



MMRC

ADDING NEW DIMENSIONS

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METRO CUBE

A MUMBAI METRO RAIL CORPORATION NEWSLETTER



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MD Speaks

Ms. Ashwini Bhide, IAS

The month long wait for arrival of monsoon is finally over and the preparations for this annual affair will be put to test. As the saying goes *“the proof of the pudding is in the eating”*; how well the Metro team will meet the challenge is going to demonstrate the preparedness and will also through some more learning on what more is required to be done. Notwithstanding how the monsoons period will unfold, all the contractors' teams are prepared to continue all tunneling and station construction works throughout the monsoon at full capacity. In conformity to this, Package 7 achieved another TBM (Wainganga-2) breakthrough at MIDC Metro Station in the downline from Pali ground to MIDC. This being the 5th breakthrough in this package that has completed a total of 5.0 km tunneling with 3 TBMs. The tunneling completed till now stands at 28 km over a period of 19 months.

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Underfloor Lifting System

The introduction of modern coupled vehicles into Metro Railway system and the creation of dedicated routes for particular vehicle types have allowed the consideration of alternative lifting methods for maintenance purposes.

One such method is Underfloor Lifting System, which has for some time been common throughout Globe, where dedicated stock on selected routes is already common practice. This method allows the trains to enter the depot and run on to the underfloor lifts positioned directly below each of the vehicle bogies. With a single press of a button, the entire coupled train is then raised to allow access below for removal of bogies and any equipment modules. Combined body supports are built into some lifters, which support the vehicle body whilst the bogie is removed.

This system uses Screw Technology as the basic lifting method offering a safe system for persons to work below and it's power requirements are optimum. Embedded with the latest control technology ensures the safety and reliability of the system as well as optimum operator ergonomics for maintenance personnel.

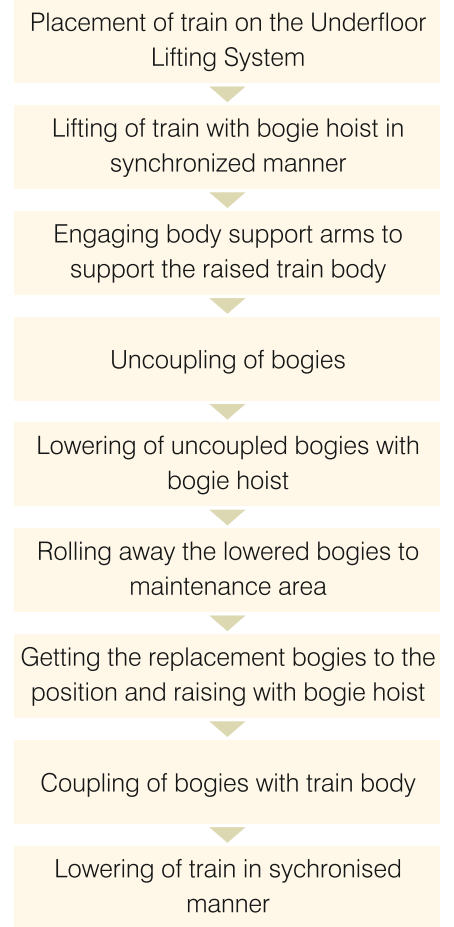
The lifting plant is monitored and controlled via a centralised Programmable Logic Controller (PLC). It ensures absolutely synchronised motions of all lifting jacks. Within milliseconds the PLC corrects any irregularity. This ensures a safety standard which is unsurpassed by any other system. Safety devices are automatically activated (safety interlocks), and maintenance personnel can safely proceed with their work details under the raised train. When combined with body support individual or all bogies can be lowered and replaced in an efficient manner as described in the flow-chart.

Synchronised Pit Jacks system provides a clear workspace when not in use, and importantly, a clear, an unobstructed flat and level workshop floor. No pit below the vehicle is required for staff to make the necessary disconnections to release the bogies as these are carried out when the vehicles have been raised on the lift tables. With the body supports in place, the bogie to be removed is lowered on the individual lifter, back to floor level and can then be pushed from below the raised vehicles for replacement.



