Project Note

Mumbai is popularly known as Commercial Capital of India. The city and the metropolitan region surrounding the city have grown rapidly over the past few decades. The population within the MCGM limit has increased from 4.2 million in 1961 to today's 12.44 million (As per 2011 Census). The growth of vehicular traffic is no exception. The city currently has close to 25 lakhs of vehicles with 500 new vehicles getting registered every day. With the present road network of about only 2000km, it is becoming difficult to handle the traffic. In order to improve the level of service, MCGM has carried out various studies in the past through reputed consultants and have identified new road links that would help decongest the existing road network. With the growth of residential and commercial development in the city, there has been an increase in demand for adequate infrastructure improvement in the suburbs to ensure proper connectivity. It has become necessary to address these issues on priority.

The city of Mumbai, due to its Geographical constraints has grown in a linear manner. The historical development of Greater Mumbai is characterized by concentration of commercial and business activities in the Island city in the South and development of predominantly residential activity towards the North along the Western and the Eastern Suburbs.

The transportation corridors in Mumbai have also therefore evolved longitudinally traversing along the North – South axis with very few East-West linkages. With rapid growth of the Eastern and Western suburbs of Greater Mumbai in the last few decades, an urgent need was felt for strengthening of the East–West road connectivity between the eastern and western suburbs. The transportation Study carried out by M/s Wilbur Smith and Associates, as early as 1963, had emphasized the need for development of the East-west linkages for Greater Mumbai. Four major East-West link roads were then planned for connecting the Suburbs to minimize travel time and cost.

Several studies thereafter have been carried out by MCGM and MMRDA with a view to improve the traffic and transportation problems of the city and suburban. One of the study was carried out by MMRDA through M/s Consulting Engineers Services (CES) India Pvt. Ltd. in the

year 2003 wherein a Master Plan for Road Network Improvement and Traffic Dispersal in Greater Mumbai was proposed.

The report of M/s CES, has indicated that the Goregaon Mulund Link Road is one of the major link that needs to be developed on priority for connecting Western Suburbs in Goregaon and Eastern Suburbs in Mulund.

The MMRDA had also carried out Comprehensive Transportation Study (CTS) for Mumbai Metropolitan Region (MMR) with an objective of preparing a Comprehensive Transport Plan for MMR for the horizon period ending 2031. The study has proposed extensive transport network for the travel needs of MMR for the horizon period up to 2031. The proposed road transport corridors included several missing links, which provide faster transport connectivity between Greater Mumbai and rest of the region as well as the road networks within the city.

In order to ease the traffic congestion and to improve inter-urban road and rail infrastructure, Mumbai Metropolitan Region Development Authority (MMRDA),the nodal agency responsible for the planning and development of region's infrastructure has thereafter evolved many projects for the development of region under Mumbai Urban Transport Projects (MUTP).With a view to supplement the efforts under MUTP,MMRDA had also embarked upon an ambitious programme of infrastructure development in Mumbai region under Mumbai Urban Infrastructure Project (MUIP). The East West link roads were identified as priority roads. The three major east-west corridors connecting WEH & EEH in Mumbai Suburbs mentioned below formed part of MUIP.

1) Santacruz-Chembur Link Road (SCLR)
2) Andheri-Ghatkopar Link Road (AGLR)
3) Jogeshwari-Vikhroli Link Road (JVLR)

All the three above mentioned major links roads providing east- west connectivity for the suburbs have become fully operational. All these link roads are now reaching their saturation limits resulting in traffic congestion and delay during peak hours. The need to augment the east-west connectivity has therefore become very crucial and is required to be addressed to on war footing.

The GMLR is the fourth and the most important east- west link planned for providing the much needed connectivity for the suburbs. The GMLR envisages road connectivity from Western Express Highway at Goregaon in the Western suburb to Eastern Express Highway at Mulund in the Eastern suburb. The completion of the GMLR will vastly decongest the existing road network of the Mumbai's suburbs.

Presently, this link of varying road width is in operation on both the eastern and the western suburbs. On the eastern suburb, the road is existing from E.E.H. to Khindipada junction, while on the Western suburb the road is existing from W.E.H. to Film City. The presently existing road varies in width from 15m to 45.70m, although the proposed final width of GMLR as reflected in the sanctioned revised D.P. of 1991 is 45.70m.

