

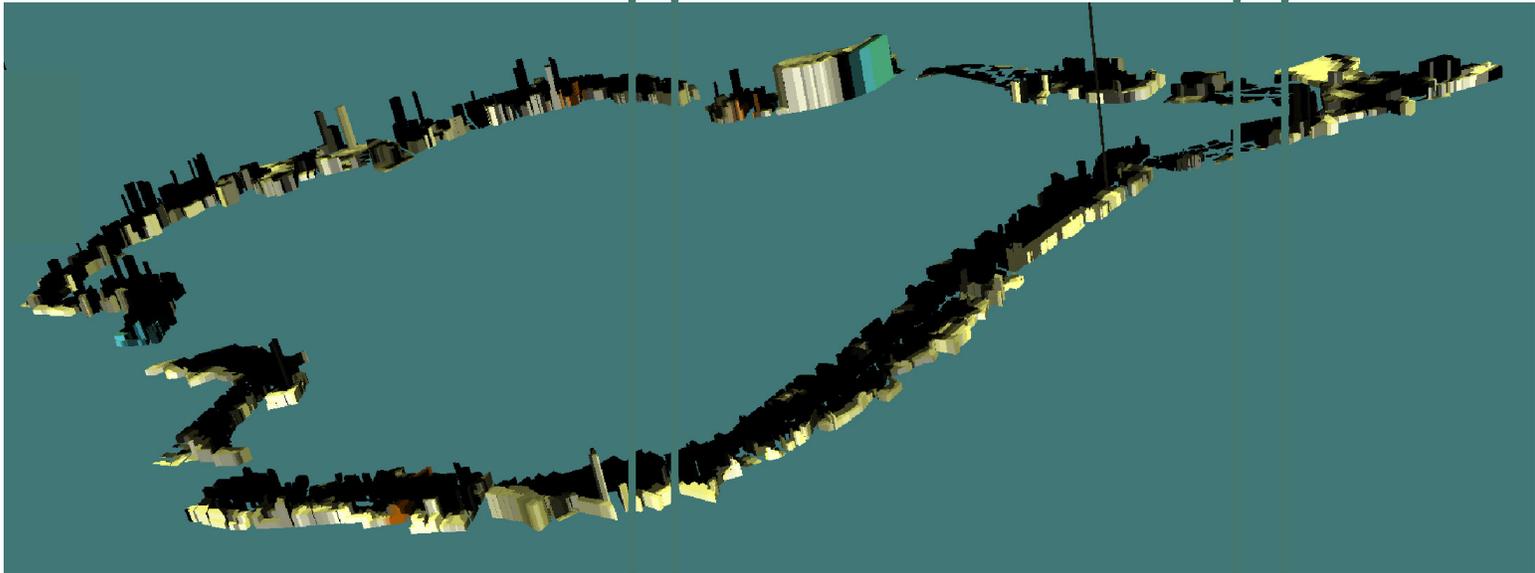
CORRIDOR IDENTIFICATION



BUS RAPID TRANSIT SYSTEM

GUJARAT INFRASTRUCTURE DEVELOPMENT BOARD

REPORT 1



Centre for Environmental Planning & Technology University, Ahmedabad

Table of Contents

1.	INTRODUCTION	ERROR! BOOKMARK NOT DEFINED.
1.1	BACKGROUND	ERROR! BOOKMARK NOT DEFINED.
1.2	AIM AND OBJECTIVES	ERROR! BOOKMARK NOT DEFINED.
1.3	STUDY AREA DELINEATION	ERROR! BOOKMARK NOT DEFINED.
1.4	DATA BASE.....	ERROR! BOOKMARK NOT DEFINED.
	1.4.1 Earlier Studies	<i>Error! Bookmark not defined.</i>
1.5	PRIMARY SURVEYS	ERROR! BOOKMARK NOT DEFINED.
2.	THE CITY AND ITS GROWTH.....	ERROR! BOOKMARK NOT DEFINED.
2.1	INTRODUCTION.....	ERROR! BOOKMARK NOT DEFINED.
2.2	THE CITY	ERROR! BOOKMARK NOT DEFINED.
2.3	LOCATION AND CLIMATE.....	ERROR! BOOKMARK NOT DEFINED.
2.4	DEMOGRAPHIC TRENDS	ERROR! BOOKMARK NOT DEFINED.
	2.4.1 Spatial Patterns of Population Growth.....	<i>Error! Bookmark not defined.</i>
	2.4.2 Population Density:	<i>Error! Bookmark not defined.</i>
	2.4.3 Population Forecast.....	<i>Error! Bookmark not defined.</i>
2.5	LAND USE.....	ERROR! BOOKMARK NOT DEFINED.