Car body and bogie lifted with Jack support (Photograph source: Internet)

Mechanism for underfloor lifting system:



Considering the Civil Engineering requirements for the pit jacks, the underfloor units require a pit of approximately 5 m x 5 m and to a depth typically of 4 m plus, for each lifter, which results in a requirement for approx. 1600 m³ of pit construction for eight-car (8) lift system. Trailing cables on multiple jack systems would normally be installed into ducts or conduits installed in the access pit.

MMRC Completes 50% Tunneling

MMRC has achieved another significant milestone as it completed 28 km of the 56 km tunneling on the Colaba-Bandra-SEEPZ Metro-3 corridor. The work-happy team attains 50% tunneling by overcoming various challenges within a period of 19 months. The total length of 56 km is calculated on the basis of two up and down tunnels for the 33.5 km alignment deducting the underground station box lengths in between. The longest tunnel so far has been the tunnel from Vidyanagari to Domestic Airport (3.9 km) and the shortest one is from Sariput Nagar to SEEPZ (562 m). In all, 19,504 segment rings have been used to complete 28 km of tunneling.

Total quantity of cement used for casting of 19504 segment rings - **145586 m³**

Total steel used for casting of 19504 segment rings - **11983.38 MT**

Total man power deployed for tunneling - **Approx 100/TBM. 1700 for 17 TBMs**

Average tunneling done/day - **47.5 m/day**

Handling of Encountered Utilities

Metro-3 is 33.5 km long fully underground line comprising of 26 underground stations and 1 at grade station. While making way for construction of tunnels and underground station, many utilities have been encountered. These utilities belong to around 25 different owners. For better co-ordination among utility owners, contractors, engineers and employers during approval and execution stage, a lead person/coordinator was nominated by each utility owner.

Major utility owners are:

- | | |
|---|--|
|  MCGM-Water, Sewer and Storm Water Drain (SWD) departments |  Reliance Telecommunication |
|  Mahangar Gas Limited (MGL) |  Reliance Jio |
|  BEST |  Tata Telecommunications |
|  Tata Power |  Mumbai Police Department |
|  Reliance/Adani |  Airtel |

Types of Utilities Encountered

- i. Water lines: Ranging from 12 mm to 2800 mm diameter
- ii. Sewer lines: Ranging from 230 mm to void sewer of size 1625 mm X 2450 mm
- iii. SWD: Ranging from 1200 mm dia to box SWD of size 3600 mm X 3600 mm
- iv. Gas lines : Ranging from 63 mm dia. to 300 mm dia.
- v. Electrical cables: 11 kV to 33 kV, 110 kV oil filled cables
- vi. Telecommunication cables: Highly sensitive submarine cables and other telecommunication cables.

Congestion of Utility

In the south Mumbai, especially Girgaon, Grant road the adjacent buildings are of Chawl system with independent water, sewage, SWD and power connections to each and every Chawl. Handling of those line to make way for driving secant pile was really tough job. Case to case basis such utilities were temporarily shifted locally beyond secant pile wall wherever land is available and wherever land was not available these utilities are shifted inside station box and supported on secant pile wall thereafter.



Congestion of Utilities at Station location of Kalbadevi, Girgaon and Grant Road

Handling of Utilities

Most of the stations are planned in existing road. The gap between secant pile alignment and the property line are very less hence, diversion of existing utilities could not be done. Option left is only to support in existing position using hangers from decking or supporting on plunge column assembly. Many of water lines which are required to be supported are pressure lines with pressure as high as 70 bar. Supporting designs of Contractor's were scrutinised and approved by GC. GC approved design was finally approved by utility owner.

Existing Sewer lines

Most of the cases existing sewer lines are of RCC hume pipes with joints at every 2500 mm length and manholes at every 30 m apart. A new line of same diameter with material MS/GRP/CI is used to divert by the side of existing line and is supported from decking/ or by set of plunge columns. Existing manholes are replaced with MS manholes at few locations.



