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RINGS RAILWAY FOR PUNE CITY

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Abstract: This study has been undertaken to provide better connectivity the main problem of traffic will be solved. In the present world of competition, there is a race of existence in which those who are having willed to come forward succeed. Project is like a bridge between theoretical and practical workings. So this study analytically investigates based on a detailed survey of route length, a number of stations, Traffic demand forecast, Train Operation, Traction Power Supply, Rolling Stock, Maintenance Depots, Signaling system, Telecommunicate & Fare Collection, Construction Methodology, Station Planning, Implementation through BOT approach, Economy (Feasibility), Geometric design & alignment and System selection.

Index Terms **– Construction, Railway Model, Feasibility, Planning.**

I. INTRODUCTION

Today Pune city is the most livable city in India. Efforts are taking by all the Central Government Leaders & authorities state Government leaders & authorities, District authorities, MLA's Pune Municipal Corporation authorities & servants, last but not least Punekars also trying their best to make Pune as number one Smart City.

Various projects have been undertaken by the central Govt. State Govt. and by Pune Municipal Corporation from the time for the development of Pune. Pune city is contented with a large network of roads, playgrounds, gardens, well maintained historic places and constructions National zoo, bird sanctuary, STP projects, primary and secondary schools, water management by pumping station, Hospital facilities, residential & commercial zones, Public and semipublic sectors, bridges and flyovers, river protection belts, SRA for slums, garbage plants and so on.

Pune is the second-largest city in the Indian State of Maharashtra after Mumbai & the eighth most popular city in India, with an estimated population of 7.4 million as of 2020 in a 331.3 km area. Population density is 5600 people per square kilometer.

Today traffic jam is the major problem. Traffic congestion has several negative effects. As a non-productive activity for most people, congestion reduces regional economic health. Delays may result in late arrival for employment, meetings & education, resulting in lost business, disciplinary action, or other personal losses. Pune Municipal Corporation is working on many infrastructure projects like BRT, parking, flyovers, underpass and new roads, etc. to solve the traffic issues.

PMC road department & traffic police, a combined team can work for the improvements at signal chowks, changing corners of signal, allowing left turns, identify & removal of obstacle in traffic congestion in minimum time, removing of path holes and speed-breakers and so on. Many small things can be done to reduce travel time by 15% to 25% people's participation in suggesting improvements, accepted ideas, rejected ideas, the feasibility of ideas, maintaining a list of ideas, etc. may help in traffic solution. With the vehicle density of 753 vehicles per 1000 people, traffic does not seem to more on the city's roads are a common picture. The absence of mass transport is also the main course of traffic adding to the woes of city commuters.

With 450 km of the area after proposed, 34 villagers from surrounding areas, Pune is set to become the largest cities in India & the population is expected to grow one crore by 2030. Yearly ESR of PMC suggests the city is an alarming rise in the levels of air & noise pollution. Therefore to enjoy safe and livable environments with good connectivity, proper planning is necessary. The ring railway project may be the best solution for it. This may be the core plan.

II. HISTORY

From time to time width of roads slowly increased as the population gets increased. New roadways were also proposed. As the need for traffic jams flyovers are developed. From 1957 since PMC is in existence, the railway line was proposed in Pune station & it slowly developed. In 1987, the ambitious ring railway project was prepared in the development plan of PMC. PMC commissioner tabled a proposal of 7000 m. for the ring railway project but it was set aside. According to section 127 of MRTP Act 1966, if PMC fails to acquire land resented for utility project within 10 years, an owner can issue purchase notice & then such land is considered as not needed for reservation and owners can develop hereafter. Gohad had first proposed the integration traffic and transportation plan in 1972. In 1982 PMC incorporated the proposal in the development plan but did not implement it. According to Gohad there is a need for strong infrastructure in place which is currently lacking. In the last few years, around 40 flyovers have been built in various parts of the city. Bottlenecks even have often led to traffic jams from 1982 till 2017. As per the Pune traffic office, the total no. of vehicles in Pune currently 3.62 million which more than the current population of 3.5 million. From 2017 onwards, no. of vehicles has increased and no. of accidents also increased. Double parking, road work, roads with bottlenecks, accidents, and lane closure due to utility work are the causes of traffic congestion.

From 2018 Metro-rail is proposed and as of December 2019, 3 lines comprising 54.58 km track. The Pune Metro is being built by the Metro Rail Corporation Ltd. in 50.50 JV of Central & State Government. Its first corridor of 16.5 km from Swargate to Pimpri Chinchwad would stretch and would have 5 underground and 9 elevated stations. Pune Metro has planned for 2 corridors.

Phase 1 – PCMC to Swargate of 10.18 km

Phase 2 – Vanaz Ideal Colony Kothrud to Ramwadi of 14.23 kms.

