



ANALYSIS ON DEVELOPMENT OF PUNE METRO

¹Dheeraj Gaikwad, ²Omkar Garje, ³Reshma Jadhav, ⁴Mansi Chavan, ⁵Seema Ghodkhe,
⁶Prof. Nilesh A. Karmuse

¹⁻⁵Student of Civil Engineering, Sinhgad Institute of Technology and Science. Narhe, Pune.

⁶Assistant Professor Department of civil engineering, Sinhgad Institute Of technology and Science
Narhe, Pune Maharashtra India

¹⁻⁵dheerajgaikwad.sits.civil@gmail.com, omkargarje.77@gmail.com, jadhavreshma221@gmail.com,
chavanmanshi870@gmail.com, sghodke8766@gmail.com, sghodke8766@gmail.com, nakrmush@sits@sinhgad.edu

Abstract— Pune is one of highly polpulated city in Maharashtra Pune is the second largest city in Maharashtra with a population of approximately 94 lacs. Also known as “The Oxford of the East “for its prestigious educational institutes which draw both national and international students. Pune is an important manufacturing hub and a thriving IT center for the Konkan region. Rated as the cleanest and the second greenest city in the country, Pune continues to grow and attract large number of people to the city.

The purpose of horizontal alignment suggestion from Katraj to Vanaz which is 11.892 km Length and width of 7m. After data obtained by survey this route requires a metro rail in near future as condition of road traffic conjunction and adverse environmental impact in this area can be reduced for such, we suggest one metro line on this route, As the various new line under metro Phases Swargate to Katraj metro is proposed by Pune Metro Rail Development Authority.

Index Terms—About four key words or phrases in alphabetical order, separated by commas.

I. INTRODUCTION

Pune metro projects provide is a world class facility, where it provides fast comfortable and economical way of transport with in Pune city and Pimpri-Chinchwad municipal corporation. Based on the existing and predicted travel demand, demographic features etc., the Detailed Project report (DPR) for Pune prepared by

DMRC Metro Rail Project suggested two corridors for laying down the metro rails. The corridors have been identified as (I) North-South (NS) and (ii) East-West (EW) corridors. The total length of the proposed route is 31.254 km of which 16.589 km is under North-South corridor and remaining 14.665 km is East-West corridor. Distance between Katraj to Vanaz is 11.98 km through best rough with over head elevated metro line.

The problem is to find out where the alignment is influenced by the location properties like geographical, topographical, soil and slope variations and land uses. If we find all these by a conventional method then it can take huge time in this tedious process and take huge expenses too, so overcome this conventional method we want to introduce some modern techniques which are more time efficient, less expensive and accurate. A GIS is a system of hardware and software that is used to capture, store, analyses, manage and distribute spatial data, GIS is a vast array of spatial analysis tools that can be used to perform tasks, such as overlay and proximity analysis. The conventional manual methods were tedious, time taking, lengthy and expensive. In this paper we are discriminating the conventional method and modern methods. The factors that we are concerned are mainly land use, slope, drainage and soil. Based on GIS thematic maps and network analysis in arc GIS we can get best route out of various alternate alignment considering near services area, less stop, river crossings, and where more inhabitants lived etc.

II. LITERATURE REVIEW

A. In Pune, Maharashtra, the Maharashtra Metro Rail Corporation Limited (Maha-Metro) and the Pune Metropolitan Region Development Authority are constructing three lines of an urban Mass Rapid Transit System (MRTS) (PMRDA). 31.254 miles In July 2009, the Delhi Metro Rail Corporation completed and filed the Detailed Project Report (DPR) for the Pune Metro Phase 1 project, which consists of two metro lines and 29 stops. It was updated to reflect current prices in January 2013, August 2014, and November 2015. The State Government approved the project in 2012, but it ran into red tape, politics, and protest from local NGOs and activists due to its largely elevated nature. The project received final approval from the Union Government's Cabinet on December 7, 2016. Furthermore, the Using a public-private partnership (PPP) approach, the Pune Metropolitan Region Development Authority is developing a third, mostly elevated line that will connect Hinjewadi and Civil Court. In September 2019, PMRDA and a partnership of TRIL Urban Transport Private Limited (a Tata Group Company) and Siemens Project Ventures GmbH signed a 35-year concession agreement to develop the line.