Existing Sewer Line is supported at Worli Station

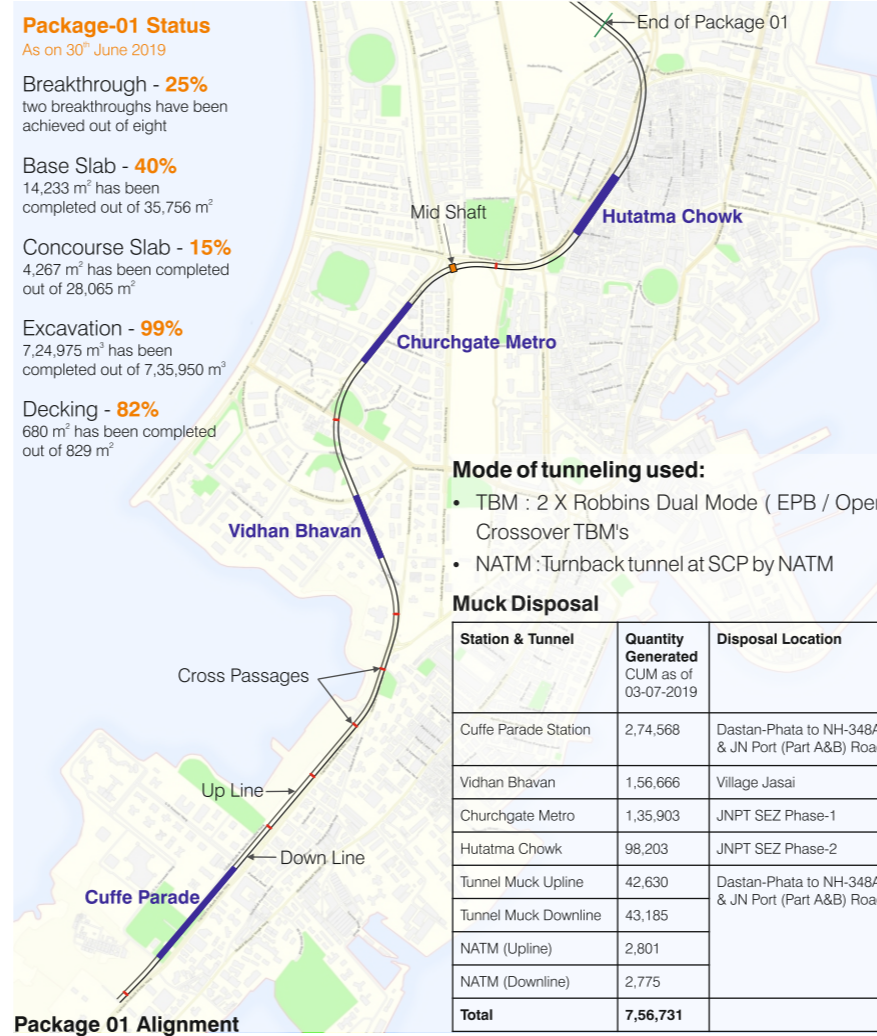
This article will be continued in next issue wherein handling of critical utilities will be discussed in detail.

All About Construction Package - UGC01

Metro-3 is a 33.5 km long fully underground corridor running along Colaba-Bandra-SEEPZ. it comprises of in total 27 stations out of which 26 are underground and 1 is at grade. The whole alignment is divided into 7 construction packages. Here we will bring the each construction package in detail through a series of articles in forthcoming issues. This article is about construction package-01.

Package-01 starts from Cuffe Parade station and ends at CST Metro station. It extends before Cuffe Parade for a length of about 200 m for the provision of stabling lines. This package includes four stations; Cuffe Parade, Vidhan Bhavan, Churchgate Metro and Hutatma Chowk. For constructing these stations, two methodologies have been used, namely New Austrian Tunneling Method (NATM) and Cut & Cover method. NATM has been adopted for the construction of Hutatma Chowk Station and remaining three stations are being constructed by Cut & Cover method. For tunneling whole package-01 alignment (upline & downline), two Tunnel Boring Machines (TBMs) have been proposed. TBMs have been named as Surya-1 and Surya-2 and are being used for upline and downline respectively.