The stretch of GMLR between Film city and Khindipada Junction forms the missing link. The missing link is reflected in the Development Plan sanctioned by the State Government in 1991-92 as a 45.70 mt wide D.P. road. The said proposed D.P. Road passes through Sanjay Gandhi National Park (SGNP) and has therefore not been developed. This East-West link is therefore incomplete and does not serve the intended purpose. It has therefore become necessary to explore the possibility of constructing this missing link to ensure complete connectivity along this GoregaonMulund link road. The possibility of exploring various options to develop this missing link has therefore been initiated by MCGM.

The study carried out by M/s CES suggested certain alternative to the alignment originally proposed in the D.P. of the MCGM. In view of the report of M/s CES and the alternative alignment suggested by them, MCGM had appointed separate technical consultant M/s Pentacle Consultants (India) Pvt Ltd. to prepare a Detailed Project Report. M/s Pentacle Consultant Pvt ltd had in the year 2015prepared a Detailed Project Report on alternative alignment for GMLR. In the DPR M/s Pentacle had in their report suggested some options.

Among the suggested options, the alignment comprising of an Elevated corridor connecting WEH near Goregaon Flyover and EEH near Mulund running along Aarey milk colony, Powai Lake and Bhandup Complex area along Trunk Main water line was proposed as the best option and the detailing has been carried out by them for this option. The option envisaged approx 13.6km of an elevated

road with 1.7km connector and 1.5km at grade road at entry/exit at WEH & EEH respectively. The alignment passes along existing Aarey Road in Aarey colony and then through Bhandup Complex up to Mulund. The alignment further traverses to Khindipada on existing Goregaon Mulund Link Road crosses LBS Marg and end up on EEH as shown in figure: 1

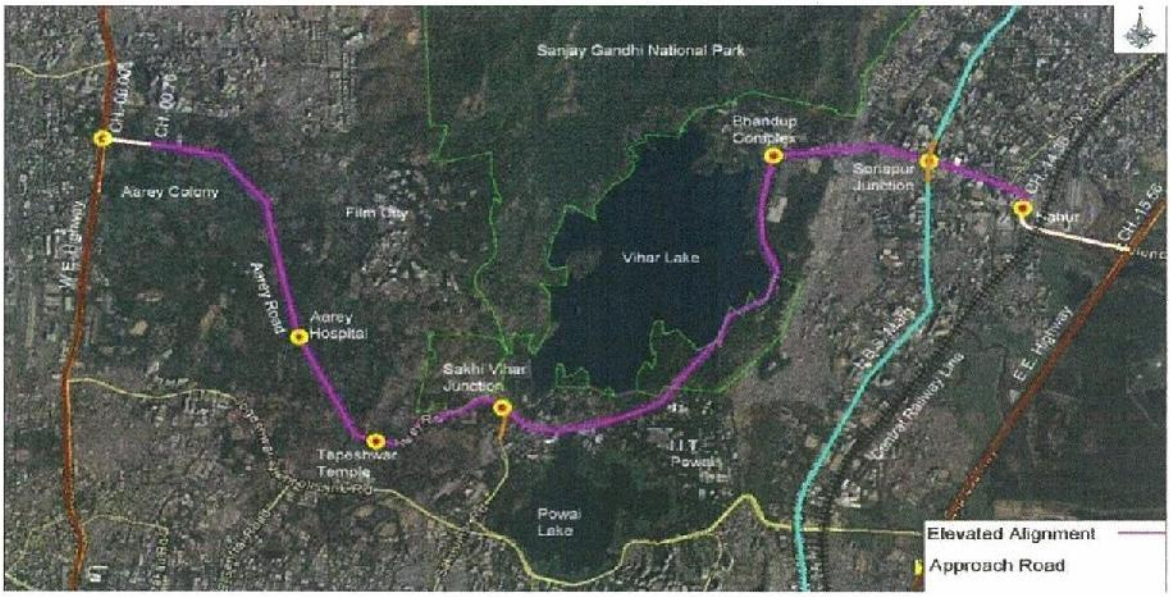

Figure:1Proposed GMLR Connectivity (Based on M/s Pentacle study 2015)

However, due to various constraints namely, removal of large number of trees, Safety of Water reservoir, Zigzag alignment, more number of PAP's in the proposed alignment along Aarey colony, L&T, IIT campus, it was decided to appoint M/s. PADECO Co. Ltd. as a consultant to peer review the DPR and accordingly finalize the most suitable alignment for Goregaon Mulund Link Road.

