

# JAIPUR PUBLIC TRANSPORT SERVICES THROUGH BUS RAPID TRANSIT SYSTEM AND MODERN CITY BUSES

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### 3.0 Jaipur Public Transport Services through Bus Rapid Transit System (BRTS) and Modern City Buses

#### 3.1 Context

Jaipur, the ‘pink city of India’, is the capital of Rajasthan. It is situated in north-eastern part of the State is surrounded by the districts of Alwar, Sikar, Bharatpur and Dausa. Jaipur is known as one of the first planned cities of India. Sawai Jai Singh in 1727 decided to move his capital to the plains from Amber. Jaipur City was not only planned but its execution was also coordinated by Sawai Jai Singh II. His reign was probably the most glorious phase in the growth of the city. Post independence, planned development of the city was taken up after the city became the capital of Rajasthan. It had a population of 2.32 million in 2001.

#### 3.2 Situation before Implementation of the Project

##### 3.2.1 Existing System

The increased social and economic status of the residents coupled with the inadequacy of public transport system has encouraged the residents to own personalized mode of transport.

The data on growth trend of vehicles show that personalized modes such as two wheelers and

cars are growing at a much higher rate. Growth of cars is found to be 11.6 % and growth of buses 2.3% in 2003-04. Overall vehicular growth has been observed as 9.4%. The public transport system in Jaipur comprises only 6.32% of the total number of vehicles; and caters to only 13% of person trips. When compared with the desirable level of modal split, it was found that the share of mass transport in Jaipur is well below the desired range (50-60 %) as per a 2007 MoUD study.

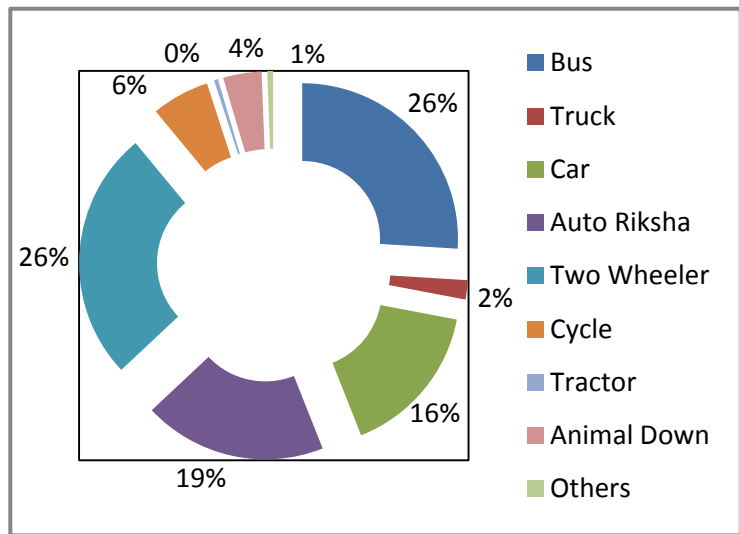


Figure 3.1: Composition of vehicles traced from Volume survey, Jaipur 2005

The share of personalized transport and Para-transit is already well above the optimal range creating big constraint for achieving the desired development profile of the city. It works as a catalyst for air quality deterioration, road congestion and reduced journey speeds, wastage of scarce fuels, besides sub-optimal utilization of infrastructure and other resources.

### 3.2.2 *Problems*

- Being the only metropolitan city of Rajasthan, the city of Jaipur has a 2.32 million population as per 2001 census, an average annual growth rate of 4.35% and load on transport infrastructure under distress.
- The share of personalized vehicles (2-wheelers, cars and jeeps) increased from 76% in 1985 to 85% in 2003.
- Existing public transport system is characterized by overcrowding, poor reliability, and long journey / waiting period. Also this system is not able to cater to the population and routes of the city.
- There is only a public transport system in the city, which has a fleet of 260 buses of standard size. Most of them are old buses, which are operated by Rajasthan State Road Transport Corporation (RSRTC). Private transport companies are operating mini buses numbering over 1800, which are unsafe, uncomfortable and unreliable, apart from having an ad-hoc operating method.
- 10% annual growth rate of private vehicle ownership in city.
- Pre-feasibility study has estimated the travel demand by 2017 to 4.6 lakhs trip per hour with Public Transport (PT) share of 25-42%.
- Most of the city arterial roads have reached their capacity and have no scope of further widening.

In view of the above, the State Government has planned Bus Rapid Transit System (BRTS), Modern Bus Service and Metro Rail project as Mass Rapid System (MRS) projects for Jaipur.

Jaipur Development Authority is the nodal agency for planning and implementation BRT infrastructure in Jaipur. The BRTS project in Jaipur is been developing and implementing through a Special Purpose Vehicle i.e. Jaipur City Transport Services Limited (JCTSL). M/s PDCOR Jaipur is the overall Project Management Consultant for the project and M/s

Consulting Engineering Services Private Limited is technical consultant for infrastructure design.