Name of TBM	Surya - 1 (Up Line)	Surya - 2 (Down Line)
Origin (Launching shaft location)	Cuffe Parade station (north end)	Cuffe Parade station (north end)
Manufacture of TBM	ROBBINS	ROBBINS
Type of TBM	Rock / EPB XRE Crossover TBM	Rock / EPB XRE Crossover TBM
Destination (Retrieval shaft)	CST station (south end)	CST station (south end)
Total km to bore	2.932 km	2.962 km
Total Tunneling done till date	1.225 km	0.989 km
Total Numbers of rings to install	2072 nos.	2094 nos.
Total numbers of rings installed till date	791 nos. – 1.5 m 032 nos. – 1.2 m	638 nos. – 1.5 m 027 nos. – 1.2 m
Date of Initial Drive	10/08/2018	12/10/2018
Date of Main Drive	22/10/2018	21/12/2018
Length of Alignment	Up Line – 4249.79 m	Down Line – 4281.22 m

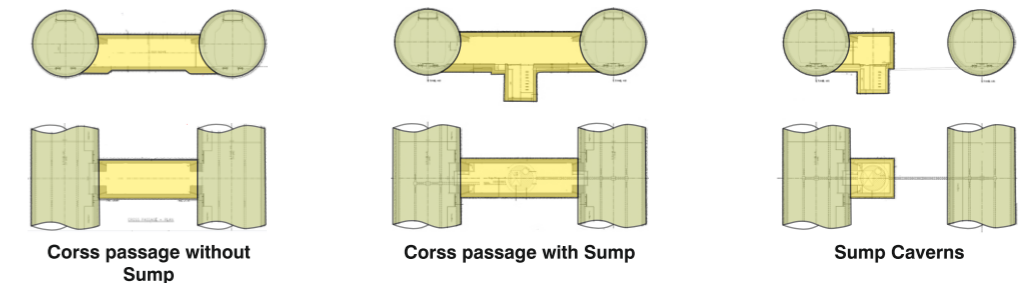


About new lunching shaft in package-01

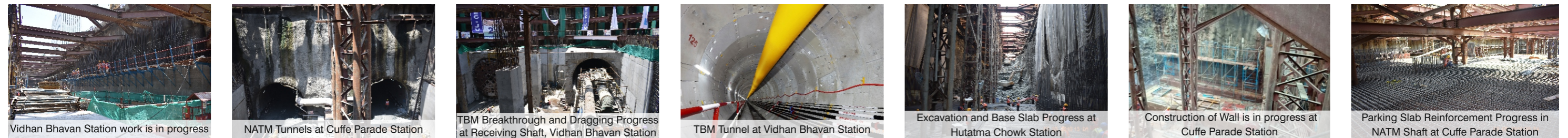
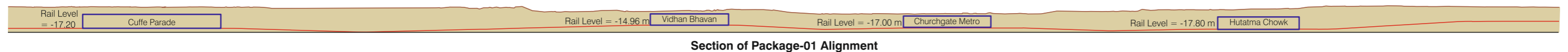
Package-01 new lunching shaft is also known as mid shaft having a area of 22 m x 27.2 m= 598.4 m² and it is located near Oval Maidan, Churchgate. Purpose of this shaft is lowering of tunnel segments and removing of muck.

Cross Passages

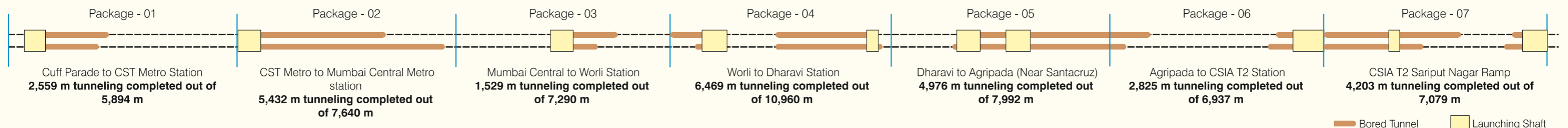
Cross Passages are required to be constructed for a certain length of underground metro tunnels to provide for emergency and maintenance access. In general, a cross passage is either built between two tunnels, or can be connected between the tunnel at surface level, more commonly known as an escape shaft. UGC-01 has total 8 cross passages, in which five cross passages are without sumps, one with sump and two are sump caverns in the bored tunnel stretch between Cuffe Parade turnback tunnels till the Hutatma Chowk Station. The provision of these cross passages is based on the requirements of NFPA (National Fire Protection Association) and necessity of providing sump at low level points.