M/s. Padeco co. Ltd. has carried out the peer review of the Detail Project Report submitted by M/s. Pentacle. After reviewing the various options mentioned in the DPR submitted by M/s Pentacle, M/s Padeco have indicated that the elevated corridor option proposed in the DPR has lot of constraints. The alignment proposed in the DPR submitted by M/s Pentacle passes through Aarey colony and will cause adverse impact on the prevailing ecology and environment. It will also involve cutting of large number of trees within the Aarey colony and Bhandup Water treatment complex. The alternative will also jeopardize the safety and security of water supply system at Bhandup Complex.

In order to offset the adverse impact on the environment and to limit the constraints of land acquisition and tree cutting, the peer review consultant has suggested an alignment involving construction of a tunnel underneath SGNP as the most desirable option. The proposal envisages a twin tunnel of length of 4.7 Km. below SGNP starting at Film city at Goregaon and exiting at Khindipada at Mulund. In view of the proposed tunnel, the length of the proposed Goregaon Mulund link road will get shortened to about 12.2km. The proposed alignment starts near Dindoshi Flyover on Western Express Highway and connects the Eastern Express Highway near Nahur crossing LBS marg. The salient features of the proposed option, based on desktop study areas given below Table 1.

Table1:- Salient Features of the new Proposal

Sr.No	Description	Value	Remarks
1	Length	5.96km	Tunnel – 4.7km underneath SGNP
2	Number of lanes	4+4 lane at grade Tunnel -3+3 lanes Elevated-3+3 lanes	
3	Proposed Structure	Twin tunnels in National Park area and approach roads on both sides.	
4	Connecting Points	Near Dindoshi Flyover on WEH and near Airoli Junction on EEH	

Based on Geotechnical Investigation and topographic survey within SGNP, the alignment has been fixed in such a way that

1. There will be no land acquisition inside SGNP
2. R & R will be minimum
3. There will be minimum disturbance during construction.
4. Shortest Route Alignment.
5. Alignment will be planned consistent with the DP road.

Figure 2 GMLR Proposed Tunnel Alignment Option by M.s Padeco Co ltd

The underground tunnel is proposed on this alignment near film city in such a way that the tunnel passes underneath the Sanjay Gandhi national park area without disturbing the premise of SGNP in any way whatsoever. The project also does not involve any land acquisition within Sanjay Gandhi National Park. As an underground Tunnel is proposed along this alignment, it can be ensured that there is minimum disturbance to flora and fauna and there is no adverse effect to the water supply system and the lakes situated in the area.

The exit point of the tunnel on Mulund side is located at Khindipada outside the SGNP premise and hence it will not involve any land acquisition in SGNP area. The alignment has been planned with minimum land acquisition beyond SGNP area and maximum benefit to local traffic and through traffic.

A comparative table of the proposed Tunnel project and the earlier Elevated option suggested by M/s Pentacle is tabulated below to finalize the most preferred alternative.

Table 2:- Pros and Cons of GMLR Proposed Alignment Options

Sr. No.	Item	Elevated Corridor Option of M/s Pentacle Advantage/ Disadvantage	Tunnel Option from M/s Padeco Advantage/ Disadvantage	Remarks
A	**Physical Infrastructure**			
1	Number of lanes for each direction	2 lanes	3 lanes	Need more than 2 lanes in future for elevated option
2	Length of corridor	19 Km with 13.5km of elevated corridor	About 12.20km with 4.7km tunnel	Elevated corridor adversely affects the ecology of Aarey colony
3	D.P road provision	No D P Road provision from Aarey road to Bhandup complex	Major portion is on DP Tunnel is also reflected in Draft DP 2014	
B	**Road User Benefits**			
1	Travel time	Not significantly reduced	reduced considerably	Travel time will be reduced to half in case of tunnel alignment
2	Connecting roads	2 connectors proposed along the corridor.	No intermediate connection	
3	Travel cost	with length not reduced significantly and corridor being congested, there will be	Considerable saving in fuel cost	Elevated corridor should be minimum of 3 lanes for each direction

The Consultant M/S Padeco Co. Ltd. had in the Peer Review Report proposed the alternative options with tunnel underneath the Sanjay Gandhi National Park (SGNP) to avoid cutting of a large number of trees and also to avoid adverse impact on the environment of Aarey colony. The tentative alignment of the Tunnel proposed in the Peer Review Report was thereafter confirmed and finalized based on the Survey and Geotechnical Investigation carried out by the Consultants. A Twin Tube Tunnel under the Sanjay Gandhi National Park (SGNP) is now proposed for a length of about 4.7 Km from Film city at Goregaon to Khindipada Mulund.

