

“PROPOSAL OF ADDITIONAL ROUTE FOR NAGPUR METRO”

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ABSTRACT: Metro rail projects are great examples of mass transport system. The main benefits addressed by mass transport are the mobility and freedom. The sustainability of mass transport has greater potential and major benefits occur through immediate means of helping the environment and conserving energy. In developing countries, like India, benefit through mass transit systems extend to urban poor with affordable fare structure when compared with costs incurred by private transportation on fuels, parking, congestion etc.

Nagpur city is having huge number of two wheelers and use of public transport is very low. An effective public transport mode in the form of metro is expected to provide a fast, reliable, convenient and economical mode of transport to the Nagpur citizens and also the public commuting to Nagpur. It will also help in growth of the city and area as well.

The work of metro phase 1 and 2 is already being carried out in Nagpur city and this project proposes an additional alignment for the same. This project includes detailed study of DPR, traffic survey, interviewing, analyzing road width, and station marking. The project work has been carried out in order to reduce traffic congestion along the proposed metro route. Reduction in traffic congestion will eventually result in decreased air pollution and accidents. Implementation of the project will also reduce petrol and diesel consumption.

KEYWORDS: Mass transport system, traffic congestion, air pollution, diesel consumption.

1. INTRODUCTION:

Transportation whether it is private or public decides the rate of development of the city. The major advantages addressed by mass transport are the mobility and freedom. The Kolkata metro is the 1st rapid transit system in India. The Delhi Metro is the largest network in India. According to recent data collected in September 2018 India has 515 km of operational metro line and 381 stations. About 500+ km of lines are also under construction. To counter the problems caused due to traffic and to manage road traffic government of India in upcoming years the government of Maharashtra launched Nagpur metro rail project. The Nagpur metro rail system spreads over a length of 38.21 km and is useful in two passages, the north-south corridor and the east west corridor. The 19.65 km long north-south corridor runs from automotive square to Mihaan and east-west corridor which is 18.55 km long that is developed from Prajapati Nagar to Lokmanya Nagar. Combined number of stations on Corridor No. 1 and Corridor No. 2 would be 17 and 19, separately. Of these 36 stations 34 are elevated stations and 02 stations are at-grade in corridor-1. Based on the different types of survey done by DMRC, metro alignment were finalized after repeated inspection of

the road network, intersections, passenger traffic flow, connectivity to important land uses. Presently the public Transportation system contributes 10% of the total trips. The motorized transport is controlled by two wheelers (28%) and so is the vehicle ownership in the city (84% of total owned vehicles are two wheelers). Moreover supply of metro rail system in Nagpur means a lot in terms of sustainable means of transit. Nagpur metro will help nagpurians and those who will come to this city by diluting the traffic congestion, controlling pollution, reducing road accidents and increasing convenience. Metro project will also reduce traffic time, transportation cost and will also help in energy saving. The Nagpur metro region requires a safe, reliable, efficient, affordable, commuter friendly and environment sustainable rapid public transport system. The basic aim of this project is to understand the process of metro route planning and also implement it by planning an additional route for Nagpur Metro.

The project includes detailed study of the Detailed Project Report (DPR) uploaded by the Nagpur Metro Rail Corporation on their official website, tentative route selection for proposing the alignment, analyzing the obstacles coming in the alignment, finding appropriate solutions. The route will pass through densely populated localities, areas with number of hospitals, colleges, schools. The route will cover major revenue generating zones of the city and areas with high traffic intensity. The proposed route will also have access with other local transportation facilities like bus stations and railway stations. The future work includes Preliminary survey and Major survey. The tasks that come under preliminary survey are analyzing the width of road, analyzing the traffic density and detailed study of the controlling points. The Major survey includes traffic survey by manual method, studying population density obtained from the Census data and interviewing the localities and passengers using public transport. This project work will be carried out under the guidance of Nagpur Metro Rail Project Office.