III. METHODOLOGY

Though the project has been planned and designed in such a manner that it creates only minimum adverse impact on people and structure and that there is minimum acquisition of land, yet structures and other assets could not be avoided. To understand social and economic impact of displacement as well as to address these issues by specific R&R intervention, the social impact assessment had to be carried out. The approach adopted to conduct socio-economic study is described below and is structured on the scope of work as mentioned in the Term of Reference (TOR) of PMRP. The study has been conducted in accordance with the guidelines of Government of India as well as the Social Standards of the European Investment Bank (EIB) and Agency Francoise De Development (AFD). The study aims at collecting baseline data for socio-economic information and identifies the affected population by residence, business base and their locality. The study is primarily based

on field data generated by the Consultant during social survey and secondary data were collected from the census handbooks / gazetteers / other relevant texts presents the methodology in the form of a flow chart which indicates various steps involved in the study have been described in brief in the following paragraphs.

IV. OBJECTIVES

A. *To study Station location and details about construction*

| Sr No | Station Name | Chainage (m) | Inter Station Distance (m) | Elevated / Underground |
|-------|---------------------------|--------------|----------------------------|------------------------|
| 1 | Vanaz | - -22 | - | Elevated |
| 2 | Anand Nagar | - 993971. | 993925.05 | Elevated |
| 3 | Ideal Colony | 1897 | 925 | Elevated |
| 4 | Nal Stop | 2753 | 855 | Elevated |
| 5 | Garware College | 3865 | 1112 | Elevated |
| 6 | Deccan Gymkha | 4718 | 852 | Elevated |
| 7 | Sambha Park | 5253 | 535 | Elevated |
| 8 | PMC | 5947 | 693 | Elevated |
| 9 | Civil Co Intercha Station | 6613 | 665 | Elevated |
| 10 | Mangalv Peth | 7533 | 920 | Elevated |
| 11 | Pune Stn | 8312 | 778 | Elevated |
| 12 | Ruby Clinic | 8985 | 673 | Elevated |
| 13 | Bund Garden | 10050 | 1064 | Elevated |
| 14 | Yerawad | 10777 | 721 | Elevated |
| 15 | Kalyani Nagar | 12958 | 2180 | Elevated |

FEM Results for models designed using IS code

B. Station Construction

It is proposed to develop the raised concourse over the street at a large portion of the areas to limit arrive obtaining. To keep the rail level low, it is proposed not to take viaduct through the stations. Consequently, a different basic design is required (although this may require the break in the starting operational at each station areas. Sub- structure for the station bit will likewise be like that of viaduct and will be completed a similar way. In any case, there will be single viaduct section in the station territory, which will be situated on the middle and supporting the concourse braces by a cantilever arm to dispose of the segment on option to proceed.

C. Operational Route plan

The basic Operation Philosophy is to make the MRT frameworks increasingly elective and affordable. The principal highlights being, Selecting the most ideal recurrence of train administrations to meet sectional limit prerequisite amid pinnacle hours on the majority of the areas. Economical and ideal train benefit recurrence amid pinnacle period as well as amid off pinnacle period A short train comprises of 4 mentors with high recurrence benefit it tends to be expanded to 6 mentors to meet future necessities.

Salient Features of the proposed train’s Operational Plan are:

Running of administrations for 19 hours of the day (5am to Midnight) with a station stay time of 30 seconds Make up time of 5-10% with 8-12% drifting. Scheduled Speed for these hallways has been taken as 33kmph for passage. A prerequisite of mentors is determined dependent on presumptions that the base unit of 4 Car train involving DTC-MC-MC-DTC setup has been chosen for Pune Metro Corridors for the year 2018.

