Evolving Guidelines For Metro Projects in Planning of Emerging Metro Cities

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Abstract- *Increasingly, local planners, transit agency personnel, other professionals, and civic and community leaders need comprehensive, readily accessible guidelines to provide a resource for developing a conceptual design and evaluation plans, particularly involving infrastructure for Mass Rapid Transit (MRTS) systems in their communities. This paper addresses this need and seeks to initiate the development of such a resource by presenting a sampling compilation of Best Practices and design recommendations for conceptual planning of MRTS alignments and associated infrastructure. This discussion lays out preliminary criteria for such a more comprehensive and inclusive guideline document, as well as providing design information based on common practice.*

Keywords- Metro City, Emerging Metricities, Tier-I and Tier II, Mass Rapid Transit (MRTS) Systems, Travel Pattern, Comprehensive Mobility Plan (CMP) Or ElevatedStations, Road Carriageway, Metro Neo Nashik, Detail Project Report (DPR).LMR, HCMRT.

I. INTRODUCTION

Transport systems and the city character are interlinked. Urbanization is a world-known phenomenon wherein public transport serves a range of the population in the city area as well as the fringe area. The traffic load on the major streets in the Indian Metropolitan cities is at an alarming situation and is surely going to higher stakes as there is an increase in traffic demand day by day. The Metro system has been launched by the government in most of the metropolitan cities in India which also manoeuvres through the prominent area in the region. As we know Indian population stood at Second rank in the world. About 43 percent of the urban population of India lives in metro cities.

Metro City: Metro city means an urban region consisting a population of ten lakhs or more. Metropolitan area covers densely populated urban area. The capital cities of India are overcrowded and dealing with overpopulation as a result of this tier-I and tier II Indian cities are emerging and growing very fast in terms of investment and economic growth.

The Fastest Emerging Metricities in India

Kanpur, Lucknow, Nagpur, Ghaziabad, Indore, Coimbatore, Kochi, Patna, Kozhikode, Bhopal, Trissur, Vadodara, Agra, Vishakhapatnam, Malappuram, Thiruanantpuram, Kannur, Vijayawada, Nashik, Madurai etc.Aim of the study is to decide the inclusion of metro projects in the development plan of emerging metro cities.And the Objectives are **1.**To provide guidelines and recommendations in the formation of development plans and review framework for drawing up metro projects in the development plan.**2.** To improvise the quality and regulatory decisions in planning, implementation and strengthen the strategic content of development plan of emerging metro cities.Chennai, New Delhi, Kolkata, Mumbai, Hyderabad and Bangalore are the six existing metro cities and new economic centres of growth are emerging. It is equally evident that we need to shift focus to these smaller cities, to plan carefully before growth overruns them. In India, integrated land use planning and transport planning is emerging with proposed Metro projects in a number of cities. The study is limited to incorporate of alignment of metro projects in the preparation of development plan of the emerging metro cities. literature 1 stated that the Metropolitan regions are being created by default and not by design. Development authorities were already in place and they continue to engage in land use planning with little regard for transport planning.It presents the experiences of peri-urbanization process of the metropolitan cities.Literature2- The Detail Project Report PUNE mentions that the elevated metro stretch is not at all feasible and so an underground stretch is the only option in core area of city, even as the cost of the project increases. The DPR Reviewed all data analysis and survey process the relevant secondary data related to land use, travel pattern and demographics, supply of transport infrastructure and road safety etc. Literature 3- Metro Policy 2017 &Appraisal guidelines for metro rail project proposals by- Ministry of Housing & Urban Affairs Government of India. The policy stated that There should be a comprehensive approach to planning for urban land use and transport infrastructure and A system approach should be applied in the planning of multi-modal transport systems in a city. For, this, a city can be

represented by land use zones superimposed with a matching transport network. Therefore, a Comprehensive Mobility Plan (CMP), is a mandatory prerequisite for planning metro rail in any city. By treating the urban area as a system, and recognizing the interactions between land use, traffic and transport, it is possible to predict future requirements and accordingly evaluate alternative **modes for the most optimum mobility plan for the city.**

