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Environmental Impact Assessment (EIA) For Bus–Based Rapid Transit System (BRTS) Bhopal, MP, India

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Abstract

EIA includes assessing the present status of air, water, land, noise, biological and socio-economic components of environment based on secondary data collected from various respective departments. Centrally located, Bhopal, capital city of Madhya Pradesh, is located on a hilly terrain within the Malwa Plateau. With an estimated population of 25 lakhs for the year 2011, it mainly relies on public transport with 48% share of passenger trips; this includes standard buses, mini buses and tempos (magic). Bus rapid transit (BRT) is a high-quality, high-capacity bus service that travels on exclusive lanes along designated routes, often compared with the speediness and comforts of a streetcar. BRT buses reducing travel time by 15 to 30 percent and with proper passenger facilities will surely revolutionize the public transport in Bhopal. While, time saving benefits, fuel savings, reduction in air pollution and in traffic congestion and noise and vibration reduction fall under the positive impacts, there are some negative impacts on environmental components of this project; which can be seen on three stages: the Design Stage, construction stage and operational stage. This paper predicts possible impacts on different component of environment during different phases of BRTS Bhopal and suggests possible mitigation measures for prevention as well as reduction.

Keywords: Bus–based rapid transit system (BRTS), environmental impact assessment (EIA), public transport, pollution.

Introduction

Environmental Impact Assessment (EIA) study is done to provide information on the surroundings and the extent of environmental impact likely to arise on account of proposed Bus based Rapid Transit System (BRTS) on environment: Assessing the present status of air, water, land, noise, biological and socio-economic components of environment based on secondary data collected from various respective departments. To give brief description of the project. To identify, predict and evaluate environmental and social impacts expected during different phases of project in relation to the existing civic infrastructure and the sensitive receptors, if any. To suggests mitigation measures to minimize the pollution, environmental disturbance during various phases of the project.

Bhopal: City Profile: Location and Linkages: Spanning over an area of about 285km^2, Bhopal the capital of Madhya Pradesh is located on a hilly terrain within the Malwa Plateau. National Highway 12 (Jaipur-Jabalpur road) links the city to many large cities in the north-west and the south-east while State Highways connect it with Indore and Sagar. It is connected to Chennai, Delhi, Nagpur and Mumbai by railways. The city is also served by regular air services to Mumbai, Delhi and Indore.

Physical and Geographical Character: Bhopal has an unusual topography which provides an exclusive attraction to the city. Hills form a continuous belt right from Singacholi to the Vindhyachal range upto an altitude of 625 meters, being the maximum in this area. However the general ground level is nearly 460 meters.

The climate of Bhopal is moderate with temperature ranging between 10-40 degree Celsius; the highest temperature although occasionally rises to 43 degree Celsius. The winter season lasts from November to February, the summer from March to June and the monsoon from mid June to September while October sees the change from rainy to the winter season. Winds blow from west and southwest during the monsoon. Soil present is hard red and black cotton having depth ranging between 4-10 feet.

Natural Drainage: Three main valleys provide the natural drainage; by river Halali on the on the north-eastern side, by river Kaliyasot on the south-eastern side while on the south-western side, the drainage is provided by various small nallahs which further drain out in Kolar river which ultimately joins river Narmada.

Regional Setting and Growth Pattern: Socio-economic linkages influence the developments taking place in the city. These linkages are changing and evolving continuously in secondary and tertiary settlement systems around the city.

The maximum growth of the city has taken place towards the south-east direction along the Hoshangabad road. The ease of transportation, levelled land and nearness to Habibganj railway station are the major factors responsible for this growth. However, the vast expanse of the Upper Lake could not encourage the Westward growth of the city.

Land Use: The various land use classification categories in the Development Plan 1994-2005 were industries, residences, commerce, schools, roads etc in order to understand the quantum of land utilization for various uses, their functional interrelationship, environmental problems etc.

The Bhopal Development Plan 2005 was planned for population of 25 lakhs. The Population of Bhopal was not grown up to the expected growth then, it was estimated that in 2005 Bhopal had a population of approximately 17 lakhs. The BDP predicted around 17,500 hectares of developed area till 2005 but the actual developed area was 10,400 hectares.

Table-1
Existing and Proposed Land Use, Source: BDP 2005

S N	Category	Existing Dev. Area 05 in ha	05 %	Proposed Dev. 2005 Area in ha.	%
1	Residential	4980	47	8190	46.48
2	Commercial	410	4	650	3.71
3	PSP and PUF	1250	12	1746	9.96
4	Industrial	900	9	1389	7.93
5	Transportation	1350	15	2600	14.85
6	Recreational	1600	13	2925	16.71
	Total	10400		17500	

Description of the Project: Bhopal depends mainly on public transport with 48% share of passenger trips, this includes standard buses, mini buses and tempos (magic). There are about 3,00,000 two wheelers and 50, 000 cars that make the private mode contribute 37.4% of passenger trips to the transportation system of the city.

