# *Rajkot* BRTS
# Blue Corridor Development

BUS RAPID TRANSIT SYSTEM
RAJKOT
*Connecting people with buses...*

***Presentation to***
***BRTS – Workshop***
***Ahmedabad***
**Dt.24-26/09/2007**

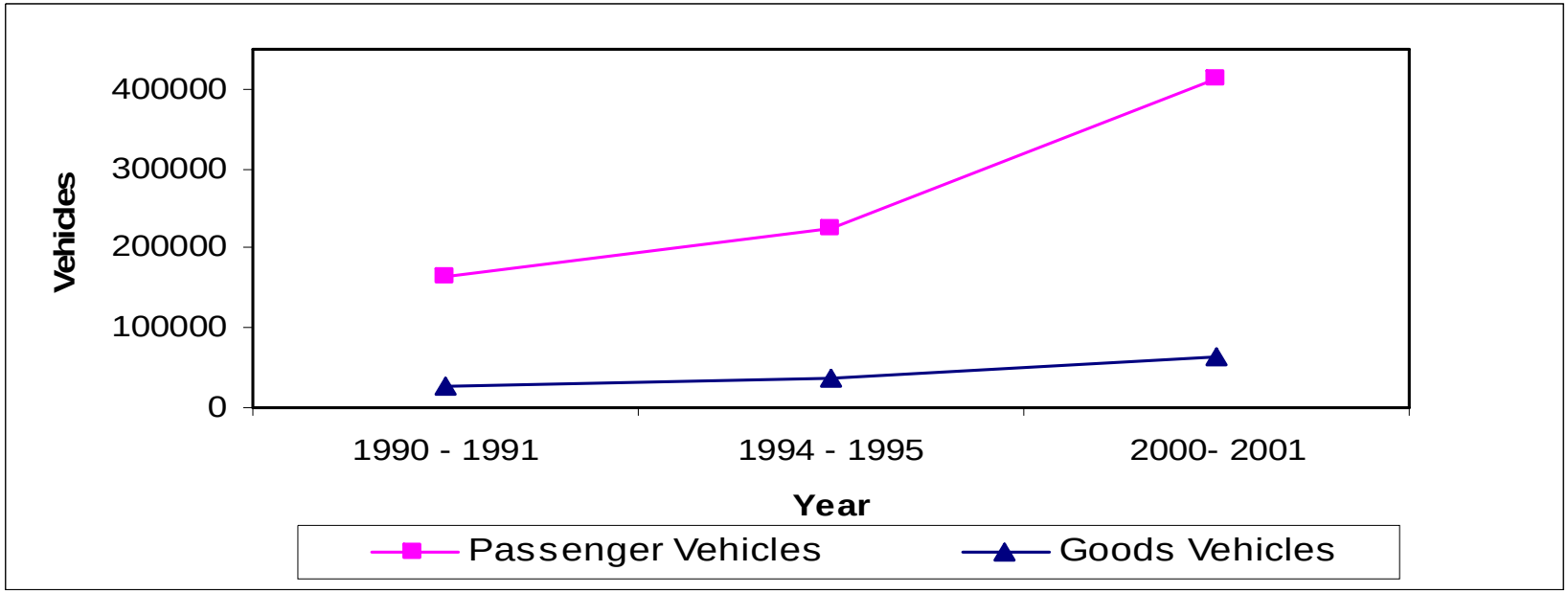
# About City…



- **Location : 20.18N & 70.51E**
- **Heart of Saurashtra region**
- **Area : 104.86 Sq.Kms**
- **Population : 10,02,000**
  **(as per census 2001)**
- **Slum Population :2,02,371**
- **Climate : Max.43.5$^{O}$ C**
  **(Avg.) : Min. 24.2 $^{O}$ C**
- **Rain fall : Avg. 500 mm**
- **City wards : 23**

# Vehicular Growth…

- Motor vehicles growth of 9.5% annually
- The highest growth is of two wheelers, which is 9.8%.
- The public transport in the city is only 0.5%
- More than 10,000 auto rickshaws and chhakda having average trip length of 5.4km and 13km respectively.
- The city has no facilities for NMVs
- No facilities for pedestrians in most areas.



# Accidents…

| Year | Fatal | Serious | Minor | Without Injury | Total |
|---|---|---|---|---|---|
| 2001-02 | 41 | 57 | 701 | 132 | 931 |
| 2002-03 | 28 | 59 | 724 | 106 | 917 |
| 2003-04 | 44 | 48 | 732 | 87 | 911 |
| 2004-05 | 50 | 70 | 660 | 98 | 878 |
| 2005-06 | 60 | 41 | 682 | 108 | 891 |
| 2006-07 | 50 | 43 | 663 | 100 | 856 |

# Background

- City without Effective Mass Transport
- City Bus with Private operator will start in full swing within a month
- Ring road having highest traffic growth, lacks Road Design , Traffic Signals, Junction Improvement and Mass Transport leads to high risk road
- National Urban Transport Policy advocates Mass Transport system in form of BRTS, Light Rail, Metro, Sky Bus option (Page:7 Para :13)