Altogether for 30.36 kms. The estimated cost is 11522 crores.

Even Metro-rail proposed is going to find the solution on a traffic jam, but there are some disadvantages:-

1. It will be used in the very limited area of Pune.
2. There are also other congested traffic areas e.g. Baner road, Pune station to Nagar Road, Pune station-Aundh-PCMC road, Hadapsar to Swargare road, Swargate Singhgad road to Dhayri, etc.
3. Now to the PMC limit 34 villages are added. In future planning should be done such that the whole Pune city should have easy & safe access and exit.

III. SURVEY

The new PMC limit comprises an area of 450 km and the city has become a global urban center. The preliminary survey of roads which are existing and having a width of 30 m is enough. First, there was a Land Acquisition 1894 Act for the acquisition of land reserved for a social purpose. But many clauses of 1894 have changed and the Land Acquisition, Rehabilitation Bill 2013 was introduced & passed. According to RFCTLAR & R 2013, if the land is acquired, then the market value (in rural) which a very difficult task for PMC as compare to giving FSI and TDR. Therefore to propose ring rail for Pune City, most of the land for a track is selected at the line of a divider of the available road of 30 m or more than 30 m. The proposed track for the project comprises about 98 km. The land acquisition of private owners is almost zero since the track is provided on the existing roads of at least 30 m or more than 30 m widths. Also to solve the problem of land acquisition, some parts of a track can be drawn underground. The survey is made with the help of PMC development plans for existing roads more than 30 m.

IV. DETAILED STUDY

1. Gauge (standard) = 1435 mm.
2. Maximum permissible speed = 70 mph
3. Route length (End to end station)

Track	Elevated km	Underground	Total (km)
track 1 (41 km)	35	6	41
track 2 (58 km)	48	10	58
Total	73	16	98

4. Number of Stations

Track	Elevated km	Underground	Total
track 1 (41 km)	10	5	15
track 2 (58 km)	13	5	18
Total	23	10	33

- Traffic demand forecast

Boarding or Ridership (day)	2025	2031	2036	2041
Online Track 1	13.98 Lakhs	14.76 Lakhs	15.65 Lakhs	16.45 Lakhs
Online Track 2				
Total of both track 1 & track 2				

Calculations –

2 DMC train

Capacity: - 594 persons

Total trains: - 2+4=6

Total trips per day: - maximum 12 Minimum 8

Total ridership per day: - 594 x 8 = 4662

Total ridership per month: - 4662 x 25 =1,16,550 (Sunday Holiday or for maintenance)

Total ridership per year: - 1,16,550 x 12 = 13,98,600

6. **Train Operation**

Train frequency	2025	2031	2036	2041
Track 1	20 min	20 min	20 min	20 min
Track 2	30 min	30 min	30 min	30 min

7. Traction Power Supply

Voltage – 25 KVAC

Current Collection – overhead current collection system.

SCADA system – provided

Power demand (MVA)

Corridor	2021	2026	2031	2036
Track 1 41 km	Traction 8.5	9.5	10.5	11.5
	Auxiliary 15.4	16.4	17.4	18.3
Track 2 58 km	Traction 12.6	13.6	14.6	15.6
	Auxiliary 22.1	23.1	24.0	24.9

8. Rolling Stock

i) Coach Size

	Length (m)	Width(m)	Ht(m)
Driving motor car (DMC)	21.64	2.9	3.9
Trailer car/Motor car (DMC)	21.64	2.9	3.9

ii) Train Composition – 2 cars Train

DMC + (DMC)

iii) Seating arrangement – Longitudinal

iv) Passenger caring capacity – 6 persons/meter sq.

Particulars	Seated	Standing	Total
DMC - 1	47	240	297
DMC - 2	47	240	297
2 car	94	480	594

v) Axle load = 16 T

vi) Max acceleration = 1.0 m/s

vii) Max Design Speed = 95 kmph

viii) Max Operating Speed = 80 kmph

ix) Schedule Speed (as per train operation) Track = 130-32 kmph & Track 2 35-40 kmph

9. Maintenance Depots

Depot cum workshop near Swargate and Pune station. Since area in pune city is very much congested by population, Swargate and pune station these are the only 2 places where the maintenance and repairs can be done once in a week on Sunday.

In future, if space is allowed or given in bulk, then Depots can be set up at 4 corners of both the tracks in the areas like Sus, Balewadi, Wagholi, Fursungi, Katraj, etc.

10. Signaling system

- Cab signaling and continuous automatic train control with train protection (ATP).
- No signals of local rail are provided at all.

11. Telecommunicate & Fare Collection

- Integrated system with fiber optic cable, SCADA, Train radio, PA system
- Train information system, control telephones and centralized clock system.
- Automatic fare collection system with POM, smart card etc.