### ***3.2.3 Preparation of Feasibility Study***

In order to plan for an efficient and sustainable public transport system in the city, the Rajasthan Urban Infrastructure Development Program (RUIDP), funded by ADB, had initiated a study in August 2005. The study was carried out by PDCOR Ltd with an objective to plan and develop an Urban Mass Transit System for Jaipur.

The scope of work at the study was as under:

- Conducting various primary surveys including traffic surveys, household surveys, road inventory and willingness to pay survey;
- Establishment of the Urban Travel Demand Model;
- Evaluate Alternative Alignments options;
- Recommend suitable Transit System;
- Estimate the Ridership on the Proposed Corridor;
- Examine the Sensitivity of Ridership; and
- Suggesting an implementation framework.

The Final Report of the Study was submitted to RUIDP in March, 2006 and the project was transferred to Jaipur Development Authority in May 2006. As a part of the study, an Urban Travel Demand Model for the city was developed to forecast the trip pattern of the city residents. The traffic forecasts generated from the model, developed for this study, indicate that in case of do-nothing scenario, the traffic conditions will only worsen in future years. The total daily-motorized passenger trips generated in Jaipur in year 2005 is about 27 Lakhs out of which only 18 percent are performed on Public Transportation.

More than half of the total motorized trips are performed on two wheelers. The projected travel demand, after taking in to consideration the future settlement pattern and employment clusters, showed significant passenger movement in the east-west and North-South direction. The total travel demand in the study area by 2021 will be about 62 Lakhs Trips. The road network of Jaipur cannot carry such a large volume of trips as the major arterial roads are

presently operating beyond their capacities. The existing level of services across major roads is presented below:

**Table 3.1: Existing Level of Services across Major Roads in Jaipur**

S. No.	Name of the Road	Ratio of Existing traffic Volume / Road Capacity	Level of Service (LOS) <sup>1</sup>
1.	Tonk Road	1.32	F
2.	Sahkar Marg	1.29	F
3.	MI Road	0.96	E
4.	Ajmer Road	1.3	F
5.	Sikar Road	0.97	E

Source: Detail Project Report (DPR): Jaipur BRTS, 2006.

In light of all this, it was proposed that there is an urgent need to plan and develop an efficient transportation system in the city which will be safe, comfortable, cost effective, sustainable and also blend with the existing heritage character of the city and will not adversely affect it.

### ***3.2.4 Reason for Adoption of BRTS***

The Mass Rapid Transit Systems (MRTS) available around the globe can be broadly grouped into a 'rail system' and a 'bus system' classification. The rail based MRTS includes systems like metro, monorail, Light Rapid Transit (LRT) etc. The bus based system includes Bus Rapid Transit, commonly known as BRT. Selection of a particular type of Mass Transit System for the city of Jaipur depended on the performance characteristics of the options.