	2.5.1 Land-use in AUDA area.....	<i>Error! Bookmark not defined.</i>
	2.5.2 Land Use in AMC area	<i>Error! Bookmark not defined.</i>
	2.5.3 Future Development Area.....	<i>Error! Bookmark not defined.</i>
2.6	TRAFFIC GENERATING ACTIVITIES	ERROR! BOOKMARK NOT DEFINED.
2.7	EMPLOYMENT DISTRIBUTION	ERROR! BOOKMARK NOT DEFINED.
2.8	SUMMARY	ERROR! BOOKMARK NOT DEFINED.
3.	EXISTING TRANSPORTATION SYSTEM - VEHICLES, FACILITIES & PERFORMANCE	ERROR! BOOKMARK NOT DEFINED.
3.1	SYSTEM COMPONENTS	ERROR! BOOKMARK NOT DEFINED.
3.2	VEHICLES	ERROR! BOOKMARK NOT DEFINED.
3.3	FACILITIES	ERROR! BOOKMARK NOT DEFINED.
	3.3.1 Road Network.....	<i>Error! Bookmark not defined.</i>
	3.3.2 Bridges and Flyovers	<i>Error! Bookmark not defined.</i>
3.4	PUBLIC TRANSPORT	ERROR! BOOKMARK NOT DEFINED.
	3.4.1 Traffic Volume	<i>Error! Bookmark not defined.</i>
	3.4.2 Network Speeds.....	<i>Error! Bookmark not defined.</i>
	3.4.3 Accidents.....	<i>Error! Bookmark not defined.</i>
	3.4.4 Effects on Air Quality.....	<i>Error! Bookmark not defined.</i>
4.	PUBLIC TRANSPORTATION SYSTEM IN THE CITY	ERROR! BOOKMARK NOT DEFINED.