Cost estimate ; cost estimates have been prepared based on the rates accepted based on the delhi metro duly escalated up to june 2012 level

Corridor 1 north-south corridor (automotive square to khapri) the overall capital cost for corridor 1 at june 2012 price level works out to Rs 3015 crore excluding taxes and duties . But including charges and design charges at rate 5% on all items except land 3% contingencies on all items . Estimated total taxes and duties are rs 420 crore

Corridor 2 east-west corridor(lokmanya nagar to prajapati nagar) the overall capital cost for corridor 2 at june 2012 price level works out to be rs 2984 crore excluding taxes and duties but including general charges and design charges at a rate 5% on all items except land and 3% contingencies on all items. Estimated total taxes and duties are Rs 443 crore.

1.1 OBJECTIVES OF THIS STUDY:

1. The project work is to plan additional route for Nagpur metro project .
2. Implementation of such modern transport system in the city.
3. Reducing traffic flow in Nagpur city.
4. Popularizing public transportation in the city.

2. PRELIMINARY SURVEY: This survey is large scale instrument survey, conducted for the purpose of collecting all physical information, which affects the proposed location of the new route.

FINAL ROUTE : DHANTOLI TO DIGHORI

DETAILED ALIGNMENT: NMC zone 4 square, along Great nag road, Sardar Patel square, Kamgar nagar square to Ashok square, along Armori-Nagpur highway to Reshimbagh square, along Umred road, to Bande plot square, along Taj bagh road to Dighori toll gate.

ADVANTAGES:

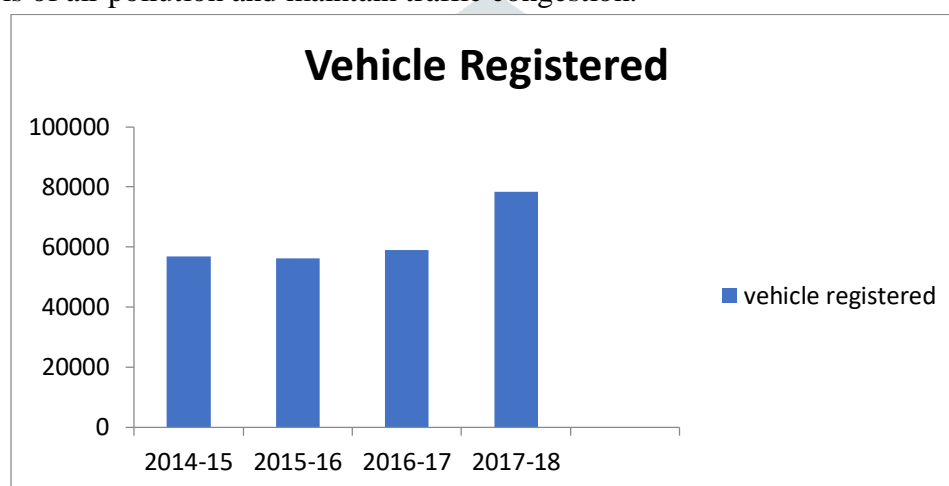
- Covering major areas, high traffic density areas and revenue generating zones of the city.
- It consisting of more than ten hospitals and greater than eight colleges and schools.
- Major controlling points such as Nagpur MSRTC bus station and medical square.

2.1. ANALYSING TRAFFIC DENSITY :

Traffic density is defined as ‘the number of vehicles occupying a unit length of lane of roadway at a given instant and usually expressed as vehicles per kilometer.

Traffic volume = Traffic density * Traffic speed

- This data has been collected from Nagpur RTO.
- The purpose of this work was to obtain growth rate of vehicular traffic along the selected route.
- According to the data given below it can be concluded that the number of vehicles purchased per year is increasing so the extension of metro project in Nagpur city is necessary in order to reduce the levels of air pollution and maintain traffic congestion.



