iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** I **Month of publication:** January 2018

DOI: http://doi.org/10.22214/ijraset.2018.1439

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor :6.887
Volume 6 Issue I, January 2018- Available at www.ijraset.com

Transit Oriented Development and Environmental Impact of Nagpur Metro Rail Project: A Case Study of Nagpur Metro Alignment-2

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Abstract: ***The growing demand for public transport in cities has serious effects on urban ecosystems, especially due to the increased atmospheric pollution and changes in land use patterns. An appropriate mix of alternative modes of transport is introduced resulting in environmental positive and negative impacts on civilians and land use patterns can be obtained by an ecologically sustainable urban transport system. It is a process of identification, prediction, evaluation, and mitigation of biophysical, social and other relevant effects of developmental activity on environment prior to make commitment. The design standards for universal access to Public Transport Infrastructure including related facilities and services, information, etc. would benefit people using public transport. The study regarding such modern transport system of Metro Rail facility to NAGPUR city is the ultimate aim of this project.***

Keywords: Transit Oriented Development, Transit Influence Area, Impact Analysis

I. INTRODUCTION

Nagpur is the third largest city of Maharashtra (India) and also the winter capital of the state, with a population of approximately 25 lakhs. Nagpur Metropolitan Area is the 13th largest urban conglomeration in India. It has also recently been ranked as the cleanest city and the second greenest city of India. In addition to being the seat of annual winter session of Maharashtra state assembly "Vidhan-Sabha", Nagpur is also a major commercial and political center of the Vidarbha region, It is also known as "Orange City" for being a major trade center of oranges that are cultivated in the region.

A. Study Area

In early 2012 Nagpur Improvement Trust (NIT) requested DMRC to provide Consultancy services for preparation of a Detailed Project Report for Metro Rail System in Nagpur, Maharashtra initially for 30 Km which was revised to 42 Km in July 2012. Thereafter, DMRC conducted Traffic Surveys, Topographical Surveys, Geotechnical Investigations and Environment Impact Assessment Survey. The study area consisted of Nagpur Municipal Corporation Area. The study area totaled to approximately 217 sq km. Based on the different types of surveys done by DMRC, metro alignments were finalized after repeated inspection of the road network, intersections, passenger traffic flow, traffic congestion, connectivity to important land uses. Alignments of routes proposed by DMRC were as follow:

TABLE I
ALIGNMENTS PROPOSED BY DMRC (IN JULY 2013)

Alignment-2 East – West Corridor (18.266 Km, 19 stations)	From Prajapati Nagar, along Central Avenue Road, Railway Feeder Road, Munje Chowk, Jhansi Ranee Chowk, North Ambajhari Road, Hingna Road, Lokmanya Nagar.

B. Cost Estimate:

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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 Rs. 2984Crore excluding taxes and duties, but including general charges & design charges @ 5% on all items except land and 3% contingencies on all items. Estimated total taxes & duties are Rs. 443Crore.

C. Geographical Conditions

Nagpur lies on the Deccan plateau of the Indian Peninsula and has a mean altitude of 310.5 meters above sea level. The underlying rock strata are covered with alluvial deposits resulting from the flood plain of the Kanhan River. In some places these give rise to granular sandy soil. In low lying areas which are poorly drained, the soil is alluvial clay with poor permeability characteristics. In the eastern part of city crystalline metamorphic rocks such as gneiss, schist and granites are found, while in the northern part yellowish sand stones and clays of the lower Gondwana formations are found.

D. Physiography

Nagpur is situated at 21° 09' N latitude and 79° 09' E longitude and a mean altitude of 310 meters above sea level. Being located far away from any major water body at the centre of the Indian peninsula, the Nagpur's climate is dry or mildly humid for most of the year except for the rainy season. The highest ever recorded temperature in the city was 49 °C, while the lowest was 3°C. The geology of the Nagpur region is famous for the metamorphic rocks, which occur in all the districts in the Nagpur region except Wardha and some part of Nagpur district. The other geological formation Deccan Traps occur in the Wardha and North and North-West part of Nagpur District. It receives an annual rainfall of 1,205 mm (47.44 in) from monsoon rains during June to September. The highest recorded rainfall was 304 mm on 14 July 1994. Summers are extremely hot lasting from March to June, with maximum temperatures occurring in May.