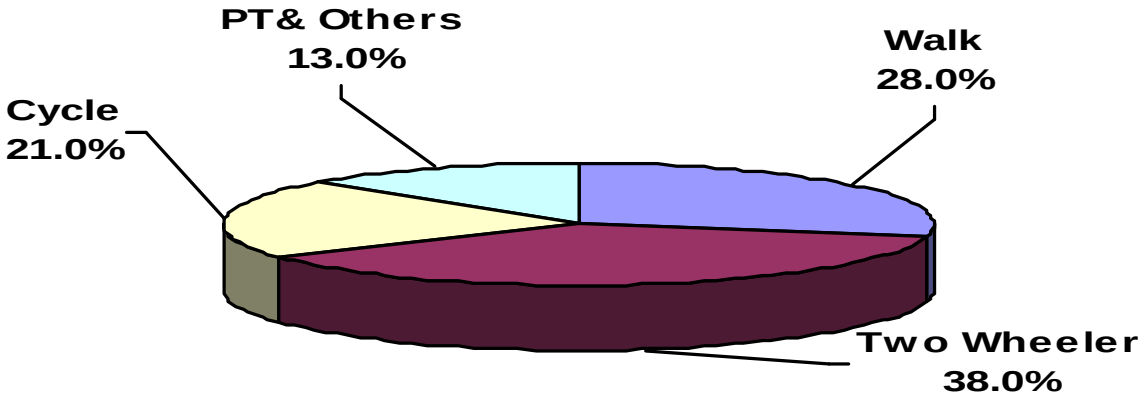
# Study of Comprehensive Mobility Plan

- Initiated by MoUD and carried out by CES(I) - Completed in year 2004

- Carried out More than 13 surveys
  - ✓ Road Network Inventory
  - ✓ Land Use
  - ✓ Speed & Delay Survey
  - ✓ Classified Traffic Volume Count Survey
  - ✓ Intersection Turning Movement survey
  - ✓ Origin-Destination Survey
  - ✓ Household Travel Survey
  - ✓ Intermediate Public Transport Survey
  - ✓ Parking Survey
  - ✓ Pedestrian Count Survey
  - ✓ Terminal Studies
  - ✓ Delay and Queue Length Survey
  - ✓ Marketing Yard Survey

# Mode of Travel and Trip Rate & Length

| Area | Trip Rate (incl. Walk) | Trip Rate (Excl. Walk) | Trip Length (in Kms) |
|---|---|---|---|
| Central Area | 1.21 | 0.90 | 2.93 |
| Rest of RMC | 1.32 | 0.95 | 3.84 |
| Rajkot OG | 0.89 | 0.53 | 3.21 |
| **(Overall)** | **1.29** | **0.92** | **3.71** |



# Comprehensive Mobility Plan

- The population of Rajkot is projected to be 2.20 million by 2021 and the workforce participation rate as 35%
- For travel demand; estimation trip end models were developed and these were then distributed. A normative modal share of 40% by the year 2021 based on the recommendations of the Study Group on Alternative Systems or Urban Transport (GOI) was adopted and then assignment was done
- The PCTR for the city for the year 2021 is expected to be 1.62
- The study of the network reflects that 50% of the network is congested with level of service D
- 34% of the roads have Volume/Capacity Ratio above 1, indicating acute congestion
- The plan has suggested a Bus Rapid Transit System which would include the conventional road based system supplemented by at grade BRTS along the identified corridors

# Comprehensive Mobility Plan – Immediate Measure

- Implementation of the proposed traffic circulation system
- Improvement of road network in Central Area internal in terms of improvement in geometrics, provision of footpaths, pavement strengthening etc.
- Development of NMV lanes
- Improvement of peripheral roads in Central area
- Operation of traffic signals
- Reorganization of on-street parking and enforcement of parking management strategies
- Revision of parking norms and standards and develop policy of parking fees
- Establishment of Rajkot Bus Transport Service with an estimated fleet of 200 buses
- Setting up of RTC (Rajkot Transport Company)
- Setting up of a Traffic Engineering & Management Unit (TEMU) in RMC
- Setting up of Rajkot Transport Development Fund
- Improvement in logistics support to Traffic Police

# Comprehensive Mobility Plan – Short Term Measure

- Conduct of techno-economic and engineering studies and preparation of functional plans
- Improvement of Arterial roads
- Identify and planning for ROB / RUB
- Pedestrian Facilities
- Parking facilities – On & Off street
- Preparation of Traffic Management Plan (TMP) for other areas and their implementation
- Improvement of all identified intersections including geometrics and control systems

## Comprehensive Mobility Plan – Medium Term Measure(2007-11)

- Improvement of radial arterial roads
- Construction of Master Plan (new major) roads
- Widening of existing river bridges (2)
- Construction of New River Bridges (4)
- Construction of ROB / RUB (5)
- Construction of pedestrian Bridge (3)
- Development of inter-city bus terminals
- Development of bus infrastructure like terminals, Work shop, bus stops, shelters, etc.
- Initiation of evaluation studies
- Preparation of Planning, Operation and Management Plan for bus system

## Comprehensive Mobility Plan – Long Term Measure(2011-21)

- Completion of all Master Plan roads
- Full phase implementation of Rajkot Mass Transport Plan to cater 40% of the population
- Construction of flyovers (5)
- Development of inter-state bus terminals on Ahmedabad Road and Gondal Road