4.1	INTRODUCTION TO THE PUBLIC TRANSPORT SYSTEM	ERROR! BOOKMARK NOT DEFINED.
4.2	AMTS - ORGANIZATION, STRUCTURE AND PERFORMANCE	ERROR! BOOKMARK NOT DEFINED.
4.2.1	<i>Management and Administration.....</i>	<i>Error! Bookmark not defined.</i>
4.2.2	<i>Level of Operations and Coverage</i>	<i>Error! Bookmark not defined.</i>
4.2.3	<i>Acquisition, Replacement and Composition of Fleet.....</i>	<i>Error! Bookmark not defined.</i>
4.2.4	<i>Route Structure and Network.....</i>	<i>Error! Bookmark not defined.</i>
4.2.5	<i>Fares and Occupancy Levels:.....</i>	<i>Error! Bookmark not defined.</i>
4.2.6	<i>Financial Performance</i>	<i>Error! Bookmark not defined.</i>
4.2.7	<i>Decline in Patronage:.....</i>	<i>Error! Bookmark not defined.</i>
4.2.8	<i>Up gradation Plans-CNG Routes:</i>	<i>Error! Bookmark not defined.</i>
4.2.9	<i>Observations:.....</i>	<i>Error! Bookmark not defined.</i>
4.3	REGIONAL TRANSPORTATION SYSTEM-GSRTC:	ERROR! BOOKMARK NOT DEFINED.
4.4	RAILWAYS:	ERROR! BOOKMARK NOT DEFINED.
4.5	INTERMEDIATE PUBLIC TRANSPORT MODES:	ERROR! BOOKMARK NOT DEFINED.
4.6	PRIVATE BUS OPERATION	ERROR! BOOKMARK NOT DEFINED.
5.	TRAVEL CHARACTERISTICS	ERROR! BOOKMARK NOT DEFINED.
5.1	INTRODUCTION	ERROR! BOOKMARK NOT DEFINED.
5.2	SOCIO-ECONOMIC CHARACTERISTICS	ERROR! BOOKMARK NOT DEFINED.
5.2.1	<i>Age wise distribution of Population.....</i>	<i>Error! Bookmark not defined.</i>
5.2.2	<i>Activity Status.....</i>	<i>Error! Bookmark not defined.</i>
5.2.3	<i>Income Distribution</i>	<i>Error! Bookmark not defined.</i>
5.2.4	<i>Vehicle Ownership.....</i>	<i>Error! Bookmark not defined.</i>
5.3	TRAVEL CHARACTERISTICS	ERROR! BOOKMARK NOT DEFINED.
5.3.1	<i>Trip Rate</i>	<i>Error! Bookmark not defined.</i>
5.3.2	<i>Trip Purpose</i>	<i>Error! Bookmark not defined.</i>
5.3.3	<i>Mode choice.....</i>	<i>Error! Bookmark not defined.</i>
5.3.4	<i>Trip length.....</i>	<i>Error! Bookmark not defined.</i>
5.3.5	<i>Women and Travel Trips.....</i>	<i>Error! Bookmark not defined.</i>
5.3.6	<i>Monthly Expenditure on Travel</i>	<i>Error! Bookmark not defined.</i>
5.4	SPATIAL PATTERN OF PASSENGER MOVEMENT ..	ERROR! BOOKMARK NOT DEFINED.
5.5	SUMMARY	ERROR! BOOKMARK NOT DEFINED.
6.	SYSTEM NEEDS & INITIATIVES.....	ERROR! BOOKMARK NOT DEFINED.
6.1	BACKGROUND	ERROR! BOOKMARK NOT DEFINED.
6.2	CHALLENGES AND OPPORTUNITIES	ERROR! BOOKMARK NOT DEFINED.
6.3	MAJOR INITIATIVES.....	ERROR! BOOKMARK NOT DEFINED.
6.4	ROLE OF BUS TRANSPORT IN AHMEDABAD	ERROR! BOOKMARK NOT DEFINED.

7. CORRIDOR ASSESSMENT AND IDENTIFICATION.....ERROR! BOOKMARK NOT DEFINED.

- 7.1 INTRODUCTION..... **ERROR! BOOKMARK NOT DEFINED.**
- 7.2 FRAMEWORK **ERROR! BOOKMARK NOT DEFINED.**
- 7.3 IDENTIFICATION OF POTENTIAL BRTS CORRIDORS.....**ERROR! BOOKMARK NOT DEFINED.**
 - 7.3.1 *DP Major Roads* *Error! Bookmark not defined.*
 - 7.3.2 *Proposals in Previous Studies* *Error! Bookmark not defined.*
 - 7.3.3 *AMTS Routes*..... *Error! Bookmark not defined.*
- 7.4 CORRIDOR ASSESSMENT **ERROR! BOOKMARK NOT DEFINED.**
 - 7.4.1 *Travel Demand Assessment* *Error! Bookmark not defined.*
 - 7.4.2 *Technical Feasibility to implement BRTS treatment*..... *Error! Bookmark not defined.*
 - 7.4.3 *Systemwide Impact*..... *Error! Bookmark not defined.*
- 7.5 CORRIDOR SELECTION **ERROR! BOOKMARK NOT DEFINED.**
 - 7.5.1 *BRTS Corridor Phasing*..... *Error! Bookmark not defined.*
 - 7.5.2 *BRTS and AMTS Operations in Ahmedabad* *Error! Bookmark not defined.*
- 7.6 SUMMARY **ERROR! BOOKMARK NOT DEFINED.**