E. Demographics

As per provisional reports of Census India, population of Nagpur in 2011 is 2,405,421; of which male and female are 1,226,610 and 1,178,811 respectively. Although Nagpur city has population of 2,405,421; its urban UA / metropolitan population is 2,497,777 of which 1,275,750 are males and 1,222,027 are females.

TABLE II
CENSUS INDIA, POPULATION OF NAGPUR METROPOLITAN IN 2011

Nagpur Metropolitan	Total	Male	Female
Population	2,497,777	1,275,750	1,275,750
Literates	2,095,419	1,102,638	992,781
Children (0-6)	248,678	1,102,638	992,781
Average Literacy (%)	93.17	129,522	119,156
Sex ratio	958	96.20	90.02
Child Sex ratio	920		

II. LITERATURE REVIEW

The literature review on Public Transportation system with particular emphasis on planning procedure. Today the cities are residence to half of the world's population, and in 2030, 60% of the population will live in a city. The urban areas have an increasing importance in our society as they are continually growing, along with all the issues related to theme. Many metro Politian cities in India are facing problem as the ones related to urban transportation, and their interrelated impacts on the environment, economical and society's are always getting bigger as the cities are growing in their size and populations. Roads and rails respective are first and second largest land consumers and cause several negative consequences such as pollution, subsequent health-related problems, traffic congestion or accidents. Implementing more sustainable transportation systems within human settlements is principal fundamental in order to limit those issues related to transportation. A review on Environmental Impact Assessment of Construction Projects by Vivek Kumar Tiwari, Anjali Verma**,** Akash Kumar and Manjul Gupta. Environmental Impact Assessment (EIA) can broadly be defined as a process, providing an anticipatory and preventive mechanism for environmental management and protection to achieve sustainable development [1]. EIA certainly plays a vital role in assessing the environmental impacts of surrounding developmental project. It is a study of the effects of a proposed project, plan or program on the environment. In other

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words, EIA is an administrative process that identifies the potential environmental effects of any proposal along with its advantages and disadvantages on environment. Positive effects are maximized whereas; adverse effects are minimized to greatest possible extent. "Impact of New Public Transportation System in Nagpur City: A Review" by Narendra M. Hatwar, Prof .V. K. Gajghate. The city will increase their role in the future due to the growth of their dweller, side by side with the increase of their urban issues. Many problems today have their foundation or its bigger share in the cities, thus the cities must be seen as the solutions to these problems. The estimate travel time, Speed before and after introducing public transport in size city through simulation and IRC standards [2]. This Dissertation has investigated a new PT introduction in cities which may lead to sustainable transport and reduce congestion problems in future. "Development of in-vehicle noise prediction models for Mumbai Metropolitan Region, India" by Vishal Konbattulwar, Nagendra R. Velaga, SauravJain,R. B. Sharmila. Road transportation is one of the major sources of noise pollution in urban area. From this study, it was observed that in-vehicle noise pollution was more than 70 dB for 50% of a person's commute. Even when the vehicle is not moving, a person will be exposed to average noise level of more than 67 dB because of vehicle horns, vehicle engine noise, noise due to adjacent vehicles, etc. Intersection area is prone to noise levels above 72 dB in most of the peak hour traffic situations because of heavy traffic and noise due to vehicle horns [3]. "Analysis of Traffic Congestion in Nagpur City**"** by Shradhesh R. Marve, Mangesh P. Bhorkar. Traffic congestion is a global as well as local problem. All over the world, the major cause of traffic congestion is on street parking of the buses or any other vehicles. By providing the bus bay at an intersection the congestion may be reduced Traffic congestion limitations can be upgraded by implementing various strategies such as road widening, improved road infrastructures, restricting routes for Rickshaw and hawkers, and application of Fly over, in future metro.