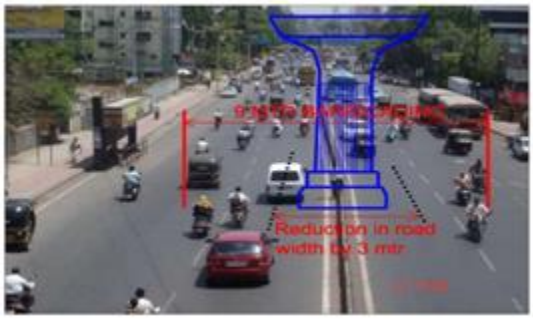
APPROACH TO AREADELENEATION –

The Project of Development of Metroin Pune was sanctioned in the year of 2008, the Delhi Metro Rail Corporation Limited (DMRCL) has prepared the Metro DPR for Pune in the year of 2014.Corridor 1: **Pimpri Chinchwad-Swargate**: Length of this Corridor is **16.58KM** and this corridor is structured in two-way Underground Section: which is constituted for about 5.01 KM having 6 station in this run and ***ii.)*** Elevated Section: which is accounting for 11.57 KM and having 9 Elevated stations. Corridor 2: **Vanaz- Ramwadi**: Length of this Corridor is **14.665KM** this is a complete elevated corridor; it has been planned for 16stations.Another corridor, Corridor- III: **Hinjewadi to Civil Court** is proposed in September, 2019, this corridor is managed by Pune Metropolitan Regional Development Authority (PMRDA), this corridor is **23.3KM** long and it has 23 elevated stations.

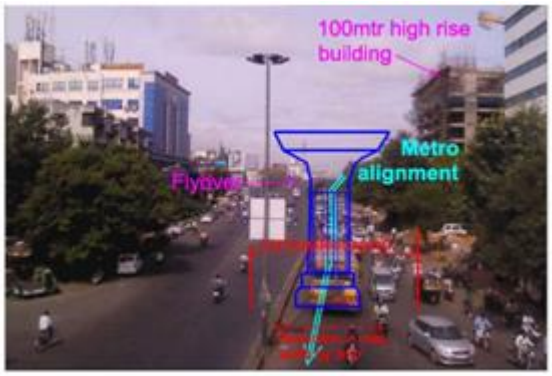
Corridor 1: **Pimpri Chinchwad- Swargate**: Length of this Corridor is **16.58KM** and this corridor is structured in two-way Underground Section: which is constituted for about 5.01 KM having 6 station in this run and Elevated Section: which is accounting for 11.57KM and having 9 Elevated stations. Underground Metro: which is accounting for 5.46 km. extension from Swargate to Katraj.

STUDY AREA – Pune Metro- PCMC to Swargate to Katraj (Proposed Extension). Pune has witnessed enormous industrial growth during the last 10 years. The existing urban transport system of Pune City which is road-based has already come under stress as the projected increase in the population of the city strengthening and augmenting of transport infrastructure has assumed urgency. For this purpose, the provision of a rail-based Metro system in the city has been considered.

Some key issues in the study areas are- Project is implemented through densely populated areas along highly congested arterial roads. Insufficient space for Metro stations - part / full demolition of buildings and flyovers, Metro construction could be very close to existing buildings Rescue in case of emergencies could be severely hampered, Shifting of surface and underground utilities. Elevated Metro has to run on the road at a height of about 10 There Will be a flyover-like structure called viaduct on piers at road median – Reduction in road carriageway width by about 3 meters. Metro will deviate from road Centre were obstructions, sharp turns on the road which Metro cannot take.



Shifting of surface and underground utilities required Serious problems in physical shifting, coordination between agencies.

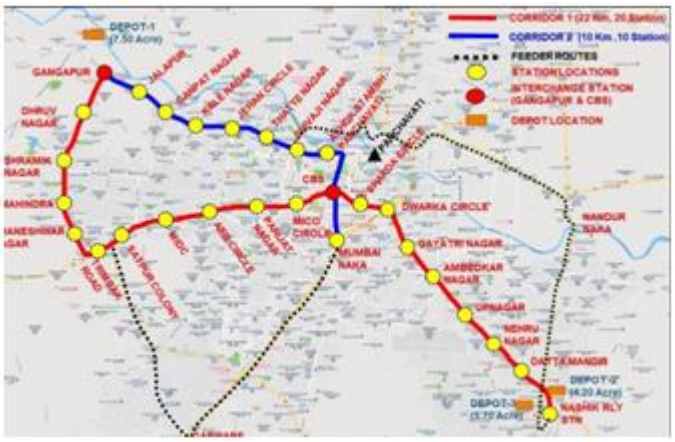


Visual impact: Metro track will be like a continuous flyover on road with huge metro stations across the entire road width.