12. Construction Methodology

- Viaduct – Prestressed concrete box shaped girders /double U-girder on single pier with pine/open foundations.
- Underground construction by TBM (Tunnel Boring machine)

13. System selection

The population growth in cities and urban centers has put a lot of pressure on the infrastructure of these cities. In rapidly developing countries like India, the urban infrastructure is stretched to limit and requires very effective solutions. The rapid development in India & in several nations took place. So several modes of urban mass transit are now available for solution to the problem of urban transit.

14. Geometric design & alignment

i) Horizontal curves parameters –

- Desirable minimum radius -200m
- Absolute minimum radius -120m
- Minimum curve radius at stations- 1000m
- Maximum permissible cant – 125 mm
- Maximum desirable cant – 110 mm
- Maximum cant deficiency – 85 mm

ii) Transition curves parameters –

- Minimum = 0.44 x cant deficiency
- Desirable = 0.72 x actual cant deficiency
- Overlap between transition curves and vertical curve is not allowed.
- Minimum straight between 2 transition curves is 25 m.
- Minimum curve length is 25 m between the 2 transition curves.
- Gradient –

  It is not more than 3%

vi) Vertical curves should be provided if gradient exceeds 4%

vii) Alignment – Alignment for both, track 1and track 2 is taken on the divider line & existing road of with minimum width of 30m.

15. Civil Engineering

Superstructure is made and the maximum standardization of the formwork for wide span ranges. Segmental construction has following advantages –

- Efficient, economical for large range of span lengths & types of structures.
- Reduction in construction time.
- Protects environment, needs only space for foundation & substation.
- Segments are easy to stack, easy to transport, gives good aesthetic view & better strength is achieved.

16. Station Planning

Track 1 (41 kms)

Sr. no.	Station	Type	Depth	Soft rock	Water table
1	Swargate	Underground	20 m		0.4 to 2
2	Mandai	Underground	20 m		0.4 to 2
3	Pune Station	At Grade	20 m		0.4 to 2
4	Shivajinagar	Underground	20 m		0.4 to 2
5	GPP	Elevated	20 m		0.4 to 2
6	Baner	Elevated	20 m		0.4 to 2
7	Balewadi	Elevated	20 m		0.4 to 2
8	Hinjewadi	Elevated	20 m		0.4 to 2
9	Mhalunge/Sus	Elevated	20 m		0.4 to 2
10	Pashan	Elevated	20 m		0.4 to 2
11	Warje	Underground	20 m		0.4 to 2
12	Nanded city	At Grade	20 m		0.4 to 2
13	Dhayari	Elevated	20 m		0.4 to 2
14	Wadgaon Hingne	Elevated	20 m		0.4 to 2
15	Rajaram Bridge	Elevated	20 m		0.4 to 2
16	Singhgadh road	Elevated	20 m		0.4 to 2

(B) Track 2 (58 kms)

Sr. no.	Station	Type	Depth	Soft rock	Water table
1	Pune Station	Elevated	-		0.4 to 2
2	Yerwada	Elevated	-		0.4 to 2
3	Chandan-nagar	Elevated	-		0.4 to 2
4	Kharadi	Elevated	-		0.4 to 2
5	Wagholi road to Manjri road	Underground	20 m		0.4 to 2
6	Manjri BK	Elevated	-		2 to 5
7	Fursungi Manjri (Near H. way)	Elevated	-		0.4 to 2
8	Fursungi	Elevated	-		2 to 5
9	Handewadi (Hadapsar)	Underground	20 m		0.4 to 2
10	Undri-Pisoli or near khadi machine	Elevated	-		0.4 to 2
11	Iskon temple	Elevated	-		0.4 to 2
12	Katraj	Elevated	-		0.4 to 2
13	Dhankawadi	Elevated	-		0.4 to 2
14	Padmavati Ranka	Elevated	-		0.4 to 2
15	Parvati post	Elevated	-		0.4 to 2
16	Aranyshewar lokesh hotel	Elevated	-		0.4 to 2
17	Swargate	Underground	20 m		0.4 to 2
18	Mandai	Underground	20 m		0.4 to 2

17. Implementation through BOT approach

The rings railway construction project can be given to a private partner to develop, operate and then transfer to the government. This will bring requisite funds and its efficiency also. The private partner would assume substantial financial, technical and operational risk in the operation of a project. This will result in definite success as that of Hyderabad and Mumbai.

High Power committee –

During the implementation of the project, issues about the acquisition of land, diversion of utilities, shifting of structures, etc. are likely to arise. For this an institutional mechanism set up by the state government is necessary. This will act as a high power committee.

Legal Cover –

In the future Government should provide legal cover for the implementation of project funds that can be made available from the central Govt. & state Govt.