III. OBJECTIVES

The primary objective of the study is to evaluate the impact of Nagpur Metro on the current Transit Orientation and on the Environmental factors. The environmental factors are both Positive and Negative. Considering case study of Nagpur Metro Alignment-II, the objectives for the present research are formulated as given below.

A. To study the current road user characteristics for the Transit Influence Area (TIA) along alignment-II of Nagpur Metro.
B. To suggest the changes in road use and its policies to increase the density within TIA.
C. To study the Positive and Negative impacts for both Construction and Working phase of Nagpur Metro.
D. To suggest improvement for reducing the Negative impacts of Nagpur Metro for Construction and Working phase.
E. To suggest improvement for enhancing the Positive impacts of Nagpur Metro.
F. To carry out financial feasibility analysis for traffic change for traffic and environment impacts.

IV. DATA COLLECTION

A. Traffic count

Traffic volume studies are conducted to determine the number, movement, and classification of roadway vehicle at a given locations. These are data can help identifies critical flows time period, determine the influence of large vehicle or pedestrian on vehicular traffic flows or document of traffic volume trends. The length of the sampling period depends on the type of count being taken and the intended use of the data recorded.

TABLE III
MOTOR VEHICLES POPULATION IN NAGPUR CITY

Sr. No.	Category	31st March, 2011	31st March,2012	31st,March, 2017
1	Motor Cycles	390102	429837	506651
2	Scooters	293926	318999	285412
3	Mopeds	283810	283771	283744
Total No. of Two Wheelers		967838	1032607	1075807
4	Motor Cars	89479	99233	109181
5	Jeeps	28244	29727	31484

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6	Station Wagons	842	842	842
7(A)	Taxi meter fitted	0	0	0
7(B)	Taxi Tourist Cabs	2661	2907	2891
8	Auto-rickshaws	16417	17149	4805
9	Stage Carriages	1741	1741	1764
10	Contract Carriages	735	899	842
11	School Buses	575	615	752
12	Private service vehicles	1307	1314	1317
13	Ambulances	525	567	639
14	Arti. &Multi.Veh.	896	925	933
15	Trucks & Lorries	12658	13024	15486
16	Tankers	2275	2532	2631
17	Delivery Van (4 Wheelers)	12879	14183	12086
18	Delivery Van (3 wheelers)	6161	6844	4805
19	Tractors	5385	5402	5486
20	Trailers	5263	5348	4076
21	Others	1153	1240	1184
TOTAL		1157034	1237099	1277011

B. Traffic Demand Forecast

To understand traffic characteristics in terms of vehicular, passenger and PCU, 40 traffic count stations were identified, some of which are mid block sections, some locations were fixed as screen line points and some were as outer cordon points.

TABLE IV
DIRECTION WISE PCU TRAFFIC DETAILS AT- NAGPUR ALIGNMENT 2

Loc. No.	Loc. Name		Direction	Traffic PCU	Peak PCU	Peak Hour
1	Wireless Land Hingna Road	E-W	Nagpur To Hingna	9,480	685	8.95%
1	Wireless Land Hingna Road	W-E	Hingna To Nagpur	9,233	638	8.63%
2	Ambazari Tank North	E-W	Nagpur To Hingna	8,866	717	9.36%
2	Ambazari i Tank North	W-E	Hingna To Nagpur	8,294	740	10.66%
3	CA Road Near Railway Station	E-W	Bhandara To Nagpur	14,440	1,074	8.10%
3	CA Road Near Railway Station	W-E	Nagpur To Bhandara	13,889	1,052	8.12%
4	Rajabaxa Road Central Jail	E-W	Ajni To Wardha	13,496	1,161	10.01%
4	Rajabaxa Road Central Jail	W-E	Wardha To Ajni	14,560	1,342	11.22%
5	Wireless – Amravati Road	E-W	Nagpur To Amravati	12,424	1,356	12.77%
5	Wireless – Amravati Road	W-E	Amravati To Nagpur	11,859	1,001	9.92%