VEHICLE REGISTRATION

2.2 POPULATION STUDY

- Population density data was collected from NMC office and census data.
- The objective of this work was to collect the population data according to zone wise/ward wise of the nearby area of the selected route.
- On the basis of this data along with traffic density we will finalize location of the stations.

| ZONE NAME | ZONE NO. | WARD NUMBER | POPULATION |
|---------------|----------|-------------|------------|
| Dhantoli | 4 | 17 | 49608 |
| | | 33 | 61984 |
| | | 35 | 60960 |
| Hanuman Nagar | 3 | 29 | 49312 |
| | | 31 | 51060 |
| | | 32 | 55680 |
| | | 34 | 52472 |

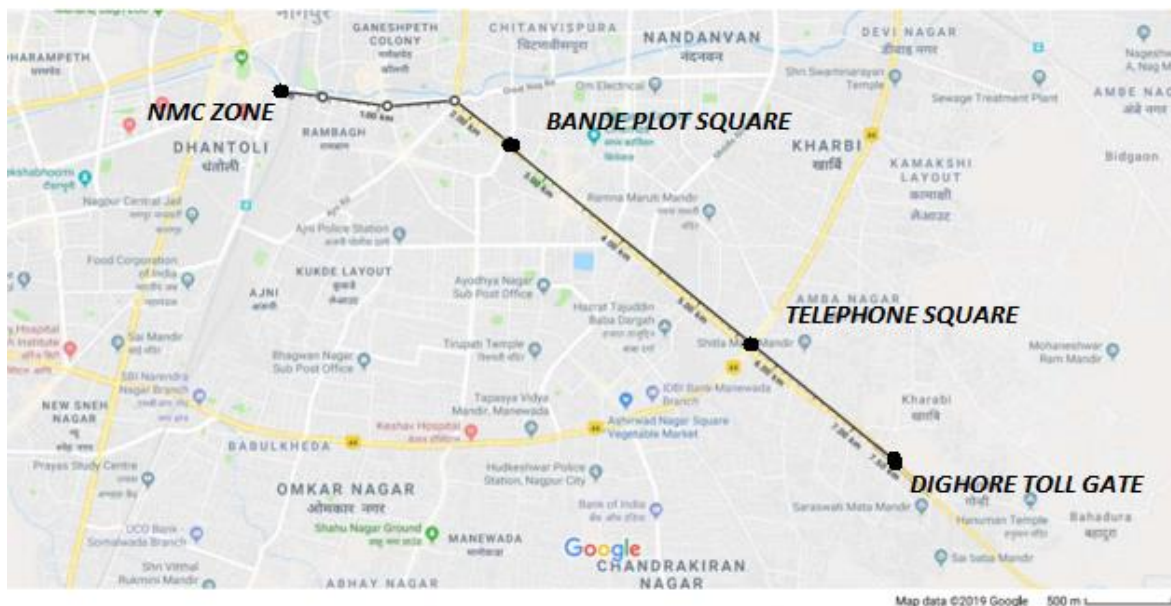
Table 4.1: Zone wise population density data

3. MAJOR SURVEY:

3.1 STUDY LOCATION:

The proposed alignment originates from NMC ZONE 4 SQUARE on GREAT NAG ROAD and ends near DIGHORI TOLL GATE in DIGHORI AREA. The total length of the route is extending to about 7.5 kms.

Google Maps Humpyard Rd



3.2 ANALYSING WIDTH OF ROAD:

- By measuring the width with the help of chain and tape number of lanes were found.
- By using google earth app and google maps(GPS)
- The purpose of the work was to check sufficient space for construction of metro.
- As per DPR of NMRC 2016 the minimum width of the road should be 7m.
- Width of road was measured at intervals of approximately 500m throughout the route length.
- It was found out that the proposed alignment satisfies the criteria of width as per NMRCL.

3.3 TRAFFIC SURVEY:

DATA COLLECTION PROCEDURE: Traffic count survey of major intersections were conducted along the route targeting the improvement of traffic condition. It is presumed that the traffic along the route is already saturated. All the data were collected for traffic signals with the help of surveillance cameras. The surveillance recordings were obtained from SMART CITY CABIN NMC.

VOLUME COUNT: To understand traffic characteristics in terms of vehicular, passenger and PCU, 08 traffic count stations were identified at major traffic signals along the proposed route. PCU is a metric unit which represents various sized vehicles as one unit. Total traffic flow for all 08 locations and for both directions in terms of PCU is given in table 3.5.

