



Bus Rapid Transit in Delhi

Prepared By

Transport Department

Govt. of NCT of Delhi

&



DELHI TRANSIT

Commute Easy

**Delhi Integrated
Multi-Modal Transit
System Limited**

September 22, 2008

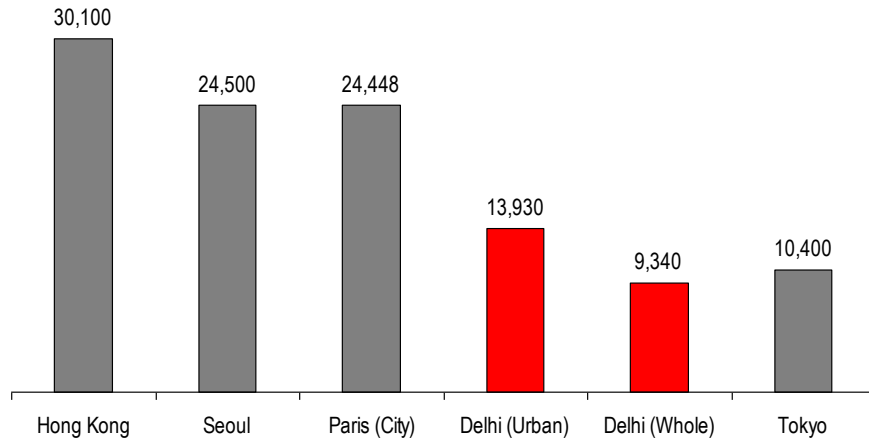
Structure of the Presentation

- Current Transport Situation in Delhi
- Need for Public Transport
- Integrated Multi-modal Public Transport Network-2021
- First BRT Corridor in Delhi
- Commuter Survey
- Lessons Learnt

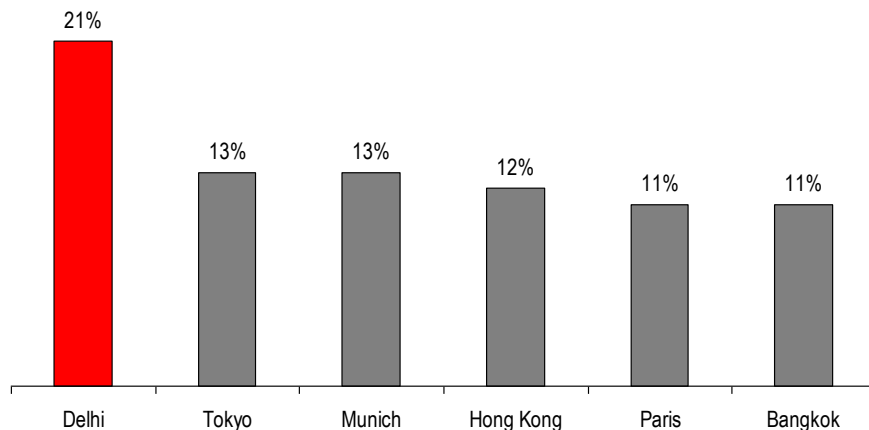
Delhi Vs. Other World Cities

Lower population density and higher road space are indicators for smooth traffic condition in the city.

World Cities - Population per sq. km.



Road Space as Percentage of Total Area



- Population per sq. km in Delhi is less compared to other cities like Hong Kong, Seoul and Paris (City) which are more densely populated.
- Road space as percentage of total land area is 21% in Delhi.
 - Present road length- 28,000 Kms with limited expansion possibilities.

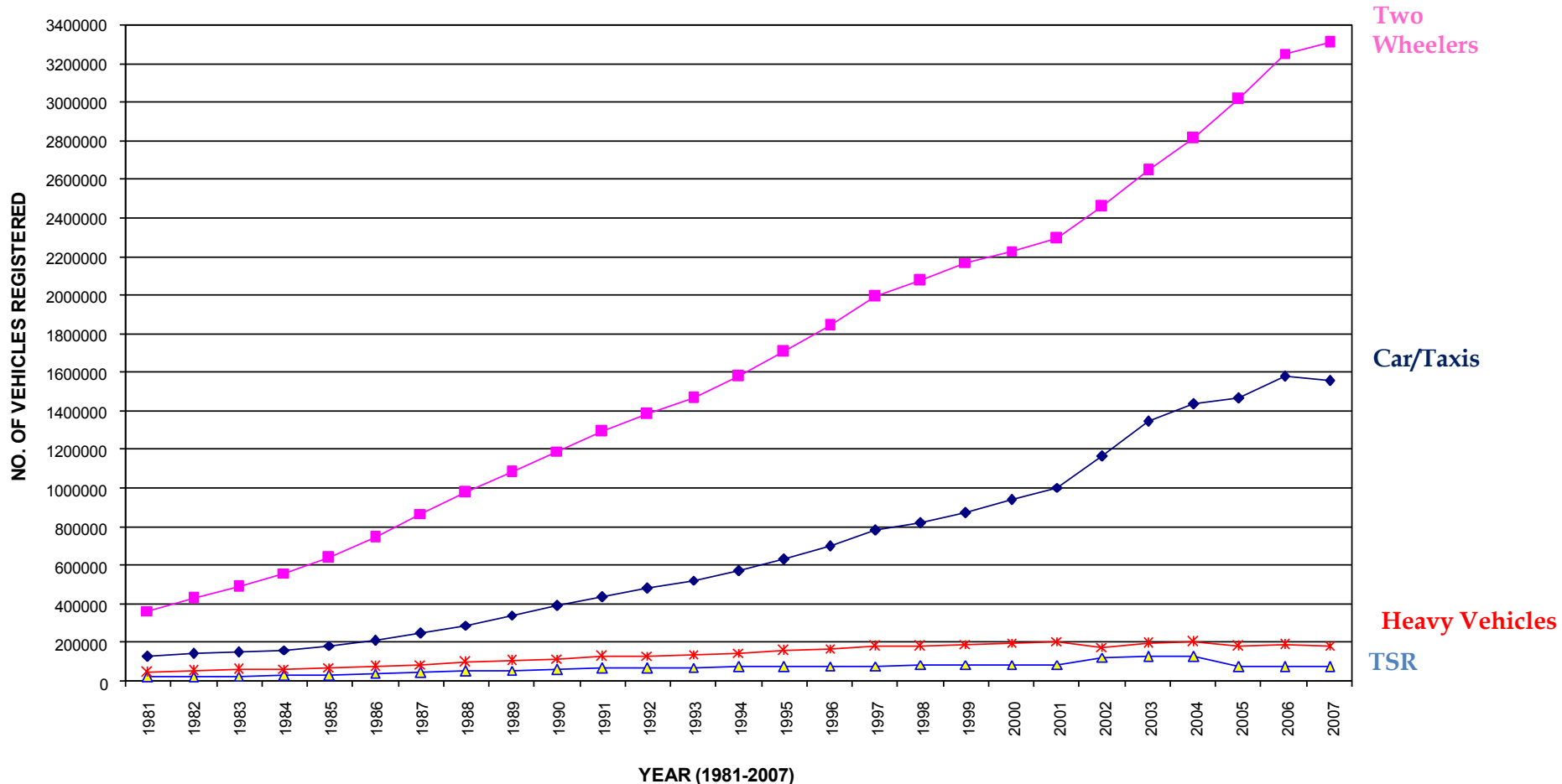
Traffic Condition in Delhi

Only a quarter of city's population own cars; cars and two-wheelers together drive less than 20% of its people -- and yet roads are choked. (Source: CSE)



Motor vehicles registered in Delhi

A total of 5.4 million vehicles are registered in Delhi as on March 31, 2008, alone amount to the total number in Kolkata, Mumbai and Chennai.