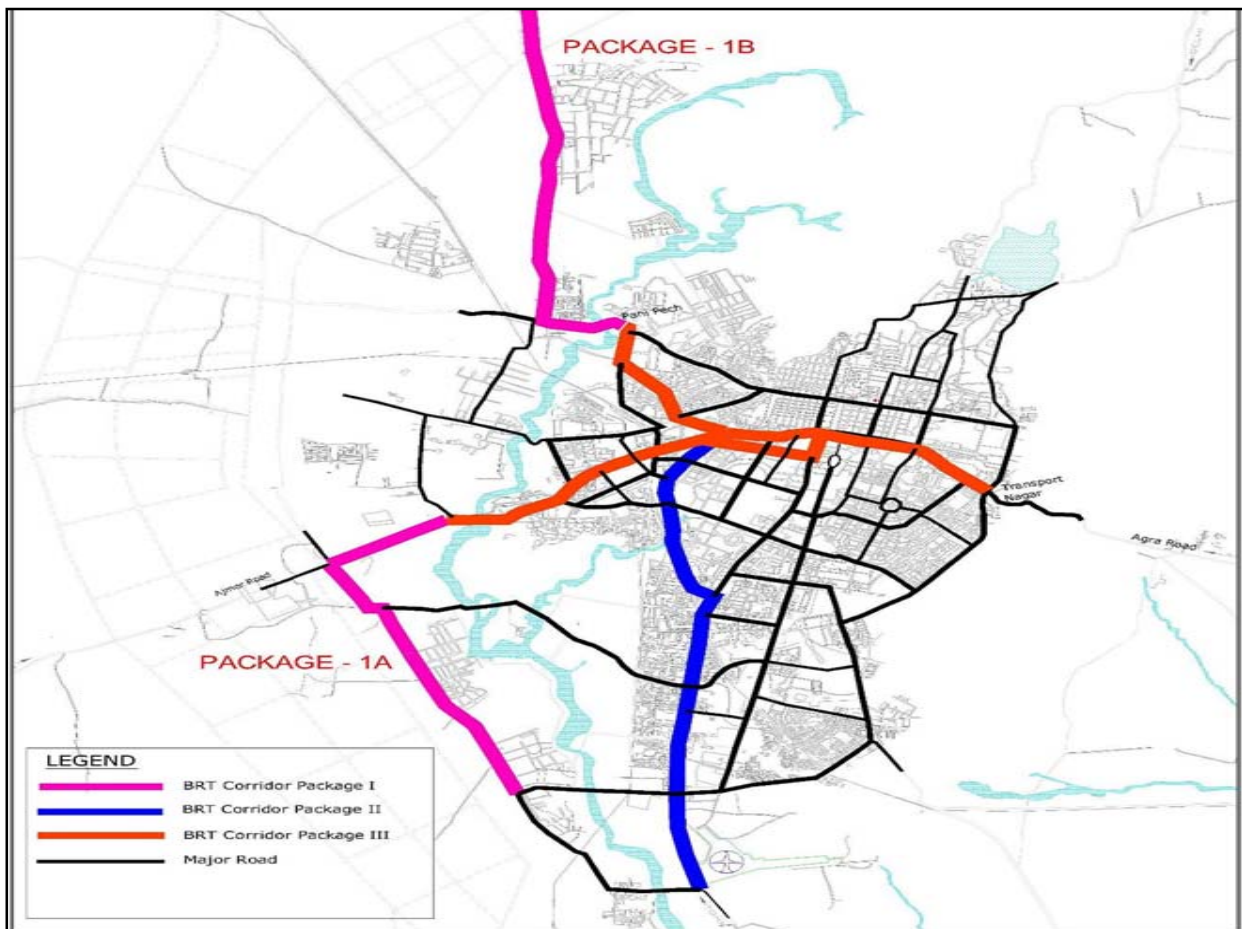
The traffic projections from the Traffic Demand Model have given a picture about the future Person per Hour per Direction (PPHPD) in Jaipur. A detailed reconnaissance of these corridors had determined the practical feasibility of introducing the type of transit system considered. Looking at the ridership numbers (which was in the range of 2000-6000 PHPDT), and considering the average trip length, (which is about 9 kms), and the bare

minimum requirement of land acquisition, it was found that a suitable BRTS should be planned along the selected mass transport corridors.

### 3.3 Project Description

As per the Master Plan of BRTS total 138 km of corridor length has been identified for the system. The project is proposed to be taken in three phases. In first phase, a corridor length of 46.7 km has been selected on priority basis for implementation purpose. Phase-I corridors connect North-South and East-West ends of the City and fulfill major transport needs of the city.

The estimated cost towards the development of road infrastructure for the first phase of BRTS, Jaipur was Rs 587.00 crores (block cost). MoUD, GoI on September 2006, approved the project in principle, for funding under JNNURM. As per the approval given on 20<sup>th</sup> July 2007, the estimated cost was ₹ 479.60 crores.



Map 3.1: Showing BRT Corridor Package First, Second and Third; Jaipur



Figure 3.2: Aerial View of North-South Corridor, Jaipur

### North-South Corridor

**Package I** (C-Zone Bypass to Pani Pech via Sikar Road) of 7.1 km length, having 22 bus stations and Right of Way (ROW) of 40-50 m, with low to medium side friction and light street parking, 9 major intersections with low congestion level, 22, 1 religious structure, connects large residential, and industrial areas and thus have potential for high traffic generation. The construction of this passageway was completed in late 2009 and recently buses have started plying on this corridor.

**Package-II** (Pani Pech to Sanganer Airport via Tonk Road) of about 16 km length has row of 20-40 m, 17 major intersections and medium to high side friction, with 1 existing ROB and 1 existing flyover.

An additional length of 2.2 km was added later from Laxmi Mandir Crossing (Tonk Road) to Bais Godam via Ram Bagh Circle. Package –II is divided into Package-IIA and Package-IIB.

**Package-IIA** has 13 Staggered Bus Stops, 3 Island Bus Stops and one Island Bus Station. However, Package-IIB has 21 Staggered Bus Stops, 1 Staggered Bus Station, 1 Island Bus Stop and 2 Island Bus Stations. The study is to cover how best to connect BRTS with Railway Station and Sindhi Camp bus stand.