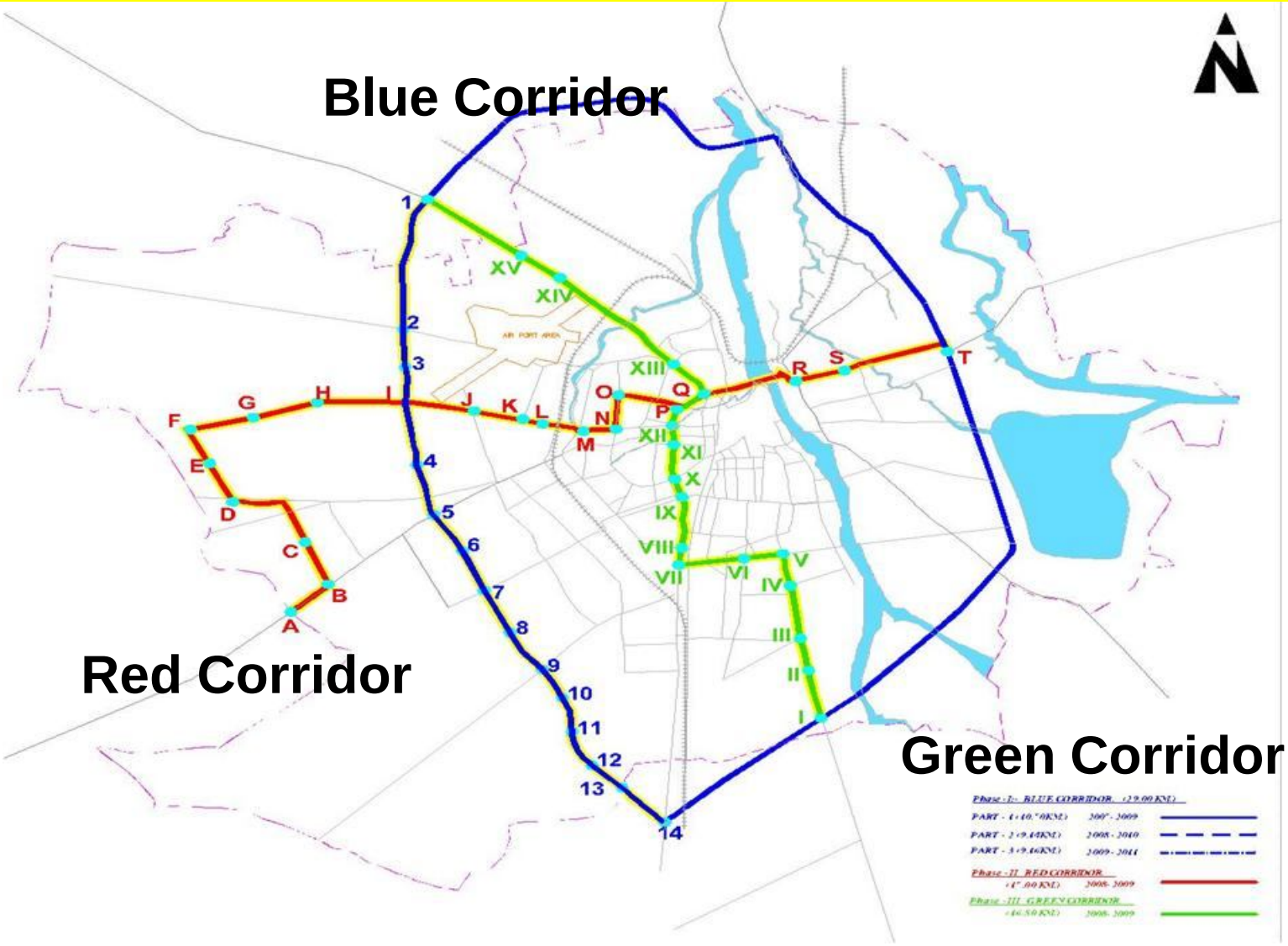
# BRTS – Project Goals

- Improve mobility along the corridor
- Reduction in traffic congestion and traffic problems
- Reduction in accident
- Improve over all mobility in city as a whole
- Increase travel speed
- Reduction in vehicular emission (GHG) & improving environmental condition
- Provision of Comfortable and easily accessible bus stop
- Provision of on street parking facilities
- Provision for separate lane for Pedestrian & Motorized and Non Motorized Vehicle

# Identification of BRTS Corridor

| No. | Name of Corridor | Name of Corridor in terms of City Coverage | Available Right of Way (in Mt.) | Length of Corridor (in Km.) |
|---|---|---|---|---|
| 1 | **Blue Corridor** (Gondal Road-Ring Road crossing to Jamnagar Road-Ring Road Crossing to Greenland Chowk to Gondal Road) | **Ring road** | 45 - 60 | 29.00 |
| 2 | **Green Corridor** (Arvindbhai Maniar Nagar to Jamnagar Road – Ring Road Crossing) | **North-South** | 18 - 24 | 16.50 |
| 3 | **Red Corridor** (Green land Chowk to Saurashtra University) | **East-West** | 18 - 24 | 18.00 |
| | **Total…** | | | **63.50** |