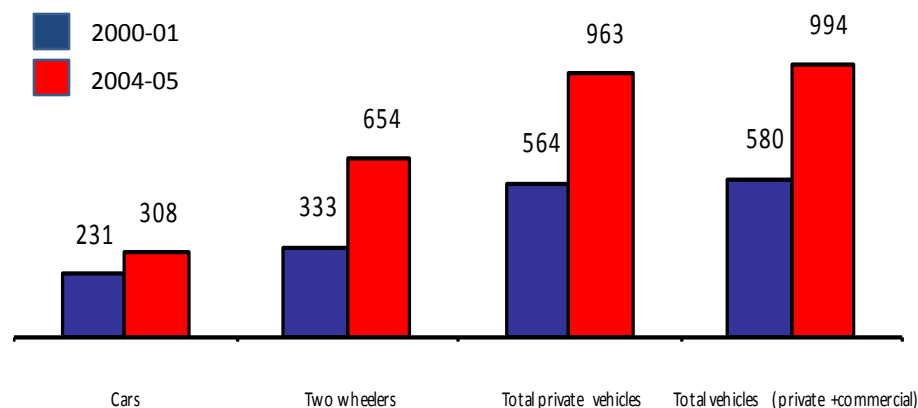
Fuel Loss at Traffic Signals

Delhi adds 1,000 vehicles each day on its roads..Builds new roads in the quest for ever expanding car based infrastructure....still no respite.



Courtesy: www.forbestraveler.com

Delhi - Number of registered vehicles per day, 2001-05
(Figures in Number)



Source: Centre of Science and Environment, 2008

Annual Loss of Fuel Due to Idling of Vehicles at Signalized Intersections in Delhi.

Type of Intersection	No. of Intersections	In Liters (In Million)			Total Amount (in \$ Million)*
		CNG	Diesel	Petrol	
Low	69	8.4	1.4	7.6	11.0
Medium	118	17.7	5.0	18.1	27.0
High	413	109.7	41.0	122.1	183.0
Total	600	135.8	47.4	147.8	221.0

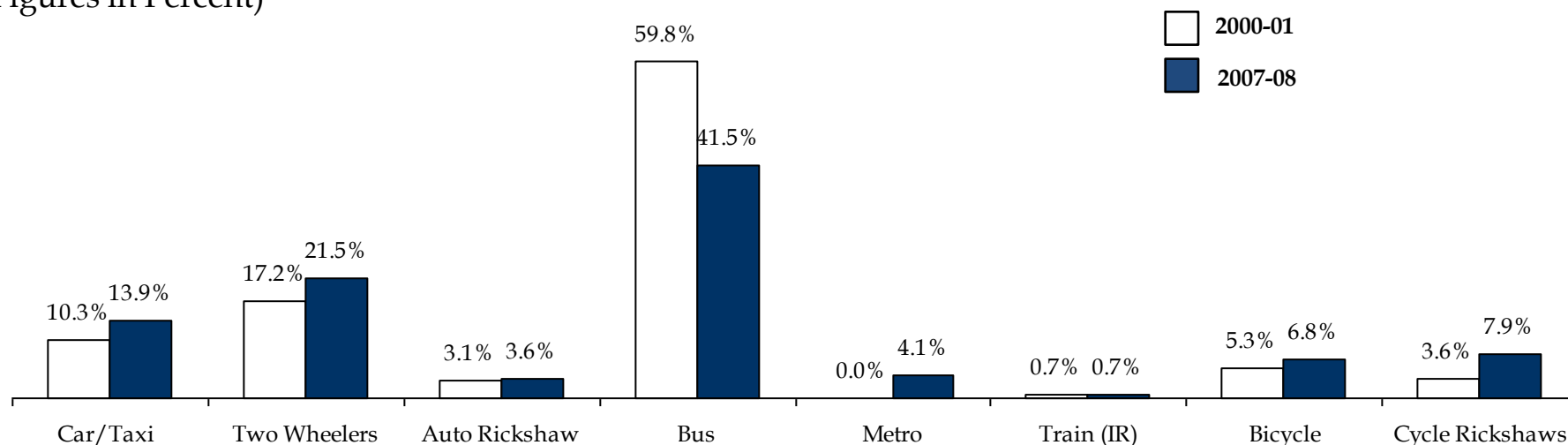
Source: Central Road Research Institute, 2008

*Exchange Rate: \$1 = INR 44.82565 (September 10, 2008)

Modal Split in Delhi

In last 8 years, Bus ridership has decreased by 17%, whereas number of person trips / day have increased by 22% during the same period.

Modal Split - % of Person Trips in Delhi*
(Figures in Percent)



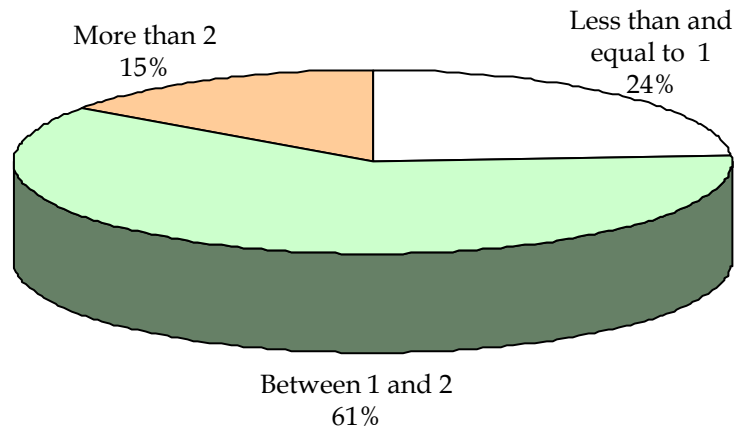
- According to RITES Report (2008), around 46% of total personal trips in Delhi are completed by using public transport system (Bus and Metro) in 2007-08, whereas around 60% of total personal trips was completed by using public transport System (Only Bus) in 2000-01.
 - Bus ridership has decreased from 7.0 million passenger trips in 2000-01 to 6.0 million passenger trips in 2007-08.

Volume Capacity Ratios in Delhi

Volume Capacity Ratio of roads at key locations in Delhi is more than 1, as per RITES Survey (2007).

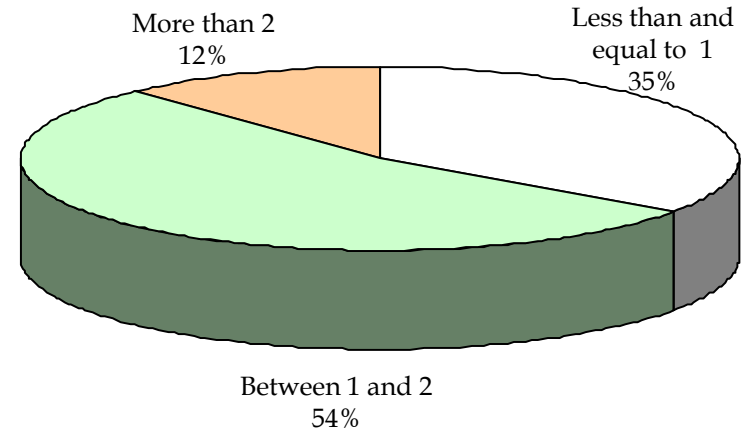
Screen Line Locations - Volume Capacity Ratios
(Figures in Percent)

100% = 33 Screen Line Locations



Mid Blocks - Volume Capacity Ratios
(Figures in Percent)

100% = 26 Mid Blocks



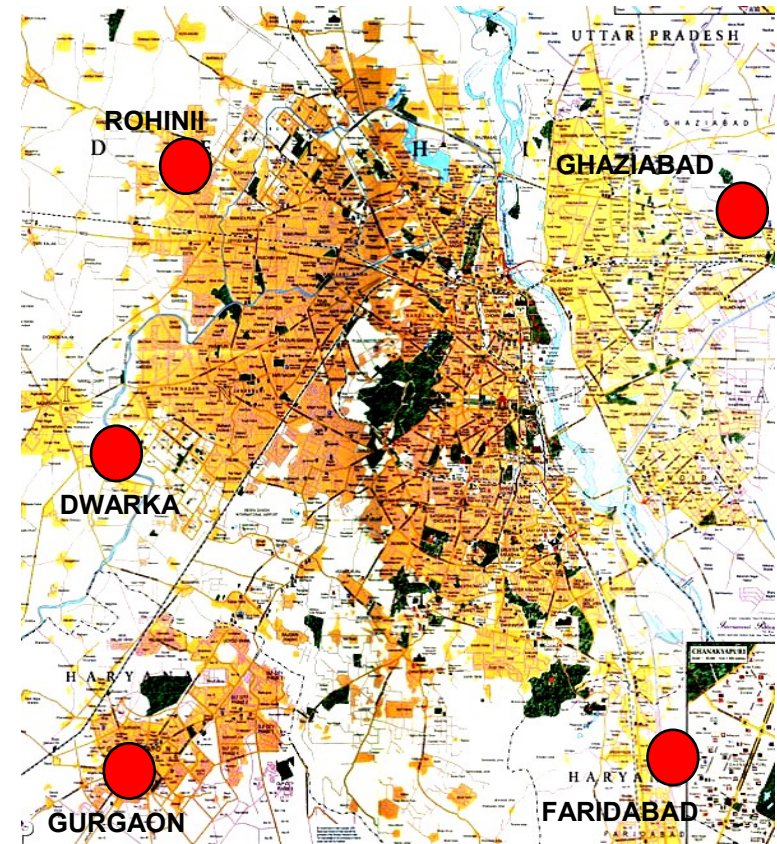
RITES is preparing a report "Transport Demand Forecast Study & Development of an Integrated Road Cum Multi-modal Public Transport Network For NCT of Delhi ". It conducted a survey to find out the volume capacity ratios of key locations.