DATA ANALYSIS: Traffic volume count was carried out during morning peak hour duration i.e. 9:30am to 10:30am. The performance analysis is done based on the average traffic volume/flow for total time period observed at each signal.

DETAILS OF COLLECTED DATA:

| NAME | BICYCLE | 2 WHEELER | 3 WHEELER | CAR /TAX I | LIGHT TRUCK | MIN I BUS | BUS /TRUCK | TOTAL |
|---------------------|---------|-----------|-----------|------------|-------------|-----------|------------|--------|
| PCU | 0.2 | 0.3 | 1.5 | 1 | 1.5 | 3 | 4 | |
| SARDAR PATEL SQUARE | 11.2 | 529.2 | 240 | 364 | 66 | 24 | 240 | 1474.4 |
| KAMGAR NAGAR SQUARE | 97.6 | 357.6 | 114 | 216 | 102 | 0 | 168 | 1055.2 |
| ASHOK SQUARE | 45.6 | 424.8 | 306 | 200 | 48 | 30 | 160 | 1214.4 |
| RESHIMBA GH SQUARE | 24 | 520.2 | 360 | 798 | 99 | 54 | 312 | 2167.2 |
| SAKARDA RA SQUARE | 36 | 760.8 | 174 | 124 | 24 | 24 | 16 | 1158.8 |
| BANDE PLOT SQUARE | 25.6 | 284.4 | 216 | 224 | 18 | 24 | 224 | 1016 |
| SHITLA SQUARE | 19.2 | 834 | 384 | 380 | 72 | 24 | 304 | 1917.2 |
| TELEPHONE SQUARE | 41.2 | 864 | 399 | 289 | 58.5 | 24 | 324 | 1675.7 |

Table 3.5: Traffic volume count in forward direction

| NAME | BICYCLE | 2 WHEELER | 3 WHEELER | CAR /TAX I | LIGHT TRUCK | MINI BUS | BUS /TRUCK | TOTAL |
|---------------------|---------|-----------|-----------|------------|-------------|----------|------------|--------|
| PCU | 0.2 | 0.3 | 1.5 | 1 | 1.5 | 3 | 4 | |
| SARDAR PATEL SQUARE | 50.4 | 918 | 210 | 312 | 66 | 18 | 144 | 1718.4 |
| KAMGAR NAGAR SQUARE | 15.2 | 544.8 | 96 | 304 | 138 | 48 | 816 | 1962 |
| ASHOK SQUARE | 8 | 333.6 | 132 | 188 | 12 | 54 | 128 | 855.6 |
| RESHIMBA GH SQUARE | 41.6 | 528 | 420 | 936 | 108 | 45 | 160 | 2238.6 |
| SAKARDA RA SQUARE | 29.6 | 531.6 | 144 | 124 | 60 | 18 | 112 | 1019.2 |
| BANDE PLOT SQUARE | 96.8 | 826.8 | 426 | 308 | 90 | 24 | 160 | 1931.6 |
| SHITLA SQUARE | 41 | 892.8 | 426 | 410 | 45 | 15 | 480 | 2309.8 |

| | | | | | | | | |
|------------------|----|-----|-----|-----|----|----|-----|------|
| TELEPHONE SQUARE | 42 | 903 | 441 | 450 | 84 | 15 | 480 | 2415 |
|------------------|----|-----|-----|-----|----|----|-----|------|

Table 3.6: Traffic volume count in backward direction

3.4 INTERVIEW RESPONSE:

Interview of localities is taken by questionnaire. The goal is obtain information in such a way that survey respondents understand the question and can provide the correct answers easily in a form that is suitable for subsequent processing and analysis of the data. Nearly 100 samples has been collected from various institution , hospital, commercial areas, traffic signals and major controlling points. Interview method which applied for this study are road side interview (Origin and Destination Survey).