### East-West Corridor

**Package-III** Transport Nagar to Ajmer bypass crossing via Ajmer Road, of about 13.35 km (sanctioned length), having row of 18-35 m and 14 major intersections on route has very high congestion level along the corridor. This Package is also divided into Package-IIIA and Package-IIIB. Package-IIA has 31 Staggered Bus Stops while Package-IIB has 8 Staggered Bus Stops and 2 Island Bus Stops. It serves institutional, commercial, walled city, and residential areas of the city. JDA is developing the corridor. The BRT lanes being in the center of carriageway, the existing overhead electrical lines in the median of the roads have been relocated.

Considering the parking demand and adequacy of ROW along the BRT corridors, on the street parking has been proposed at a number of locations. Service roads of 5.5 m width have been proposed depending upon the ROW available. Spacing the bus stops at an average distance of 500 – 700 meters has been proposed on the BRT corridor (Annex II). In addition to above, bus shelters handling large commuter volumes and feeder bus services have been planned. The shelters will provide additional facilities, viz. Off-board ticketing, passenger information etc. besides those at the stops.



Figure 3.3: View of Bus Station / Stop on BRTS Corridor



Figure 3.4: BRTS corridor having side lanes and footpath on both the side

**(a) Salient Features**

- Low floor buses with manual transmission and inbuilt PIS System;
- Route rationalization for mini buses;
- NMV tracks along the BRT route;
- FoBs provided at mid-block bus stops;
- No exclusive phases for buses and NMV at junctions;
- Free left turns at crossing for pedestrians;
- Separate contracts for bus operators;
- Advertisement cum corridor Management;
- Closed System with direct services;
- Railing has been provide on both sides of the BRT corridor to avoid accidents; and
- Rumble strip has been provided to segregate the BRT, up and down bus movement (wherever the median cannot be provided).

**(b) Intelligent Transport System (ITS)**

- Passenger information system (PIS) is planned for 'on-board' application, GIS based system is suggested for vehicle tracking, operations monitoring, 'off-board' PIS0.
- System used for data acquisition and process, bill payments and MIS.
- The service quality attributes like punctuality, reliability, vehicle productivity, etc. are also monitored.
- Manually steered and optically guided system is planned to be used for bus guidance and alignment with the platform.
- Automatic Fare Collection.

**(c) Bus Stops / Shelters / Stations**

Bus stops/shelters on the BRT corridor have been constructed on By JDA. The details are given below:

- Bus Stops are 35.0 m long and 3.0 wide.
- Bus Stations are 54.0 m long and 3.5 M wide.
- These bus stops are planned in such a manner, by which both, up and down lane of BRT Buses can be served with ease.
- Bus stops are planned aesthetically beautiful with adequacy of light and ventilation. The structures are made of Mild Steel Circular Pipes.
- Lots of space is provided in these bus stops for advertisement, which can be a source of collection of revenue.
- Bus-Queue-Shelters, on PPP format, would be constructed in the city through the loan assistance under Rajasthan Urban Development Fund, Government of Rajasthan.

