ISSN (Online) 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Special Issue
INSIGHT'17 - Advanced Transportation Systems And Infrastructure Development in Developing India

Collation between Underground and Elevated Metro System

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***Abstract :-* Pune, the cultural capital of Maharashtra and Oxford of the east, has now emerged as an important industrial and commercial center. Due to rapid development in economic, industrial and commercial activities, there is an enormous increase in traffic which causes traffic congestion and pollution problems. There are arterial roads passing through Pune city. National highway No. 4, 9, and 50 are some of the important state highway across pune city. From geographical point view, this city is divided by MulaMutha and Pavna rivers. As this city is divided by railway lines of Central and South Central Railways, there are number of crossings. Due to this there is tremendous traffic congestion on important roads in the city.**

As there is a poor and slow public transport connectivity, one loses time to reach from one destination to the other increasing usage of personal vehicles to travel within the city causing the traffic congestions. Aunderground metronetwork will minimize the transport time and also reduce the road traffic in the heart of the city.

This paper proposes that an underground metro connectivity will be more beneficial rather than an elevated metro as in Delhi, Mumbai and Bangalore and highlights various parameters of its onsite implementation

***Keywords: -* Oxford of the east, traffic congestion, arterial roads, underground metro network**

I. INTRODUCTION

A metro or a metropolitan railway system is a passenger transport system neededin an urban area having a higher frequency of traffic. Rapid transit systems are typically located either underground or elevated viaducts above the street level. Elevated metro system is a rapid transit railway with tracks above the street level via ducts or other elevated structures. On the other hand underground metro , as the name suggests the tracks are below the ground surface.

We definitely need a very good public transport system which can solve the traffic congestion problems which are increasing due to the increase in the number of vehicles on roadand elevated metro would also add more to the problem, hencethis paper has been proposed to enlighten the advantages of underground metro over elevated metro systems.

II. LITERATURE SURVEY

William Cartwright suggested that the results of an evaluation of this proposal for a new map for the Melbourne metropolitan rail system. It begins by providing a brief history of metropolitan rail maps in Melbourne, to provide a background to what now exists. Then it looks at this recent proposal and outlines Raghavendra V1, Stanley Jose, G.H Arjun Shounakand Dr. T.G system subjected to gravity, hydrostatic pressure conditions combined with blast induced pressures. The intention is to study the blast effects of a terror-attack on the tunnel system, by simulating a pressure wave and study the effects on neighbouring tunnels for various time instances. This geotechnical and structural modelling along with its analysis are carried out using ANSYS. The validation of the results with Kirsch and Bray's solutions is the back bone of this numerical model. Further, plane-strain analysis is done to study the effects of various shapes of tunnels under such loads, by comparing the responses of single and twin, with and without support systems.

ITA Working group Number 13 answers the question about how the decision is made as to whether to place Urban Mass Transit Systems above ground (either at surface or elevated) or underground. Following collection of a substantial amount of data from 30 cities in 19 countries, representing the situation from 1995 to 1998 (with some later updates), analysis of that data and deliberations on the issues raise d has led to the findings and recommendations contained in this report. For many developing

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countries, the investment cost of a fixed guideway urban mass transit the basis for evaluation, which is built around the design principles of Beck's London map. Finally, it provides the results from the evaluation, reports on conclusions from this evaluation and makes recommendations about how the proposed map might be improved.

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III. METHODOLOGY

There are two types of metro -

- Underground metro
- Elevated metro

I) Undergroundtunneling by using TBM

A **tunnelboringmachine(TBM)** also known as a "**mole**", is a machine used to excavate tunnels with a circular cross section through a variety of soil and rock strata. They can bore through hard rock, sand, and almost anything in between. Tunnel diameters can range from a metre (done with micro-TBMs) to almost 16 metres to date. Tunnels of less than a metre or so in diameter are typically done using trenchless construction methods or horizontal directional drilling rather than TBMs.

