The Delhi Bus Corridor

A Report by EMBARQ – The WRI Center for Sustainable Transport

June 2009
Table of Contents

Authors 1
Benefits & Achievements 2
Promising Beginnings 4
Evaluation Methodology 8
How a BRT System Works 10
Answering the Public’s Questions 12-17
EMBARQ’s Recommendations 18-27
  IMPROVING BUS OPERATIONS 18
  MEASURING TO MANAGE 20
  ADJUSTING TO CHANGING CIRCUMSTANCES 22
  SERVING THE CUSTOMER 24
  MARKETING THE PRODUCT 26
Additional Challenges 28
Design & Performance 30
Since 2006, the Centre for Sustainable Transport in India (CST-India) has been working at the national, state and city level. CST-India continues to provide technical support and capacity building activities to a growing roster of clients and partners on bus planning, cycling and pedestrian projects. CST-India has since expanded into other areas of sustainable transport, taking advantage of emerging trends and partnerships. For example, CST-India has been working with the World Resources Institute (WRI) to diagnose and solve transport problems in Indian cities. Based in Mumbai, the Centre for Sustainable Transport in India (CST-India) has been working since 2006 to catalyze and help implement sustainable solutions to problems of urban mobility. Since 2002, the network has grown to include five Centers for Sustainable Transport, located in Mexico, Brazil, India, Turkey and the Andes, that work together with local transport authorities to reduce pollution, improve public health, and create safe, accessible and attractive urban public spaces. The network employs more than 60 experts in fields ranging from architecture to air quality management, geography to journalism, and sociology to civil and transport engineering.
Moving more people, faster
The average time for motorized travel along the Delhi bus corridor decreased from 27 to 22 minutes. This is the combined effect of a reduction in travel time for bus users from 30 to 22 minutes and a slight increase in travel time for car users from 22 to 26 minutes.

The average speed of buses along the pilot corridor has increased from about 12 kilometers per hour to 18 kilometers per hour.1 As a result, the average travel time for bus users has decreased by 35%.

Satisfied Commuters
An overwhelming majority of bus commuters (88%), as well as of pedestrians and cyclists (85%), said they were happy with the new system.2 And about half of car drivers, two-wheelers and other commuters expressed similar sentiments.

New space for pedestrians and cyclists
As a result of the pilot project, cyclists and pedestrians have, for the first time, a high-quality space for moving around Delhi. The effort has paid off; between 1100 and 1300 cyclists use the new cycle facility everyday in the peak hour.3

Quick Facts

<table>
<thead>
<tr>
<th>Delhi Bus Corridor</th>
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</thead>
<tbody>
<tr>
<td>Date of launch</td>
<td>April 20, 2008</td>
</tr>
<tr>
<td>Length</td>
<td>5.6 kilometers</td>
</tr>
<tr>
<td>Number of stations</td>
<td>9</td>
</tr>
<tr>
<td>Number of different routes</td>
<td>17</td>
</tr>
<tr>
<td>Peak ridership</td>
<td>6,500 passengers per hour (in each direction)</td>
</tr>
<tr>
<td>Frequency</td>
<td>120 buses per hour</td>
</tr>
<tr>
<td>Average commercial speed</td>
<td>18 km per hour (during peak hours)</td>
</tr>
<tr>
<td>Total infrastructure investment</td>
<td>Rs. 14 crores per km</td>
</tr>
<tr>
<td>Average bus fare</td>
<td>Rs. 1 to Rs. 4 per passenger citywide</td>
</tr>
</tbody>
</table>

Source: Delhi Integrated Multimodal Transit System Ltd., February 2009

1 DIMTS, 2009  
2 www.cseindia.org/AboutUs/press_releases/press_20080521.htm  
3 DIMTS, 2009
Promising Beginnings

With the launch of its new bus corridor in April 2008, Delhi took the first step toward developing a sustainable transport network for the city. The 5.8-kilometer pilot corridor stretches from Moolchand to Ambedkar Nagar in South Delhi, giving priority to public buses on segregated lanes and creating dedicated spaces for bicycles, cycle-rickshaws and pedestrians.