Need of an integrated Public Transportation System in Delhi

Delhi Characteristics and Public Transport

- Relatively low rise development
 - Multiple business districts
 - Delhi expanding in a radial mode
- Central City not the main destination**
- Car - about 15 % families
 - 2-wheeler - about 35% families
 - No vehicle - about 50% families
- 50% people with no option but public transport**
- Marginal cost of two wheeler trip about Rs 1.00 per km -
- Maximum fare level cannot be higher**
- Mixed land use patterns, strict zoning impossible
- Majority trips less than 10 km**



Transit system therefore must be low cost and wide spread

Planning requirement

There is an urgent need to augment mass transport facilities to reverse the trend of increasing use of personal vehicles.

- Promoting the use of mass transport through user friendly features and a city-wide network.
- To ensure balanced use of road space by 2021, and to contain the problem of pollution etc., it is essential that at least 10 million additional vehicular trips are catered to by mass transport.

Corridor Identification

- GNCTD commissioned study in 2005 which identified 43 corridors (575 km) with PHPDT exceeding 5,000, assuming the following exist:
 - Metro Phase I & II
 - Ambedkar Nagar-Delhi Gate BRT
 - Phase I IRBT corridors (2 nos.)
- Study was based on and took into account:
 - RITES Computer model (2001)
 - DDA MPD 2021
 - NCR Plan 2021
 - Corridors with <5,000 PHPDT were assumed to be adequate for bus services

Choice of Mode

Demand-wise Number and Length of Corridors

PHPDT	Length (in Kms)	No. of Corridors	Choice of Mode*
>25,000	93	4	Metro
20,000-25,000	57	4	Elevated LRT
15,000-20,000	131	8	At grade LRT
10,000-15,000	179	13	At grade BRT / Elevated Monorail
5,000-10,000	115	14	At grade BRT
Total	575	43	

* Based on World Bank and other studies

- Choice of mode depends mainly on demand level on a corridor, capacity of the mode and the available Road/Right Of Way (ROW).
- Other considerations are the land-use along the corridor, the location of building lines, and the potential for increasing the ROW .
- Choice will be based on techno-economic considerations, initial cost and life cycle cost of other modes applicable to a corridor.

Proposed Network

Based on demand level, mode capacity and available ROW, the following network is approved by GNCTD.

Mode	Total Length	No. of Corridors				Estimated Cost Per Kms ³
		Phase I	Phase II	Phase II	Total	
Metro	256 km	3	4	4	11	\$35 million
BRT	294 km	6	3	17	26	\$2.5 million
LRT ¹	74 km	3	2	1	6	\$28 million
Monorail ²	48 km	2	1	0	3	\$32 million

* Investment include Construction cost, cost of private land acquisition and interest during construction

1. As Indicated by Egis

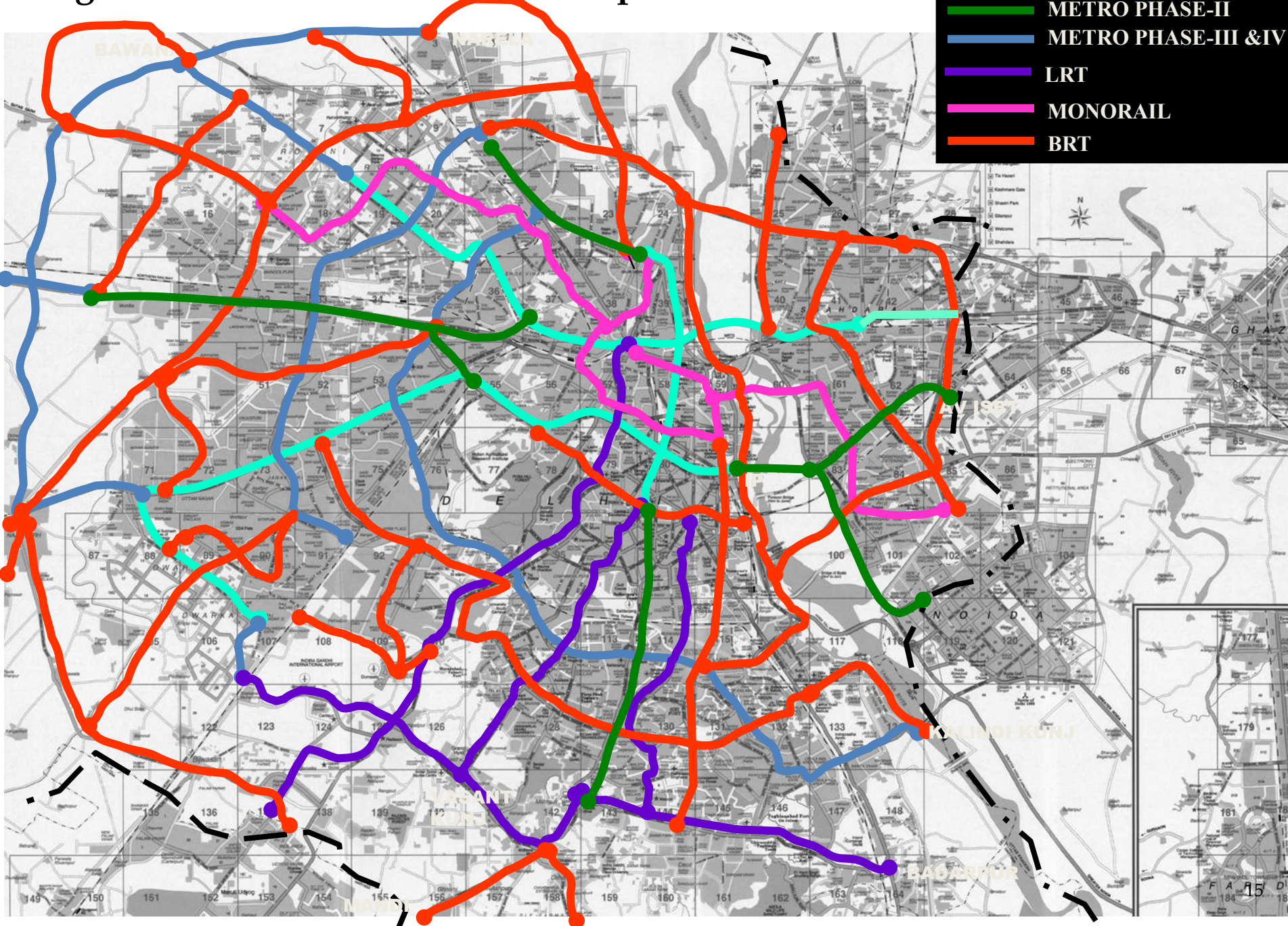
2. As Indicated by RITES

3. Exchange Rate: \$1 = INR 44.82565 (September 10, 2008)



Integrated Multi-modal Public Transport Network-2021

- METRO PHASE-I
- METRO PHASE-II
- METRO PHASE-III & IV
- LRT
- MONORAIL
- BRT



BRT Vs. Metro

Besides PHPDT of particular link, other constraints like construction time and investment limit construction of Metro to few corridors.