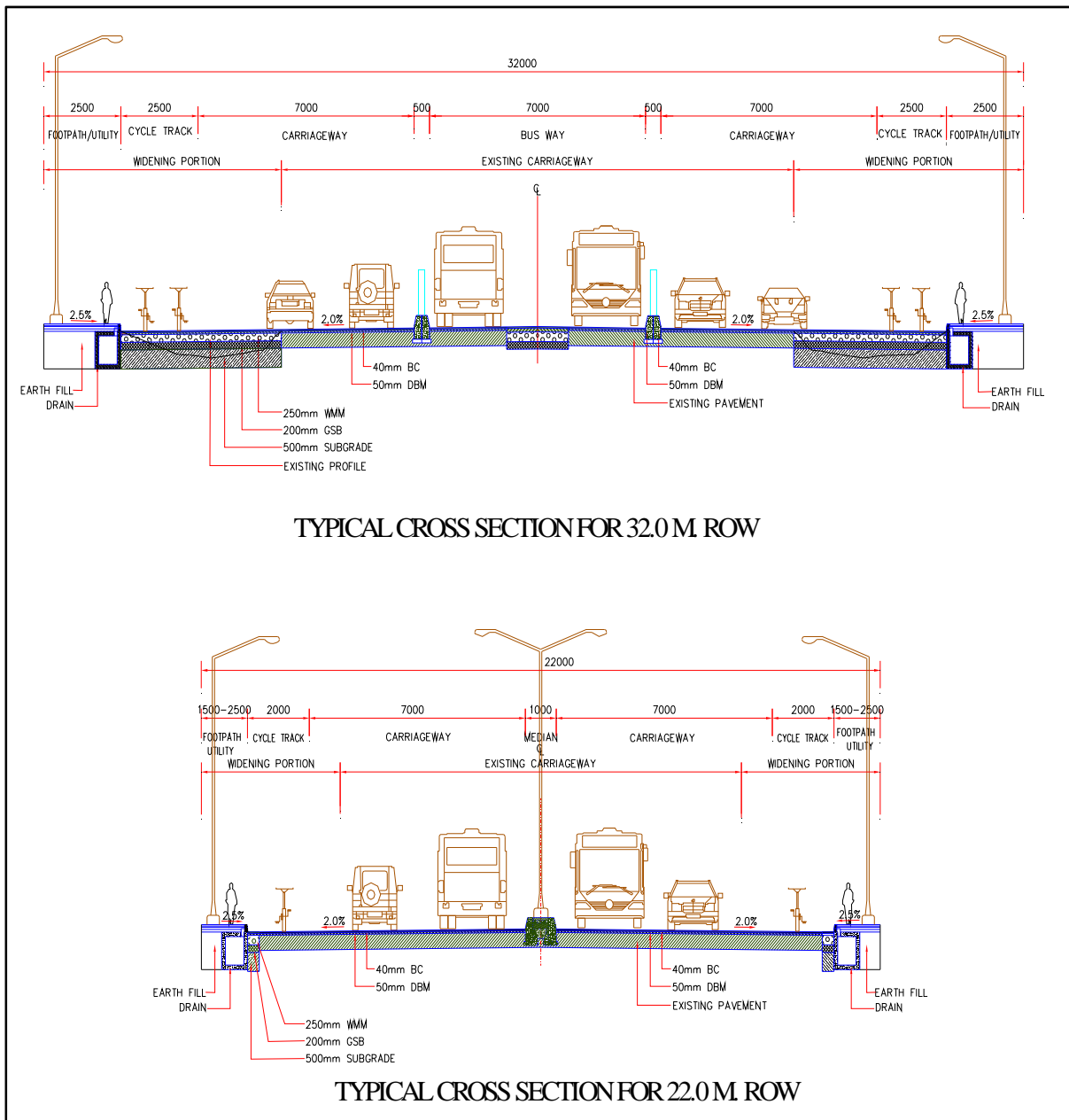
**(d) Services and Operation**

Considering all relevant factors and for providing universal accessibility, the destination oriented service design (Direct) is envisaged where the BRT vehicles, are proposed to operate beyond the BRT corridor up to the high traffic nodes in mixed traffic. The railway station and the bus terminal and other major traffic generating points are planned to be serviced by direct

BRT services. The BRT operations are spread over a period of nearly 18 hrs (0530 hrs to 2330 hrs) with on an average; the operational headway is 2 to 4 minutes.

**Table 3.2: Width of Bus, Motorized and Non-motorized Vehicle Lanes**

Bus Lane	Motorized Lane	NMV Lane
Middle side 3.5m wide	7.0 m to 9.0 m	2.0 to 2.5m