As a result of the project, bus speeds on the corridor have increased considerably, moving more commuters than ever before. Bus riders have responded positively to the new bus corridor, with an overwhelming majority (88%) indicating that they are happy with the service. Pedestrians and cyclists have also benefited from the Delhi bus corridor, with 85% of them saying the same. And about half of car drivers, two-wheelers and other commuters said they are also happy.
A Global Trend

The most famous cities around the world are expanding mass transit and promoting cycling and walking to reduce congestion and improve air quality.

Under the leadership of Mayor Michael Bloomberg, New York City built the city’s first bus corridor, segregated cycle facilities, and pedestrian-only streets. The Mayor also closed Broadway to cars in Times Square, creating pedestrian plazas and improving safety and access.

Los Angeles, one of the world’s most car-centric cities, is also turning things around. In 2007, it opened a thriving BRT with a cycle path segregated from motorised traffic.

A number of large cities outside the United States, including Beijing, London, Paris, Istanbul, Bogotá, México City and São Paulo, have taken similar steps, which have been successful and popular.

Indian cities can—and should—do the same.

These setbacks put the Delhi bus corridor under the microscope of the media, generating negative attention throughout India. The initial response to the project by some media outlets and opinion makers was negative and a political firestorm ensued. Critics of the system attacked the Delhi Government, accusing it of botching the city’s highly anticipated bus corridor.

In response to mounting public pressure, the Delhi Integrated Multi Modal Transit System (DIMTS), the city agency in charge of managing the bus corridor, took several steps to improve the system and calm the critics. At key intersections, it deployed additional traffic wardens to organize vehicle flows and check traffic violations that slowed traffic. It also began upgrading traffic signal technology and modernizing the bus fleet in an effort to improve the entire system.

To help the city make additional improvements, transport experts from EMBARQ—The World Resources Institute Center for Sustainable Transport conducted an independent evaluation of the corridor in February 2009. The evaluation was made possible with the support of the Centre for Science and the Environment and the financial support of ClimateWorks.

Through technical observations and interviews with key stakeholders, EMBARQ concluded that Delhi’s inaugural bus corridor succeeded in meeting some of its key objectives. Yet, the system can still be improved through gradual and systemic efforts to enhance bus operations. In the following pages, EMBARQ details its findings.

Despite these successes, the pilot project experienced several setbacks during the first months of operation. Problems included congestion in non-bus lanes, high incidents of bus breakdowns in the segregated lanes, confusion about where passengers should board and exit buses, unauthorized pedestrian street crossings (jaywalking) and faulty traffic signals.

A Global Trend

The most famous cities around the world are expanding mass transit and promoting cycling and walking to reduce congestion and improve air quality.
EMBARQ transport experts Dr. Dario Hidalgo and Madhav Pai evaluated the Delhi bus corridor in February 2009. A set of meetings and interviews with local planning and implementing agencies formed the basis of recommendations and analysis presented in this report. On three separate occasions, Dr. Hidalgo and Mr. Pai visited the bus corridor, where they examined pedestrian and cycle facilities, bus lanes and stations, and motor vehicle lanes. Although the study is primarily intended for a technical audience, it also addresses several of the major concerns raised by the general public and news media. Its findings were presented to Rakesh Mehta, chief secretary of the Delhi Government and DIMTS.
How a BRT system works

Street without BRT System

Street with BRT and bike lane
(buses reduce traffic and pollution)
Q: Has the Delhi bus corridor increased congestion, making it more difficult for people to get around Delhi?