D. Finance and tenders

Pune metro finance:

The first phase of the Rs 11,420-crore Pune Metro covers 33.2 km and it has been partly funded by loans of Rs 5,800 crore from AFD (Agence Française de Développement) of France and the EIB. The governments of India and Maharashtra share ownership of the corporation Maha Metro 50:50. 10% of the project's finance

will come from the federal government, 15% from the state, and the other 60% from the civic organisations in Pune and Pimpri Chinchwad. The European Investment Bank (EIB) has signed a \$182m (€150m) finance contract with the Indian Government for the Pune Metro Rail project’s second portion in Maharashtra through a virtual signing ceremony.

Contract And Tenders :

Companies:

Maharashtra Metro Rail Corporation Limited. Maharashtra Metro Rail Corporation Limited (MAHA-METRO). MAHA-METRO a Special Purpose Vehicle (SPV), a 50:50 jointly owned company of Government of India and Government of Maharashtra. The contract was signed between EIB vice-president Christian Kettle Thomsen and the Ministry of Finance on behalf of the Indian Government. The funds will be utilised for carrying out the construction and operation of Corridor 1 (North-South) from Pimpri Chinchwad Municipal Corporation (PCMC) to Swargate, as well as Corridor 2 (West-East) from Vanaz to Ramwadi.

The total length of both corridors will span around 31.25km. In addition, the EIB’s financing will aid in the acquisition of a related fleet of metro cars.

| | Shivaji Nagar station | | Civil court station | | Koyna nagar | |
|-----------------------------|-----------------------|------|---------------------|------|-------------|-------|
| | ODE | MD E | OD E | MD E | ODE | MD E |
| Axial force (KN) | 800 | 850 | 630 | 760 | 140 | 210 |
| Bending moment (KNm) | 5.59 | 5.69 | 5.88 | 6.23 | 0.745 | 0.822 |
| Shear Force (KN) | 5 | 5.11 | 4.85 | 5.01 | 1.88 | 1.73 |
| Displacement (mm) | 3.75 | 3.81 | 4.65 | 4.89 | 0.677 | 0.74 |

V. METRO LINE ALIGNMENT DESIGN

Deap Study :

GEOLOGY OF THE AREA

i.The study region consists of multiple layers of solidified fluid basalt in base. The main geological formation is Deccan trap. The Deccan lava flows are found mostly in the form of

horizontal bedded sheets. Usually, the flows are flat trooped hills which are the major characteristics of the trapping country. Deccan trap is distinguished into two varieties viz. vesicular and non-vesicular. The vesicular formation is soft, friable and breaks easily while non-vesicular is hard, tough, compacted and medium to fine-grained and breaks with a conchoidal fracture.

i. CLIMATE OF THE AREA

This region experiences tropical monsoon climate.

- The climate of the area can be classified into three distinct seasons as given below.
- Monsoon- commencing from the middle of June to end of September
- Winter- commencing from October to the middle of March.
- Summer- starting from the middle of March to mid of June. The region experiences moderately cool climate. The temperature ranges from 10° to 35°C in summer and its drops down up to 10° to 12°C in winter (Jain, 2009).