**Figure 3.5: Cross Sections of 32.0 M and 22.0 M ROW**



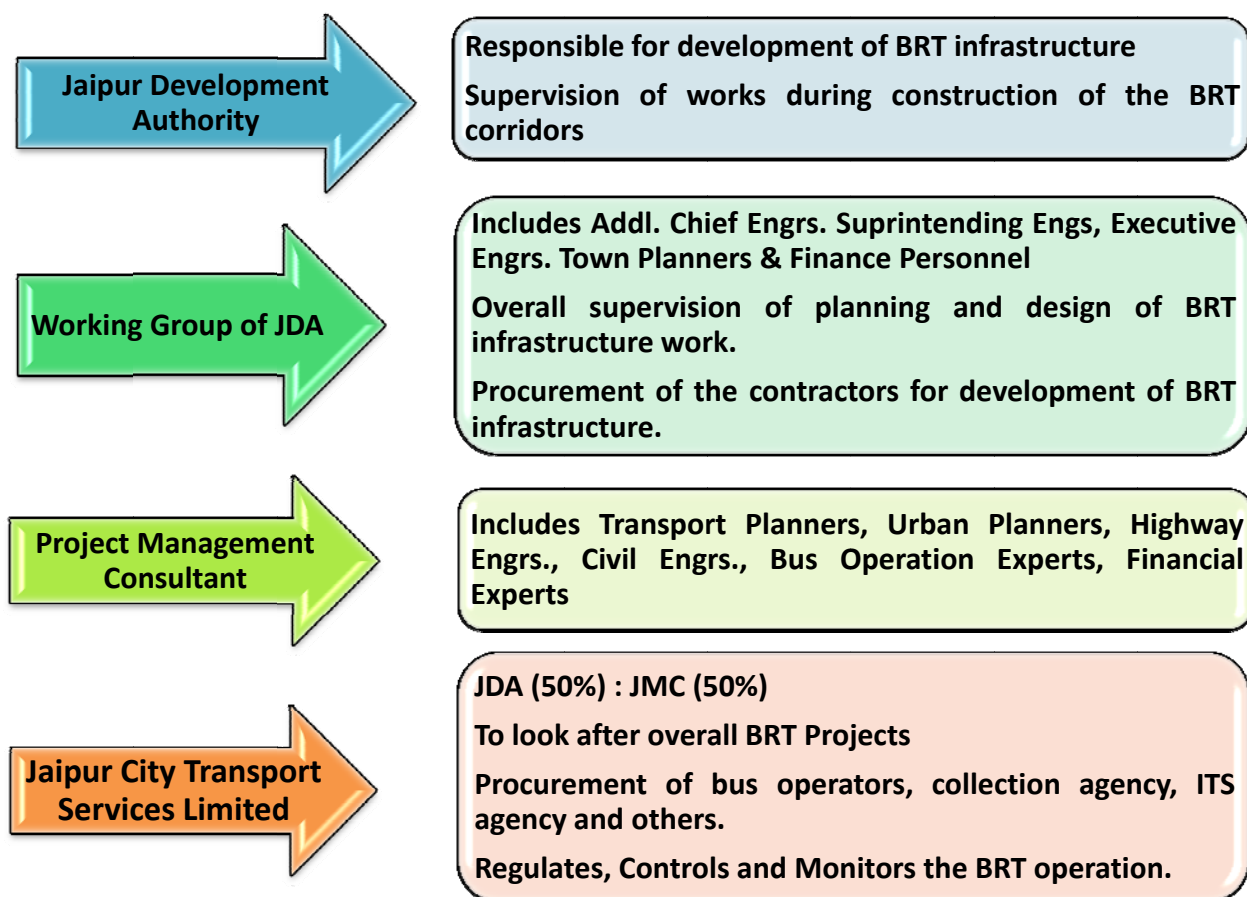
Figure 3.6: Bus and Bus Station

### *3.3.1 Goals of the Project*

- Provision of bus based public transport system in the city.
- Bus priority initiatives: Priority at the junctions, dedicated lanes for the buses.
- Operation of the state of the art and commuter friendly low floor buses.
- Provision of passenger information system through various applications of Intelligent Transport System (ITS).

### *3.3.2 Strategy Used to Achieve the Desired Goals*

The State Government has already constitution of Unified Metropolitan Transport Authority (UMTA) under the chairmanship of Hon'ble Chief Minister on 16<sup>th</sup> August 2008. Role of different agencies in Jaipur BRTS is as follows:



### 3.3.3 Activities Implemented to Achieve the Desired Goals

- Conduct of feasibility study for identification of an Efficient Transport System (ETS) for Jaipur.
- Securing approval of DPR from MoUD, GoI under JNNURM.
- Formation of dedicated teams in JDA for design and implementation of BRT corridor.
- Packaging of the total corridor length for implementation purpose.
- Formation of a Special Purpose Vehicle “JCTSL” to control, regulate and operate the BRT buses.
- Challenges/Constraints Encountered and how it was conquered.
- Required RoW is not available in old city. Most of the roads have less than 30 m. width and corridor requirement is more than 30 m. width.

- The average speed of traffic within Walled City is a low of 15-20 kmph. Its lead to environmental pollution, accidents and parking problems in City.
- Fears of accident and lack of awareness may lead to unacceptability of the project amongst the public.
- Already existing mini buses are operating on 36 routes and carry about 4.5 lac passengers daily. Fear of losing passengers and profits, mini bus operators and their Route Associations are opposing BRTS.
- Multiplicity of function of government and other working authorities.
- Expanding economic growth is providing a base for the development of newly emerging upper and middle income classes, demanding access and mobility.

### **3.3.4 *Expected Outcome of the Initiatives***

- The BRTS operating on all road corridors having a demand ranging between 2000 Person per Hour per Direction (PPHPD) and 20,000 pphpd and also its lead to considerable reduction of journey times in order to carry out commuters productive activities.
- At large level use of public transport system lead to less air pollution in the city and further it will reflect in the citizen's health.
- Cost effectiveness in terms of saving in fuels, affordable for users, profitable for private operators, and economically feasible for state.
- Promote continuous improvement in service and guarantee of service quality.
- The study has estimated share of Private Vehicles, Public Mass Transport and IPT will be respectively 30%, 60% and 10%.

### **3.3.5 *Role and Activities of the Partner***

- JDA: It is responsible for development of BRT infrastructure and supervision works during construction of BRT corridors.
- Jaipur City Transport Services Limited (JCTSL): It is responsible for procurement of bus operators, collection agency, its agency etc. It will also regulate, control and monitor the BRT operation.

- STUP Consultant Limited, Jaipur: It is responsible for supervision on engineering works.
- Unified Metropolitan Transport Authority (UMTA): It deals with the policy level decisions, which are related to land use and transport.
- Rajasthan State Road Transport Corporation (RSRTC): It is an existing agency responsible for operating the buses in the state as well as in the city. GoR has decided to handover the new BRT buses to RSRTC for operation.
- PDCOR Ltd: It is the Project management consultant including infrastructure design and bus operation.