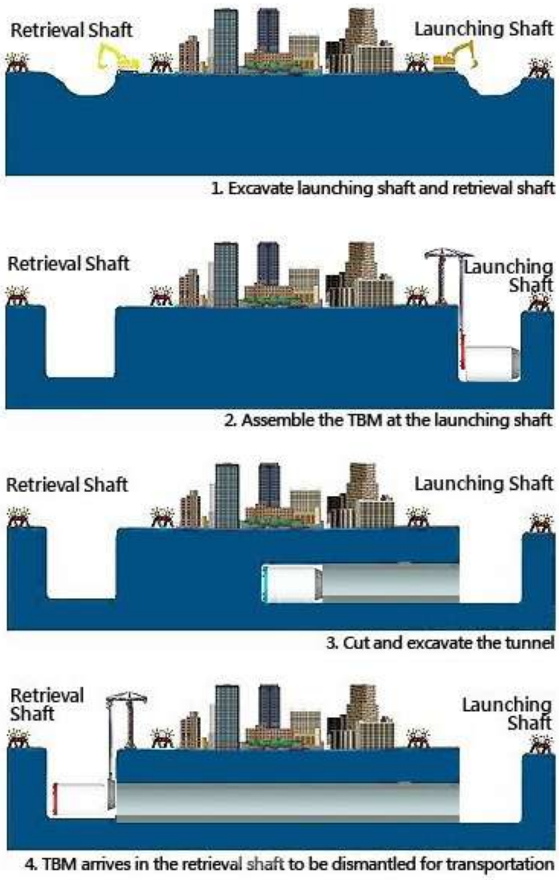
Tunnel boring machines are used as an alternative to drilling and blasting (D&B) methods in rock and conventional 'hand mining' in soil. TBMs have the advantages of limiting the disturbance to the surrounding ground and producing a smooth tunnel wall. This significantly reduces the cost of lining the tunnel, and makes them suitable to use in heavily urbanized areas. The major disadvantage is the upfront cost. TBMs are expensive to construct, and can be difficult to transport.

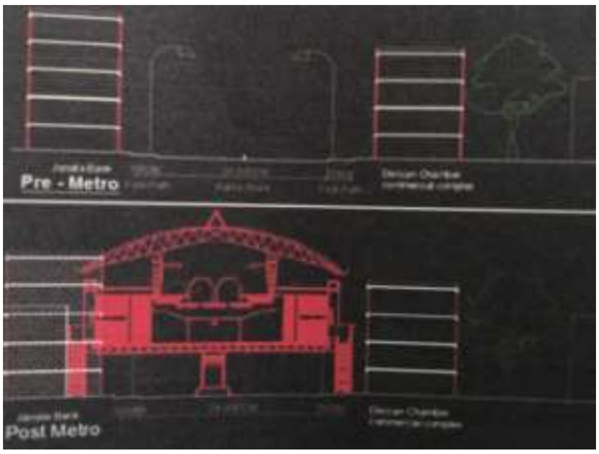
However, as modern tunnels become longer, the cost of tunnel boring machines versus drill and blast is actually less—this is because tunnelling with TBMs is much more efficient and results in a shorter project.

Urban tunnelling and near surface tunnelling Urban tunnelling has the special challenge of requiring that the ground surface be undisturbed. This means that ground subsidence must be avoided. The normal method of doing this in soft ground is to maintain the soil pressures during and after the tunnel construction. There is some difficulty in doing this, particularly in varied strata (e.g., boring through a región where the upper portion of the tunnel face is wet sand and the lower portion is hard rock).

TBMs with positive face control, such as EPB and SS, are used in such situations. Both types (EPB and SS) are capable of reducing the risk of surface subsidence and voids if operated properly and if the ground conditions are well documented.

When tunnelling in urban environments, other tunnels, existing utility lines and deep foundations need to be addressed in the early planning stages. The project must accommodate measures to mitigate any detrimental effects to other infrastructure.





Elevated metro

Most of viaduct structures are being constructed using pre-cast segments installed using the underslung girder technique. The advantage of this technique is that it enables the viaduct deck spans to be erected very rapidly on site with minimal disruption to traffic below.

Viaducts are essentially multi-spanned bridges crossing over roads or rivers or valleys. On the Gautrain project, viaducts typically span in the order of 40 to 50m between piers.

Over the past months erection of viaduct decks has been ongoing at many locations along the route. Three girders are being used simultaneously and together they will erect approximately 10.5 kilometers of viaduct deck structure.

IV. ADUCT CONSTRUCTION

Designed in Singapore and fabricated in China, each set of launching girders weighs about 400 tonnes. These massive 118 metre long, hydraulically powered, steel structures are fitted onto the sides of the pier heads using temporary brackets.

The Launching Girders span between two of the bridge piers at any one time. The pre-cast segments of the viaduct (each weighing between 45 and 60 tonnes and wide enough to carry two railway tracks) are placed by crane onto the girders and, using of a system of trolleys, are slid along the top of the girders into their final position.

High strength epoxy glue is then applied to the segment joints before post-tensioning takes place. The epoxy also seals the joint against water ingress from the outside. Once all the segments for a given span are in position on the girders, steel cables are threaded through ducts cast into the segments and which run the length of the span. These cables are then tensioned ("stressed") such that all the pre-cast segments are compressed together to form a continuous beam – one bridge span.

