

Prospect And Viability of Metro Rail Project In Nagpur City

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ABSTRACT

As the population of a city increases, the number of vehicular trips on road system goes up. This leads to the introduction of (MRTS) Mass Rapid Transit System viz. Metro Rail. The Prospect and Viability of a Metro Rail is the interpretation of the metro facility from the environmentally, economically, strategically preferable point of view. Metro rail facility enhances employment opportunities, growth of economy, less fuel consumption and air pollution, reduction in traffic congestion, etc. In this paper, the data of Nagpur city related to population (2011 census) and traffic system (2011-12) was collected from different surveys involving Nagpur Metro Office, Metro construction works, RTO Nagpur office. Most of the countries have the evolutionary story of changing old transport system with new transport development in response to perceived socio economic needs of people. Viability is the case in which probable construction and operation of the metro project can be financially feasible as well as manageable. Practicability of such modern transport system of Metro Rail facility to NAGPUR city is the ultimate aim of this project.

I. INTRODUCTION

Nagpur Metro is a new mass rapid transport system (MRTS) under development in Nagpur, the capital city of Maharashtra state, India. The MRTS will cover a total length of 38.21km and is estimated to cost Rs 86.80bn (\$1.4bn). The two routes will be served by 36 stations in total. The public transportation system in Nagpur currently caters to just 10% of commuters. Motorized transport is dominated by two- wheelers (28%) and other vehicles, causing pollution as well as traffic congestion on roads. As the population of the city is increasing along with vehicles, there is a need of policy shift to discomfort private modes and encourage public transport as the traffic level along any travel direction exceeds 8000 passengers per hour. The city thus needs a safe, reliable, cost-efficient, commuter-friendly and pollution-free rapid development. Thus the success of the project is decided on the points that are set during the viability study process.

The government of India sanctioned the project in August 2014 and foundation stone was laid by the Indian Prime Minister in the same month. The government of India and the government of Maharashtra will fund 20% each of the total project cost, whereas NIT and Nagpur Municipal Corporation (NMC) will contribute 5% each. The remaining 50% funding will be secured through loans and other sources.

II. ADVANTAGES

The project will provide higher living standard, better

public transport system to resolve these issues. The new rapid transit system proposed for Nagpur will reduce the travel time by approximately 50% and offer easy and uninterrupted movement in major parts of the city. Depth investigation of the profitability of the project idea which is to be converted into a business enterprise indicates viability study of any aspect. Such a viability study refers to the valuation of result which concern the economic forecast in relation to other significant factors, such as socio-economic efficiency and environmental impact. The highlighting point of the viability study is the necessary information which leads decision makers to decide whether the proposed option or project should be implemented. Errors, if found any, in this stage contributes to the better performance of the project and it is considered as the significant aspect in project

quality of life, less travel time, better connectivity and transport facilities. The management plans are essential to ensure that stress/loads on the systems are within carrying capacity. Some of the following advantages can be stated as follows:-

1. Employment Opportunities:

Manpower will be needed in various activities during construction. In operation, about 45 persons per kilo meter length of the corridor, i.e. (approx. 1,700 persons) will be employed for operation and maintenance of the proposed system. Thus the project would provide substantial direct employment; besides, more people would be indirectly employed in allied activities and trades.

2. *Enhancement of Economy:*

The construction of Nagpur Metro will facilitate the population to move from one end of the city to another. The proposed transport facility will facilitate rural population to move quickly towards urban centres and return there from. With the development of Nagpur Metro, it is likely that more people will be involved in trade, commerce and allied services.

3. *Mobility:*

Metro lines will facilitate people to move quickly towards urban centres and return from there. Any reduction in number of private vehicles will result in reduction of accidents which will involve savings from damage to vehicles and savings towards medical and insurance expenses to persons involved in accidents.