8. THE BUS RAPID TRANSIT SYSTEM DESIGNERROR! BOOKMARK NOT DEFINED.

- 8.1 INTRODUCTION..... **ERROR! BOOKMARK NOT DEFINED.**
- 8.2 POLICY ISSUES..... **ERROR! BOOKMARK NOT DEFINED.**
 - 8.2.1 *Median versus Side Lanes*..... *Error! Bookmark not defined.*
 - 8.2.2 *Open versus Closed System* *Error! Bookmark not defined.*
 - 8.2.3 *Exclusive/Dedicated versus Mixed Corridor* *Error! Bookmark not defined.*
 - 8.2.4 *Land Ownership of the corridor* *Error! Bookmark not defined.*
 - 8.2.5 *Bus Technology/Size Issue* *Error! Bookmark not defined.*
 - 8.2.6 *Advance Technology* *Error! Bookmark not defined.*
 - 8.2.7 *Fare Policy*..... *Error! Bookmark not defined.*
- 8.3 DESIGN CONSIDERATION..... **ERROR! BOOKMARK NOT DEFINED.**
 - 8.3.1 *Geometric Design* *Error! Bookmark not defined.*
 - 8.3.2 *Pavement Design & Drainage Arrangement* *Error! Bookmark not defined.*
 - 8.3.3 *Location of Bus Stop/Bus shelter* *Error! Bookmark not defined.*
 - 8.3.4 *Access to Bus Stop* *Error! Bookmark not defined.*
 - 8.3.5 *Treatment of Intersections* *Error! Bookmark not defined.*
 - 8.3.6 *Parking Provision* *Error! Bookmark not defined.*
 - 8.3.7 *Bicycle Tracks*..... *Error! Bookmark not defined.*
 - 8.3.8 *Pedestrian Facilities* *Error! Bookmark not defined.*
 - 8.3.9 *Street Lighting*..... *Error! Bookmark not defined.*
 - 8.3.10 *Street Furniture* *Error! Bookmark not defined.*
 - 8.3.11 *Relocation of Existing Services/Utilities* *Error! Bookmark not defined.*

8.4	OPERATIONAL ISSUES	ERROR! BOOKMARK NOT DEFINED.
8.5	EVOLVING ALTERNATIVE CROSS SECTIONS	ERROR! BOOKMARK NOT DEFINED.
8.6	PLAN/PROFILE FOR A TYPICAL SECTION.....	ERROR! BOOKMARK NOT DEFINED.
8.7	BLOCK COST ESTIMATES	ERROR! BOOKMARK NOT DEFINED.
8.8	CONSTRUCTION SEQUENCE.....	ERROR! BOOKMARK NOT DEFINED.
8.9	SUMMARY	ERROR! BOOKMARK NOT DEFINED.
9.	SUPPORT MECHANISM	ERROR! BOOKMARK NOT DEFINED.
9.1	TRANSIT SUPPORTIVE ACTIVITIES	ERROR! BOOKMARK NOT DEFINED.
	LAND USE.....	ERROR! BOOKMARK NOT DEFINED.
9.2	RESOURCE GENERATION	ERROR! BOOKMARK NOT DEFINED.
	9.2.1 Land Development.....	<i>Error! Bookmark not defined.</i>
	9.2.2 Other Options.....	<i>Error! Bookmark not defined.</i>
9.3	END NOTE.....	ERROR! BOOKMARK NOT DEFINED.