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6	Ansari Road – Near Sitabuldi	E-W	Ganeshpeth To Zero Mile	13,566	1,384	12.60%
6	Ansari Road – Near Sitabuldi	W-E	Zero Mile to Ganeshpeth	15,533	1,289	10.20%
7	Old Secretariat – Palm Road	E-W	Nagpur To Amravati	890	9,614	12.39%
7	Old Secretariat – Palm Road	W-E	Amravati To Nagpur	6,977	570	9.83%
8	Raisoni College-Hingna Road	E-W	Nagpur To Hingna	10,347	676	8.40%
8	Raisoni College-Hingna Road	W-E	Hingna To Nagpur	9,535	719	9.87%
9	Untkhana- Nag Road	E-W	Ajni To Bhandara	9,953	1,203	10.75%
9	Untkhana- Nag Road	W-E	Bhandara To Ajni	8,773	698	8.59%



Figure 1: Nagpur Metro Alignment

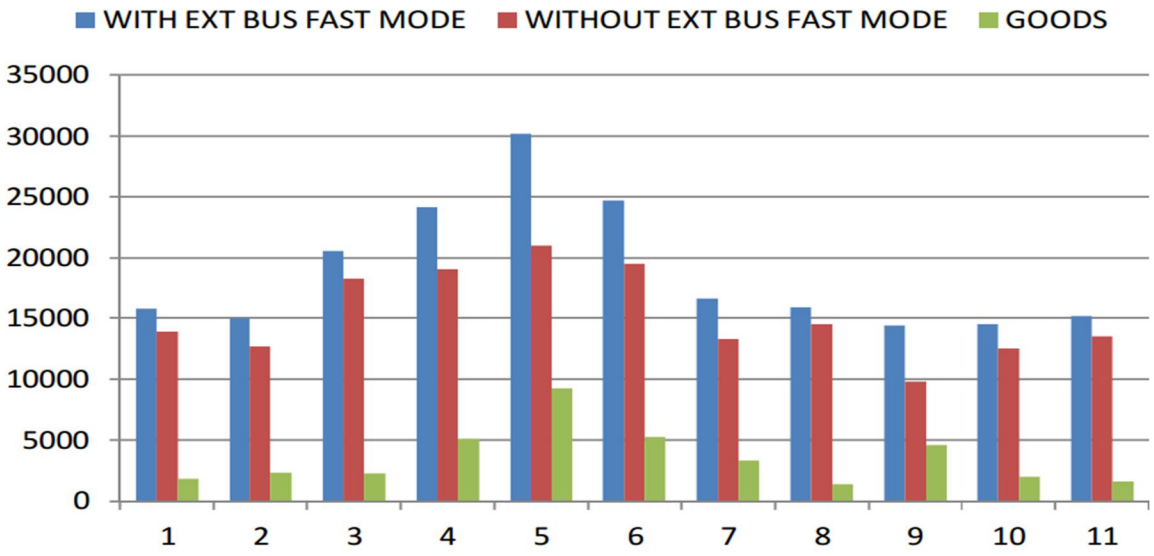


Figure 2 : East-West directional flow (PCU's)

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C. Land Use

The land use/land cover pattern of a region is an outcome of natural and socio –economic factors and their utilization by man in time and space. Hence, information on land use / land cover is essential for the selection, planning and implementation of land use which can be further used to meet the increasing demands for basic human needs and welfare. The different categories of land use of the study region are given in the Table V:

TABLE V
LAND USE CATEGORIES

Sr. No.	Land Use Category	Area (sq.km)	Area Percentage (%)
1	Agricultural Land	11.34	14.52
2	Built-up Area	38.85	49.75
3	Open Area	7.31	9.36
4	Plantation	8.25	10.56
5	Institute	0.51	0.65
6	Industry	6.79	8.70
7	Lake	1.57	2.01
8	Water body	0.42	0.54
9	Canal	0.23	0.29
10	Ground	0.19	0.24
11	Wasteland	2.63	3.37
Total		78.09	100.00

V. IMPACT ANALYSIS

A. Positive Environmental Impacts

1) *Employment Opportunities:* Manpower will be needed in various activities during construction. In operation, about 45 persons per kilo meter length of the corridor, ie (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 centre 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 centre and return from there. Any 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.
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.
7) *Environmental Management Plan:* The project will provide higher living standard, better 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

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carrying capacity. The management plan aims at maintaining the environmental quality of project area minimal in pre-project stage. Environmental management strategy/plans were developed to mitigate the adverse impacts.