BRT
1.5 years



Metro
3-5 years
(~18 km)

Shortest planning & construction time

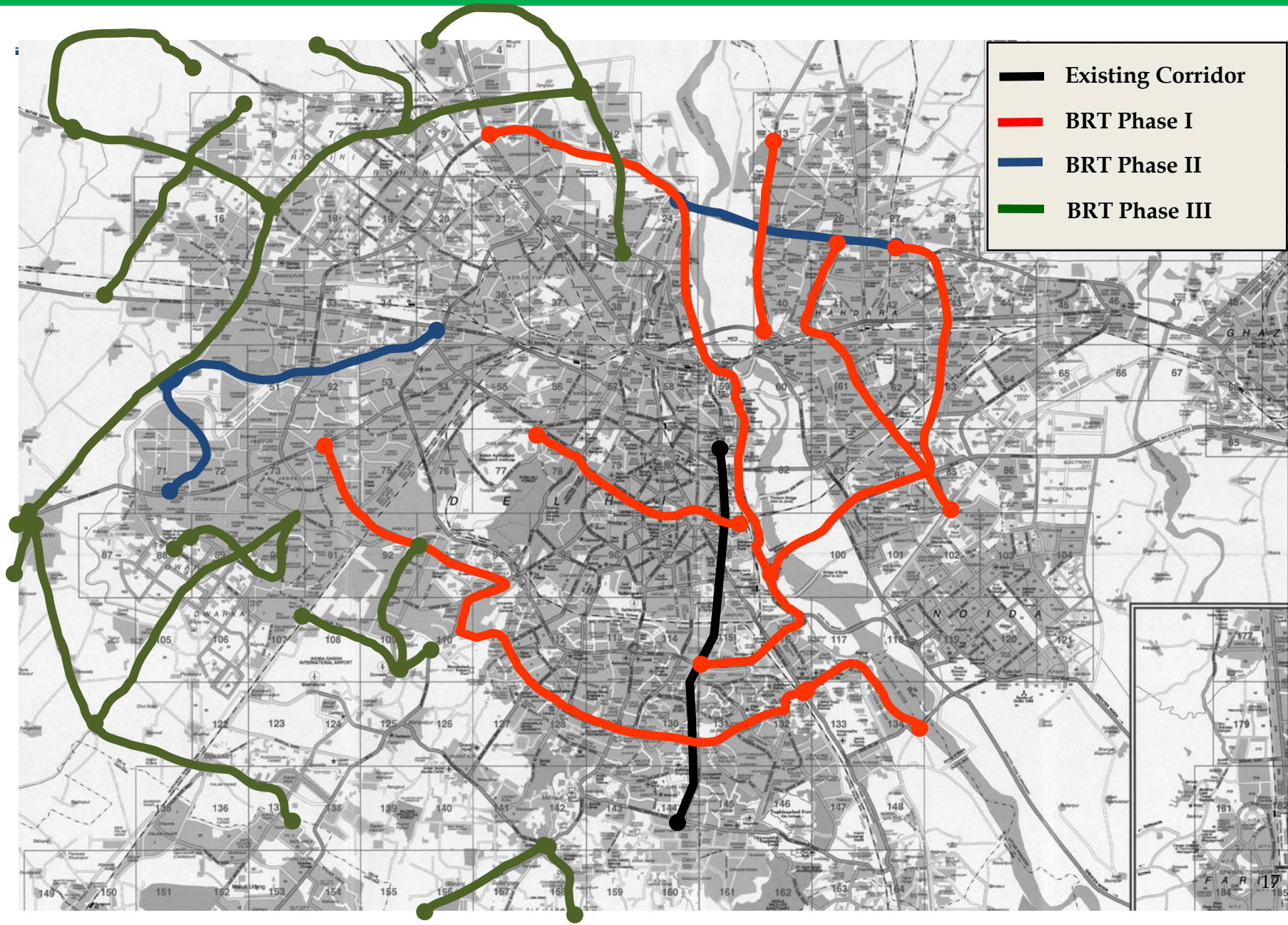
BRT
\$2-3
million/
km



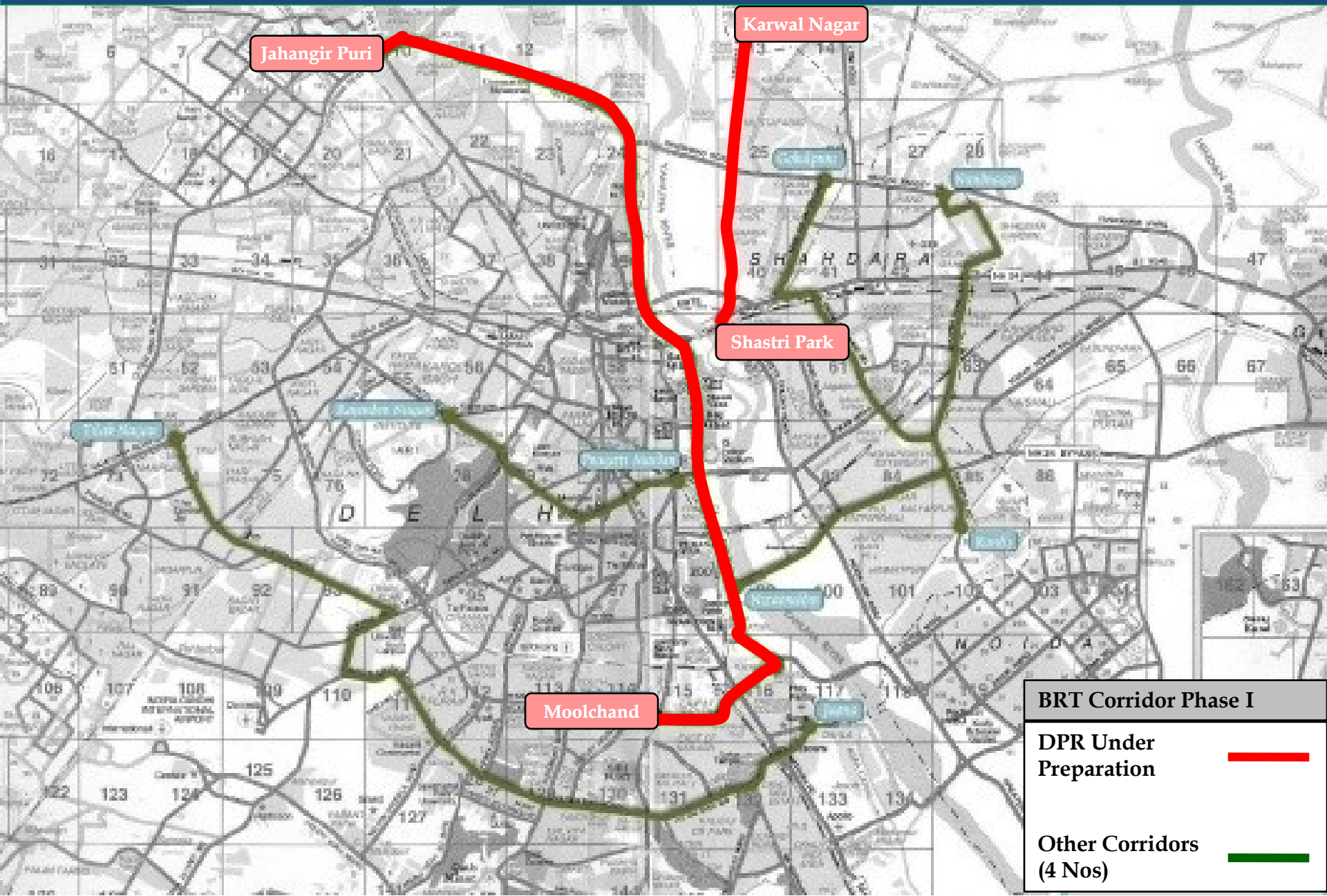
Metro
\$28 - 50
million
/ km

Cost considerations

BRT Network In Delhi 2021



New Two Proposed Corridors



Proposed Corridors Detail

Request for Proposal (RFP) for preparation of Detailed Design and Engineering Report for two corridors was released on August 08, 2008.