Project Description

- **Type of the project-** Twin Tube Tunnel Road Project- 4.7Km (3+ 3 Lan,e) Missing Link of Existing Goregaon Mulund Link Road for connectivity of road from East to West corridor of Mumbai.
- **Relevance of the project:** It is the missing link proposal which, if completed would provide the much needed East-West connection in the Suburbs, while at the same time ensure protection of the environs of SGNP and Aarey colony. The project assumes enormous significance as it will help meet the following important objectives.
  - To augment much needed road connectivity between eastern and western suburbs
  - To propose an alignment along the shortest route
  - To establish a high speed, high capacity, East-West link
  - To plan the link without adversely affecting environment, SGNP, Aarey & the lakes

Project Benefits:

- The travel time will get reduced by almost one hour between Mulund and Goregaon
- Traffic congestion on Western Express Highway and the Link Roads will be substantially reduced
- Saving in Fuel Consumption to a substantial extent
- Cutting of about 2224 trees envisaged earlier option will be avoided
- Win- win situation as Road Link gets established without disturbing SGNP, Aarey and the city's lakes

- **Project coverage, master plan, phasing and scope:-**

The tunnel project forms part of the Goregaon Mulund Link road. The GMLR is already reflected as a 45.70 mt wide Development Plan road in the sanctioned revised Development Plan of Greater Mumbai. The alignment of the Tunnel is also reflected in the Sanctioned Plan for Greater Mumbai 2034.

The widening of the existing roads along the alignment of MGLR is already undertaken separately in a phase wise manner. The Twin Tube Tunnel with approach road is now being proposed under this project with a view to complete the missing link and ensure east west connectivity.

The tunnel construction will be undertaken on a Design Build Contract basis.

The details of the proposed tunnel is as under:

- Length of Twin tunnel underneath SGNP – 4.7 km
- Difference between two Tunnel – 15 m
- Tunnel Diameter – 14.2 m
- Tunnel depth varying from 20mt to 220 mt
- To avoid invasive activity, Tunneling methodology is proposed by use of TBM only without any shaft inside SGNP
- Ventilation inside tunnel proposed by way of artificial means
- Area of Tunnel underneath SGNP - 21.50. Ha approx (does not involve diversion of any forest land on the surface)

- **Description of a project site:** - Tunnel Alignment passes through Hilly terrain of Geology profile comprising Basalt and Breccia as per Geotechnical Investigation report. Tunnel and Approach Alignment level is matched with existing at grade road on both ends. The project involves Partial resettlement of R/R at Khidiapada and Film City side of Entry and Exit of Tunnel which is beyond the SGNP boundary.
- **Capacity**: - The configuration of Road Tunnel is 3 lane + 3 lane for traffic from East to West vis sa vis West to East. The total capacity traffic Total volume PCU/Day anticipated is 28271nos from Mulund and 40230 no from Goregaon for projection for the horizon period 2042
- **Technologies involved for design, construction, equipment and operation:** - Advance Technology Tunnel Boring Machine of 14.2 m approx. will be used for Tunneling work below Sanjay Gandhi National Park. RCC Segmental Lining will be used for Surface permanent lining of Tunnel. RCC road pavement will be constructed by Paver machine and all advance technology for surveillance, firefighting equipment's, ventilation system, Substations at both ends and Control room to monitor the traffic will be installed in Tunnel.
- **Use of existing public infrastructure** – Existing GMLR Road for construction material transportation will be used.
- **Estimated water budget for the proposed project**- 92KL/Day for construction

- **Estimated cost of development of the project:** - Rs 2000 crores estimate approx.
- **Details of land acquisition, rehabilitation of communities / villages present status of such activities**'/R settlement and Land acquisition is already in progress which is beyond the Sanjay Gandhi National Park boundary.
- **Resources, manpower and time frame etc** –required for project implementation :- Tunnel Boring Machine, Heavy Crane, Excavator, Dozer, Pavers etc Total 500 manpower is estimated and 4 year Time frame is anticipated for completion of project.
- **Total Muck generated** :- 2.3 Million cubic meter

Chief Enginee.
(C.T.I. & R.C.)
Chief Engineer
(C.T.I & R.C)