Biggest Infra Project In Decades Cuts Through Underbelly Of Congested Localities & Narrow Streets

25M BELOW THE CITY

Massive drill as Metro takes shape



nside the site office of the under-ground metro project in Mahim's Naya Nagar, one Jitender is mak-ing a call to a colleague named Dharmender. Outside, Stand other unintentional reminders of Bollywood from the technicolour 80s. There's the nameless device with green and real Mogambo, a humongous 25-metro-deep pit with a white cage in the centre straight from a climax, and a singular

anogamio, a humongous 25-metr-eeep jit with a white cage in the centre straight from a climax, and a singuist blonde man among an army of helmetrees are not become a constraint of the contraction of the contractors steering the Metro III ship, he whispers instructions into a colleague's ear dismisses guests with a polite wave and has no time for chit-chat. Work on the 4-km-long tunnel that would end near Shivaji Park has begun in full flow, as is well-documented through signs that scream Mumbais 15 (Bygrading' and 'Hot work progress' that stands in the foreground of concrete mixers at the entrance. A huge fabric pipe that leads right into the heart of the excavated pit looks like an amusement park ride but it actually just a lump Through a temperis actually just a lung. Through a temper

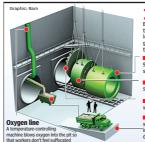
is actually just a lung. Through a ta a ture-controlling machine, it blows oxygen into the pit so that workers don't feel suffocated. To create this pit in September ast year; close to 300 families and last year; close to 300 families and resettled in Kurta, 18 commercial units were moved to Govandi. "No hats, no boots, no job" reads a signiboard, welcoming both overkers and visitors descending overkers and visitors descending to the property of the source of the property and white helmets into the 25 enter-deep pit. The shaft is lined with pillar-like walls called Secant Piles that are a seepage preventing with pillar-like walls called Secant Piles that are a seepage-preventing standard in deep excavations and the staircase leads you to two mas-sive cylindrical underground Tun-nel Boring Machines (TBMs) that stand next to each other facing a wall like two punished school stu

wall like two punished scnool sudents.

While the one meant for the up line is still in the making, the other one is exhibiting the care of a skilled dentits as it gently and the still of the control o

long dent, coaxing out silt. A bathtub-like tray then lifts this debris by a crane and a sliding bridge-like structure called 'gan-try' lifts it to finally empty it into a truck. The fate of this rejected silt is unclear at the moment but the word is that some of second the source of the structure of the structure of the source of the s

It may be used to reclaim land from the sea for the Shivaij statue. The most striking wy from the Them the striking the strike the s excavated material. An ambulance is excavated interest at Ari ambutance is stationed. Also, a board near the entrance here dissuades workers from urinating, spitting, smoking and sleeping inside the premises. And that mysterious white cage, it turns out, is a rescue box meant to retrieve injured staffers in case of ar



3 Boring machines
TBM propels itself forward
through hydraulic rams moving on
newly placed concrete segments.
The machine drills 8-12 metres
everyday. The finished tunnel will
be around 6 metres or 18 feet in
diameter

Lieven shafts being dug, where the tunnel boring machines will be lowered 25-30 metres below ground level. The machines have three parts

The main piece, which weighs 90 tonnes, is lowered first into shaft by 500-tonne capacity crane

The middle piece lowered

It is followed by the front part. which is the cutter

■ Heavy-duty cranes pull the wagons filled with muck from inside the shaft and load it on

5 Cut & cover: Concrete lining for tunnel stopped and a steel reinforced concrete tunnel lining is stopped and a steel reinforced concrete tunnel lining is installed. Rotating arm adds six pre-cast segments—standard segments and one tapered to close and hold the ring together. About 40,000 segment rings are required on the corridor

GIANT MACHINES WILL DIG 12 METRES DAILY

33.5km

Elevated metro ₹250cr-₹270cr Underground Triple the cost

Cost comparison (per km)

Control room inside machine The machine is operated from here. Around 30 people will be working in the tunnel at any given time. The machine also has amenities like rest room and toilet

7 TBM lifted from tunnel end
The drilling process continues till TBM reaches its destination where it recovered from the shaft to the surface

Rehab for 2,000 slums and

Station development rse level, and platfo area, connected with state-of

2021

the-art escalators & lifts Platforms designed for eight car trains

Smoke Management System and Tunnel Ventilation System **Automatic Fare Collection**



Muck moves
The excavated muck

2 How tunnel is drilled with cutters
The rock is sheared by rotating disc cutters mounted in front
of the cutter head. They can bore through any rock formation.
Water/foam is sprayed on surface to make drilling smoother

is sent into TBM via a

6 Plaster cover The gap between the concrete ring and rock is filled

19 buildings is underway

Mumbai Metro Rail Corporation's managing director Ashwini Bhide says the project is on track for comple tion in 4 years Q: By when will the underground metro be ready for

Services? Will it be done in phases?