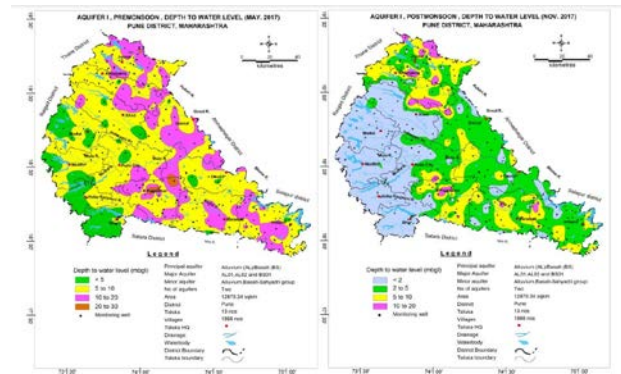
ii. RAINFALL OF THE AREA

This region experiences tropical monsoon climate. Due to uneven topography, rainfall is unevenly distributed in study region. Mostly rainfall receives from southwest monsoon and accounting 90% during June to September. Accordingly, to metrological department of Pune, the average rainfall in Ambegaon Taluka is around 800.44 mm. Ambegaon receive moderate type of rainfall with respect to whole district of Pune i.e., Avg. rainfall 1600mm (Gupta and Subbarao, 1987). During rainy season, many landslides occur in Ambegaon.

iii. SOIL OF THE AREA

Ambegaon having two major types of soil namely reddish brown and medium black soil. The reddish-brown soil is covered the area of about 894 sq. km (most of Ambegaon area) along hill slope. This soil is originated by oxidation of iron and mostly found in coastal areas. This is semi fertile, loose and easily flowable due to

heavy rainfall. The depth of soil varies in the range of 1 m to 7 m. The medium black soil covered the area of about 76 sq. km. of Ambegaon. Apart from this, coarse shallow soil is also present in the area of about 46 sq. km. This soil is hard in nature and locally known as murmadsoil. It is found on high hill of west part. It is similar to lateritic soil.



VI. CONCLUSION



From above maps Map is the most fisible route for the developmant of metro alignment because Of following reasons

Distance of route no one is 11.982 km where there are six horizontal curves and highest elevation point 678m and lowest elevation point is 563m as per corinates.

This proposed alignment is route no 01, as this whole alignment lies under Ministry of National Highway Authority of India. Where diatance between katraj to Navle bridge is 4.3 km which is NH548DD, Distance between Navle bridge to 5.5 km NH48 and NH753F, last phase is of PMC road of 2km in such a case there will be no land acquisition problems.

- As per maha metro in Pune city there will be around 132km of metro rail development of which 42km will be Mono rail Covering

densely populated are in Pune city, where development of bigger project has various problems. This development will reduce air pollution of Pune city by 28% in coming future. As government of India and State Government trigate to make Pune city green clean and healthy under various incentives, development of Pune metro is one of them as result we as student, after study/analysis of ongoing (under construction) and completed project of Pune Metro Rail. We Proposed a new metro line from Katraj Chowk to Vanaz Metro Station, which is of 11.982 km length.

I. Alignment:

- Distance of route no one is 11.982 km where there are six horizontal curves and highest elevation point 678m and lowest elevation point is 563m as per corinates.

- This proposed alignment is route no 01, as this whole alignment lies under Ministry of National Highway Authority of India. Where diatance between katraj to Navle bridge is 4.3 km which is NH548DD, Distance between Navle bridge to 5.5 km NH48 and NH753F, last phase is of PMC road of 2km in such a case there will be no land acquisition problems.

I. Population: Population increase in areas of starts from Katraj to Vanaz covering areas between, which are Ambegoan budruk, Vadgaon budruk, Narhe, Warje, Girdhar nagar, Motiram nagar, Urit nagar, Shastri nagar, and Vanaz Metro car sheed is Ten Lakhs Frouirty Eight Thousand Five Hundred and twelve till 2030.

REFERENCES

1. M. A. Adam, A. M. Elleboudy, and M. F. Soliman, "Seismic Site Response Analysis of a Cairo Metro Tunnel," *Geotech. Struct. Eng. Congr. 2016 - Proc. Jt. Geotech. Struct. Eng. Congr. 2016*, pp. 1114–1126, 2016.
2. O. Report and O. F. The, "Guidelines for the design of shield of tunnel lining," *Tunn. Undergr. Sp. Technol.*, vol. 15, no. 3, pp. 303–331, 2000.
3. Y. M. A. Hashash, J. J. Hook, B. Schmidt, and J. I-Chiang Yao, "Seismic design and analysis of underground structures," *Tunn. Undergr. Sp. Technol.*, vol. 16, no. 4, pp. 247–293, 2001.