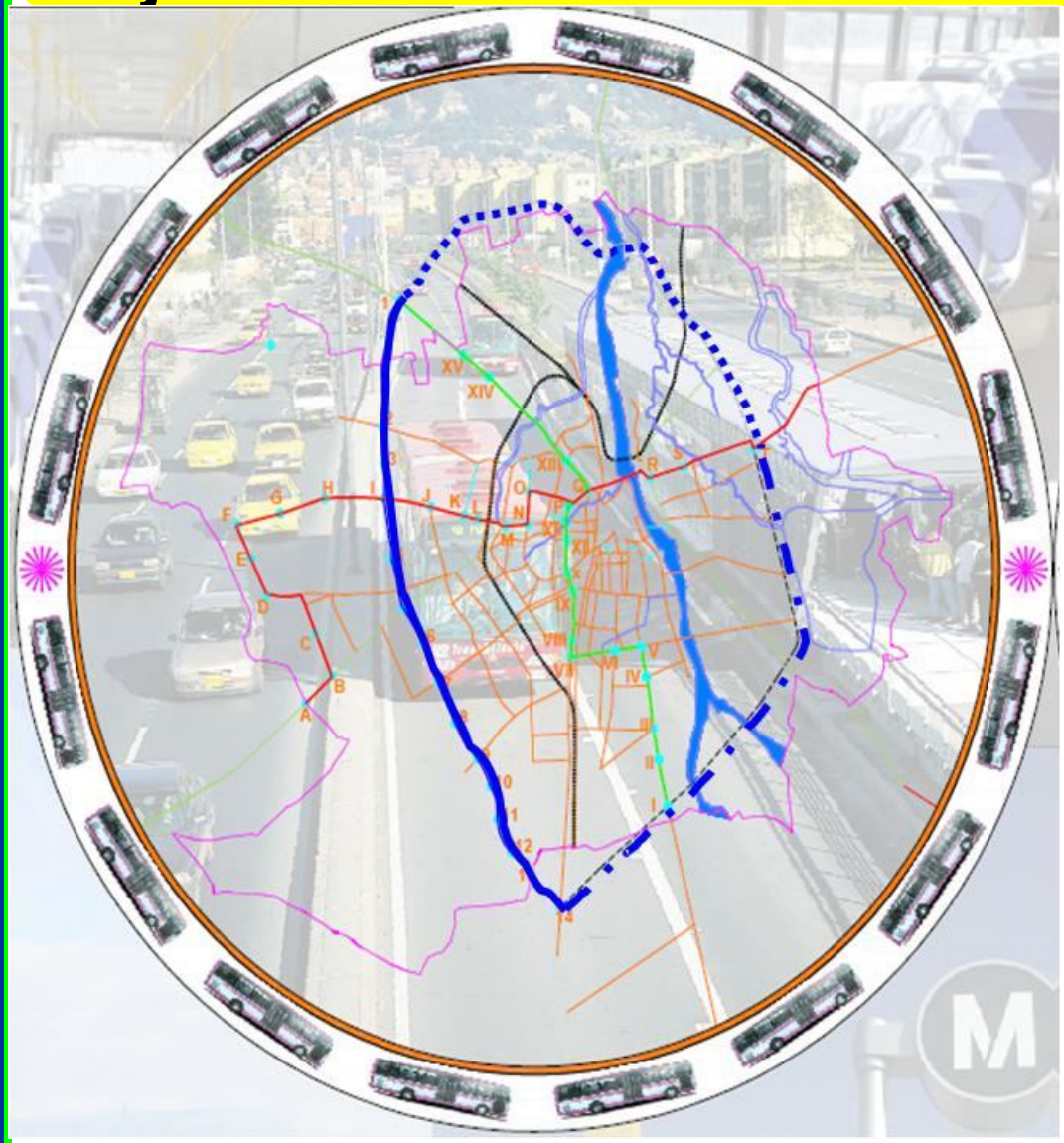
# Identified Corridors



# Assessment of Corridor

| No. | Description | Blue | Rank | Red | Rank | Green | Rank |
|---|---|---|---|---|---|---|---|
| 1 | Width of Corridor (in mt) | 45 – 60 | 1 | 18 -24 | 2 | 18 -24 | 3 |
| 2 | Length of in Kms | 29.00 | 3 | 16.50 | 2 | 18 | 1 |
| 3 | Proposed width for BRTS (in mt.) | 8.00 | 1 | Mix mode or 3.75 | 3 | Mix mode or 3.75 | 2 |
| 4 | No of Junctions | 55 | 1 | 61 | 2 | 63 | 3 |
| 5 | No of Bottle Necks | 0 | 1 | 1 | 2 | 2 | 3 |
| 6 | Environment Issues | 75 trees | 2 | No Impact | 1 | 105 trees | 3 |
| 7 | Social Issues | Hawker / Street Vendors | 3 | Road side encroach ment | 2 | Lesser Impact | 1 |
| **AVG. RANKS** | | | **12** | | **14** | | **16** |
| **FINAL RANK (LESSER IS BETTER)** | | **1** | | **2** | | **3** | |