### **3.3.6 Stakeholders Consultations**

Projects discussed at the level of:

- Unified Metropolitan Transport Authority;
- Traffic Control Board (MLAs, NGO's, JDA, JMC and citizen groups); and
- Traffic Police.

### **3.3.7 Challenges Faced**

- Re routing of 1800 mini buses;
- Lack of understanding of BRT elements by contractor;
- Inadequate RoW on few sections;
- Land acquisition delays the implementation process and land acquisition issues;
- Unavailability of lands for provision of parking near bus stops;
- Unacceptability of one way traffic movement;
- Shopkeepers / property owners habitual to free on-street parking (as they consider it as their right);
- Shifting of existing utilities services;
- Monopoly of bus manufacturers;
- Low floor buses are costly to operate and procure; and
- Financial sustainability of overall operational.

### 3.4 Factors of Success

- Corridor Planning and Design part;
- Technological Inputs like:
  - a) Low floor Buses;
  - b) AC Buses;
  - c) Next Vehicle display Board/System;
  - d) Automatic Vehicle Location Information System through GPS;
  - e) On Board Stop Announcement;
  - f) Signal Priority on specific signals; and
  - g) Ticket System-prepaid / Automated.

### 3.5 Budgetary Implications and Sustainability

#### 3.5.1 Total Cost of the Project

The project *‘Improvement of Public Transport Services in Jaipur through Creation of BRTS Corridor and Introduction of Modern City Buses under JNNURM’* comprises of investment under the following two heads:

- Development of dedicated corridor of 46 km. in length for Bus Rapid Transit System (BRTS) under JNNURM - Capital expenditure of ₹ 480.00 Cr.
- Purchase of 400 nos. of Semi Low Floor/Low Floor AC and Non AC Buses under JNNURM – Capital expenditure of ₹ 142.00 Cr.

#### 3.5.2 Source of Finance for Sustainability of the Project

Financial partners are MoUD, GoR, JDA and JCTL. Total capital cost in terms of input (funding pattern): Central Government–50%, Government of Rajasthan–20%, JDA (BRTS Corridor) and JCTSL (purchase of buses)–30%. In order to meet the operational losses from new buses, GoR has constituted a dedicated Urban Transport Fund (UTF) which includes the Advertisement charges, fare charges and property development cost. The Government has also decided to fund an amount of ₹ 10 Crore per annum to City level Transport Fund. In the meantime, the State Government is actively considering other possible streams for this fund.

### 3.5.3 *Operation of Buses*

Semi-low floor and low floor modern city buses are plying on 10 radial and circular routes covering the entire city. These buses also operate on 7.1 km Pilot BRTS corridor which is exclusive for these buses. RSRTC, the State owned unit has been roped in to operate the buses on mutually agreed terms and conditions.

## 3.6 Impact of the Initiatives

The successful execution of project has resulted in a paradigm shift in urban transport scenario of the city. Slowly but gradually the required changes in the urban transport pattern of the city can be observed.

The project has lead to improvements, which are summarized below:

- **Improvement in Travel speed**

The bus travels 7 km in about 18 min, leading to a speed of about 25 km /hr.

- **Reduction in accident**

The statistics shows that number of accidents has been reduced by 12.65%.

- **Reduction in green house gas emissions**

The engines of the Modern City buses are complying with BS-III emission norms, which resulted in significant reduction in pollution.

- **Reduction in noise pollution**

Buses with rear engine are purchased which reduces noise pollution.

- **Service Frequency**

Buses are operating at a frequency ranging from 7 to 15 minutes. Consequently commuter satisfaction is greater.

- **Geographical Coverage**

The grid system of Jaipur covers the entire urban area for the BRTS corridor. On JCTSL routes, with one change only, passenger can reach any part of the city.

- **Reduction in energy consumption**

Savings in energy (fuel) consumption on account of less no. of vehicles on road and decongestion.

- **Increase in Overall Capacity of Public Transport Services**

220 rear engine semi low floor (650mm) buses have been introduced in the city for the commuters.

- **Color Coding:**

Each route is assigned a particular shade of color for ease in identification.

- **Flat Fare**

✓ It is the first city to introduce single flat fare system. The cost per passenger trip is reduced.

- **Shifting Pattern of Users**

Since July, 2010 ridership on buses has been considerably increased from 55,000 to 200,000.

- **Level boarding into city buses from 400mm height BRTS bus stops.**

- **Staggered BRTS bus stops reduce the effective walking distance for bus commuters.**

### *3.6.1 Intermodal Connectivity*

In the Master Plan 2025 a provision has been kept for integration of land use with public transport system. Proposed transport system (BRTS, city bus system and Metro) will also strengthen the connectivity of future growth area and satellite towns.