4. I. During, "Rock mass classification," no. 1972, pp. 1–23, 2006.
5. J. N. Wang and G. A. Munfakh, "Seismic design of tunnels," *Adv. Earthq. Eng.*, vol. 9, no. June, pp. 589–598, 2001.
6. Maharashtra Metro Rail Corporation Ltd.
7. DPR, Pune Metro Rail Project. [2] Khang, Do Ba, and Tun Lin Moe. "Success criteria and factors for international development projects: A life-cycle-based framework." *Project Management Journal* 39.1 (2008): 72-84
8. <http://themetrorailguy.com/>
9. <https://www.mahametro.org/>
10. <https://www.punemetrorail.org/>
11. Koyna Design Circle, Jal Sampatti Bhavan Pune Maharashtra.
12. Feasibility study of Metro Rail Project in Nagpur city Authors-Akshay.M. Ramteke1, Prof. Vishal Gajghate2 *International Journal of Advance Research in Science and Engineering* <http://www.ijarse.com> IJARSE, Vol. No.4, Issue.
13. Optimization of Pune Metro Rail Author-Priyanka Chib *International Journal of Engineering Trends and Technology (IJETT) – Volume17 Number7–Nov2014*
14. Feasibility Study of Pune Metro Transport: Case Study Madurai. Authors- S. M. Subash1, K. Chandrabose2, U. Umamaheshwari3, T. Maharajan4 *International Journal of Civil Engineering and Technology (IJCIET)*, ISSN 0976 – 6308 (Print), ISSN 0976 – 6316(Online) Volume 4, Issue 4, July-August.
15. Pune Metro Rail Project: A Review Authors- W N Deulkar1, A.F. Shaikh2 Sujit Kadam1, Atul Autade2, Hrishikesh Mane3 , Akshay Chakke4 , Abdulmalik Chaudhari5 , Prof. V. R. Turai6 * www.ignited.in 111 *Journal of Advances and Scholarly Researches in Allied Education* Vol. XV, Issue No. 2, (Special Issue) April-2018, ISSN 2230-7540
16. *Int. J. Struct. & Civil Engg. Res.* 2015 ISSN 2319 – 6009 www.ijscer.com Vol. 4, No. 1, February 2015. Economic Analysis of Hyderabad Metro Rail Project Authors-Bharath.K.1, Shishir K. Jain2, Kottam Varun3, Ramakrishna N.4 *International J. Technology*; July – December, 2015; Vol. 5: Issue 2 6. An Investigation of Financial

Analysis of Delhi Metro and Factors Influencing Ridership Ali Esmailian and Ali Akbar Jamali, Railway Optimal Routing Using Spatial Multi Criteria Evaluation (Smce), Shortest Path

17. Chris O'Dell, Ian Reid and Ashley Trinder, an Innovative

18. Approach to Rail Options Analysis Using GIS

19. [Dell'acqua G. Using Fuzzy Inference Systems to Optimize Highway Alignments
Ing. J.B.K. Kiema, M.A. Dang'ana, Ing. F.N. Karanja GIS-Based Railway Route Selection for the Proposed Kenya-udan

Railway: Case Study of Kitale-Kapenguria Section Jacobs and Voung, Routing a High Speed Railway: A GIS Approach.

20. Jignesh padaya, jayesh juremalani, indraprakash, new railway alignment design based on geo-informatics: literature review

21. Mario De Luca, Gianluca Dell'acqua, Renato Lamberti, High-Speed Rail Track Design Using GIS and Multi-Criteria Analysis

22. Subramani. Nanda Kumar, National Highway Alignment Using GIS T.

23. Yourself Shafahi and M. J. Shahbazi, Optimum Railway Alignment in GIS.