A: Simply put, congestion in Delhi is caused by too many private vehicles on the road. The Delhi bus corridor actually reduces congestion by increasing the speed and quantity of people who move on the road. At the Chirag Delhi Junction, for example, buses in the bus corridor account for only 2% of all vehicles but move 55% of the people. By contrast, private cars and two-wheelers account for a staggering 75% of the vehicles but move just 33% of the people.

Recommendation: Delhi can adopt a number of measures to discourage private vehicle use, the main cause of congestion. These measures include parking restrictions, parking fees, congestion and pollution charges, fuel taxes and administrative restrictions on vehicle use in certain parts of the city. These policies can be accompanied by more mass transit, like bus corridors, so that people have an alternative mode of transport.

Q: Should the Delhi bus corridor use painted side lanes like those used by bus systems in the United States and Europe?

A: Middle lanes, not side lanes, are the international standard for BRT. Unlike middle lanes, side lanes can easily be invaded by hawkers, taxis, and auto rickshaws, significantly slowing bus traffic. It shouldn’t come as a surprise that buses operating in middle lanes travel faster and provide more reliable service than buses in side lanes.

Recommendation: The expansion of the Delhi bus corridor should use segregated middle lanes, not painted side lanes. If the city were to use painted side lanes, it would need to double the size of its bus fleet in order to maintain the frequency of buses and accommodate the same number of passengers. It would also experience a drop in the reliability of service. As a result, traffic congestion would continue to deteriorate.

Answering the Public’s Questions

55% Percent of people who commute through the Chirag Delhi intersection by bus.

2% Percent of vehicles that pass through the Chirag Delhi intersection that are buses.

6 km per hour Reported increase in speed when buses drive in median lanes.
Answering the Public’s Questions

Q: Should the traffic signal cycles be longer in order to shorten the queues at intersections?

A: In fact, the opposite is true; increasing the signal cycle increases the waiting time for all users. Moreover, increasing the signal cycle has the biggest negative impact on bus riders, who comprise the majority of people traveling on the corridor. It also increases the likelihood of impatient pedestrians crossing the street at the wrong time.

Recommendation: In order to reduce the length of traffic queues, the signal cycle must be shortened. This strategy will also reduce delays for pedestrians waiting at intersections, and the potential accidents resulting from waiting times longer than 60 seconds.

Q: Is the Delhi bus corridor dangerous?

A: The Delhi bus corridor is as safe as other traffic corridors in the city. EMBARQ’s analysis shows that there is no statistical difference between the number of current fatalities on the corridor and those before the bus line was implemented. What’s more, DIMTS reports a gradual decrease of traffic accidents since the start of the operations.

Recommendation: The aim of all bus corridors is to bring the number of traffic fatalities and accidents to zero. The city should continue to make pedestrian crossings safer, prevent jaywalking, improve the management of bus operations to reduce spillover at the bus stations and increase public education and enforcement.
Answering the Public’s Questions

**Q:** Is the Delhi bus corridor safe for school children who ride in buses in the median lane?

**A:** With proper management and operations, the Delhi bus corridor is safe for all people, including children, the elderly and passengers with special needs.

**Recommendation:** The city can implement a special management program for school buses. It should study specific bus routes and define the points of departure from the middle bus lanes to gain access to the side and the colonies. Parents and schools should be consulted throughout this process.

**Q:** Should space for pedestrians and cyclists be given over to cars in order to reduce traffic congestion?

**A:** Pedestrians and cyclists are important to the function of the entire system. At the Chirag Delhi Junction, nearly 1,300 cyclists use the cycle lane every hour, representing nearly 11% of people on the corridor. Space for pedestrians and cyclists takes up a relatively small amount of total road space and moves people in the most socially and environmentally friendly way.

**Recommendation:** Additional space for cars and other private motor vehicles should not come at the expense of space for pedestrians and cyclists. Already, a left-hand turn lane at the Chirag Delhi Junction cuts into pedestrian and cycle space, threatening cyclists and compromising the integrity of the entire system.