OBSERVATIONS: We all know how Pune has changed over the last 30 years. Many open areas on the route as planned in 1987 are now built up or congested. There are conflicts with the Metro lines and flyovers at Paud-Phata and the University which did not exist in 1987 DP. As per the study of the development plan of Pune 1987, it is observed that the reservations for METRO alignment and Stations are not specified. On 15 August 2008, the preparation of Detailed Project Report work was started by DMRC. The alignment of the metro line is incorporated in the revised development plan.

METRO NEO NASHIK:

METRO NEO NASHIK: The Government of Maharashtra has entrusted the task of implementing an efficient Mass Rapid Transit System (MRTS) to Maha-metro for the city of Nasik. A Detail Project Report (DPR) was prepared by M/s RITES Limited and after approval of the State Government, it has been sent to the Government of India for sanction. The Report has identified a 32 km main route and 24 km feeder routes for implementation of this project. The concept of MetroNeo was formulated after very extensive and comprehensive technical consultations, interactions, and due diligence with several stakeholders/technical experts. The system is eco-friendly, energy-efficient, cost-effective, and capable of providing an efficient mass public transport system that is ideally suitable for the traffic need of TIER 2/ 3 cities in India as well as similar cities abroad



OBSERVATIONS-Nashik is emerging as a metro city it has changed over the last 20 years. It is observed that the reservations for METRO alignment and Stations are specified in the revised development plan. Detailed Project Report is in process. As in the comprehensive mobility plan, the metro alignments were suggested as per the feasibility and alternative analysis report of the Nashik Metropolitan Area. Nashik has greater road connectivity and the alignment of the metro is in liner form the road widths are sufficient for surface metro alignment.

SR. NO	PARA-METERS	CASE STUDY (METRO CITY) PUNE	NASHIK (EMERGING METRO CITY)	INFERENCES
1	Population	1987- First DP- 2,161,000 DPR 2008 - 4,676,387 YEAR 2020- 7,276,000	DPR YEAR 2020 - 2,066,000 Proposed – Metro Neo	The Population projection which requires for the finalized the mode of transport as per the comprehensive mobility plan of the city. Need to identify appropriate mode of transport as per Alternative analysis report.
2	Modes Of Transport	Public Transport, Rail, Bus, PMT, Autorickshaw, Private Vehicles.	Public Transport, Bus, PMT, Auto, Private Vehicles.	
3	Traffic Flow	Towards the city center (CBD) and Hinjewadi area, IT sectors	Towards the city center (CBD)	Considering the traffic flow the Preparation of CMP, Alternative's analysis.
4	Influence Zone	PCMC, Hinjewadi, Ramvadi, Shivajinagar, Swargate, Vanaz, Hadpsar	Gangapur to Mumbai Naka Gangapur to Nashik Road	As per the comprehensive mobility plan flow of traffic and the major growth centers influence zone should be mark.
5	Alignments/ Reservations	✔	✔	Reservations for the metro stations
6	Type OF Alignment	As per the avability of space and road width	Linear alignment -along the road Due to avability of space.	In case of elevated metro need the larger road width of 2.2 m from both side of the piers and also for the surface metro road minimum 8.5 m is required
	Elevated Metro	✔		
	Surface Metro	✔	✔	
	Underground Metro	✔		
7	Road space required	In case of elevated metro and surface metro.	✔	
8	BUFFER SPACE	Construction of the metro stations at adequate distance.	✔	In case of elevated metro and for surface metro need the service road or buffer zone of 6 metre
9	Land Use, Land value	Seen the change in land use, and increase in land value due to metro alignment.	The change in land use, and increase in land value will see along metro corridor.	