LIST OF TABLES

Table 1-1: Study Area Zone System	Error! Bookmark not defined.
Table 1-2: Details of Surveys	Error! Bookmark not defined.
Table 2-1: Population Growth – Greater Ahmedabad	Error! Bookmark not defined.
Table 2-2: Population Density	Error! Bookmark not defined.
Table 2-3: Population Forecast	Error! Bookmark not defined.
Table 2-4: Population Distribution	Error! Bookmark not defined.
Table 2-5: Existing and Proposed Land use of AMC area.....	Error! Bookmark not defined.
Table 2-6: Existing and Proposed Land use of AUC area (Excluding AMC)	Error! Bookmark not defined.
Table 3-1: Total number of vehicle registered and decadal vehicular growth pattern in India, Gujarat and Ahmedabad	Error! Bookmark not defined.
Table 3-2: Total motor vehicle growth and growth of two/three wheelers and AMTS buses in Ahmedabad (1961-2001)	Error! Bookmark not defined.
Table 3-3: Distribution of Rods by Width (No. of lanes).....	Error! Bookmark not defined.
Table 3-4: Types of Roads in AMC	Error! Bookmark not defined.
Table 3-5: Road widths of Major Roads	Error! Bookmark not defined.
Table 3-6: Characteristics of Bridges across River Sabarmati	Error! Bookmark not defined.
Table 3-7: Characteristics of Flyover/ROB/Underpasses	Error! Bookmark not defined.
Table 3-8: Traffic Volume at different locations	Error! Bookmark not defined.
Table 3-9: Speeds on Major Roads.....	Error! Bookmark not defined.
Table 3-10: Population, Vehicles and Accidents in Ahmedabad City	Error! Bookmark not defined.
Table 3-11: Accident Rate along major roads of Ahmedabad	Error! Bookmark not defined.
Table 4-1: Level of Operations of AMTS (1948-2005).....	Error! Bookmark not defined.
Table 4-2: Existing AMTS Fleet.....	Error! Bookmark not defined.
Table 4-3: Average Fleet Utilization of AMTS	Error! Bookmark not defined.
Table 4-4: Year-wise Service-km to Scheduled km, Average Breakdowns, Bus Accidents and Average age of bus	Error! Bookmark not defined.
Table 4-5: Year-wise Fare Levels and Occupancy Ratio	Error! Bookmark not defined.
Table 4-6: Financial Performance of AMTS	Error! Bookmark not defined.
Table 4-7: Financial Performance of AMTS	Error! Bookmark not defined.
Table 4-8: Decline in AMTS Patronage levels.....	Error! Bookmark not defined.
Table 4-9: Routes on which CNG Buses have been introduced	Error! Bookmark not defined.
Table 4-10: GSRTC Operation from the City.....	Error! Bookmark not defined.
Table 5-1: Distribution of Persons by Activity Status	Error! Bookmark not defined.
Table 5-2: Distribution of Income levels in the study area	Error! Bookmark not defined.