A: We plan to complete construction by 2021. It will be in two phases. First phase from Aarey to BKC will be commissioned in June 2021, and the second phase from BKC to Cuffe Parade by December 2021.

Q: This is the longest underground corridor in India

Q: This is the longest underground corridor in India. What are the hurdles?

A: The city is witnessing such a big infrastructure intervention for the first time in recent history Being fully underground Metro corridor; it poses administrative, geological, technical and construction-related challenges as well as social and logistics challenges. High water table goo strata made of hard rock, congested areas with old and heritage structures, proximity of residential buildings, masc of underground utilities and traffic diversions. We need land parcels to hvild stations and multilary facilities.

utilities and traffic diversions. We need and parcels to build stations and ancillary facilities. Many land parcels handed over to us were encrached by slums. Rebabilitation of more than 2000 slum structures was a major challenge. Rebabilitation of legal occupants at Girgatum and Kalbadevi is also challenging. Public concern over safety of buildings as well as three cutting has also been a challenge. We have been able to tackle this also by engaging with resonle and helien transparent people and being transparent.

A: For the first time, there will be rail-based connec-tivity to ix major employment hubs. Fort, Kalladewi, BKC, Lower Parel, Worli and MIDC. It will take 66 lakh vehicles of the road which would save 3.54 lakh litres of fuel per day and reduce emission of CO2 and other greenbuse gases up to 10,000 tonnes per year. This corridor will carry 17 lakh com-muters per day and benefit 30 lakh staying in the influence zone of the corridor.

Q: When will rehab of Girgaum-Kalbadevi project-affected people (PAP) be done? A: Considering the demand from local resi-dents, we have designed an in-situ rehab dents, we have designed an in-situ rehals scheme for Girgaum-Kalbadevi, which has been approved by the state. For construction of Kalbade-vi and Girgaum stations, approx-imately 19 buildings are affected consisting of 277 residential units and 346-plus commercial units.

The plan is to rehabilitate them at the same location after carving out land for metro stations. MMRC has beld meetings with the PAPs. They have been provided rent or transit accommodation. Since redevelopment is under Dr. regulation 337, procedure to obtain Mhada NOCs is underway. Land acquisition is in progress. Once tenants get shifted in the next two months, construction of buildings and stations will be taken up. The plan is to complete most rehab buildings along with Metro station work by 2021.

Q: Why is MMRC unwilling to look for ontions other

G. Why is IMMC unwilling to look for options other than Aaray for the Marto deport?

A: The question itself is wrongly framed. The site at Aaray was selected after exploring all other options. Government had transferred the land to MMRC in 2014. However, on demands from activists, MMRC and the state revisited the issue in 2015 by stopping work and spent almost one and a half years to get an alternative site at Kanjurmary though it was not technically fully suitable. When the land could not be made available because of legal and technical issues. Aaray Colony The care depot and is not forest fand nor is it part of the eco-sensitive zone. It belongs to the dairy development department and we need just 25 hectares. There are no plans for commercial development. It is jurdy going to be used for a car depot for tracks, an administrative building, sheels, etc.

Q: What measures have you taken for safety of di-lapidated and heritage buildings along the corrido?" A: Safety of citizens is of paramount importance and hence the project is being executed by following strin-gent safety protocols and using calibrated monitoring instruments. We have conducted a Building Condi-

instruments. We have conducted a Building Condi-tion Survey for all buildings in the influence zone to which safety limits have been assigned. Pred-son monitoring instruments are in-stalled on buildings to measure im-pact of our activities. We are follow-ing the same procedures which are followed internationally.

Many land parcels were encroached by slums. Rehabilitation of more than 2 000 slum structures was a najor challenge. Rehabilita-tion of legal occupants at Girgaum-Kalbadevi is also

'Boring beasts' have their task cut out: Fewer shafts & longer tunnels

ts middle name is 'Boring'. The verb, not the adjective, although the slothful, droning noise it

the slothful, droning noise it tamakes may suggest otherwise. The Tunnel Boring Machine or TBM—as it is called in the office of Bandra's Mumbai Metro Rail Corporation (MMRC)—must execute a Rs 19,000-crore civil engineering project. Within two years, it has to—along with 16 of its kind—rlip through Mumbai's rocky stomach lining from Colaba to Bandra-Seeps to prepare the nation's longest underground tunnel, the 33.5-km-long Metro Illnetwork. To study the com-

Metro III network. To study the com-position of this underbelly, 367 nar-row bore holes had to be dug every kilometre and data excavated given to contractors to plan the project. While the TBM at Mahim's Naya

While the TBM at Mahim's Naya Nagar is already on the job, IT belta Nagar is already on the job, IT belta in all are on their marks, ready to chomp through a gravel-sand-clay-filled concrete cake that comes with toppings of unrelenting traffic, trees and buildings. It is the kind of multi-tiered cake that has pulti-gorithm of the control of the control of the agowing challenge on their results fearing loss ists fearing loss of trees, minority community members fearing loss of heritaxe, and other citizens wor-

of heritage, and other citizens wor-ried about the general wreckage.

