



# INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact factor: 4.295

(Volume 3, Issue 6)

Available online at [www.ijariit.com](http://www.ijariit.com)

## A Study of Sustainable Transportation System in Ahmedabad and Delhi

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**Abstract:** This paper on sustainable urban transport attempts to overview an all-inclusive set of indicators which are taken up by planners, authorities in order to help cities for developing an integrated and sustainable transportation system. Developing countries like India, where unplanned urbanization and unparalleled growth in motorization have led to increased focus on sustainable use of mass transit systems like commuter rails and bus transportation. An integrated transportation strategy is most needed so that these modes of transport are integrated efficiently to facilitate the sustainable transportation. The vision of planners is to ensure easy access, safe, affordable, quick, comfortable, reliable and sustainable mobility for all sections of the society in our cities. The present transport system in most of the Indian cities is stressed under an urban environment which is made up of different sub-systems. Hence it is obvious to understand how these sub systems perform in order to have a sustainable mass-transit transportation network. The various modes of urban transportation – BRTS, Metro, Bicycle-sharing, usage of CNG fuels – currently available in the city of Ahmedabad and Delhi are discussed in the paper in the context of urban transport characteristics, public transport, and non-motorized transport. For promoting sustainable urban transport in a holistic manner it is equally important to understand the social, economic and environmental sustainability of each of these sub-systems.

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**Keywords:** Sustainable Transport, Mass-transit, Integrated Transportation System, BRTS, Metro Mass Transit.

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### INTRODUCTION

India now accounts for one-sixth of the world's population. In the past 20 years, India has experienced rapid economic growth and urbanization. The Indian economy has become the fourth-largest economy in the world. This rapid expansion presents new and significant challenges to India, global economy, and the environment. India's population was approximately 30% urbanized in 2006, but this share is expected to grow to 60% before stabilizing [1]. The transportation sector in India is rapidly expanding its share of energy use. If India follows the typical model of economic growth that involves high energy use and high consumption, its continued growth will have a significant, and potentially dangerous, the effect on the global environment. Air quality and traffic safety have declined tremendously in many urban areas as street congestion have increased a lot, and India is already amongst the world's largest producer of greenhouse gas (GHG) emissions.

### I. CASE STUDY OF AHMEDABAD & NEW DELHI

Ahmedabad, with a population of approximately 5 million, is the largest city in the state of Gujarat and serves as its commercial and financial hub. For long, Ahmedabad's economic strength was based on its manufacturing industry, mainly pharmaceutical and textiles, making it as the fourth most polluted city in India in 2001. With all this development taking place around, the city faced various transportation challenges due to increased vehicle ownership, population growth, and longer traveling distances. To tackle this growing issue of chaos in the city, in 2007 the Ahmedabad Municipal Corporation proposed India's first citywide BRT system. A substantial portion of the funding for design, engineering, and construction was provided by the Jawaharlal Nehru National Urban Renewal Mission (JNNURM), a flexible program initiative administered under Ministry of Urban Development. Ahmedabad city was honoured with the Sustainable Transport Award in 2010, which is given yearly by the Institute for Transportation Development and Policy (ITDP) in recognition to its progress in increasing mobility for all residents while reducing transportation GHG and air pollution emissions and increasing safety and access for cyclists and pedestrians. Ahmedabad is now being acknowledged for its BRT system and superior pedestrian and bicycle friendly facilities.

## New Delhi

The population of New Delhi is expected to cross 20 million in the coming 10 years. Similar to Ahmedabad and other metro cities in India, the primary causes of severe congestion is the rapid growth in vehicle ownership and steadily rising incomes, which allow residents to live farther from work. Unlike many other metropolitan areas in India, however, Delhi's potential for redevelopment in the urban core is limited by the presence of the federal government and its associated buildings, institutions, and services. Delhi's more advanced highway infrastructure and higher rates of automobile ownership have generated substantially more sprawl than in many other Indian cities.