4. *Less Fuel Consumption:*

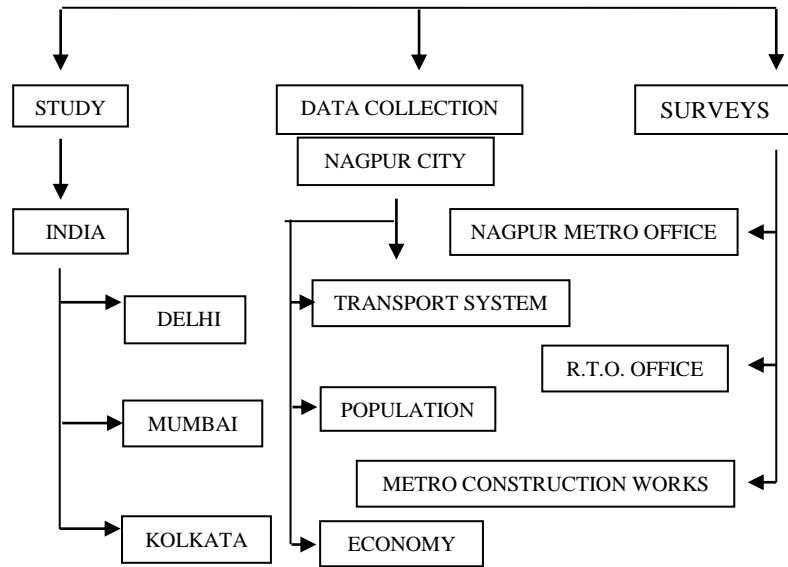
On implementation of the project both petrol and diesel consumption will get reduced due to shift of passengers from road to rail and also due to decongestion on road.

5. *Less Air Pollution:*

With the construction of metro, there will be less vehicular traffic by road, and consequently less air pollution, and hence the air quality will improve.

6. *Reduction in Traffic Congestion:* Metro will reduce the congestion and journey time on roads because of diversion of some traffic to Metro. Reduction in traffic congestion will save the necessary capital investment and vehicle operating cost as well as increase in time saving per vehicle.

III. III. METHODOLOGY



IV. DATA PARAMETERS

4.1 *Traffic Demand Forecast*

Traffic Study and Ridership estimation are the first tasks in any metro project report which imply finalizing a feasible alignment plan of the proposed metro network and then locating normal and interchange metro stations (if any). Total daily boarding ridership in 2016 is estimated as 3.52 lakhs in which share of line 1 as 47% and line 2 as 53%. Average trip length is 6.41km. The daily and peak station loads of the Metro System comprises of the following lines, are described as under in Table 1.0.

Table 1.0: Summary Output: Traffic

BOARDING / RIDERSHIP (DAY)	2016	2021	TOTAL OF BOTH	352442	383439	419135
ON LINE 1 (AUTOMATIVE – KHAPRI)	168361	185531	AVERAGE TRIP LENGTH PER KM	27.7104	6.453	6.494
			MAXIMUM PHPDTON LINE 1	10089	10936	11915
ON LINE 2 (PRAJAPATI – LOKMANYA)	184081	197908	MAXIMUM PHPDTON LINE 2	276031	8460	9154

TERMINAL NAME	IP	IG %	OP	OG %	TOTAL
Nagpur Main Rly Stn	32862	50.1	32757	49.9	65619
Ajni Rly Stn	2263	27.9	5850	72.1	8113
Itwari Rly Stn	5502	37.9	9001	62.1	14503
Sitabuldi Bus Stand	8360	45.0	10206	55.0	18566
Ganespath Bus Terminal	32130	49.9	32282	50.1	64412
Ravi Nagar Bus Stand	9803	52.2	8973	47.8	18776
Chattrapati Square	3720	33.2	7494	66.8	11214
Gandhibag Bus Stand	1755	56.2	1368	43.8	3123
Indora Bus Stand	3395	55	2777	45.0	6172
More Bhavan Bus Stand	10580	62.0	6482	38.0	17062

4.2 *TERMINAL SURVEY*

Bus and Rail Terminal stations were surveyed mainly to understand the magnitude of external trips. There are 3 railway stations and 7 bus terminals. A summary of incoming and outgoing passengers is given in table 2.0

Table 2.0 External Trips of Nagpur City

Mp Bus Stand	2954	54.6	2453	45.4	5407
	113324	48.64	119643	51.36	232967

*IP –INCOMING PASSENGER , IG – INCOMING,
*OP-OUTGOING PASSENGER, OG- OUTGOING.