The cross passages in the project are to be constructed using NATM technique. The geotechnical investigations at the cross passage/tunnel location has revealed the presence of competent rock mass at the intended depth and location of cross passages. A sealing layer of shotcrete will be provided immediately after the excavation. The primary supports as and when required will be provided according to the designer's recommendations /geological profile. After the completion of excavation for the cross passage, the cast-in-situ secondary lining will be installed.



Tunnel Progress Update - As on 28th June 2019



Expert Speaks

Interview with Mr. Vivek Sahai



Mr. Vivek Sahai is a distinguished Fellow at ORF. The projects he is currently associated with include performance of Indian Railways, Mumbai's transport network and urbanisation process in India. Mr. Sahai started his career with Indian Railways in the year 1973. He retired from the apex post of the Chairman Railway Board in 2011 and acquired critical knowledge on Mumbai's suburban network while working as Divisional Railway Manager of Mumbai Division of Central Railway and Additional General Manager of Western Railway. He planned the Chhatrapati Shivaji Terminus Mumbai yard remodelling in 2001-02 making it possible for introduction of several new trains and has also won plaudits for restoration of suburban services within four hours of the serial train blasts in Mumbai suburban system in 2006. Mr. Sahai assisted the National Transport Development Policy Committee of the Planning Commission under the Chairmanship of Dr. Rakesh Mohan and also served as an advisor to the Minister of Railways, Mr. Mallikarjun Kharge in 2013-14.

1. Being an ex-Railway Official, what is your opinion about Mumbai's first fully underground Metro-3 project? Why a city like Mumbai needs it?

Indian Railways have been catering to the needs of commuters for over 100 years as it is the most affordable mode of transport for Mumbaikars. However, last mile connectivity is a problem. Many areas in suburbs do not have rail connectivity. A Mumbaikar has to rely on road public transport (bus, cabs or auto rickshaw) to reach station. To overcome this issue, metro rails will provide last mile connectivity and also improve the travelling experience of the commuters. It will be like sharing the complete resources of three different kinds of services complementing each other for the passengers.

2. Do you think the present transportation system is feasible for people with special needs?

The railways have provided separate compartments for disabled commuters to make their commuting easy and hassle free. However, the reserved coaches for them are almost always encroached upon by the general commuters. For visually impaired, guiding blocks of tactile tiles have been laid on every platform. Sound devices have been installed at the door to sense the door opening of the coach as well as the movement of the train. Presently, fully functional escalators have been installed for quick evacuation of crowd on platforms but, it is not useful for disabled commuters as wheel chair bound people and people with crutches cannot use it. Elevators need to be provided at all railway stations especially long distance train platforms, so that they do not have to climb stairs to switch onto stations. Hopefully, Metro Rail System will provide disabled friendly facility travel experience to cater to their needs.

3. With emergence of Metro Rail System in the city, do you think it will change the whole transportation scenario of Mumbai?

Just as water finds its level under the gravitational force, volume of commuters patronising a mode of traffic finds its level under the economic forces operating. Pocket friendly fares will definitely increase the ridership of Metro. I would suggest that the Metro Rail should keep itself nimble enough to quickly respond to increase in traffic. I would advise to keep the length of platforms keeping in mind anticipated increase in passenger traffic in the next 10 years, so that metro rakes can be augmented easily. Indian Railways almost took 15-20 years to change from 9 to 12 coaches and the increase from 12-15 coaches is stuck for the same reason. I'm sure Metro projects will take care of it.

4. After Metro-3 becomes operational, will it ease overcrowding on Mumbai Suburban Lines?

The Indian Railways have 1st & 2nd class compartments and frequency of trains in every 3-5 minutes. Railways are the cheapest and most affordable mode of transport for lower- and middle-income group. Despite season tickets being very cheap still of about 35% single journey tickets are sold every day. This is because there is a huge population engaged in informal employment. So, it all depends on the fares of Metro-3 once it becomes operational. 90% of Mumbai's population travel in second class and

remaining 10% travels in first class. India is becoming an affluent country and I believe the 1st class passengers will definitely shift to Metro, but it all comes down to fares. If it is affordable, then we can expect diversion of commuters. It is the increase in fare which comes as a sudden jump; to which passengers are sensitive. In my opinion, fares should be increased every year by 3-5% or whatever is the inflation rate. If this policy is implemented, the commuters will not feel the pinch of excessive increase in fares. Fare structure should be planned in such a way that it can help the organisation to remain viable and also provide quality of travelling experience to the commuters.