## II. OVERVIEW

'Sustainability' is defined as meeting today's needs without compromising the ability of future generations to meet their needs. With respect to sustainable transportation programs/projects, three critical aspects should be considered to implement the decisions.

**1. Environmental aspects:** Attention should be given to methods that minimize or reduce any negative effect and maximize the benefits to the environment from any transportation program/project decision.

**2. Economic aspects.** Due weightage should be given to financing a transportation project in a manner that maximizes the economic viability of those affected by the decision over the long term.

**3. Social issues.** Consideration should be given to how the program/project will affect society in general, as well as individuals who might be affected directly by the decision.

Public transportation plays an important role in moving people but also in sustaining economic development. In most Indian cities, intense growth in automobile ownership and increased usage is causing severe congestion, and adding new highway capacity is not seen as a sustainable option.

These cities face environmental quality issues caused by air pollution from traffic congestion. Central, State & local level government bodies have reacted to these challenges through a wide variety of policy initiatives and programs. During study, it was observed that various modes of public transportation – traditional fixed-route bus service, BRT, metro, bicycle share, and pedestrians – struggle to grab the market share both in terms of revenue and passenger load. Each of these transit systems attempts to make service convenient and affordable. Advancements in technology, ranging from fare collection to real time information systems, are critical to the success of the services.

## III. SUSTAINABLE TRANSPORT & PUBLIC POLICY

In India, reactions to the challenges of unplanned urbanization and rapid economic growth are being incorporated in a national policy framework. The planners and authorities have recognized the importance of public transportation to their national growth strategies and have taken various sustainable initiatives to provide strong policy guidance for building and operating the public transit systems.

India's National Urban Transport Policy, adopted in 2006, includes the following policy objectives:

- Encourage greater use of public transport and non-motorized modes by offering central financing assistance for this purpose.
- Incorporate urban transportation as an important parameter at the urban planning stage
- Encourage integrated land use and transport planning in all cities so that travel distances are minimized
- Bring about a more equitable allocation of road space with people, rather than vehicles, as its main focus. (2)

## IV. SUSTAINABLE PUBLIC TRANSIT SYSTEMS

### 1. Bus Rapid Transit

In the city of *Ahmedabad*, Janmarg BRT system was developed by the Gujarat Infrastructure Development Board (GIDB) with planning and implementation assistance from the Ahmedabad Urban Development Authority (AUDA) and the Ahmedabad Municipal Corporation (AMC). BRTS buses started running in October 2009 on the first corridor of the Janmarg BRT system. The contract for the operation was given to a private operator who is rewarded based on the service level provided. A global positioning system (GPS) provides vehicle location in real-time to dispatchers and real-time next-stop information to bus riders. The driver-operated remote-controlled gate system provides a safe, simple-to-implement, and cost-effective system for boarding/alighting passengers.



Fig 1: Janmarg BRT station in Ahmedabad.

Delhi Transport Corporation (DTC) operates around 6,000 buses in *Delhi* which travels on daily basis carrying four million passengers daily. Fares on these buses are based on distance, but higher fares are charged on AC buses than on non-AC buses. Delhi's BRT system currently operating on mere 5.8 kilometre corridor. On completion, it will serve almost 14 corridors on more than 100 kilometres of BRT lanes. Each BRT station has around 6-7 passenger shelters.



**Fig 2 CNG Buses at the DTC Depot in Delhi**

There are no exclusive BRT lanes. Instead of physical barriers, lane marking is used, and BRT buses operate in middle lanes. Frequency on BRT routes is 5 minutes. At intersections, within the BRT corridor, transit signal priority is given in the queue area using loops. Since bus stations are used by different public and private transit providers, bus stops are provided with no entry barriers and therefore, fare collection is done after boarding the bus.

## **2. Metro**

Ahmedabad is planning MMRTS (Metro Mass Rapid Transit System) in near future.