Above data shows that 2.32 lakhs trips are external trips (which could be more as there are many boarding and alighting bus stops except main bus terminals) out of which 38% are by train and 62% are by regional and interstate bus service. Above data is for 16 hours (6AM-10PM). Many trips are purely external to external (incoming by bus and outgoing by train and vice versa). Quantum of external trips is about 10% which is expected for a city like Nagpur.

4.3 WORKPLACE SURVEY

15060 workers were interviewed and several interesting information were extracted from the interview. From table 2.16, it is observed 45.66% is one earning member family and 39% has two earners. From the table it is deduced workers /population ratio is 0.35. It is also seen student / population ratio is 0.32 (within sample). But it is not possible to know whether all these workers make work trips using vehicle. Trip length frequency is constructed and shown in table 3.0. Average trip length of workers was computed as 8.47 km.

Table 3.0 Trip length frequency of workers

FROM KM	TO KM	PERCENT %
1	5	28.9
6	10	45.4
11	15	18.2
16	20	4.3
21	25	1.4
26	30	1.9

Table 4.0 Monthly income of workers

Rs	Rs	PERCENT
0	10000	49.5
10000	20000	20.7
20000	50000	19.8
50000	100000	8.8
100000	200000	1.3

As reported, 50% have income less than Rs. 10,000 per month. Average monthly income was deduced as Rs. 22022. As far as vehicle used for coming to work place is concerned, it is found 50% use two wheelers.

Nearly 15% use public transport system. Frequency distribution is given in table 5.0.

Table 5.0 Mode used by the workers

Vehicle Type	Sample %
Two Wheeler	49.24
Auto Rickshaw	20.17
Shared Auto Rickshaw	3.41
Car	8.12
Taxi	2.20
Mini Bus (Public)	3.80
Mini Bus (Regional)	1.20
Bus (Public)	8.42
Bus (Regional)	0.48
Cycle Rickshaw	0.32
Cycle	1.81
Train	0.35
Walk	0.47
TOTAL	100

Average journey time (as reported) is 26.6 minute.
Average expenditure on travel per day is Rs. 24.56.

4.4 COST ESTIMATES

Detailed cost estimates for Nagpur Metro Rail Project has been prepared corridor wise covering civil, electrical, signaling and telecommunications works, rolling stock, environmental protection, rehabilitation, etc. considering 25 kv ac Overhead Traction System at June 2012 price level. In order to arrive at realistic cost of various items, costs have been assessed on the basis of rates accepted for Delhi Metro. The details of taxes and duties are worked out separately. The capital cost has been worked out for :

CORRIDOR - 1: NORTH-SOUTH CORRIDOR (AUTOMOTIVE SQUARE TO KHAPRI)

Cost without land = Rs. 2593 Cr.

Cost with land = Rs. 3015 Cr.

Total taxes & Duties = Rs. 420 Cr.

CORRIDOR - II: EAST-WEST CORRIDOR (LOKMANYA NAGAR TO PRAJAPATI NAGAR)

Cost without land = Rs. 2763 Cr.

Cost with land = Rs. 2984 Cr.

Total taxes & Duties = Rs. 443 Cr.

TOTAL COST OF PROJECT : 6882 Cr.

TOTAL COMPLETION COST :8680 Cr.

The estimated cost at June-2012 price level includes Rs. 410.00 Crore and Rs.214.00 Crore as land cost respectively for Corridor I and II. The estimated cost at June-2012 price level also includes an amount of Rs.20 Crore as one-time charges of security personal towards cost of weapons, barricades, and hand held and door detector machine etc. However, the recurring cost towards salary and allowances of

security personal have not taken in to account in FIRR calculation with an assumption that the required police personnel will be provided free of cost by the state government since it is as state subject.

4.5 FINANCIAL INDICES

Economic benefits are social and environmental benefits which are quantified and then converted into money cost and discounted against the cost of construction and maintenance for deriving Economic Internal Rate of Return (EIRR). When actual revenue earned from fare collection, advertisement and property development are discounted against construction and maintenance cost, interest (to be paid) and depreciation cost, Financial Internal rate of Return (FIRR) is obtained. Therefore, EIRR is viewed from socio-economic angle while FIRR is an indicator of pure financial profitability and viability of any project.

