Colaba-Bandra-SEEPZ Corridor

Special Safety Measures by MMRC for Labourers' Safety in Tunnelling Operations

In Mumbai's first underground metro, Mumbai Metro Rail Corporation (MMRC) is using TBMs for the Tunneling construction works and the New Austrian Tunnelling Method (NATM) techniques Cross passages and station box construction.

- **Major activities involved during tunneling** are Launching Shaft works, TBM Lowering and Assembling, Segment Casting and Transportation, Tunnel Excavation and Segment lining installation by the TBM, and parallelly Muck disposal by Locomotives and dumpers to the muck dumping sites/land fill queries as identified by MMRC.

- TBMs can be **operated in closed and open mode** depending on the ground/geological conditions

- **Special Safety Provisions** in TBMs and tunnels
    - **Smoke and Fire Detection**/Alarm System
    - **Water Sprinkling** and Fire Curtain
    - **Dewatering Pumps** to tackle flooding
    - **First-aid** room and first-aid kits at strategic locations for emergencies
    - **Gas detectors** at Cutter Head monitoring presence of toxic gases at the TBM face
    - **Chiller plant** to maintain the ambient temperature for workmen
    - **Fire points and extinguishers** at 15-30 m
    - Walkie talkies and telephones are installed at every 100 m for undisturbed **communication**
    - Emergency lights at every 50 m for proper illumination
    - **27 Self Rescuers** inside the TBM for **25 workmen and five Self Rescuers** for the visitors are available at the bottom shaft
    - **5 Close Circuit Breathing Apparatus (CCBAs)** for emergency response team to handle fire emergencies
    - **Man Lock provision** to access the excavation chamber required for the TBM maintenance
    - Continuous site monitoring at emergency control room, using **CCTV** surveillance for early Emergency response in case of any emergencies
    - **Locomotives** for transporting muck out of TBM are installed with Speedometer, Speed Governors, Rare-view Cameras, Manchester gates and Track Signalling
    - **Electrical Cables Power supply cables** are water proof, dust proof, fire-retardant and produce low smoke and fumes
    - **First-aid** rooms available at shaft surface and inside the TBM for workmen. A team of dedicated doctor, first aider, male nurses and technicians equipped with first kit, ambulance, stretcher and resting beds are available round the clock
    - **Eye wash station** is provided in the TBM

- Some of the basic protocols that are mandatory on the site are:
- Training imparted before entering the tunnel:
    - A **96-hour Workers Safety Training**
    - Confined space safety training
    - First-aid medical training
    - Daily Tool Box Talks
    - Fire-fighting training
    - An audio-visual site-specific safety induction/brief to all visitors
    - Use of **Personal Protective Equipment (PPE)** for any site activity is compulsory
    - Number of **Workmen restricted to 25** and **five visitors** per Tunnel at a particular time
    - **27 Self Rescuers Breathing Apparatus (SRBA)** inside the tunnel for the workmen are available. Every visitor is also provided with a self-rescuer at the bottom shaft before entering the tunnel
    - Emergency ladders and rescue basket is available
    - Elevated walkways with guard rails and suitable toe boards installed inside the tunnel
    - **Emergency response plans and contact numbers** displayed in shaft area

- **Hyperbaric Interventions During Tunneling**
    - During tunneling operations workers are often required to change the cutter discs tools.
    - When the TBM is operating in closed air mode, the workers have to work in compressed air environment. This is called Hyperbaric intervention.
    - Man Lock is provided to allow workmen access to the excavation chamber for replacement of the cutter discs.
    - Manlock comprises of 2 chambers, first aid box, inspection viewpoints, compressed breathable air supply, relaxation seats, and communication lines with the workers.
    - Hyperbaric intervention is carried out in the presence of highly trained professionals and supervision.
    - In case of further emergency and discomfort to the workmen **Medical-lock** is situated at the Top of Shafts, to further handle the decompression of the workmen who went inside the compressed chambers of more than 1 Bar air pressure.

- **Approximately 7,600** of manpower, including skilled and unskilled, are on the job at MML3. This is in addition to General Consultants (GC), MMRC personnel, managers and engineers of the civil contractors and various vendors working on the project
- More than 100 safety signages are placed at each site in Hindi, Marathi and English