Table 5-3: Distribution of Household According To Monthly Income.....	Error! Bookmark not defined.
Table 5-4: Household Vehicle availability within Income groups.....	Error! Bookmark not defined.
Table 5-5: Trips Rates and % Distribution of Trips.....	Error! Bookmark not defined.
Table 5-6: Trip Purpose in the study area.....	Error! Bookmark not defined.
Table 5-7: Modal Split.....	Error! Bookmark not defined.
Table 5-8: Trip Purpose v/s Mode in The Study Area.....	Error! Bookmark not defined.
Table 5-9: Mode of Travel and Vehicle Ownership.....	Error! Bookmark not defined.
Table 5-10 : Trip Length and Age Group.....	Error! Bookmark not defined.
Table 5-11: Percentage Trips Purpose and Mode of Travel.....	Error! Bookmark not defined.
Table 5-12: Trip Length and Mode of Travel.....	Error! Bookmark not defined.
Table 6-1: Metro Proposal.....	Error! Bookmark not defined.
Table 6-2: Regional Rail Proposal.....	Error! Bookmark not defined.
Table 6-3: Public Transport Demand Parameters.....	Error! Bookmark not defined.
Table 6-4: Bus Operating Characteristics and Fleet Requirements.....	Error! Bookmark not defined.
Table 7-1: List of Potential Corridors.....	Error! Bookmark not defined.
Table 7-2: Assumed Modal Split along the Corridors.....	Error! Bookmark not defined.
Table 7-3: Divertible Trips in the Study Area /Day.....	Error! Bookmark not defined.
Table 7-4: Potential BRT Trips.....	Error! Bookmark not defined.
Table 7-5: Potential BRT Trips on Various Corridors and Ranking.....	Error! Bookmark not defined.
Table 7-6: Bottlenecks on the Corridors.....	Error! Bookmark not defined.
Table 7-7: System-wide Impacts.....	Error! Bookmark not defined.
Table 7-8: Final Ranking Of Corridors and Recommendations.....	Error! Bookmark not defined.
Table 7-9: Service Types and Fleet Requirement.....	Error! Bookmark not defined.
Table 8-1: Vehicle Capacity.....	Error! Bookmark not defined.
Table 8-2: Cost Estimate.....	Error! Bookmark not defined.
Table 9-1: Land Use along Corridor.....	Error! Bookmark not defined.
Table 9-2: Revenue Yield from sale of FSI.....	Error! Bookmark not defined.
Table 9-3: Revenue Options and Realization Potential: Preliminary Estimates.....	Error! Bookmark not defined.

List of Figures

Fig 2-0	Land Use of AUDA Area (1997)
Fig 2-1	Existing Land Use of AMC Area (1997)
Fig 2-2	Proposed Land Use of AMC area (2011)
Fig 3-1	Figure showing the composition of vehicles in Ahmedabad
Fig 3-2	Growth of two wheelers in Ahmedabad 1990-2003
Fig 3-3	Growth Rate of vehicles in major Indian Cities
Fig 3-4	Vehicles per 1000 population in Major cities, 1990 and 2002
Fig 3-5	Figure showing Number of Accidents year wise
Fig 3-6	Causes of Fatal Accidents
Fig 4-1	AMTS All routes
Fig 4-2	Decline in AMTS Patronage Level
Fig 5-1	Household Distribution in Selected cities
Fig 5-2	Income and Vehicle Ownership
Fig 5-3	Bus Trips and Vehicle Ownership
Fig 5-4	Mode Choice and Household Income
Fig 5-5	Vehicle Ownership and Mode of Travel
Fig 5-5 a	Zone-wise Demand for Bus
Fig 5-5 b	Zone-wise Demand for Bicycles
Fig 5-5 c	Zone-wise Demand for 2-wheelers
Fig 5-5 d	Zone-wise Demand for shared auto
Fig 5-5 e	Zone-wise Demand for Cars
Fig 5-6	Age and Mode of Choice
Fig 5-7	Trip Length Distribution and Age Group
Fig 5-8	Monthly Expenditure on Travel
Fig 5-9	Desire Line Diagram-2000
Fig 5-10	Desire Line Diagram-2003
Fig 8-1	CS:A-A: BRT System Cross section at Bus Station (Total 60 m)
Fig 8-2	CS:B-B: BRT System Cross section at Bus Station (Total 40 m)
Fig 8-3	CS:C-C: BRT System Cross section at Bus Station (Total 35 m)
Fig 8-4	CS:D-D: BRT System Cross section at Bus Station (Total 30 m)