Intermediate public transport has autos and taxis and share about 5.7% of the passenger trips and non motorized vehicle such as cycles share 8.3% of the same. On an average the route length is about 27km. The average journey time is 1 hour 35 minutes for boarding and alighting, with an average travel speed of 45km/hr. And the net travel time comes out to be 40 minutes.

The number of passenger per trip is about 46, there are frequent request stops and most of the routes pass through the old city area, primarily because of the demand. The pilot study of BRTS in Bhopal was conducted by BCLL & BMC.

4 Identified BRTS Corridors to be Developed under Phase-I are: Corridor 1-Bairagarh to Misrod (23 km), Corridor 2-Roshapura to ORR (14km), Corridor 3- Board Office to Raisen Road (2.94 km), Bharat Talkies to Tajul Masajid (3.33 km) All Corridors put together account for a total length of 44kms. Corridor 3 and 4 are only road links to connect Corridors 1 and 2. For operational purpose, it can be safely assumed to have only two Corridors i.e.: Corridor 1 Length (23.5 + 2.9) 26.4kms say 27kms, Corridor 2 Length (14.6 + 2.9) 17.5kms say 18kms

A Detailed Engineering Study of identified Corridors by BCEOM French Consultant is under progress.

The major elements of BRTS are running ways, stations, vehicles, fare collection, ITS, Service and operations plan. The system performance will have travel time savings, reliability, safety & security, capacity, identity & image, reduction in congestion on road.

Design features: Length of the platform would be 25 metres and with 3.5 metres. The pavement will be flexible and location of bus way would be at central median, the width of bus way will be around 3.3 to 3.5 metre. The bus stop would mostly be located near intersection. The bus lanes will be segregated up to ROW of 30 metres and above. The running way will be a combination of partially open and partially closed system.

Details: With 30m ≥ RoW - it will be a *partially* closed system. With 24-30m RoW - it will be an open system (bus lane priority with Road Marking only). With 20-24m RoW - it will be *partially* open system (bus lane priority with Road Marking). With <20m RoW - there will be one-way system. Wherever 45m RoW is available, service lanes for access and MVs/Cycles would be provided.

Other Features: Bus stands at an average distance of 500m and as per Boarding-Alighting survey results (demand). Provision of pedestrian actuated signals at bus stop and automatic signalling at intersections. There will be aesthetically designed buses, with features like right side wide door hydraulically operated by driver and front left hand emergency door. Also, height of bus floor and platform to be at same level.