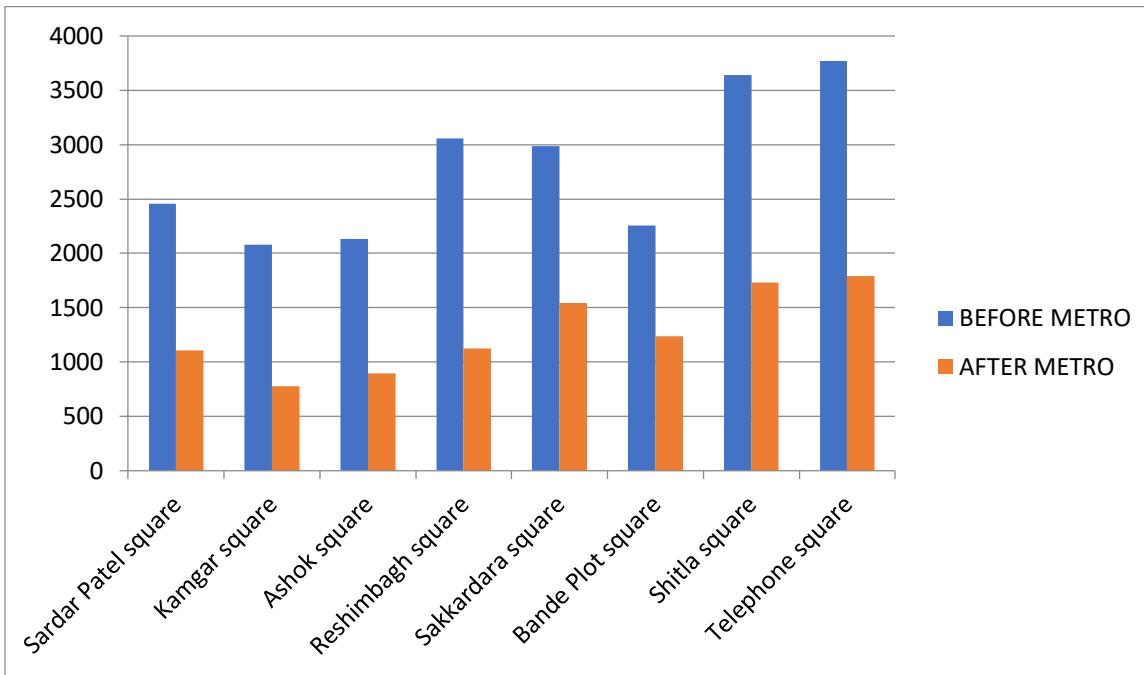
| Sr No. | Questions | RESULTS |
|--------|--|--|
| 1 | What is the mode of transport you are using? | Bus-30% Four wheeler-5% Two wheeler-60% Other-5% |
| 2 | Are you able to reach your destination in time using the present mode? | Yes-85% No-15% |
| 3 | What are the problems that you face while in movement inside Nagpur? | Heavy flow of vehicle-25% Traffic congestion-65% Inadequate width of roads-10% |
| 4 | What is your choice to relief from the traffic congestion? | Rail Transport-70% Increase of public Buses-20% Own use of Vehicles-10% |
| 5 | Is metro transport necessary in Nagpur? | Essential-70% Compulsory-20% Not Necessary-10% |