B. Negative Environmental Impacts

1) *Project Affected People (PAPs):* The proposed Ahmadabad metro rail project shall cause involuntary displacement of people along the alignment, which shall include both title holder and non-titled holder land owners. The issue of Rehabilitation and Resettlement (R&R) is addressed in a separate SIA report**.**

2) *Change of Land Use*: Acquisition of the private land may cause social disruption and economic loss for the project affected families/people. While implementing the project, there is a need to take into account these disturbances and losses due to the project, their impact on socio-economic condition of the people and plan for their mitigation measures to minimize any negative impacts.

TABLE VI
SUMMARY OF PERMANENT LAND REQUIREMENTS

Land Details	East-West Corridor Prajapati Nagar To Lokmanya Nagar		North-South Corridor Automotive Square To Khapri Depot	
	Govt. Land (SqM)	Pvt. Land (SqM)	Govt. Land (SqM)	Pvt. Land (SqM)
Station Exit/Entry	3644.80	7769.40	7525.30	13812.50
Running Section	3255.33	5680.80	101882.00	19025.90
Depot Area	258973.00		339000.00	
Traffic Integration/Parking	8779.10	1465.70	53759.80	5179.60
Total	274652.20	14915.90	502167.10	38017.60
Total Govt. Land	776819.30	Say 77.68 Hectares		
Total Pvt. Land	52933.50	Say 5.3 Hectares		

From the data it could be concluded that out of total permanent land requirement about 94 % land to be acquired is from Government and 6 % from private sector for both corridors. The compensation for land is included in Social Impact Assessment Study Report.

3) Loss of Trees/Forests: The proposed alignment of metro rail is in urban/ city area and not passing through any forest. Hence no loss of forest is anticipated. The trees are getting affected along alignment, stations and at depots location. There are 279 trees observed along the East West alignment and 222 trees are at depot. Hence the total number of trees observed on East-West corridor is 501. These trees which are having girth below 1 meter will be trans-planted and remaining trees from both corridors (i.e 521) of the trees needs to be cut. With removal of these trees the process of CO_2 absorption and O_2 production will get affected and the losses are reported as follow:

TABLE VII
OXYGEN DEFICIT DUE TO TREE LOSS

Sr. No.	Description	Quantity
1.	Total no. of Trees to be cut	521
2.	Increase in CO_2 @ 21.8 Kg/year/ tree	11538 kg
3.	Decrease in Oxygen production @ 49 Kg/year/ tree	25529 kg

4) Utility/Drainage Problems: Large number of sub-surface, surface and over head utility services viz. sewers, water mains, storm water drains, telephone cables, O.H electrical transmission lines, electric poles, traffic signals, etc. are existing along the proposed alignment. The utility services are essential and have to be maintained in working order during different stages of construction, by temporary/permanent diversions or by supporting in position. Since these may affect construction and project implementation time schedule/costs, for which necessary planning/action needs to be initiated in advance.

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5) Impact on Historical and Cultural Monuments: The proposed metro rail project will affect residential and commercial structures at some of the portion of alignment and metro stations where construction be made by cut and cover method. No Archeological Monuments are directly affected. Utmost care needs be taken so that no significant impact is anticipated on the historical structures due to project activities during construction and operation.

6) Noise Pollution: The cumulative noise on the elevated route alignment will be more than the Noise Standards for Commercial area (National Ambient Noise Standards) of 65db (A) due to the traffic and noise levels from the metro operations.