COMPARATIVE ANALYSIS

The table contains the comparative analysis of Pune Metro and Nashik metro

The population is the main criteria that have to be taken into consideration and the Recognition of the fast-growing need for improvements in the public transport system in a large number of cities. The Evaluation of various options of Mass Rapid Transit Systems (MRTS), along with a comparative analysis of alternate modes of transport is a vital part. Metro Rail system is often considered the most suitable urban transport system due to high capacity and speed, along with comfort. 2Appraisal Guidelines for Metro Rail Project Proposals are preferer along with the metro rail policy. These are the guidelines for approval of proposed metro rail projects by departments of the Government of India.35 3. Comprehensive Mobility Plan (CMP) a pre-requisite for planning metro rail systems in any city and the Integration of suburban systems with the proposed metro rail. CMP is the basis for approving projects, plans, and various regulatory measures within the city related to transport and it is therefore important to monitor and measure the impact of interventions. The reservations and provisions were given in the development plan for the metro stations. 5. Due to metro projects the change in land use already considered as per the FSI and TDR policy land value will be increased.

FINANCE AND ECONOMICAL ANALYSIS: Most of the metro rail projects have been financed by the central government in partnership with the state governments, while some have been funded by the state governments either on their own or with private partnerships. In addition, the external loan has also been taken under sovereign guarantee. Metro rail projects provide high-capacity public transit and are capital intensive.

Economic Benefits of Underground Metro: Less number of Vehicles on road with MRTS Implemented, Decongestion Effect, Savings in Time and Savings in Accidents, Savings in Vehicle Operating Cost (VOC), Savings in the cost of Road Infrastructure, Saving in Land Acquisition Cost, Savings in Pulling Down the Structures, Savings in Shifting of Utilities Service.

Demerits of Elevated Metro: Technical Issues, Legal, Social/Quality of Life, Other Infrastructure, Environment, Cost, Finance & Economics, Integrated Transport Plan

ANALYSIS: The original plan of the High-Capacity Mass Transit Route (HCMTR) is based on traffic and transportation requirement studies conducted about 40 years ago during the period, 1978-82. The project was subsequently included as an exclusive mass transport corridor in the 1987 Development Plan for Pune. It is after three decades that the PMC has now taken up the project for implementation. Considering the excessive delay and the major change proposed, serious consideration needs to be given to two aspects for proper assessment of the feasibility and utility of the proposed HCMTR. The proposed alignment passes through fully developed residential areas. Some buildings **may** be partly or fully demolished causing displacement of people. HCMTR was planned in the 1980s when the road was outside the city limits. It would not be feasible in any form or modification currently as a lot of constructions in the form of residences and commercial establishments are on the route. It is ridiculous to persist in 2020 with an alignment that was proposed 40 years ago for a Pune of the 1980s. The route was planned in the "periphery" of the city. Today, these areas are densely populated. Last year, thousands in the city were served eviction notices. The land acquisition costs estimated by PMC are grossly underestimated. Our traffic flows are dramatically different now and there is no recent study that supports the proposed alignment as a good alignment for solving the traffic woes of the city. HCMTR alignment cuts through our last remaining urban forests. This is the case of Pune Metro city so as far the planning of the new emerging metro cities the alignment of such metro projects should be noted while preparing the development plans considering the feasibility of that particular transport plans and topographical circumstances of that city.

RECOMMENDATIONS: There are 169 metro systems in the world, out of which 81 systems are more than 30 years old. Even in India, metro systems are developing at a rapid pace with 400 km across 10 cities either operational or under construction, and another 500 km across 40 cities at the planning and conceptual stage.

Class	Definition (Population)	Census 2011 No. of cities	Metro Projects and Proposals.	Metro Projects Type
Class I				
Below Mn+	1 to 10 lakhs	415	✔	HCMRTS
Million Plus cities	>10 lakh	53	✔	HCMRTS
Mega cities@	>1 crore	3	✔	HCMRTS
Class II	50k to <100k	605	✔	LMR(Proposal)
Class III	20K to <50k	1905	✔	–
Class IV	10k to <20k	2223	–	–
Class V	10k to <20k	2187	–	–
Class VI	<5k	498	–	–

Parameters Should be Consider in Planning of Metro Projects

POPULATION: The Census 2011give useful indicators for the trend's urbanization and Metro transportation pattern as mentioned in chapter 1 Introduction, Metro projects are proposed in the cities having population more than 10 lakh. LMR- in cities having a population of 50,00038 and HCMRTS in the Megacities like Greater Mumbai, Delhi UA, and Kolkata with a population above 1 crore.

2. ROUTE SELECTION: Certainly, the most prominent feature of any rail transit line (except perhaps for a subway) is the running way or trackway itself and its associated infrastructure (stations are discussed in another section, below). Identifying a viable route is critical.