4. REDUCTION IN TRAFFIC VOLUME:

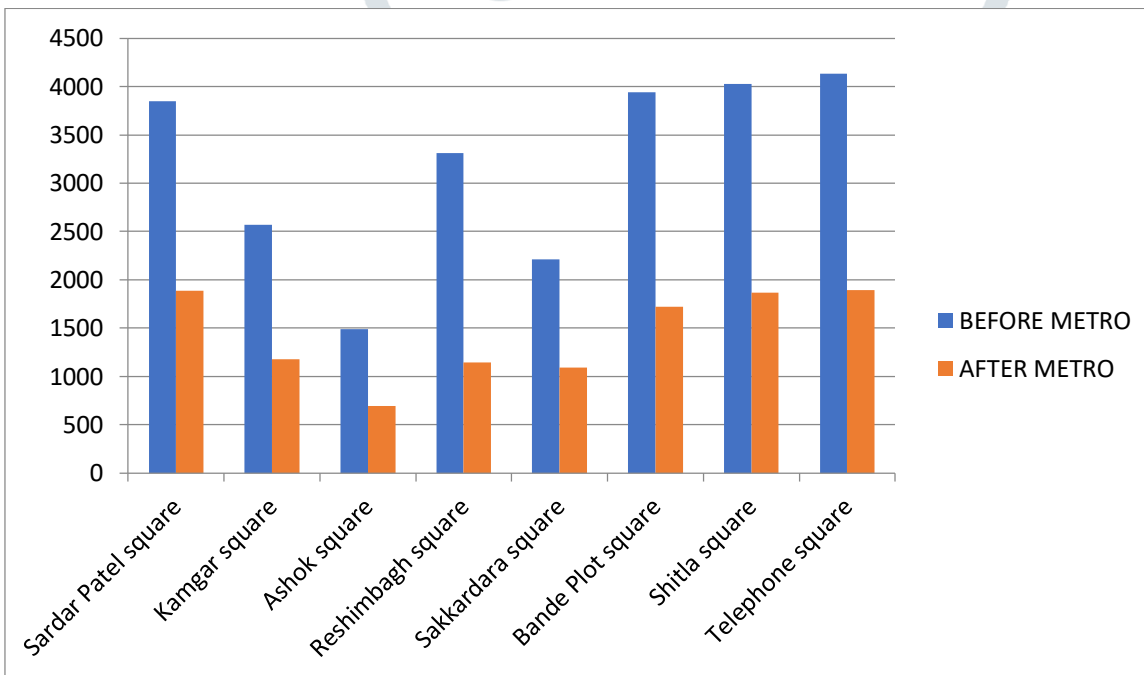
The following question was asked to the passengers in the interviewing process. Based on their response the traffic volume reduction was carried out along the proposed alignment.

Q. Will you replace your current mode of transport with Metro Rail?

| Sr no | Mode of transport | Usage | Agree | Disagree |
|-------|-------------------|-------|-------|----------|
| 1 | Bus | 30% | 25% | 5% |
| 2 | 4 wheeler | 5% | 0 | 5% |
| 3 | 2 wheeler | 60% | 35% | 25% |
| 4 | Others | 5% | 3% | 2% |



REDUCTION IN TRAFFIC CONGESTION IN FORWARD DIRECTION



REDUCTION IN TRAFFIC CONGESTION IN BACKWARD DIRECTION

5. STATION PLANNING:

- The proposed metro alignment originates from NMC ZONE 4 Square where it joins the preexisting metro route i.e Phase 2.
- The stations were selected at the locations surrounded by major controlling points and with highest traffic volume.
- Two stations have been marked at Bande plot square and Telephone square based on preliminary and major survey.
- Finally the route terminates near Dighori toll gate.
- CORRIDOR: Central South.

6. CONCLUSION:

- As per Appraisal Guidelines for Metro Rail Project Proposals by Ministry of Housing & Urban Affairs Government of India the criteria for proposing metro in a city are : Traffic count should be above 6000-8000 phpd and the population should be more than 10 lakhs. So according to the study and observations, proposed route satisfies the above criteria and it can be implemented as Phase-3 for Nagpur Metro.
- Based on the interview responses the traffic congestion along the proposed alignment will reduce effectively after implementation of the proposed metro route. Average reduction in traffic volume count in forward direction is 45.37% and in backward direction is 45.16%
- 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.
- Reduction in number of private vehicles will results in reduction of accidents which will involve savings from damage to vehicles and savings towards medical and insurance expenses to persons involved in accidents.
- 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.

7. FUTURE SCOPE:

Based on the literature the following recommendations for future research are below:

- Further study should be conducted to check the experience of beneficiaries of Nagpur metro rail.
- Study should be carried out on the design of proposed metro rail alignment.
- Further study should be conducted on comparison between Nagpur metro rail project and other metro rail project in India
- Analysis should be carried out on the estimation and costing of proposed metro rail alignment.
- Future work can also be carried out on revenue generated from proposed route.

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