5. Passenger interchange facility will be provided at existing Central and Western Railway Stations by Metro-3. Do you think it will be an advantage for the commuters as well as Railways and Metro-3? In your view, what actions/works are expected from railways to make these interchanges more efficient.

I would suggest keeping common pass for Railway, Bus and Metro-3. This will make it easier for passengers to interchange from existing suburban railway stations to Metro. Also, travelator, escalator or walkway should be provided at the interchange suburban stations for hassle free switch from Metro stations to suburban stations and vice versa. Metro-3 ridership will slowly but steadily increase if the Indian Railways and MMRC go out of their way to streamline the travelling experience of Mumbaikars.

Continued on Page 7



MD Speaks

Continued from Page 1

Construction work at various Stations is in different stages like casting of columns, construction of base slabs, concourse slabs etc. At Acharya Atre Metro Station, work to support a 50-year-old sewer line is in progress. Although, the pipeline is not in good condition, it will be converted into a Glass Reinforced Polymer (GRP) line & then be supported within the station box area by steel framing. Contract Package 15; Tunnel Ventilation & Environmental control system (TV & ECS), Phase-2; BKC to Mumbai Central (Lot-1), has been awarded to Blue Star Limited on 18th June followed by contract agreement signed on 28th June 2019. With this, 14 system contracts are awarded till date. In all the earlier awarded system contracts, contractors' teams are mobilised, preliminary and final design activities are underway.

Team MMRC observed World Bicycle Day to spread the message of clean environment healthier life and sustainable transport for better living conditions of Mumbai. It's an accepted fact that Bicycles are most efficient mode of last-mile connectivity for public transport like Metro. The team cycled from Vidhan Bhavan Metro Station to CSMT Metro. MMRC Leadership firmly believes that mega infrastructure projects like Metro-3 should offer younger generation training opportunity to gain hands on experience. In this regard 100 internships are being offered twice a year (Summer and Winter) for undergraduate (UG)/post graduate (PG) students of Engineering, Architect and Management courses. In addition to this, MMRC in collaboration with Observers Research Foundation (ORF) have launched a Students Design Competition for Multi-modal integration planning of Metro-3 station areas. This competition is thrown open at the beginning of new academic year (2019-20) for final year students of UG and PG programs of Engineering and Architecture colleges.

As they take part in the competition, the students will be applying their knowledge of engineering, architecture, public space planning process, environmental sustainability which they are going to use in their future professional life. It is expected that young minds will not only offer some great ideas under this crowd sourcing approach, they will also be part of the history of Metro-3.

52 teams comprising 238 students from 13 Engineering and Architecture institutes across MMR will participate in this competition which will go through different stages of design enquiry, interactive discussions and reviews with the student around 26 Metro Station areas of Metro-3. Results of the competition will be announced in November 2019.

Team MMRC wishes all citizens to have a safe and pleasant Monsoon 2019.

Expert Speaks

Continued from Page 6

6. With the increasing population and changing technologies, what are your thoughts on how transportation will be like in the future?

We survive on this planet by use of the land. A land has limitations, how much water would be available below, how much clean air would be available above, all that depends on the congestion you create on the piece of land. I am in favour of well-planned mode of transport for residential areas, industrial areas and business districts. Proper planning is important. Metros have come but the problem of last mile connectivity is still not attended. Public transport has to provide end to end connectivity at both the ends. For changing technologies, I am in great favour for bringing in electric buses and electric cars so there is less pollution on roads. Keep elevated roads for public transport (electric buses) right outside Metro stations and no personal vehicle should be allowed access on it. A bus going on an elevated road providing last mile connectivity can reduce travel time and ease commuting experience. If buses are provided, the overall cost of transport comes down tremendously, as operational cost of the buses is very low compared to other modes of transport. Common pass to share the fare will definitely increase ridership.