Figure 1 : File photo of viaduct showing launching girders resting on brackets attached to piers

ISSUES RELATED TO ELEVATED METRO-

- Elevated metro has to run on the road at a height of about 10mtr. There will be a flyover like structure called via duct with pillars on road. Reduction in total road carriageway width by about 3mtr.
- 9mtr of central road portion will be barricaded during construction causing a traffic chaos as no suitable alternative roads are available. (examplekarve road, jm road, sasoon road, railway station area etc.)

- 35-40mtr wide, 140mtr long and 23mtr high metro stations will be constructed at a distance of 1km increasing traffic congestion.
- Parking space will not be available at metro stations due to the location in congested city areas. Alignment of the metro-

- It cannot be at the centre of the road because in case of an obstruction the metro cannot take any sharp turns.

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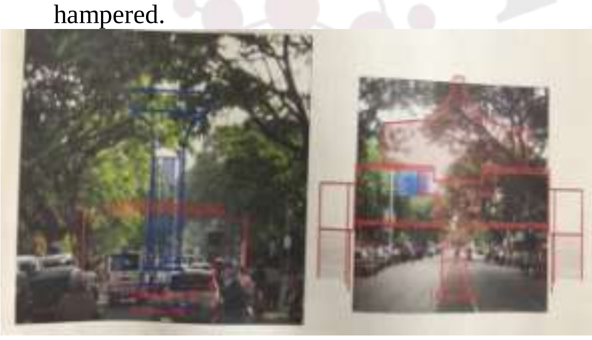
- Existing paudphata flyover will shift the metro to Paudphata – SNDT road further reducing the road width, demolition of road side buildings, land acquisition etc.
  Railway crossings at pune railway station also pose a big problem as it is a very important rail route. Risks and trauma-
- Because of the construction of elevated metro system there will be a risk to the existing buildings.
  Mental trauma to citizens due to continuous disturbance, disruption of utility services, mobility problems, changes n daily life pattern, rehabilitation due to demolitions, land azquisitions etc.
  Violation of fire safety norms and DC rules in metro construction-
- Insufficient space for metro stations and alignment.
- Part or full demolition of existing buildings.
- The construction will encroach on the footpaths and side margins of road side buildings.
- It could be very close to existing buildings without sufficient circulation of space between them.
- Natural light, ventilation for buildings will be affected.
- All portions and floors of buildings will not be easily accessible for fire engines and in case of any emergencies, the rescue will be severely hampered.



Visual impact and quality of life-

- Hundreds of trees on the roads will be cut down.
- Building side margins and road side open spaces, beautification will vanish.
- Huge metro stations across the entire road will also create problems in traffic congestion.
- The overall aesthetical view of a particular road will change due to this elevated metro.
- The view of all the historical monuments across pune will be distorted.

This visual pollution on prime roads will reduce the quality of life for the citizens. shifting of surface and underground utilities required

- serious problems in physical shifting
- poor co-ordination between different agencies
- availability of suitable space for re location will be a problem
- citizens will suffer due to disruption of services during shifting, relocating and replacement
  traffic management during construction a big problem
- suitable roads for traffic diversion are not available
- there are severe traffic congestion and unsafe road conditions
- insufficient traffic police strength for traffic management

Advantages of underground metro-

- Underground metro electrification system has less number of components and a very simple design as compared to overhead or elevatedelectrification system.
- These projects are usually funded by the World bank with very low interest rates at free of custom duty because they reduce large amount of co2 emission done by the vehicles.
- Expected life of elevated metro is much less than underground metro- due to the above ground steel and concrete structures.
- Interconnectivity of elevate d metro route with other routes cannot be done but it is possible in the case of underground metro.
- Operation and maintenance cost of underground metro is very less because it is unaffected by external weather conditions.
- Additional traffic capacities were provided for individual transport.

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- Relief from traffic congestion can be achieved due to underground metro.
- Architectural quality and the aesthetical view of a particular city can be maintained by underground metro

V. CONCLUSION

Thus this paper concludes that underground metro system is much more preferable than elevated metro system. In a metropolitan city like Pune, to avoid traffic congestion which may be caused due to piers and metro stations of elevated metro system can be avoided by implementing this proposed idea.
The data we collected enables us to take better decision and provide more efficient, environment friendly and equitable service and thus not affecting the pace of development of the city. This study examines the cost and benefits of underground metro projects for achieving the twin goals of inclusive and sustainable development.

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