1

Karawal Nagar to Shastri Park

- The proposed BRT corridor of 8.7 km length starts from Shastri Park (Metro Station) and ends at Karawal Nagar (also known as DLF Chowk).
- The daily traffic intensity of **fast moving and slow moving** traffic along the homogenous sections of the this corridor is in the **ratio of 3:2**.

2

Moolchand to Jahangir Puri

- The proposed BRT corridor starts from Moolchand and ends at Jahangir Puri on outer ring road by-pass covering approximately a length of 28 km.
- The daily traffic intensity of **fast moving and slow moving** traffic along the homogenous sections of the this corridor is in the **ratio of 9:1**.

About Delhi BRT System

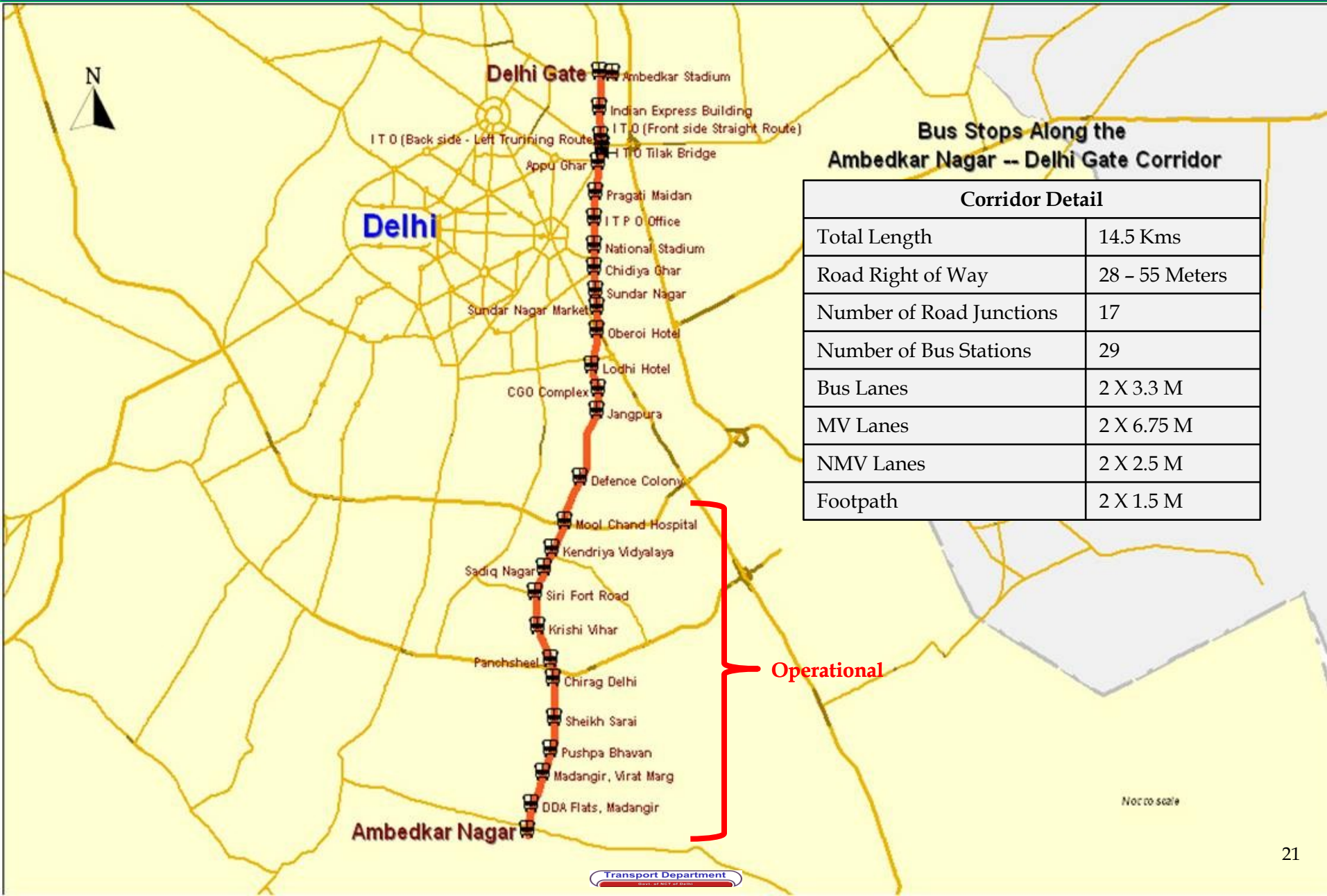
The first corridor of BRT in Delhi is from Dr. Ambedkar Nagar to Delhi Gate and is 14.5 km. long.



More than 200 buses move on various sections during peak hour catering to a maximum PHPDT of about 12,000 on an average day.

- Currently, the stretch from Dr. Ambedkar Nagar to Moolchand (5.8 km) is operational.
- There are segregated lane for Buses, Motor Vehicles, Cycles & Rickshaws and Pedestrians.
- The project has been implemented after rigorous analysis and intensive stakeholder consultation and validated by national and international transportation experts.
- Total cost of the project is \$48 million (INR 215 crores) at an average cost of \$3.3 million / km (INR 14.83 crores/ km).

Delhi First BRT Corridor



Bus Stops Along the Ambedkar Nagar -- Delhi Gate Corridor

Corridor Detail	
Total Length	14.5 Kms
Road Right of Way	28 - 55 Meters
Number of Road Junctions	17
Number of Bus Stations	29
Bus Lanes	2 X 3.3 M
MV Lanes	2 X 6.75 M
NMV Lanes	2 X 2.5 M
Footpath	2 X 1.5 M

The BRT Story

The idea of BRT was first mooted in 1995-96.

2004

- A pilot project for construction of 6 km BRT Corridor conceptualized.
- Transport Department appointed RITES as PMC (Project Management Consultant).

2005

- Initiated the work for complete stretch (approx 14.5 km) and tenders invited.
- Supreme Court ordered implementation of BRT project in Delhi.
- EPCA (Environment Pollution Control Authority) was directed to monitor the progress by the court.

2006 - 07

- Agreement executed between M/s RITES Ltd and Contractors in September.
- Construction was started in September.
- Construction was estimated to be completed by December 2007.
- DIMTS (Delhi Integrated Multi-Modal Transit System) Limited is entrusted with the responsibility to manage the operation.

2008

- Work delayed, revised completion date for first phase up to Moolchand by March.
- Work up to Moolchand (5.8 Kms) completed in March/ April.
- The complete stretch of 14.5 Kms by December.
- Corridor operationalised and trial runs started in 3rd week of April 2008.
- RFP (Request for Proposal) for Detailed Project Report of two more corridor* was released in August.

* Moolchand to Jahangir Puri (28 Kms) and Shastri Park to Karwal Nagar (8.0 Kms)