7) Vibration Impact due to train: The vibration level due to train operation will be in the range 0.062 to 1.0 mm/s. There would be no vibration impact on any structures due to train operation.

C. Impacts Due To Project Design:

1) *Platforms Inlets and Outlets:* The platform level has adequate assembly space for passengers for both normal operating conditions and a recognized abnormal scenario. The platform level at elevated stations is determined by a critical clearance of 5.50 m under the concourse and above the road intersection. The platforms in an elevated situation at least 12.9m above road level. Tunnel Ventilation fans and ASS in underground stations are provided at platform level/ concourse level depending on availability of land for locating vent shafts.
2) *Ventilation and Lighting:* The underground stations are built in a confined space. A large number of passengers occupy concourse halls and the platforms, especially at the peak hours. The platform and concourse areas have a limited access from outside and do not have natural ventilation. It is therefore, essential to provide forced ventilation in the stations and inside the tunnel for the purpose of:
   a) Supplying fresh air for the physiological needs of passengers and the staff;
   b) Removing body heat, obnoxious odours and harmful gases like carbon dioxide exhaled during breathing;
   c) Preventing concentration of moisture generated by body sweat and seepage of water in the sub-way;
   d) Removing large quantity of heat dissipated by the train equipment like traction motors, braking units, compressors mounted below the under-frame, lights and fans inside the coaches, A/c units etc.;
   e) Removing vapour and fumes from the battery
3) *Metro Station Refuse:* The collection and removal of refuse from railway stations in a sanitary manner is of great importance for effective vector control, nuisance abatement, aesthetic improvement and fire protection. The refuse from railway station includes; Garbage, Rubbish, and Floor Sweepings.
4) *Risk Due to Earthquake:* The project area lies in Zone III of Bureau of Indian Standards (BIS) Seismic Zoning Map. Seismic factor proposed by India Meteorological Department (IMD) for the purpose of design of Civil Engineering structures shall be incorporated suitably while designing the structures.

D. Impact Due To Project Construction:

1) *Soil Erosion:* Though the project may not have significant impact on soil erosion, however, minor impact on soil erosion due to runoff from unprotected excavated areas may result in soil erosion, especially when erodibility of soil is high. Problems could arise from dumping of construction soils (concrete, bricks), waste materials (from contractor' scamp) etc. causing surface and ground water pollution. Mitigation measures include careful planning, timing of cut-and-fill operations and re-vegetation. It is also proposed to have Ready Mix Concrete (RMC) directly from batching plant for use at site. The construction material such as steel, bricks, etc. will be housed in a fenced stored yard. The balance material from store yards will be removed for use/disposal at the end of work.
2) *Traffic Diversions:* During piling and open foundation work, a width of about 9 m will be required for construction and the same will be barricaded. It is proposed that two lanes are provided for traffic on either side during construction by widening of roads, if necessary. In certain cases, one way traffic may be resorted.
3) *Muck Disposal:* The proposed metro route is underground for 6.335 km including 4 stations. The construction activity involves tunneling, cut and cover, foundation, fill and embankment. All these activities will generate about 16,03,000 m3 of muck. On land disposal, 40 Ha of area will be required taking an average depth of filling as 4 meter.
4) *Increased Water Demand:* The water demand will increase during construction phase. The water requirement estimated for the proposed Metro rail project during construction will be about 244KLD. Sufficient water for construction purpose is made available by digging borehole/borewell within the vicinity of the project site during the construction phase. Hence proper care shall be taken while deciding the location of these activities or drawing water from public facilities.

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TABLE VIII WATER REQUIREMENT DURING CONSTRUCTION

Sr. No.	Water Requirement	Quantity
1	At Labor Camps	63 KLD
2	At Construction site for drinking	20.5 KLD
3	Construction activities	244 KLD
	Total	327.50 KLD

5) *Loss of Historical and Cultural Monuments:* No historical/cultural monuments will be affected/ damaged as a result of the proposed development.

