depth ranging from 25 to 57 metres below ground level

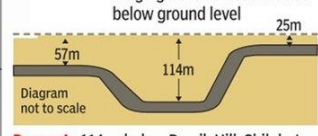


Diagram not to scale

Deepest: 114m, below Parsik Hill, Shilphata

HOW MANY TBMs?

- > 3 will be used to make about 16km of the tunnel portion
- > The remaining 5km will be made through the New Austrian Tunneling Method (NATM)
- > Two TBMs expected to reach the site by Oct 2024, and the third in 2025
- > TBM 1 and 2 to be launched to bore tunnels between Sawli and Vikhroli, and Vikhroli and BKC, before the year-end
- > TBM 3 to be used from the Vikhroli side to Sawli

STATUS OF SHAFT WORK

- BKC (shaft 1):** Depth: 36m | 100% secant piling work completed, excavation work underway
- Vikhroli (shaft 2):** Depth: 56m | 100% piling work completed, excavation work underway
- Sawli (shaft 3):** Depth: 39m | 87% excavation work completed

Shilphata: This is the NATM end of the tunnel. Portal work has already begun

lower TBMs, in less than a month, 120 metres towards BKC and 110 metres on the Shilphata end have been dug, for which engineers carried out 218 blasts using gelatin. The pace of work on the Rs 1.1 lakh crore project has been a lot faster in Gujarat than in Maharashtra. Of the total 502km stretch, the 352km route through Gujarat

is expected to be operational in 2027, after the opening of the 50km Surat-Bilimora section in August 2026. The project is expected to be ready by 2028-end, six years past its original deadline. Construction work is in progress for the underground portion of the corridor in Mumbai and Thane. This includes excavation for the station at BKC,

and shafts and portals for tunnelling work.

The tunnel under the creek will be bored 25-57 metres below ground level. Three mega TBMs will be deployed to excavate 16km of the 21km underground stretch, including the 7km creek section. The remaining 5km will be constructed using the New Austrian Tun-

nelling Method (NATM), which involves sophisticated monitoring to optimise various wall reinforcement techniques based on the type of rock encountered as tunnelling progresses.

"Highly sensitive geotechnical monitoring instruments are being deployed to ensure the safety of civil structures and service utili-

ties at and around all construction sites in Maharashtra for the bullet train corridor," said an NHSRCL spokesperson.

These instruments play a crucial role in making sure that there is no risk to ongoing underground work like excavation and tunnelling or to the structures surrounding the site.