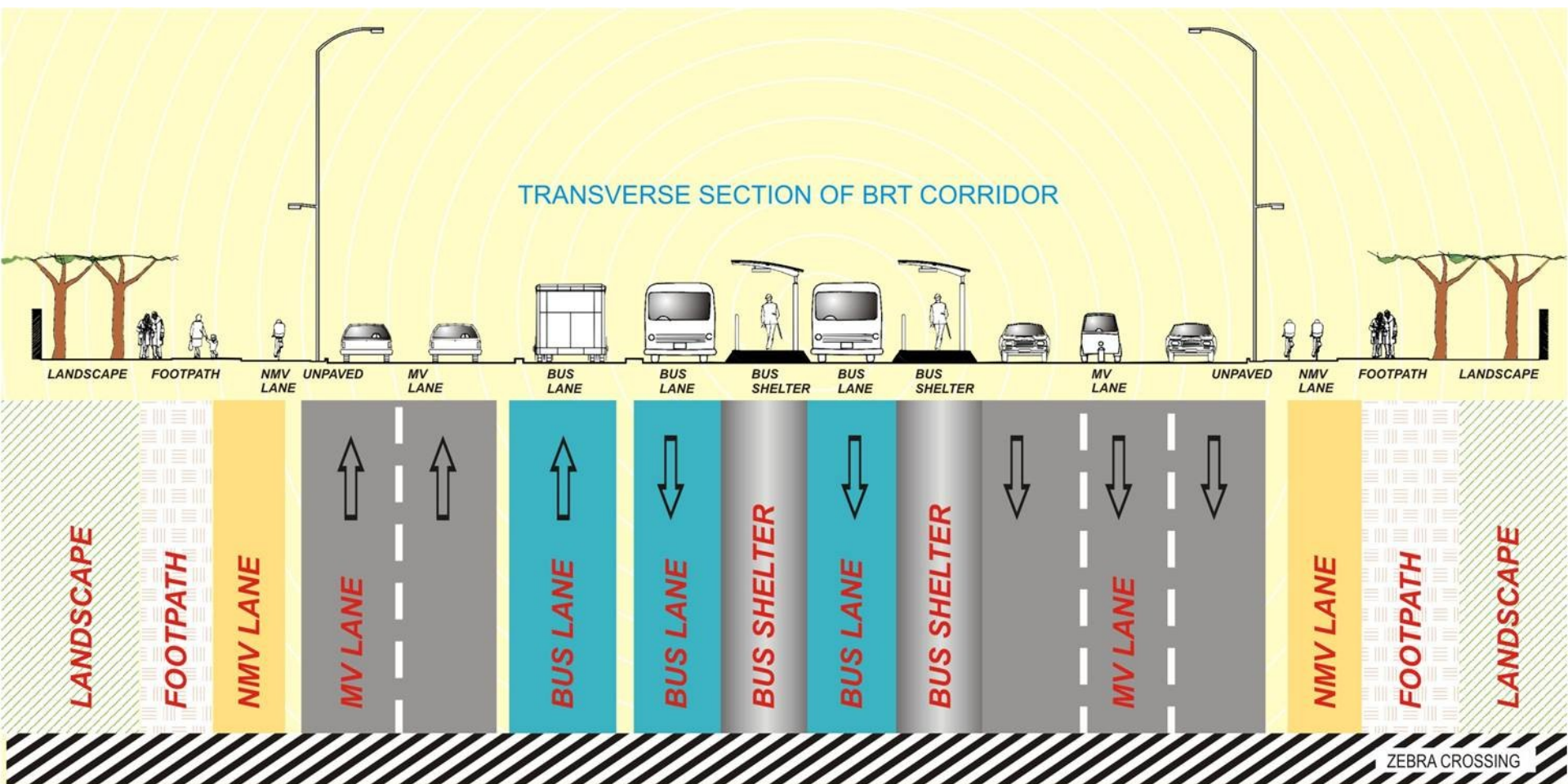
Separate Bus Lanes provide clear right of way for buses and make them faster and safer.



Delhi BRT System moves more than 12,000 passengers/hr during peak time.

Overview of BRT Corridor

The first road in Delhi, providing dedicated lanes to Non-motorised vehicles and pedestrians.



Dr Ambedkar Nagar - Before BRT



Dr Ambedkar Nagar - After BRT



Promote the use of Non-motorized Vehicles

BRT System provides equal road space to all types of commuters and offers safety to cyclist & pedestrians.



Courtesy: ITDP

Before BRT



After BRT

ITDP has rated Cycling Facilities at BRT as Grade "A". Bicycles flows at peak time are as high as 1,200 per hour, highest in world after China

New Low Floor CNG Buses

Delhi Government introduces Modern Low Floor CNG Buses, which is a big improvement: Lower Particulate emissions than TransMilenio*.



New Low Floor CNG Non-AC Buses
Cost - \$116,000 (INR 5.2 million) Per Bus



New Low Floor CNG AC Buses
Cost - \$138,000 (INR 6.2 million) Per Bus

- It is essential to improve the image of bus services so that the commuters voluntarily shift from their personal vehicles to public transport.
- Bus travel has to be made an overall pleasant experience. Corridor ambience has to be world class.

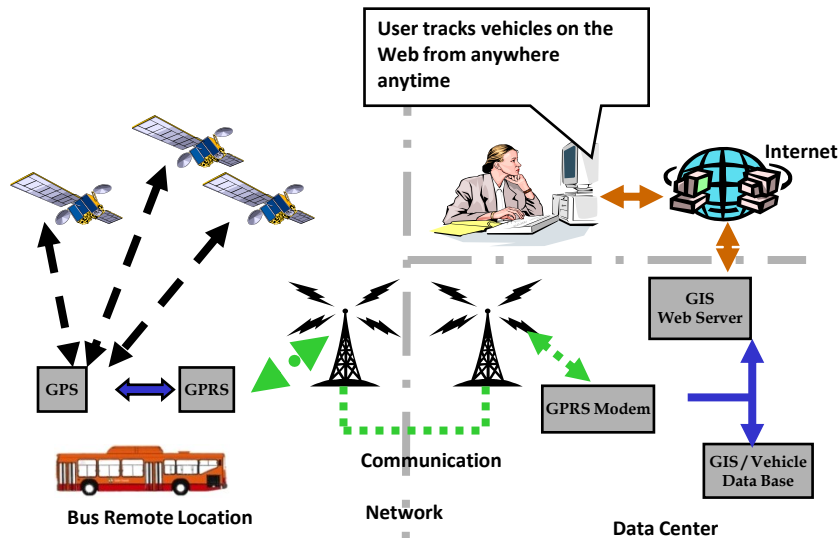
*Source: "Bus Rapid Transit: How Delhi Compares" - Walter Hook (May 14, 2008)

Exchange Rate: \$1 = INR 44.82565 (September 10, 2008)

Real-time Passenger Information System

To reduce the waiting anxiety of passengers, 59 PIS boards have been installed.

GPS Tracking System



- The system uses the Global Positioning System (GPS) technology to determine real-time information (location and time) of the bus & taking into account the current position of the buses, speed & scheduled stops, predicts the expected time of arrival of bus at any stop on the selected route.
- DIMTS is also working on additional activities including information dissemination through website as well as, through SMS.
<http://www.dimts.in/passengerinfo.html>,

PIS Boards at BQS



Online Bus Tracking System

trako One View Solution from TMT - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://210.210.24.104/pistrakoonewview/Login.do?name1=%2005Md3wb90f0mQDI3oPyf2FIVQC85N724YAsb02KQW6942Ibp08userName=dims8name

Show Live On Route

- 423DN
- 419UP
- 419DN
- 423UP
- 521DN
- 521UP
- 522DN
- 522UP
- 423DNAC
- 419UPAC
- 419DNAC
- 423UPAC
- 521DNAC
- 521UPAC
- 522DNAC
- 522UPAC
- All