- i. FIRR: (Cost with central taxes) 10.35 %
- ii. EIRR: 17.70 %

4.6 FARE STRUCTURE

Table 6.0 Fare Structure in 2018-19

Distance in Kms	DMRC Fare as Revised in 2009	Nagpur Metro Fare (Rs) in 2018-19
0-2	8	15
2-4	10	19
4-6	12	23
6-9	15	28
9-12	16	30
12-15	18	34
15-18	19	36
18-21	21	39
>21	22	41

The Delhi Metro Fares structures fixed by fare fixation committee in 2009 have been assumed, which have been duly escalated @15% for every two years to arrive at the initial fare structure for Nagpur Metro, which is placed in Table 6.0

Other sources of revenues:

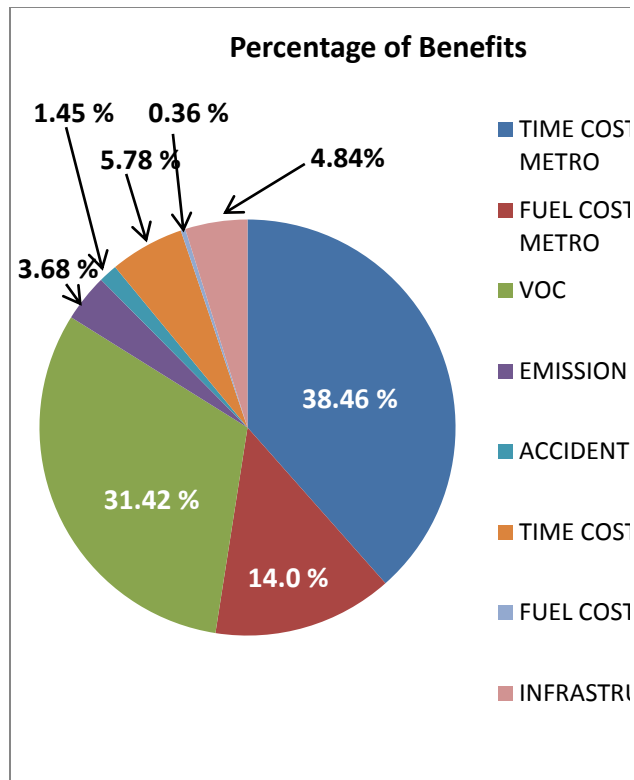
Property Business- Other revenues from Property business i.e. advertisement, Kiosk, ATM etc. have been estimated at 10% of the fare box revenues during operations.

Additional Taxes- Income assumed from additional taxes i.e. FSI, Additional Stamp Duty, Development Fund as proposed by Nagpur Improvement Trust.

V. CONCLUSION

From the ‘Traffic Demand Forecast’ it can be seen that peak hour peak direction trips (PHPDT) on the North South Corridor is 10089,10936,12934 and 15729 the year of 2016, 2021, 2031 and 2041 respectively. Similarly PHPDT on East West corridor in the year of 2016, 2021, 2031 and 2041 is 7746, 8460, 9906 and 11882 respectively. Road-based systems can optimally carry up to a maximum of 8,000 PHPDT. Since the PHPDT assumed on the above corridors exceed 8,000, there can be two options namely 1) Mono Rail and 2) Light Capacity Metro. Mono rail can carry the PHPDT projected but this technology is not a tested one. The operation and maintenance cost is much higher that Light metro. The capital cost of Mono rail is also almost same as that of Light Metro with no experience of Mono rail in India. Even in the other countries, the Mono rail is being adopted only for small lengths and as feeder to Metro.

FIRR is an indicator of pure financial profitability and viability of any project. Government of India expressed that the FIRR of the project should be at least 8% and FIRR (Cost with central taxes) of the Nagpur Metro is 10.35 %. Due to presence of metro existing bus routes may change, some old routes may stop operation and some new routes may be introduced.. Nevertheless, it will be interesting to know, for 10% increase of ridership, increase in EIRR value will be 6.57%, and for 20% increase EIRR will increase by 9.96%, keeping other traffic inputs unchanged. So this project, considering above all aspects , is viable.



VI. REFERENCES

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