7. Lastly, ORF will be co-hosting competition for Station Area Planning/Management and Multi Modal Integration for Metro-3 stations. How this competition will benefit the project?

It is one of the most challenging and magnificent project in today's time. All these young lads have got a great opportunity to apply their minds for the first fully underground project of Mumbai. The competition is a great platform for their intellect to look for lateral solutions. These students will be its users in future in a big way, as they are commuting on suburban railways and know its shortcomings and difficulties of it.

The daily commuting experience will help them to look for solutions to the problems. The participants of this competition will have a sense of ownership towards the project as they would know that their inputs have been incorporated to improve the travelling experience of the metro. It will be a victory of rational thinking. They might have ideas which we would not have thought of. I'm looking forward to wonderful solutions and creative ideas from these young minds for Metro-3 project.

"On an ending note, I would like to say that I am delighted with the way the work of Metro-3 is progressing, comforting to see the 50% tunnelling work has been completed so far. The milestone is an achievement for the whole team of Metro-3. I give my kudos to the MD and whole team of Metro-3 for it. I wish the team all the very best. Once Metro-3 becomes operational I am sure it will be patronised by large number of commuters".

News @ MMRC



To encourage student participation in planning Mumbai's infrastructure, MMRC in collaboration with ORF Mumbai is initiating the "Mumbai Metro Line 3 Student Competition" on station area planning & management for Line-3. 52 teams-238 innovative minds from 13 Engg & Arch colleges across MMR will be participating in this competition. The inaugural workshop of the Student competition-connecting the unconnected was inaugurated by Dr. Ramanath Jha & Mr. R. Ramana, ED(Planning), MMRC followed by speed talks by start-ups to guide students.



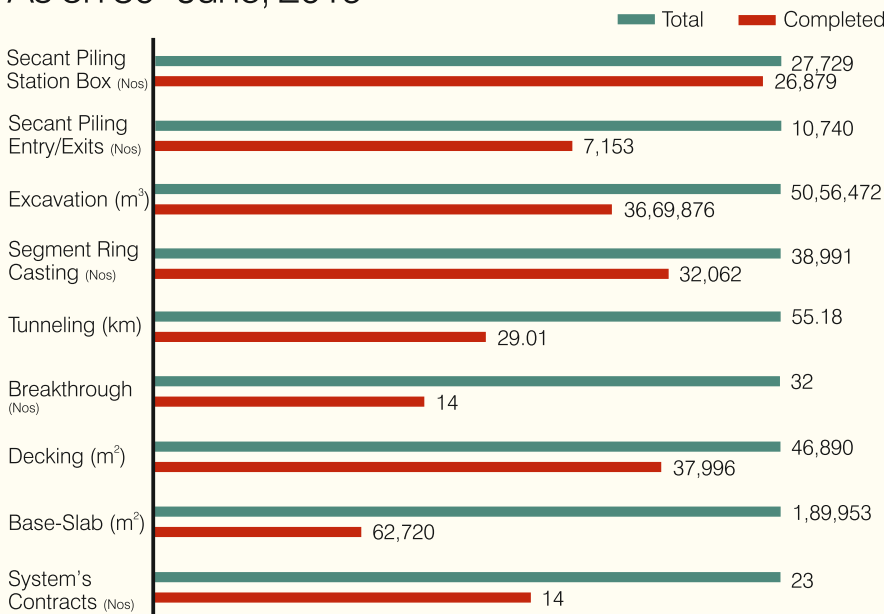
Managing Director & Director Project of MMRC had visited to MCGM Emergency Operation Centre (EOC) at MCGM HQ. The functions, working of EOC and facilities provided were explained by Shri Narvekar in charge of EOC. It was suggested that Metro-3 details could be superimposed on the base map and integrated with the existing features.

MMRC will explore sharing of such information suitably.



MMRC organized Bicycle Rally to mark the occasion of World Bicycle Day. MMRC Team cycled from Vidhan Bhavan metro station till CST spreading the message for a cleaner environment and a healthier life. MMRC, from Vidhan Bhavan Metro Station with a motive to sensitize Mumbaiers about the greater benefits of using sustainable mode of transport, a common factor between cycle and metro.

Project Progress Update As on 30th June, 2019



MMRC celebrated International Yoga Day in the office premises

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