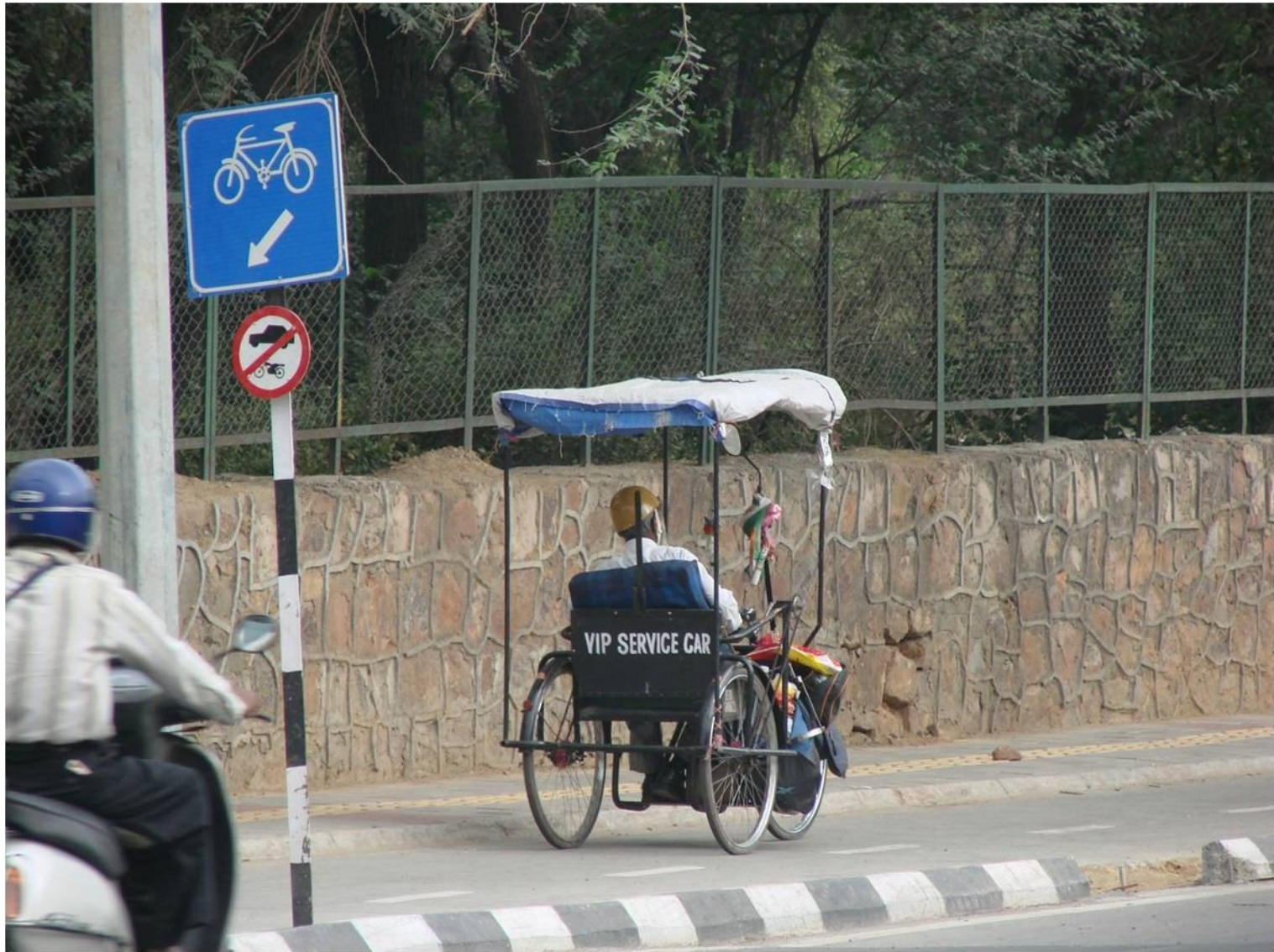
Map Satellite Hybrid

DLIPB9769
DLIPB9916
DLIPC0349
DLIPC0092
DLIPC0128
DLIPC0127
DLIPC0476
DLIPC0503
DLIPC0114
DLIPC0171
DLIPC0248

Transport Department

31

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Accessibility Features

BRT System – Giving Equal Rights



BRT system is designed to provide all kinds of facility to commuters and makes buses a user-friendly transportation system.

BRT is Physically Challenged Friendly



There is a segregated lane for pedestrian on the corridor.

Bus Queue Shelters (BQS) and pedestrian lane have been provided with tactile tiles to guide blind people.



Intelligent Signaling System

An Intelligent Signaling System will be installed at the corridor to manage the traffic system efficiently.

Signalized NMV Lane

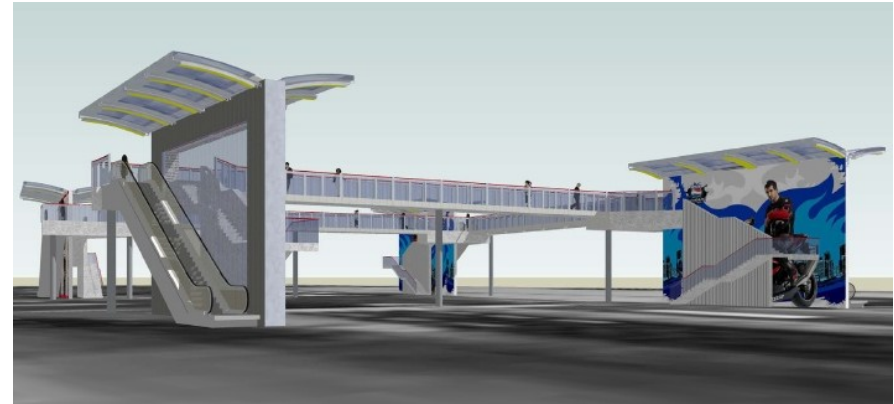


- Delhi Government has planned to integrate BRT with the latest intelligent transportation systems (ITS) technologies to improve operational performance and customer satisfaction.
- A UK-based consultant is appointed to identify a suitable intelligent signaling system on the corridor from Dr. Ambedkar Nagar to Delhi Gate.
- The central management system would be linked to on-street equipment via a dedicated communication network.

Foot Over Bridges (FOBs)

Three FOB'S are planned on the pilot stretch from Ambedkar Nagar to Chirag Delhi.

FOBs - BRT Corridor



Ambedkar Nagar Junction



Chirag Delhi Junction

High Standards of Cleaning



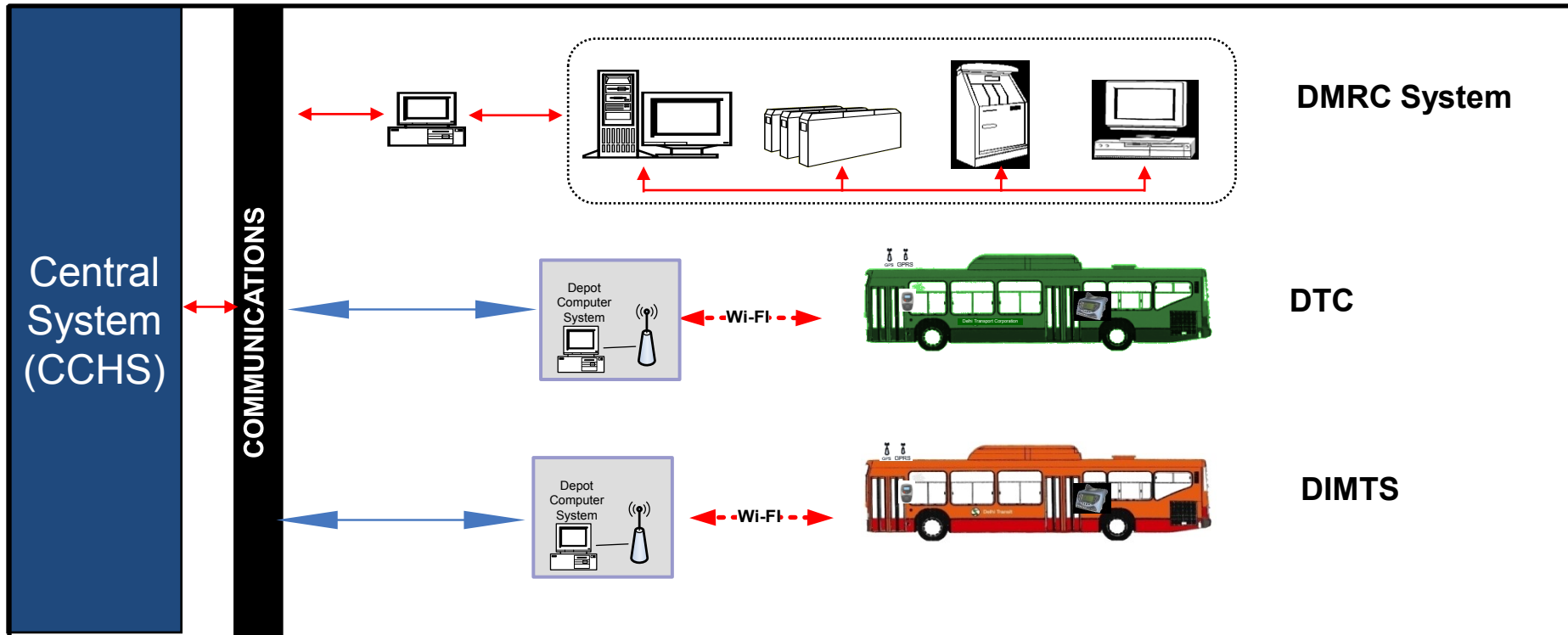
Mechanized Cleaning of the Corridor at Night



Pressure Washer Machine to clean the BQS

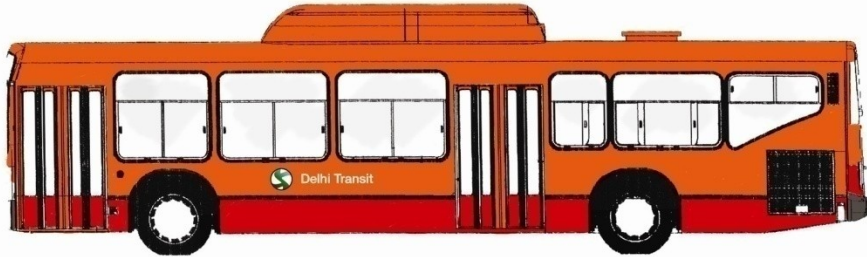
Automated Fare Collection System

Delhi Government is also planning to create an Integrated Multi-Modal Ticketing system, comprising DTC, DIMTS and Delhi Metro.