The highlight of Delhi's urban transit system is its metro rail system. Even though the capital cost of the metro is significant, but it helps in saving a lot of GHG emissions (As per a study by the CRRI. (3)

Delhi Metro is being constructed in phases. Phase 1, (started operating in 2005), consisted of 65 kilometers, Phase 2 added another 125 kilometers which was completed in 2011. Phase 3 will have 115 kilometres, and Phase 4 will add another 108 kilometers to the existing network.

To have an integrated public transportation network in and around Delhi, local mini-buses, buses are redirected to feed metro rail stations thus acting as a feeder to the metro which was initially having a low load. To reach out benefits of metro rail to the neighbourhood areas, DMRC started operating its own feeder bus and Tata-magic network to locations within 4-5 kilometers. To increase the ridership, a joint ticketing system is suggested to jointly serve metro rail, BRT, and local buses.

Delhi metro authorities are trying to preserve the environment through earning carbon credits through the United Nations Framework Convention on Climate Change. Carbon credits are earned by redeemable energy in operation (through regenerative braking) and by achieving modal shift. DMRC estimates that the Delhi Metro has generated savings of 217 tons of fuel and 492 tons of emissions (including carbon dioxide) and prevented 161 road deaths, resulting in approximately US\$500,000 in credits earned through energy savings and US\$3 million in credits earned through modal shift. DMRC is providing easy and friendly access to disabled persons by installing elevators at multilevel stations. Personal attendants from station ingress to exits are also available on request. Real-time next-train arrival information is available at all the metro stations as a customer comfort, and tap-and-go smart tokens are used for one-time journeys.

## **3. Bicycle-Share Programs**

Historically, India has a strong bicycle modal share. But due to the unprecedented industrial development and rapid and unplanned expansion of urban areas have led to a sharp drop in the usage of bicycles for travelling. In Delhi, the share of bicycle trips fell from 17% in 1981 to 7% by 1994. Transport planners and government agencies are struggling to increase the use of bicycles by integrating bicycle-share programs into their public transit systems. India's NUTP states that "non-motorized modes are environmentally friendly and have to be given their due share in the transport system of a city," and that "the central government would give priority to the construction of cycle tracks and pedestrian paths in all cities." (4)

Bicycle sharing was announced in Delhi as part of the Green Bike Cycle Initiative during the operation of the BRT service. This initiative is managed by DIMTS. 5 bicycle-sharing locations were established along the BRT corridor to incorporate the new program with bus-based transport. (5)

## **4. Alternative Fuel and Vehicle Technologies**

One of the most important sustainability steps taken by the city authorities was the replacement of diesel public transport vehicles, including autos, with vehicles running on CNG. In Ahmedabad, the BRT operates 145 dedicated CNG, low rise-floor, special-purpose buses. Auto-rickshaw is a popular, efficient, and affordable transit medium used throughout Ahmedabad. Till 2005, out of 50,000 3-W auto-rickshaws, about 15,000 were more than 20 years old, and a most of them used contaminated fuels (diesel and kerosene). In an aggressive attempt to improve environmental pollution, all autos registered before 1991 were called off the road.

Also, diesel run autos were not allowed to run within city limits and only CNG based auto was registered. Low-interest loans were provided to operators to promote the purchase of new eco-friendly CNG auto-rickshaws. In Delhi, the DTC operates CNG fleet of around 6,000 buses, which helped in reducing GHG in the city. Delhi High Court ordered that all buses, rickshaws, and taxis were to be converted to CNG and new 70 CNG fuelling stations were to be made available. The court also directed the government to provide financial incentives for these conversions. By the end of 2002, the diesel bus had almost disappeared from Delhi's roads.

#### **V. CONCLUSION**

To achieve sustainability in terms of public transport in the cities, following conclusions are drawn:

1. In order to ensure mass mobility, public transportation should be a priority
2. A multi-modal and integrated transit systems comprising of pedestrians, bicycles, buses, metro, and rail is to be created
3. To monitor the sustainable development of the city, use of an integrated mass-transportation system as a planning mechanism.
4. Adopting more economical, sustainable and environment friendly technologies to mitigate air quality problems (CNG vehicles, hybrids, electric vehicles, etc.).

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