**POLL: ARE YOU HAPPY WITH THE BUS CORRIDOR AND DEDICATED BUS LANE SYSTEM?**

<table>
<thead>
<tr>
<th>Category</th>
<th>% of interviewers who answered yes</th>
</tr>
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<tbody>
<tr>
<td>Bus Commuters</td>
<td>90</td>
</tr>
<tr>
<td>Pedestrians &amp; Cyclists</td>
<td>80</td>
</tr>
<tr>
<td>Car &amp; Two-Wheeler Commuters</td>
<td>60</td>
</tr>
<tr>
<td>Other Commuters</td>
<td>40</td>
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</tbody>
</table>

Source: Centre for Science and Environment
With much of the Delhi bus corridor’s infrastructure in place, the city can turn its attention to bus operations and management. Successful bus corridors in other cities focus on the following strategies, each of which will be explained in the following pages:

1. Measuring to manage
2. Adjusting to changing circumstances
3. Serving the customer
4. Marketing the product
Measuring to Manage

Delhi needs to continuously collect a set of transport indicators.

Indicators allow officials to measure performance of a system and guide operational changes that are needed to improve the service. The process of determining indicators and collecting data should always involve external stakeholders.

User surveys, which transport agencies typically conduct every 4 to 6 months, are also a valuable tool for evaluating bus performance and user satisfaction and identifying service shortcomings.

Sample Indicators

- User ratings
- Travel time
- Reliability
- Comfort
- Productivity
- Bus frequency
- Passengers per vehicle
- Fleet size
- Monthly revenue
- Average user fare
- Monthly operational costs
- Fuel consumption
- Average commercial speeds
- Annual fatalities involving buses
EMBARQ’S RECOMMENDATIONS

Adjusting to Changing Circumstances

During peak hours, service should be increased to reflect the increased demand. Similarly, during off-peak hours, service should be decreased to match lower demand.

One of the things that makes BRT so innovative is that a service plan can be easily modified at very little cost. For example, Delhi could introduce flexible route planning, using short loop routes and express routes that bypass certain stations to make the service as efficient as possible.

When ridership numbers increase or decrease and stations become more or less crowded, service should be adjusted.
Bus passengers want a service that is clean, reliable, fast, safe and comfortable. If buses are slow and don’t arrive on time, passengers will find other ways to commute. To improve reliability, the city should maintain a steady dispatch of buses and control bus intervals along the corridor. It should also use advanced information technology and global positioning systems (GPS) on buses to manage operations in real time.

Because buses are generally crowded, especially during peak hours, the city can consider running more buses in the corridor. The bus terminals should be located near other mass transport hubs so that passengers can seamlessly transfer between different modes of travel. Making improvements to bus terminals is another important way to improve the quality of service. Crowds at terminals that spill into the streets can be managed by building wider and larger stations. Terminals are best kept clean, well maintained and well lit. Locating a security guard at every terminal can improve safety and comfort. User information, like maps, bus schedules, routes, fares and bus arrival times, should be put in prominent locations in every terminal. They should be clear and well designed so that even the youngest riders can understand them.
EMBARQ’S RECOMMENDATIONS

Having branded buses, terminals, maps, fare schedules, websites and videos to engage and educate the public is essential. It is also imperative for cities to constantly explain—in layman’s terms—the importance of bus corridors as tools for reducing traffic congestion and air pollution and improving overall quality of life. They should have strategies to engage print and news media. In some cases, a public relations firm may be best equipped to help a city with this task.

Case study

Macrobus

Macrobus, a twenty-kilometer BRT line in Guadalajara, Mexico, is an exceptional example of a BRT system that has effectively used marketing strategies to engage the media and the general public. It has a unique logo prominently displayed on every bus, each of which is also heavily branded, differentiating the bus corridor from ordinary buses on Guadalajara’s streets. It has also created a website (macrobus.gob.mx) targeting bus riders, providing them with all the information they need: routes, fares, a system map, and scheduling information. An entertaining video even explains to the public the importance of the project and how it will improve their daily lives. Not only was Macrobus a successful engineering project, it was also a successful marketing and public relations project.