The Government of Rajasthan has approved the Jaipur Metro Rail Project to be executed by SPV called Jaipur Metro Rail Corporation Limited incorporated on 1<sup>st</sup> January 2010. The DPR has been prepared by DMRC Limited. Phase-I of the project is proposed to be implemented in two Stages:

**Stage-I:** The civil work including the Permanent way and electrification for the Line from Mansarovar to Chan pole of about 9.25 Kms to be done by DMRC Limited on turnkey basis. An agreement for this has been executed on 05-08-2010 between JMRC and DMRC.

**Stage-II:** Proposed to be executed on PPP basis. A total work of about 25 Kms metro rail line and the operation and maintenance of the entire project will be executed. The process of selection of consultants for the purpose, on the guidelines of the Ministry of Finance and Planning Commission – GOI, has been started.

### SCHEMATIC REPRESENTATION OF BRT & MRT INTERCHANGE



### 3.7 Summing Up

It may be seen from the above that in the project has been executed successfully and resulted in paradigm shift in urban transport scenario of urban areas of Jaipur. The project has initiated some changes, viz. improvement in travel speed (17 Km in 18 minutes at 25 Km/hr), reduction in accidents (reduced by 12.65 %), reduction in green house gas emission (complying with BS-III emission norms), reduction in noise pollution (as engine is fitted at rear of buses), increase in service frequency (7 to 15 minutes), more geographical coverage (grid system for route designing), reduction in energy consumption etc.

All these changes make the project successful. The reasons for the success are attributed to planning and design: technical inputs like, low floor buses, AC buses, next vehicle display board / system, GPS, on board stop announcement, signal priority on specific signals and ticket system-prepaid / automated.

The project has been planned and executed by the public entities, viz. Jaipur Development Authority, Jaipur City Transport Services Limited, Urban Metropolitan Transport Authority. PDCOR Limited is the project management consultant for infrastructure design and bus operation. STUP Consultant Limited is responsible for supervision of engineering works.

It is to be mentioned that no private sector was involved for constructing bus stops / shelters and Information Technology means. It was reported that Bus-Queue-shelter / shelters etc shall be constructed on PPP format through the loan assistance under Rajasthan Urban Development Fund, Govt. of Rajasthan.

Major challenges encountered during the implementation of the project, are mostly related to availability/acquisition of land, shifting of existing utilities, road side parking etc. In order to address these challenges, the ULB or other concerned departments should take action.

**Table3.3: Jaipur BRTS at a Glance**

S.No.	Components		Jaipur
1)	<b>Consultant</b>		PDCOR as PMC, CES is associated with MAUNSELL, AECOM as technical consultant.
2)	<b>Population of City (Million) - Present</b>		2.3
3)	<b>No. of Corridors</b>		
	A)	Total	
	B)	Sanctioned	05
4)	<b>Length (km)</b>		
	A)	Total	138
	B)	Sanctioned	7.1 (Package I), 19 (Package II) and 13.35 (Package III)
5)	<b>Type of Operation (open/closed)</b>		Closed with direct services
6)	<b>Buses</b>		
	A)	Floor Height	650mm and 400mm
	B)	Bus Capacity (Seating and Standing)	90
	C)	Fuel Type (CNG/Diesel)	Diesel
7)	<b>Type of Road Surface</b>		
	A)	BRTS Lane	Flexible Pavement
	B)	Other lanes	Flexible Pavement
	C)	Bus Station	Flexible Pavement with Mastic Surface
8)	<b>Expected year of Commissioning</b>		July, 2010 (Package-I)
9)	<b>No. of Bus Stations</b>		Package I-22 nos., Package IIA- Staggered Bus Stops -13, Island Bus Stop-3, Island Bus Station-1, Package IIB- Staggered Bus Stops -21, Staggered Bus Station- 1, Island Bus Stop-1, Island Bus Station-2, Package IIIA- Staggered Bus Stops 31, Package IIIB- Staggered Bus Stops-8, Island Bus Stop-2

10)	<b>No. of Bus Terminals</b>	04
11)	<b>Spacing of Stations (m)</b>	400-700
12)	<b>Special Purpose Vehicle</b>	
	A) Name / Constitution	Jaipur City Transport Services Limited (JCTSL)
	B) Partners	JDA-JMC-RSRTC
13)	<b>Public-Private Partnership</b>	
	A) Bus Terminals	Y
	B) Parking	Y
	C) Bus Operation	Y
	D) Bus Stops	N
	E) Road Infrastructure	N
14)	<b>Cost (₹ in Crores)</b>	
	A) Total	479.6
	B) Cost per Km.	12.15