Private Stage Carriage Corporatization

GNCTD has launched a scheme to corporatize the private stage carriage (known as Blue-line) buses operation.



- All 657 bus routes in Delhi have been aggregated into seventeen (17) clusters.
- There will be about 4,400 buses under the scheme, after corporatization.
- Bidding is under process for Cluster 1 (covering 32 routes, including all routes along BRT Corridor).
- Private players can operate their fleet in one or more clusters, after fulfilling all the criteria.
- The contract will be awarded for a period of 10 years.

Awareness Campaign

An introduction of new system requires a change in behavioral pattern of the users.

BRT Brochures



Cycle Rally



- Different kinds of Brochures for all types of commuters are prepared and a list of do's and don'ts were printed and distributed over a period of time in large nos. (300,000 approx.).
- Bus queue shelter advertising space is also being used to educate people.
- DIMTS is also producing educational films aimed at building awareness. Message are designed for different types of BRT users - Drivers, Passengers, Cyclists etc. These are proposed to be screened for appropriate audiences

Road Marshals

DIMTS deploys more than 90 road marshals and 15 Security Guards along the Corridor in each shift.



Helping Old man to cross the road



Helping School boy to Cross the Road

- DIMTS has deployed manpower to ensure the safety of children & old persons .
- The company has also organized special training session with different agencies.

Design Issues

Implementation of BRT System not only requires building of new infrastructure, but modifications in the existing one as well.

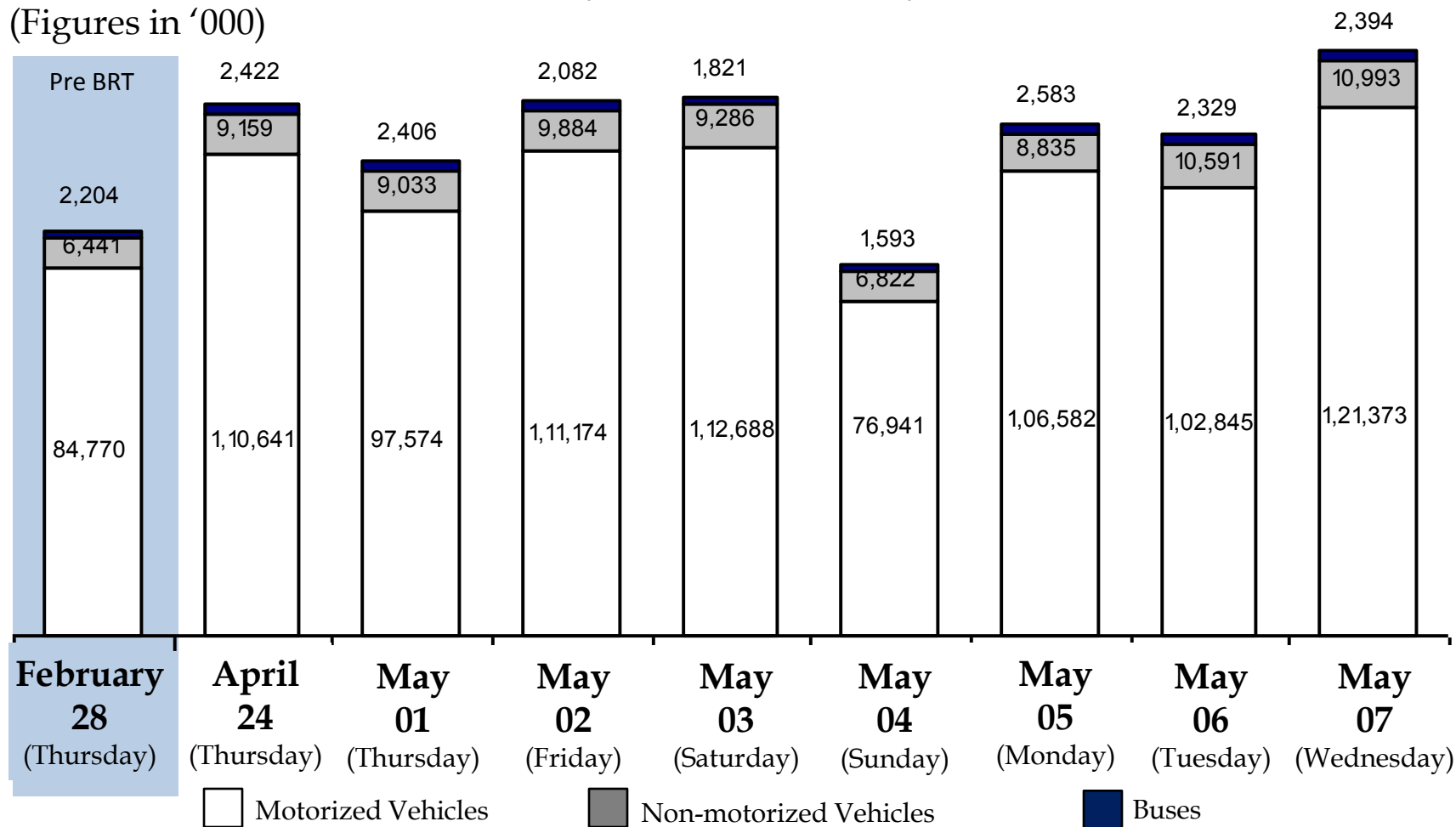
- Certain minor structures and electrical installations need to be shifted.
- Choice of center or side lane should depend on site conditions.
- At existing flyovers, Bus lanes should remain at-grade on the side with adequate weaving length.
- New flyovers to be split to permit center bus lanes.

Number of Vehicles Crossing Chirag Delhi

Chirag Delhi Intersection is the most critical and busiest junction on the BRT corridor.

Total Number of Vehicles, February 28, April 24 & May 01-07, 2008

(Figures in '000)



Commuters Survey

Two different agencies, Centre for Science and Environment (CSE) and NDTV, conducted commuters surveys.



Key results:

- 83% Commuters are happy with dedicated BRT Lanes and want BRT System should be continued in city.
- A whopping 88-91% of all respondents (1,500) said that they are happy with BRT system and want that it should be extended to more areas of Delhi.



Key results:

- 72% of bus drivers said the middle-of-the-road stops are working better than the earlier system.
- 61% of car drivers said driving is easier now that buses have their own lane bus drivers.
- 88% of bus commuters feel the new BRT and its buses are an improvement on Delhi's public transport system.

Lesson Learnt from the First Stretch

There are many lessons need to be learnt from the existing BRT Corridor, which will help to increase its acceptability in future.

Special Act

There is a need for special regulation Act for better management and regulation. The act will help to address some key issues like traffic violation, property damage, jaywalking etc.

Park and ride facility

A efficient 'park and ride facility', can compensate the feeder service, enabling people to use their private vehicles till the corridor.

Junction Capacity

At BRT corridor, the adequate junction capacity should be created so that there is no bottleneck for other motorized vehicles.

Intelligent traffic signals

An intelligent traffic signaling system with vehicle tracking facility will increase the throughput. A static system cannot sense the change in traffic pattern, thus result in slow throughput and unutilized green time.

Restricted movement

BRT system aims to give priority to buses. A successful BRT system requires some special measures like restricting the right movement of the traffic on junctions.

FOBs and Subways

FOBs or Subways should be planned, connecting directly with the BQS, thus causing little disturbance to the moving traffic in other lanes.



40



*Commute
Easy...*

BUS & EMERGENCY VEHICLES