18. About Model

The project model is prepared by Ravi raj Art Studio as per the instructions – For this first of all help from PMC authorities is taken in form of development plans. But physically the attachment of development plans is tedious work. So to work within the PMC limit, Google earth maps are prepared and then the rail track is set up. Stations are set up. Though the model is prepared without scale, it is very much nearer to the scale.

The track is selected where 30 m or more than 30 m roads are present and on which elevated tracks are possible to build in the future.

19. Economy (Feasibility)

The Ring rail of the project provided is already comprised some part of metro-rails. According to a project, the track is provided for about 50 km. In the future according to ready reckons of 2022 the approximate estimate for a 1 km track will require 204 crores. Therefore the total estimate of 98 km track will be 98 x 204 = 19992 crore. This is a very-very big amount. The project seems to be not economical. This is not feasible. But if the area of 20 km which is common in a metro project is subtracted then only an additional 78 km track is to be required to extend. For this 78 km extension, the maximum estimate will be 78 x 204 = 15912 crores. Thus the ring metro rail for PMC will be feasible and economical if the central Govt and state government contribute 50:50 in JV. This will help in the future for maximum villages included in the PMC limit. Also, the IT Park at Hinjewadi, Pune will be at easy reach for maximum villages. Ring railway will also cover the maximum area of Pune city with better connectivity to future ring roads.

V. ADVANTAGES AND DISADVANTED OF RING RAILWAY TRAIN

ADVANTAGES OF RING RAILWAY TRAIN

- Less power usage.
- Job opportunities.
- Most effective in transportation as compare to others.
- Travelling time is very less as compare to road ways.
- Ring rail is eco-friendly No. air pollution & noise pollution.
- It is very cheap mean of communication.
- It can afford by a middle class.
- In future ring railway will provide better connectivity to the ring road proposed outside the PMC limit.
- It can also reduce the load of transportation or goods
- It will help in development of entire Pune city.
- It will also bring economy from other states by remuneration to the Pune city.
- Pune darshan.
- An alternate route for rail is provided for easy conveyance as well as maintenance.
- It can also revert train directly coming from out station.
- Land acquisition problem will be resolved by using new technology of TBM (tunnel boring machine) for underground roads.
- Very high space occupancy

DISADVANTAGES OF RING RAILWAY TRAIN

- It is expensive to build.
- It will take more time to build.

VI. CONCLUSION

PMC if pass this project titled "Rings Railway for Pune City" on today's date and starts work then work will complete up to 2024. The work can be possible & feasible for present & including 34 villages. A project can be run on the BOT level. The two tracks proposed will help people of Pune city and around areas. This project will provide better connectivity the main problem of traffic will be solved. Further developments can be possible after this project definitely in nearby areas of PCMC, Maval, Paud, and other areas. This project may help to stand at no. 1 city of India.

VII. REFERENCES

1. Abbink, E.J.W, Van der Berg, B.W.V., Kroon, L.G., Salomon, M. (2004). Allocation of Railway Rolling Stock for Passenger Trains. Transportation Science, 38(1):33–42.

2. BruniS, BuccaG, CarnevaleM, et al. Pantograph–catenary interaction: recent achievements and future research challenges. Int J Rail Transp. 2018;6:57–82.

3. BruniS, AmbrosioJ, CarniceroA, et al. The results of the pantograph–catenary interaction benchmark. Veh Syst Dyn. 2015;53:412–435.

4. FacchinettiA, GasparettoL, BruniS . Real-time catenary models for the hardware-in-the-loop simulation of the pantograph–catenary interaction. Veh Syst Dyn. 2013;51:499–516.

5. F. Piu, V.P. Kumar, M. Bierlaire, M. Speranza, Introducing a preliminary consists selection in the locomotive assignment problem, Transport. Res. E Logist. Transport. Rev., 82 (2015), pp. 217-237

6. L. Ozdamar, T. Yazgac, Hierarchical planning approach for a production- distribution system, Int. J. Prod. Res., 37 (16) (1999), pp. 3759-3772

7. M. C. Agarana, T. A. Anake, H. I. Okagbue. Optimization of Urban Rail Transportation in Emerging Countries Using Operational Research Techniques. PP. 1116-1123

8. M. Milenkovic, N. Bojovic, Optimization Models for Rail Car Fleet Management, Elsevier (2019)

9. Phil Ireland, Rod Case, John Fallis, Carl Van Dyke, Jason Kuehn, Marc Meketon. The Canadian Pacific Railway Transforms Operations by Using Models to Develop Its Operating Plans. 34(1), pp. 5– 14.

10. Ravindran, Phillips, Solberg, (2001) OPERATIONS RESEARCH: PRINCIPLES AND PRACTICE, 2ND ED, John Wiley & Son.