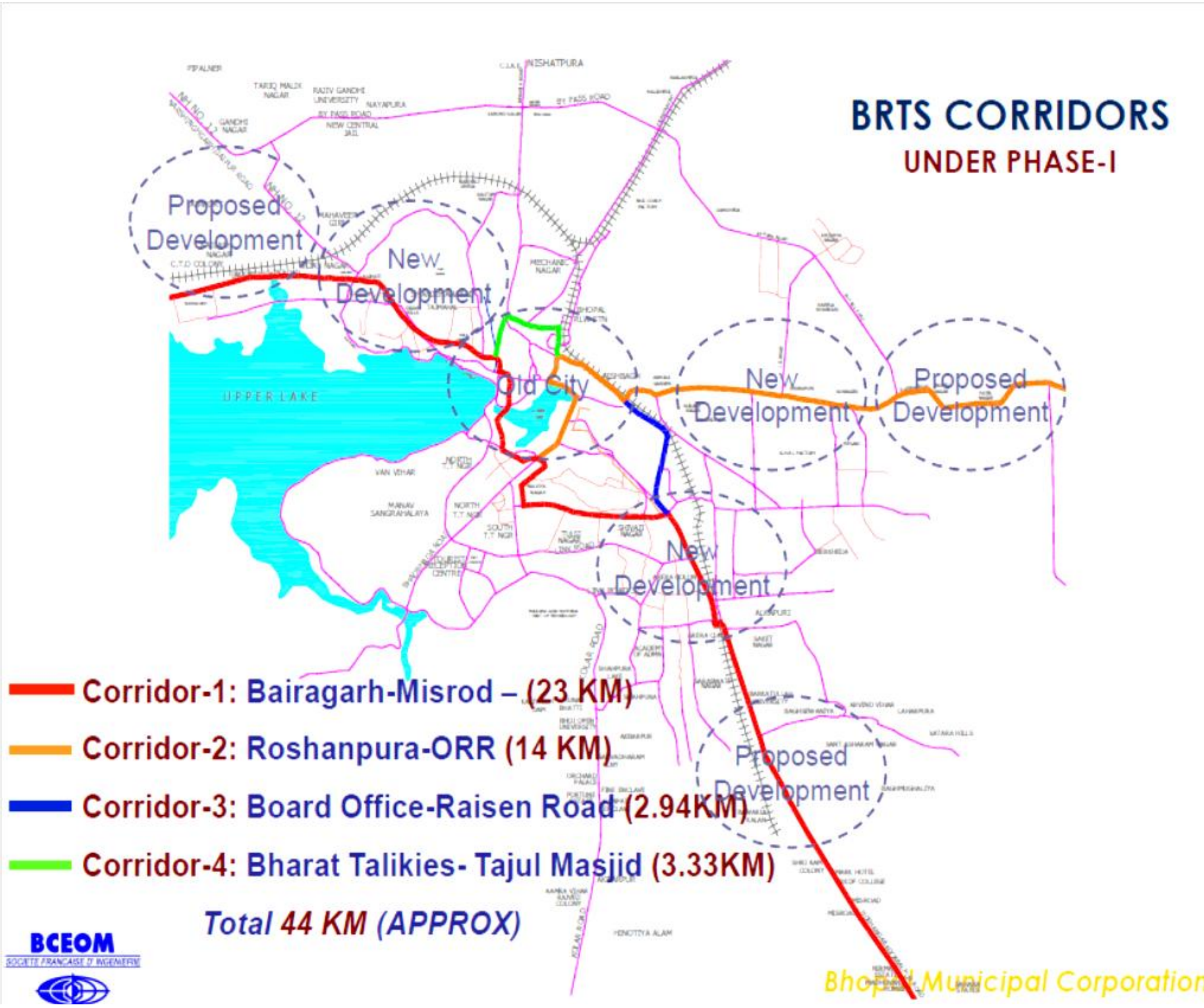

Figure-1
BRTS Route Map, Source: BMC, Bhopal

The issues that came up after the study by BCEOM were: Road widths are not uniform throughout the Corridors. On street parking need to be restrict along the BRTS corridors. A comprehensive Parking Policy to be evolved. Additional Demand on BRTS corridors to be created through: Restricting other competing modes of transport (including individual private modes). By attracting people to BRTS with world class services.

Assesment of Potential Impacts: The impact of this project can be seen on three stages: i. the design stage, ii. construction stage, iii. operational stage.

Positive Impacts: Time saving Benefits to transit users, Fuel Savings from public transport operations, Reduction in air pollution, Reduction in traffic congestion, Noise and vibration reduction, etc.

Negative impacts on components of environment: Design Stage: Removal of Structures, Removal of trees and vegetation, Land Acquisition

Construction Stage: Earth works including quarrying, Laying of pavement, Vehicle & Machine operation and maintenance, Asphalt and crusher plants, sanitation and waste (Labour campus)

Operational Stage: Vehicles Operation and Emission

Impact on Soil:

Design Stage	*Construction Stage*	*Operational Stage*
• Loss of useful soil • Generation of debris • Wearing away of top soil	• Erosion of top soil • Contamination by lubricants and fuel • Compaction of soil • Contamination from wastes	• Spill from accidents • Deposition of lead

Impact on Air:

Design Stage	*Construction Stage*	*Operational Stage*
• Dust generation during dismantling • Reduced buffering of air and noise pollution, • Hotter and drier microclimate	• Dust generation • Asphalt odour • Noise, dust, pollution • Odour/ smoke	• Noise • Dust • Pollution

Impact on Water:

Design Stage	*Construction Stage*	*Operational Stage*
• Siltation due to loose earth	• Change of drainage • Stagnant water pools in quarries. • Decrease of ground water recharge area • Contamination by fuel and lubricants • Contamination by asphalt leakage • Contamination from overuse waste	• Spill contamination by fuel, lubricants and washing of vehicles

Impact on Flora:

Design Stage	*Construction Stage*	*Operational Stage*
• Loss of Biomass	• Loss of ground for vegetation • Removal of vegetation • Lowered productivity use as fuel wood	• Impact of pollution on vegetation • Toxicity of vegetation.

Impact on Fauna:

Design Stage	*Construction Stage*	*Operational Stage*
• Disturbance • Loss of Habitat	• Disturbance • Poaching	• Collision with traffic

Climate: There are no adverse effects on climatic conditions such as temperature; wind etc. microclimate may get affected due to removal of vegetation and addition of road surface. There may be a temperature difference in the areas adjacent to road surface and other areas due to reduction in roadside plantation.

Physiography: BRTS Project may alter the local physiography as well as the drainage pattern. Minor cut-and-fills are designed to improve the road geometry and parallel cross structure is added to improve drainage. These changes are minor as there will be a slight change in height and width of the road cross-section.

Drainage: There is no alteration of existing drainage system but there will be slight changes in drainage characteristics because of topographical changes. This project can only have a negative impact when the slopes created for the improvement of road geometry are not re-vegetated or stabilized.