# Rajkot Blue Corridor BRTS – Phasing



## *Three Parts*

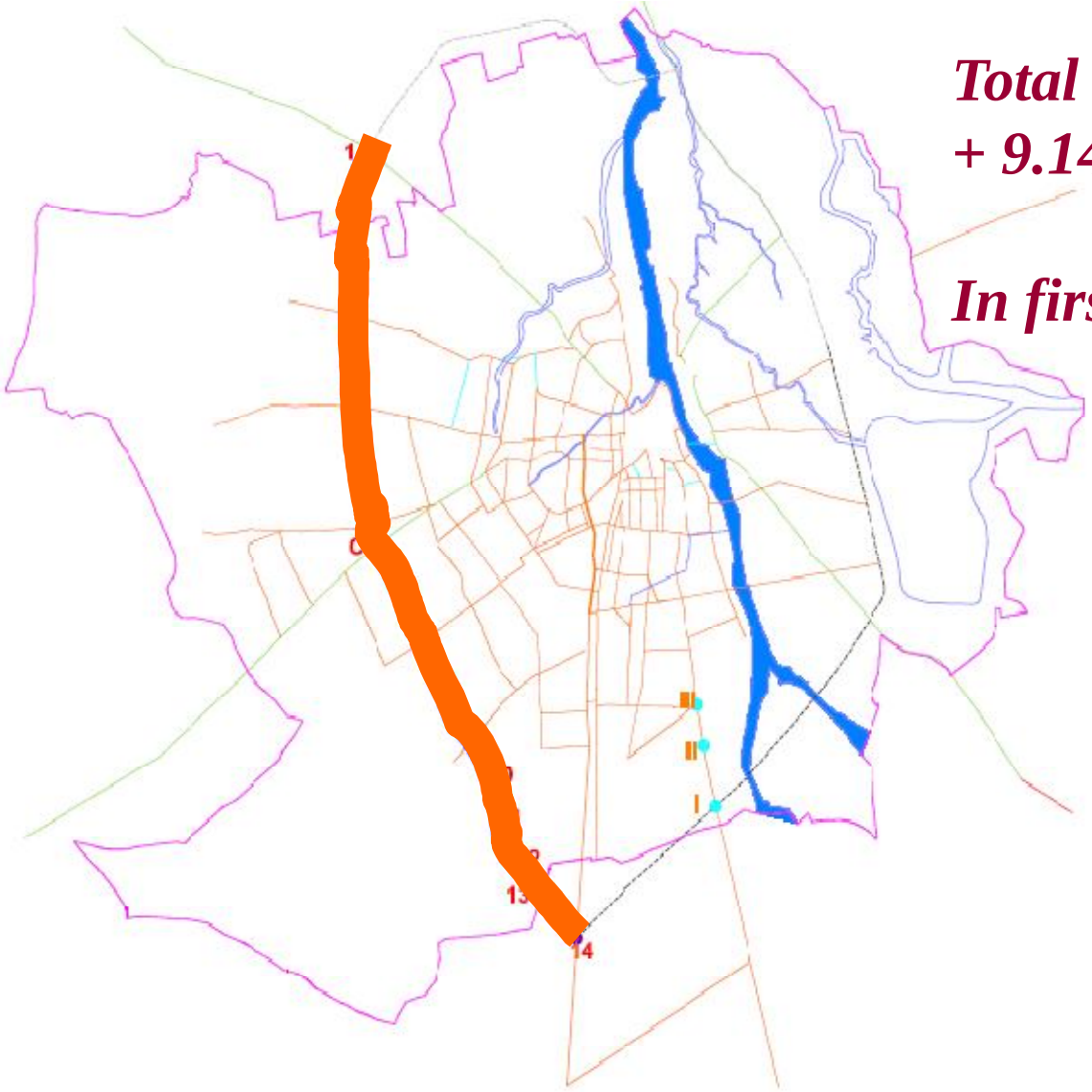
- **Gondal Road to Jamnagar Road- Part-I (10.70 kms.)**
- **Jamnagar Road to Morbi Road (RUDA area) Part-II (9.16 kms.)**
- **Morbi Road to Gondal Road (National Highway) Part-III (9.14 kms.)**

# Blue Corridor Part-1: Photos


# Blue Corridor Part-1: Assessment


| Location | Length (in mt.) | T- Jn | Cross Jn. | Other Jn. |
|---|---|---|---|---|
| Jamnagar road Cross | | | | |
| Dharamnagar | 1736 | 5 | 0 | 0 |
| Gandhigram Police Chowki | 750 | 1 | 1 | 0 |
| Raiya road | 675 | 1 | 1 | 1 |
| Raiya Telephone | 777 | 4 | 3 | 2 |
| KKV Hall | 858 | 2 | 2 | 1 |
| Big Bazar | 787 | 2 | 1 | 0 |
| Nanamuva Circle | 590 | 1 | 1 | 0 |
| Balaji Hall | 535 | 2 | 0 | 0 |
| Mavdi Circle | 823 | 5 | 1 | 3 |
| Dhareswar Chowk | 567 | 1 | 1 | 1 |
| Tirupati chowk | 500 | 1 | 0 | 0 |
| JayVijay Dharmshala | 549 | 3 | 1 | 1 |
| Punitnagar | 840 | 2 | 1 | 1 |
| Gondal road cross | 661 | 0 | 2 | 0 |
| Total | 10648 | 30 | 15 | 10 |