WEBSITE: www.macrobus.gob.mx

Delhi can benefit from a sophisticated marketing strategy to promote the Delhi bus corridor and mass transit in general.

Marketing the Product

Delhi can benefit from a sophisticated marketing strategy to promote the Delhi bus corridor and mass transit in general.

Marketing the Product

Marketing the Product
Additional Challenges

- Bus breakdowns in bus lanes
- Pedestrian “jaywalking”
- Encroachment of bus lanes by motor vehicles
- High bus occupancy levels during peak hours
- Unreliable bus operations
How does the Delhi bus corridor compare to a full BRT system?

**DESIGN**

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>CHARACTERISTIC</th>
</tr>
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| Bus Lanes          | ✔ Buses physically segregated from car traffic
|                    | ✔ Median bus lanes
|                    | ✔ Clear signage for bus corridor
| Traffic Management Planning | ✔ Improved road design
|                    | ✔ Short traffic signal cycles for buses and pedestrians
|                    | ✔ Advanced traffic signal technology
|                    | ✔ Management of bus turning
| Stations            | ✔ Protected bus stations
|                    | ✔ Level boarding for buses at stations
|                    | ✔ Prepayment system at station
|                    | ✔ Stations comfortably accommodate all passengers
|                    | ✔ Handicap accessible
| Vehicles            | ✔ Easy boarding/shielding for bus stops
|                    | ✔ Low-emissions buses (compressed natural gas)
|                    | ✔ Buses use emissions post-treatment to reduce air pollution
|                    | ✔ Multi-door buses for easy boarding
| Service             | ✔ Express routes
|                    | ✔ Short service routes
|                    | ✔ Bus supply matches passenger demand
| Information Technology | ✔ Electronic fare collection systems
|                    | ✔ Automatic vehicle location (GPS)**
|                    | ✔ Real-time user information systems
|                    | ✔ Real-time control and dispatch of buses

**PERFORMANCE**

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>ADVANCES</th>
</tr>
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</table>
| User Acceptance        | ✔ High ratings from bus users
|                        | ✔ Monitoring system for user acceptance
| Travel Time            | ✔ High commercial speed: 16–19 km/h
|                        | ✔ Short waiting time for bus arrival
|                        | ✔ Short bus and pedestrian wait time at traffic signals
| Reliability            | ✔ Automatic vehicle location (GPS) for bus fleet
|                        | ✔ Buses arrive at stations at consistent intervals
|                        | ✔ Buses travel at consistent speeds
|                        | ✔ Limited bus breakdowns
| Comfort                | ✔ Protected bus shelters
|                        | ✔ Presence of guards to increase passenger safety and security
|                        | ✔ Integrated with other modes of transport (metro, buses, regional buses)
|                        | ✔ User-friendly information systems
|                        | ✔ Optimal occupancy of buses
|                        | ✔ Optimal occupancy of stations
| Cost                   | ✔ Low cost* |
| Externalities          | ✔ Low emissions
|                        | ✔ Low fatalities
|                        | ✔ Land development opportunities around bus corridor
|                        | ✔ Attractive to non-bus commuters

*2% of buses
**Available in a fraction of the bus fleet
*Capital investment of 14 Crores/km for infrastructure

Acknowledgements

Interrviews with representatives of:
- Government of Delhi
- Traffic and Injury Prevention Program (TRIPP) at the Indian Institute of Technology (IIT) Delhi
- Delhi Integrated Multi Modal Transport Systems (DIMTS) Delhi
- Delhi Transport Corporation
- Delhi Traffic Police
- Centre for Science and the Environment
- ClimateWorks
- Shell Foundation
- Caterpillar Foundation