Ambient Noise: Noise, aptly defined as unwanted sound is one of the most undesirable consequences of road development. Crushing plants and asphalt production plants produce high noise levels, 90-100 dBA. Movement of vehicles, unloading of construction materials, construction activities are some of the sources during construction phase whereas heavy traffic adds to the noise pollution during operation phase. Average noise levels increase from 1 to 2 dB for each 10km per hour increase in average traffic speed.

Social Impacts: As with other indicators, the social impacts of a BRTS will depend on how the system is designed, some of these impacts are stated below:

Property expropriation and resettlement: Usually the greatest concern in social appraisal of infrastructure projects is with property expropriation and involuntary resettlement. Normally BRT systems will be designed in such a way as to minimise involuntary resettlement, and in fact BRTS frequently make it possible for municipalities to put off or stop all together new road projects which would have much higher levels of involuntary resettlement.

Displacement of Para-Transit workers: Of much greater concern with BRTS is what will happen to the former para transit operators and the families that rely on them for income. In most BRTS, negotiations with existing bus operators have been tense. Certainly, if all the most lucrative public transport routes in a major city are taken away from local para-transit operators who own their own vehicles and these routes are given to a different corporation. The former para transit drivers who have put their life savings into their minibuses, now are holding a worthless asset. Such a decision would no doubt lead to significant social upheaval.

System Sociability: Public transport systems can also provide one of the few places in a city where all social groups are able to meet and interact. An affordable and high-quality system can attract customers from low income, middle income and high income sectors. This role as a common public good can be quite healthy in creating understanding and easing tensions between social groups. The new system may also mean that persons who previously had no travel options now can visit the entire city.

Safety: The separation of public transport vehicles from mixed traffic and the improvements to pedestrian crossings and traffic signalisation are measures typically employed to make a new BRT operate efficiently. These same measures also tend to produce significant safety benefits. Thus reductions in vehicle accidents and pedestrian, accidents often accompany the implementation of a new system.

Suggested Mitigation Measures: Development of site for proposed BRTS routes to a certain extent, create inevitable impacts mainly during construction phase. Some mitigation measures are suggested below to reduce these impacts:

Design Stage: Plans should be made such that minimum vegetation is removed. Excavation should be avoided during monsoon to reduce soil erosion. Rainwater harvesting system should be proposed to reduce water runoff.

Some major social impacts like displacement of Para-Transit workers could be avoided by negotiation and compromise to ensure that at least some existing operators enjoy the benefits of the new system, while at the same time not holding the public interest hostage to the demands of these private interests.

Construction Stage: Soil contamination by oil/grease should be prevented by using leak proof containers for storage and transportation of oil/grease and wash off from the oil/grease handling area shall be drained through impervious drains and treated appropriately before disposal. As majority of waste generated consist of concrete and masonry, recycling of this waste by conversion to aggregate can offer benefits of reduced landfill space and reduced extraction of raw material for new construction activity. Recycled aggregate can also be used as a sub base for road construction. Domestic waste generated from labour camps should be collected and composted on site along with the biomass from the land clearing activities. The non-compostable and non-recyclable portion of the waste should be collected and transported to the nearest identified landfill site. Noise prone activities could be restricted to the extent possible during night.

Operational Stage: Bare areas should be re-vegetated after the construction stage. Greenbelt should be proposed to increase vegetation. Use of organic fertilizer should be maximised for landscaping and greenbelt development. Restriction of speed should also be imposed to reduce emission rate. Regular maintenance of the vehicle should be made mandatory.

Conclusion

Environmental Impact Assessment (EIA) study was done to provide information on the green lush surroundings of Bhopal city and the extent of environmental impact likely to arise on account of proposed Bus based Rapid Transit System (BRTS) on the environment and livelihoods of people consequently.

Analysing the characteristics of the city in terms of climate, socio economic activities, land use, network and connectivity, it was easily seen that the city enjoys a moderate climate, being centrally located it is well connected to all the regions, and being a state capital a large number of people are engaged in administrative activities, about 47% of the total land-use belongs to residential area, and that of transportation is 15%.

Talking about the project, as 48% of the trips depend on public transportation, the proposed BRTS is divided among 4 different corridors; all the corridors put together account for a total length of 44kms. All in all, the project will not only be time saving, fuel saving, but will also reduce traffic congestion and noise pollution. But as every job has its pros and cons, the project comes up with problems like, land acquisition and removal of green cover.

The suggested measures from our side are that plans should be made such that minimum vegetation is removed, for every amount of removed vegetation, new green belt should be proposed. Avoiding excavation during monsoon and noise prone activities during night will be of great relief to the city dwellers. Lastly, restriction of speed should also be imposed to reduce emission rate. Regular maintenance of the vehicle should be made mandatory.

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