# Rajkot BRTS – Blue Corridor (Ring road)




*Total Length =10.70 + 9.16 + 9.14 = 29.00 kms*

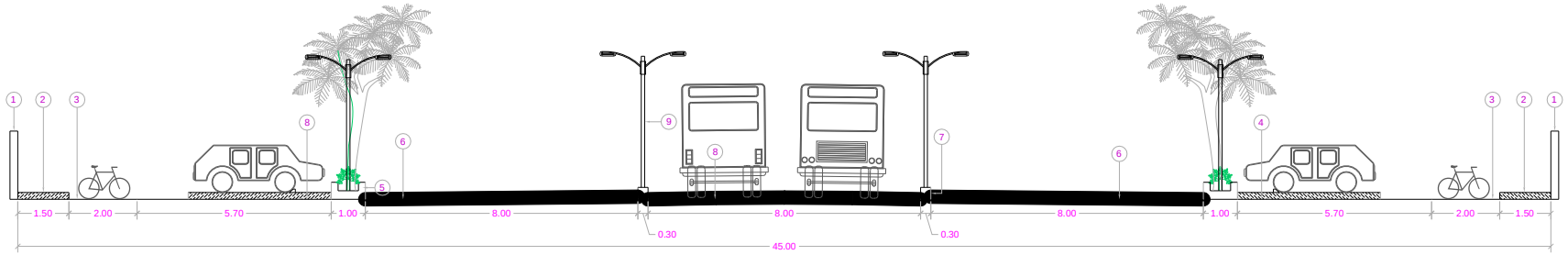
*In first stretch,*

- ✓ *10.70 kms*
- ✓ *15 Junctions*
- ✓ *14 Bus stops*
- ✓ *Avg Trip Length 3.71 km*

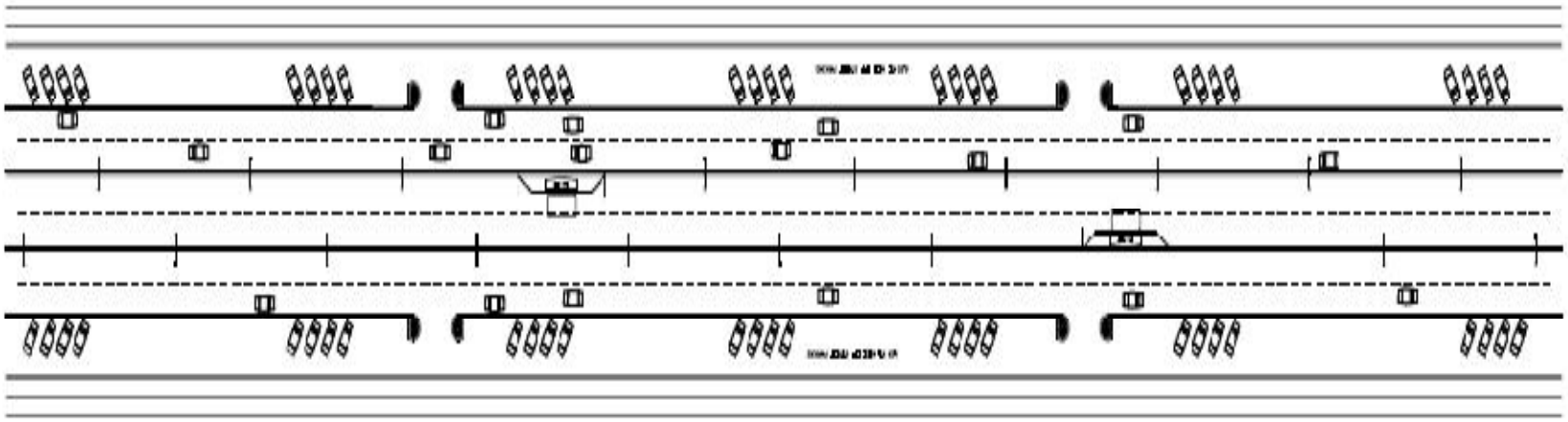
# BRTS – Median Lane

- Easy to Integrate bus flow at intersection
- Optimum road width for both direction movement
- Infrastructure can be used for future upgradation like LRT
- Control access at Bus Shelter

# BRTS – RoW Distribution




CROSS SECTION OF 45.0 MT. WIDE RING ROAD



| | |
|---|---|
| 1 | Building Control Line |
| 2 | Pedestrian Way |
| 3 | Non Motorized Vehicle Lane |
| 4 | Parking Area |
| 5 | Landscaping strip |

| | |
|---|---|
| 6 | Motorized Vehicle Lane |
| 7 | Curb |
| 8 | BRTS Lane |
| 9 | Street Light Pole |

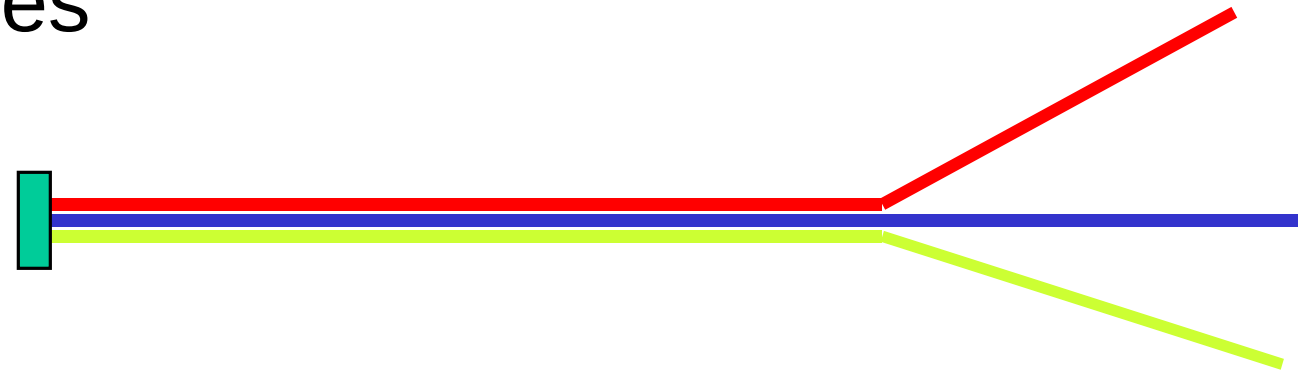
# CC Road Surface for BRTS lane

- **Cement concrete has been preferred for better Strength, longer life and lesser maintenance**