F. Impact Due To Supply of Construction Material

Metro construction is a material intensive activity. Quarry operations are independently regulated activities and outside the purview of the project proponent. It is nonetheless, appropriate to give consideration to the environmental implications in selection of quarry sources since poorly run operations create dust problems, contribute noise pollution, ignore safety of their employees, or cause the loss of natural resources. About 10-15% of the construction material such as waste material from contractor camps is left behind by the contractor as construction waste/spoils. Dumping of construction waste/spoil in haphazard manner may cause surface and ground water pollution near the construction sites.

VI. CONCLUSION

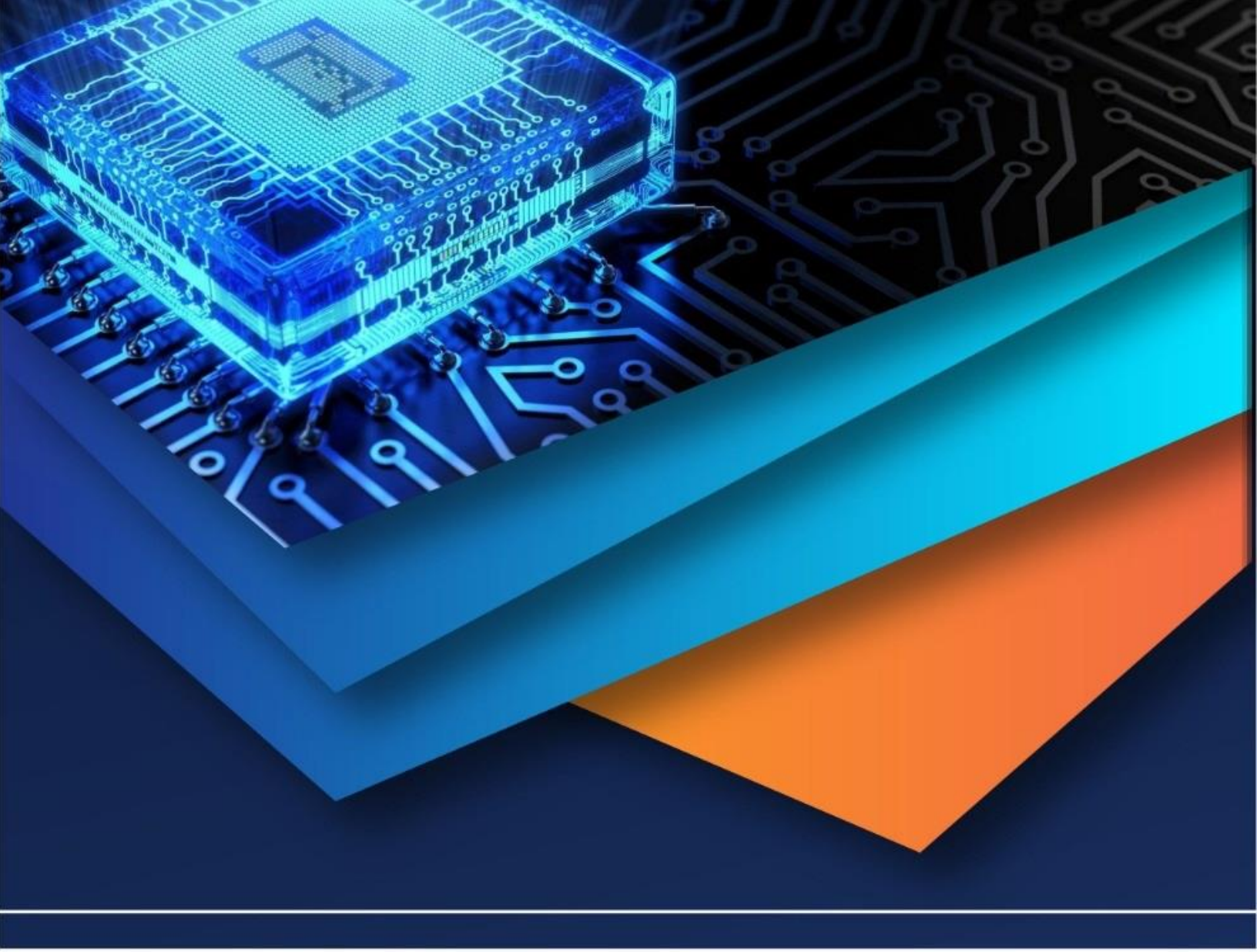
The methods and data used for environmental assessment are insufficient to meet the objectives of rapid assessment, and there are no national standards for data collection. However, tools for in-situ monitoring, remotely sensed monitoring, data compilation, analysis and modeling are continually being improved, and because advances in computer technology practitioners have quick access to tools. The new and improved tools now allow for substantial improvements in environmental assessments.