Most LRT routes are typically selected on the basis of existing travel corridors, with specific alignments utilizing "opportunity assets" — existing infrastructural assets (such as existing roadways, lightly used or abandoned railway corridors, etc.) which provide an opportunity for enhanced or re-purposed use by the rail project. In selecting a potential rail transit route, the existence of one or more "opportunity assets" is an important factor along with travel patterns and density, locations of activity centers and residential areas, Residential and employment density, etc. Broadly defined, a corridor generally refers to a geographic area that accommodates travel or potential travel. Normally, a corridor is considered to be a "travel shed," an area where trips tend to cluster in a generally linear pattern, with feeder routes (highway, transit, or non-motorized) linking to trunk lines that carry long-distance trips in a metropolitan area. Alignments that can minimize costs (especially by facilitating surface construction) within a corridor serving clear travel patterns and mobility needs are desirable. The experience of many new North American LRT systems suggests that local arterials, or available railway corridors, are ideal in this regard. Arterial alignments often follow busy inner-city corridors, facilitate lower-cost surface construction, and offer relatively close surface access to activity points. Railway alignments typically offer opportunities for the lowest surface construction costs together with rapid connections to outlying suburban and regional stations.

3. COMPONENTS OF THE METRO PROJECT COST:

Components of metro project cost are Alignment and Formation, Station Buildings, Permanent way, Traction and Power supply, Automatic Fare Collection System, Platform Screen Door (PSD), Shifting of Miscellaneous Utilities, Multimodal integration and Depot, Admin Building and Control Centre (OCC), Rolling Stock, Security, Escalation of Cost.

PROPOSALS

PROPOSAL 1: SURFACE METRO- FROM SWARGATE TO KATRAJ.

(LIGHT RAIL METRO) Proposal to Scrapping the HCMTR Project Entirely and Rethinking Mobility Considering Light Rail Metro Plan in Mind to look into the option of having a Metro Neo corridoralong the Stargate-Katraj BRTS route aligning with the city bus services. Metro Neo is a rail-guided urban transport system with rubber-tired electric coaches powered by an overhead traction system running on elevated or at-grade sections.

PROPOSAL 2: SURFACE METRO -NAHIK METRO NEO.

The planning a surface Metro for Metro Neo projects for tier 2 and tier 3 cities.

TYPICAL DETAILS OF SURFACE FOR METROPROPOSAL 1 AND 2:

Here is the typical road section of 24-30 mtr wide road which will be designed for the Swargate to Katraj Road and also for the Nashik

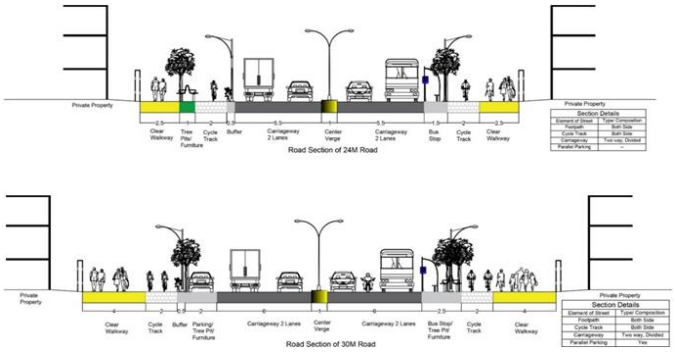


Figure 1Road Section of 18 and 21-Meter-wide

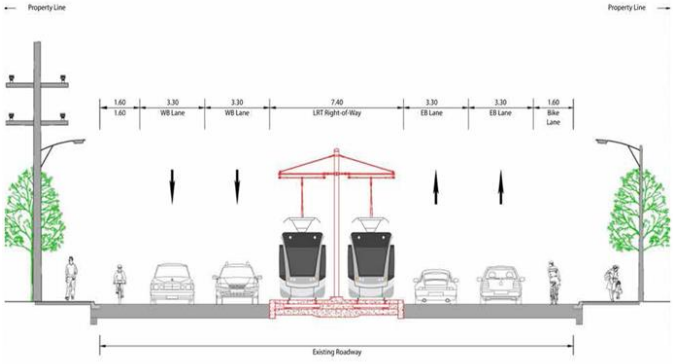


Figure 2 Proposed Road Section of 18 and 21-Meter-wide

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