# BRTS – Junction Design

# BRTS – Open V/S Closed System

Open v/s Closed System: Open for all Buses



Closed System – Only BRTS

***However, considering the criticality of services, it is recommended that Fire Brigade and Ambulances will be allowed on the BRTS Lane.***

# BRTS – Footpath / Parking Space / Cycle Track

# BRTS – Bus Shelter

# BRTS – Foot Over Bridges

# BRTS – ITS

IT services shall be used for:

- Network surveillance
- Meter ramps
- On & Off board passenger information system
- Accident Management System
- Vehicle tracking system
- Fleet management system
- Central control room

# BRTS Fleet Calculation on Blue Corridor Part-1

| | |
|---|---|
| Max. Section load | 389857 |
| Present share of Public transport =20% | 77971 |
| 10% of Daily traffic is taken as PHPDT in both direction | 7797 |
| Final load in uni direction | 3899 |
| Taking capacity of bus | 100 |
| Nos. of Buses required in operative condition | 39 |
| Length of corridor stretch in km. | 10.7 |
| Average Speed in Kmph | 35 |
| Effective Travel time in Minutes | 18.34 |
| Stoppage time at every bus stop and signal in minutes | 33.5 |
| Total time required in minutes | 52 |
| Frequency of bus in uni direction | 1.33 |
| Actual nos. of fleet required base on frequency 1.5 (Uni direction) | 35 |

# BRTS – Bus Technology Options

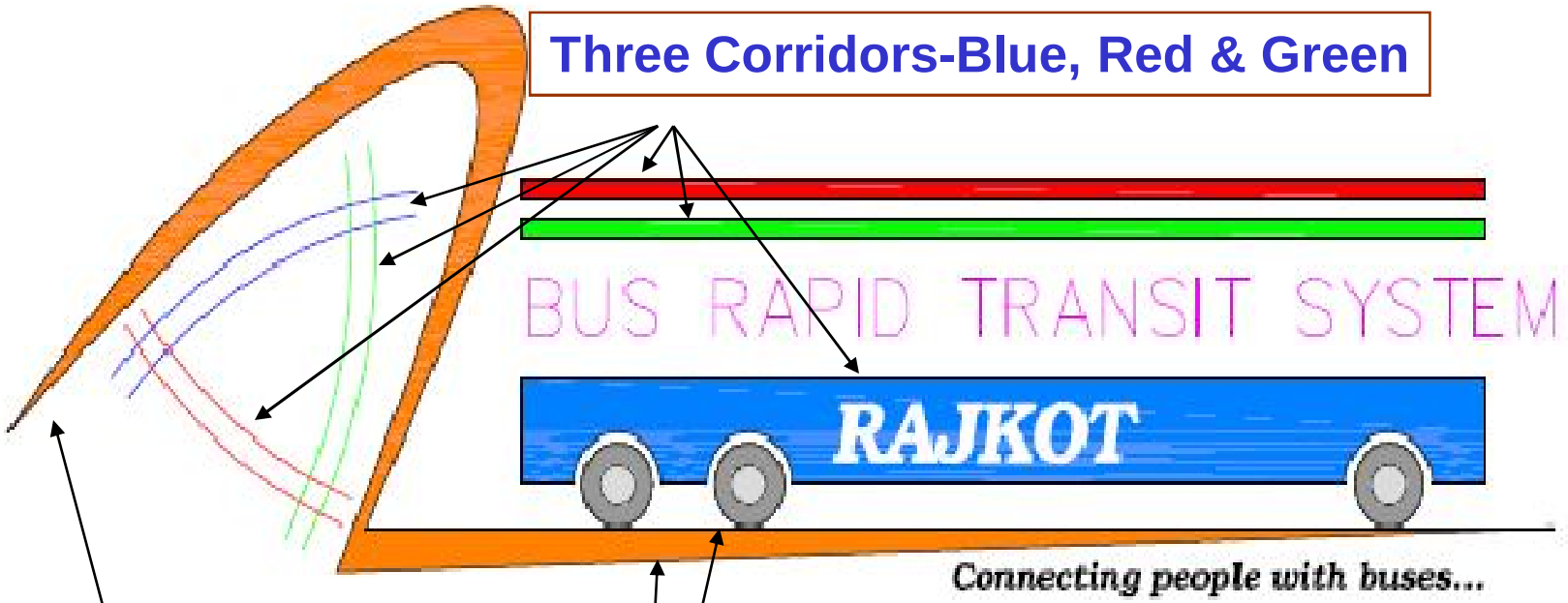

**Clean Diesel Bus is recommended based on PPHPD**

| No. | System | Maximum System Capacity (PPHPD) |
|---|---|---|
| 1. | Diesel Bus System (road) | 5000 |
| 2. | Diesel Bus System (exclusive RoW) | 10000 |
| 3. | Urban bus or Bus way | 15000-20000 |
| 4. | Electric Trolley Bus (shared road) | 7000 |
| 5. | Trams (Shared road) | 6000 |
| 6. | Rubber Tyre guided system (automated) | 10000 |
| 7. | Mono Rail | 15000-20000 |
| 8. | Light Rail Transit System | 20000-30000 |
| 9. | Heavy Rail Metro System/ sub-urban system | 30000-60000 |
| 10. | Suburban Electric multiple units | 30000-60000 |