The proposed Metro line is proved to have significant positive effects to the development of Nagpur City. Benefits to the economy, traffic congestion reduction, quick and safe transport, employment opportunities, fuel consumption reduction, and air quality improvement are the obvious positive effects from this Metro Rail. Appropriate mitigation measures have been developed for potential adverse environmental impacts. With the implementation of the EMP and the environmental monitoring plan, the project is not expected to have significant residual environmental impacts. The city will increase their role in the future due to the growth of their dweller, side by side with the increase of their urban issue. Many problems today have their foundation or its bigger share in the cities, thus the cities must be seen as the solutions to these problems. The estimate travel time, Speed before and after introducing public transport in size city through simulation and IRC standards. This Dissertation has investigated a new PT introduction in cities which may lead to sustainable transport and reduce congestion problems in future.

REFERENCES

[1] "A review on Environmental Impact Assessment of Construction Projects" by Vivek Kumar Tiwari, Anjali Verma, Akash Kumar and Manjul Gupta. Department of Environment Science, Babashaheb Bhimrao Ambedkar (A Central) University, Lucknow, 226025 Paramarsh Consultancy Service for Environment, Viram Khand 4 H. NO 97 Gomti Nagar, Lucknow.
[2] "Impact of New Public Transportation System in Nagpur City: A Review," by Narendra M. Hatwar, Prof .V. K. Gajghate. Civil Engineering Department, M-Tech Transportation G. H. Raisoni College of Engineering Nagpur Maharashtra, India Assistant professor Civil Engineering Department G. H. Raisoni College of Engineering Nagpur Maharashtra, India.
[3] "Development of in-vehicle noise prediction models for Mumbai Metropolitan Region, India," Vishal Konbattulwar, Nagendra R. Velaga , Saurav Jain , R. B. Sharmila. Transportation Systems Engineering, Civil Engineering Department, Indian Institute of Technology Bombay, Mumbai 400076, India Civil Engineering Department, Indian Institute of Technology Bombay, Mumbai 400076, India
[4] Sustainable Transportation Systems Linkage between Environmental Issues, Public Transportation, Non-Motorized Transportation and Safety, Economic and Political Weekly, 1999. Gee tam Tiara.
[5] F. Vanclay, and D. A. Bronstein, Environmental and social impact assessment, New York: Wiley, (1995).
[6] B.A Dutta, and Sengupta, Environmental Impact Assessment (EIA) and Construction, International Research Journal of Environment Science, (2014).
[7] Arrington, G., Cervero, R., 2008, Effects of TOD on Housing, Parking, and Travel. Transit Cooperative Research Program (Report 128)
[8] Cervero, R., 2006, "Public Transport and Sustainable Urbanism: Global lessons" Science Council of Japan, 2006.
[9] City of Ottawa Planning, Transit and the Environment Department, Transit Oriented Guidelines for OTTAWA. Ottawa, 2007.
[10] Clower, T., Ruggiere, P., Bomba, M., Arndt, J., Li, J., Edrington, S., et al., 2011. Evaluating Impact of Transit Oriented Developmet.
[11] A Report on Delhi Metro Rail Corporation, Transit Oriented Development (TOD): Study for Existing Metro Corridor between Chattarpur and Arjangarh of Delhi Metro Project of Phase II, Delhi by Govt of India.

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