List of Maps

Map 1-1	Zoning Map
Map 2-1	Greater Ahmedabad
Map 2-2	Ahmedabad Growth Pattern
Map 2-3	Population Density
Map 2-4	AUDA Land use Map
Map 2-5	AUDA Proposed Land use 2011 Plan
Map 2-6	Land use Map of Ahmedabad Municipal Corporation
Map 2-7	Maps showing various activities (Residential, Commercial)
Map 2-8	Job distribution in Study Area
Map 3-1	AUDA DP Proposed Road Network
Map 3-2	Map showing Road Widths
Map 3-3	Map showing all the bridges across river Sabarmati
Map 3-4	Existing/Proposed Flyovers
Map 3-5	Traffic Volumes at Different Locations in the City
Map 3-6	Accident Rate in Ahmedabad
Map 3-7	Fatality Rate in Road Accidents in Ahmedabad (Accidents/km)
Map 4-1	AMTS Route Network
Map 4-2	GSRTC Routes in the City
Map 4-3	Map showing Railway Network
Map 5-1	Income Group wise Distribution of Population
Map 5-2	Spatial Distribution of Households by type of Vehicle Ownership
Map 7.1 a	LB Transit Proposal: Alternative 1
Map 7.1 b	LB Transit Proposal: Alternative 2
Map 7.1 c	Proposals by RITES and DMRC
Map 7.1 d	CEPT (1995) Proposed Bus way
Map 7.2	AMTS Corridors
Map 7.3	Intra Corridor Passenger Trips
Map 7.4	BRTS Network
Map 7.5	BRTS Phasing and Integration
Map 7.6	BRTS Transit Line Diagram
Map 9.1 a	Curitiba : Land Use Zoning
Map 9.1 b	Curitiba : Density
Map 9.2	Landuse along the corridor
Map 9.3	F.S.I Utilization along the corridor

List of Abbreviations

AMC	Ahmedabad Municipal Corporation
AMTS	Ahmedabad Municipal Transport Service
AUDA	Ahmedabad Urban Development Authority
Avg	Average
B.G.	Broad Gauge
BRTS	Bus Rapid Transit Service
C/c	Center-center
CEPT	Centre for Environmental Planning and Technology University
C.G. Road	Chimanlal Girdhardas Road
Cm	centimeter
CNG	Compressed Natural Gas
CS	Cross Section
EWS	Economically Weaker Sections
d	Day
DMRC	Delhi Metro Rail Corporation
DP	Development Plan
FSI	Floor Space Index
GIDB	Gujarat Infrastructure Development Board
GNA	Gandhinagar Notified Authority
GPS	Global Positioning System
GSRTC	Gujarat State Road Transport Corporation
ha	Hectare
HIG	High Income Group
HT	High Tension
IIM	Indian Institute of Management
IPTS	Integrated Public Transit System
IRC	Indian Roads Congress
ISRO	Indian Space Research Institute
ITS	Intelligent Transportation Systems
km	Kilo meter
kmph	Kilometer per hour
LB	Louis Berger Associates
LCV	Light Commercial Vehicles
LIG	Low Income Group
LPG	Liquefied Petroleum Gas
LT	Low Tension
m	meter
MAV	Multi Axle Vehicles
M.G.	Meter Gauge
MIG	Middle Income Group

Min	minimum
MoRTH	Ministry of Road Transport and Highways
NAAQS	National Ambient Air Quality Standards
NH	National Highway
NHAI	National Highway Authority of India
O-D	Origin-Destination
Pass.	Passengers
PCU	Passenger Car Unit
PPHPD	Passenger Peak Hour Per Direction
RITES	Rail India Techno Economic Services
RoW	Right of Way
ROB	Rail Over Bridge
RSPM	Respiratory Suspended Particulate Matter
RTO	Regional Transport Office
SAC	Space Application Centre
Sec	Second
S.G.	Sarkhej Gandhinagar
SPM	Suspended Particulate Matter
S.T.	State Transport
sq.	Square
TAZ	Traffic Area Zones
T-W	Two Wheelers
UA	Urban Agglomeration
UDPFI	Urban Development Plans Formulation and Implementation
WHO	World Health Organization
Yr.	Year