# Hawkers & Vendors Recognisation

- Policy for Hawker is outlined
- Pre designed Food and cart kiosk are suggested
- Shifting vendors of building material is suggested
- Shifting of Second hand Car Market is suggested
- A Committee has been suggested to frame the policy

# BRTS – Logo




Three Corridors-Blue, Red & Green

R for Rajkot
R for Rapid

Philosophy

Speed by Wheel & Narrow path

# BRTS – Ticketing Options


Internal Ticketing

- Initially – Internal
- Proposal for Zone base
- No of zones =10
- Interchangeability with standard buses
- Monthly, Season, Smart card provision

# BRTS – Blue Corridor Costing

| Summary of Cost Estimate for Development of Rajkot BRTS Phase–I (Part-1) | | |
|---|---|---|
| **No.** | **Description** | **Amount (in Rs. Crores)** |
| 1 | Costing of BRTS Roadways development | 59.89 |
| 2 | Costing of Vehicles, Services & Operations | 9.24 |
| 3 | Costing of Feeder Network & Infrastructure | 4.00 |
| 4 | Costing of Terminals & Parking | 1.53 |
| 5 | Costing of ITS development | 3.40 |
| 6 | Costing of other Infrastructure development | 25.50 |
| | **Total ……..** | 103.56 |
| | **Add 5% Consulting/Supervision & Contingency Charges** | 6.23 |
| | **Total ……..** | **109.79** |
| | **Say Rs. (in Crores)** | **110.00** |

# Revenue Generation – Sale of FSI

| Sale of addi. FSI by 'x' | Generation of Revenue based on Rate chargeable for additional FSI | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Option:1 | | | | Option:2 | | | | Remark |
| | Resi. | Comm | Vacan | Total | Resi. | Comm | Vacant | Total | |
| | Rs.750 | Rs.1000 | Rs.800 | | Rs.1500 | Rs.2000 | Rs.1750 | | |
| X =0.50 | 22.41 | 13.38 | 5.55 | 41.33 | 44.81 | 26.75 | 9.71 | 81.28 | |
| X=0.75 | 33.61 | 20.06 | 8.33 | 62.00 | 67.22 | 40.13 | 14.57 | 121.91 | Selected option |
| X =1.00 | 44.81 | 26.75 | 11.10 | 82.66 | 89.63 | 53.50 | 19.43 | 162.55 | |

# Revenue Generation – Parking

| | Types of vehicle | Total Vehicle | Fee collection based on 2 hours parking slots and considering 5 slots during whole day (Fee: Two wheelers=Rs.2/slot Four wheelers=Rs.5/slot) | Total Income per day (in Rs.) |
|---|---|---|---|---|
| 1 | Two wheelers | 2400 | 2 x 5 | 24000 |
| 2 | Four wheelers | 500 | 5 x 5 | 12500 |
| | | | Total | 36500 |
| | | | **Total Income Rs. (in Lakhs / annum)** | **109.5** |
| | | | **Say Rs. (in Lakhs) …** | **100** |

# Revenue Generation_ Advertisement Income

| Types of advertisement Display | Nos | Income from each unit / annum (in Rs.) | Total Income per annum (Rs. in Lakhs) |
|---|---|---|---|
| Kiosk on main streetlight poles | 250 | 3000 | 7.50 |
| Advertisement on specially designed road side uni-pole structure | 120 | 12000 | 14.40 |
| Advertisement on Bus stands | 30 | 24000 | 7.20 |
| Advertisement on pedestrian over bridge | 10 | 120000 | 12.00 |
| Advertisement on traffic signal system | 5 | 3000 | 0.15 |
| | | **Total ……** | **41.25** |
| | | **Say Rs. (in Lakhs)……** | **40** |

# Resource Generation Summary

| Sr | Description of Potential in Revenue Generation | Revenue Potential Rs in Lakhs |
|---|---|---|
| 1 | Land Development / Allowing additional FSI over a period of ten years (Total) | 12000 |
| 2 | Pay & Park charge | 100/annum |
| 3 | Advertisement Rights | 40/annum |

# Rajkot BRTS – Planning Management & Control

## Planning, Management and Control

**Infrastructure (Public)**
- Corridors
- Stations
- Garages
- Complementary Infrastructure

**Billeting (Private)**
- Equipments
- Smart Cards
- Trust Fund


**Operation (Private)**
- Multiple Companies on each trunk line.
- Buses
- Employees

# Rajkot BRTS – Implementation Agency

## Rajkot Transport Company (RTC)

- Proposed SPV under Company Act
- Responsible overall development & supervision of Rajkot Mass Transport Service
- Responsible for Rajkot Transport Development Fund

## Transport Engineering and Management Unit (TEMU)

- Employees of RMC
- Engineers / Planners/Architects / Economist
- Responsible for Engineering Design and site supervision of all traffic & transportation projects including Rajkot BRTS development

## Urban Mass Transport Agency (UMTA)

- Private Operator
- Fixed based on any mode i.e. BOT, Contract or Annuity Bases
- Responsible for Operation & Maintenance of Rajkot BRTS and development along the corridor

# Thanks..