"How many expats do we have?"
S K Gupta, the soft-spoken director (project) of MMRC asks someone.

the 34 foreigners who form the brain of the project, he says, were hired because of their international experience in such projects.

For a sense of the scale of the operation, digest these figures; 6.5 lakh tonnes of reinforcement steel, and 4,000 workers. Though it may conjure up the image of one harge, beat recome with real-time CCTV feed flashing on screens, the project is too massive to be managed from a single room. So, at the moment, workflow is designed, managed, controlled and monitored at various

TRAIN TO SEEPZ

points by consultants from nine countries including China, Japan, France and the UK. With 27 stations planned, work

Frailer and trib to be planned, work as With a standard prover by rojects, says an official. Hong Kong-based AECOM Asia-led consortium of firms including the British Louis Berger Group, French Egis Rail and Japanese Padeco are assisting in design, supervision, quality control, safety and contract management. They act as mediators between MMRC and the contractors with all the communication on a software. They are the second to the contract of the communication on the contract of the communication of the communication of the contract of the communication of the complex German yellow camerates and the communication of the complex German yellow camerates and the communication of the complex German yellow camerates and the communication of the complex German yellow camerates and the communication of the complex German yellow camerates and the communication of the communication

Mumbai's congested roads, figuring out logistics such as transport, fer-rying of raw material, leaving utili-ties such as building intact and even disposal of muck becomes a task. disposed as Demonstrate network and the control of the Control of

will be retrieved from Azad Maidan only after it cuts four km channel. MMRC executive director R Race explains with yellow 10 library 10 librar

DIGGING AT 11 SITES

Due to narrow width of Mumbai's streets, shafts will not be dug at many points for tunnelling. Unlike Delhi where digging took place in several areas, here tunnel boring machines areas, here tunnel boring machines be lowered into the city's underbelly at 11 spots to create a 33.5-km-long underground network



Ground beneath your feet noai lies on Deccan Trap Basa are believed to be formed by va flows following volcanic Rocks are believ vast lava flows following volcanic eruptions around 66 million years ago

Marine clay too forms extensive areas of Mumbai, especially along the shore as well as near creeks, tidal flat and formerly submerged areas

Silt can fill 100 Shivaji Parks, may pave way for coastal road



etro III will have two tunnels stretching 33.5km each, and 26 stations—all 25-30 metres below the ground. It means 112 million cubic metres of soil and rock materials will be excavated for the project in the next two years—enough to fill about 100 Shivaji Parks up to a height of one metre. Officials say this silt can be used for reclaiming land from the sea for the coastal road and the Shivaji statue projects. But, till work on these projects start, the silt will be dumped at seven heavily eroded stone and sand quarries in Thane,

Vasai, Bhiwandi, Kalyan, Ambernath and Navi Mumbai, says Mumbai Metro Rail Corporation

Mumbai, says Mumbai Metro Rail Corporation (MMRC) dinector (regiocts) 8 K Gupta.

Contractors have been assigned quarries where their clumpers can either dumpthe siltor sell it. Sources said most of these quarries near the creeks have an evoded cosystem and the soil from the metro will help restore them—through replantation after quarries are filled.

The quarries will accommodate six to seven million cubic metres of silt, and when work on the Shivaji statue in the sea, the coastal mod and Navi Mumbai airport start, the soil and rock materials can be diverted and used there, says

MMRC executive director (planning) R Romana. To dispose of the soil, dumpers will make one lash trips to the quarriss from 26 sists for stations and seven spots where shafts are being dug for tunnel boring machines. Each dumper will earry about 16 tonnes. This means, motorists will have to brace for chaos on roads as the Bombay high court recently ordered that digging and construction activities be restricted till 10 pm. On an average, dumper will make 1,500 trips to the quarries during the day This will eventually not only create huge traffic congestion (one dumper is equal to four passenger cars) during peak hours, but

will also add to pollution.

Asked about it, MMRC Managing Director Asked about it, MMRC Managing Director Ashwini Bhide said the dumpers will be covered with plastic and their wheels will be washed to avoid any dust pollution on the city's roads. "Tun-nelling in Mumbai is full of challenges. However, with the help of advanced technology and a team of experts, we will ensure there is minimum inconvenience to Mumbaikars during our work."

sne said.

Besides, officials say that due to the court order, the work may be delayed by six to eight months, which, in turn, is likely to escalate the project cost.