

Sustainable Urban Design and Development - Role of EST

M. THENNARASAN

MUNICIPAL COMMISSIONER

SURAT MUNICIPAL CORPORATION

October 2018



ABOUT SURAT CITY



8th Largest
in India as
per
population



4th fastest
growing city
globally



Termed as
Economic
Capital of
Gujarat



9/10 Diamonds
in the world are
cut and polished
here



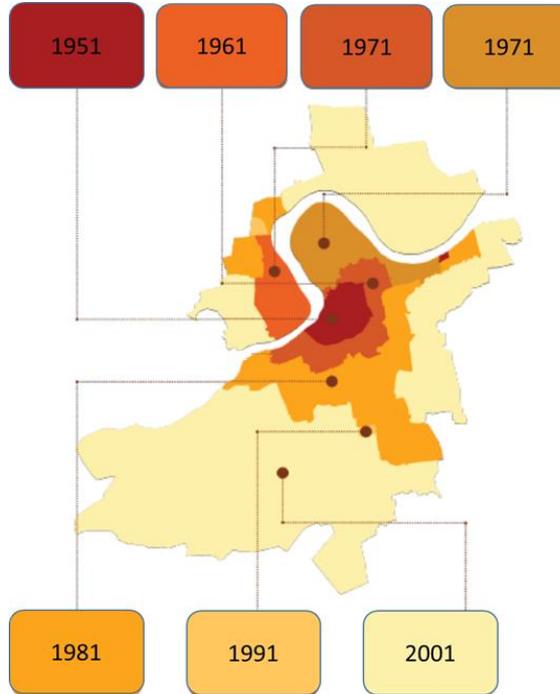
40% of nations total
man-made fabric
& **28%** of nation's
total **man-made**
fiber production



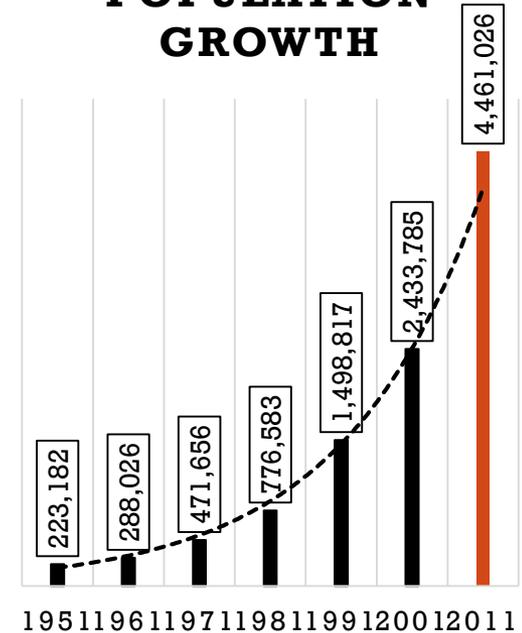
- Surat dates back to 300 BC
- Municipality Established in 1852
- Municipal Corporation Formed in 1966
- Hazira Industrial Estate near the City
- An Environment with Peace, Alliance & Unity
- Density : ~138 Persons/ Ha (Census-2011)
- Decadal Growth Rate : 60% to 80% (since 4 decades)
- Admin Zones : 7
- Ward Offices : 88
- Election Wards : 29

GROWTH OF THE CITY

Year	Area in Sq. Km	Population
1951	8.18	2,23,182
1961	8.18	2,88,026
1971	33.85	4,71,656
1981	55.56	7,76,583
1991	111.16	14,98,817
2001	112.27	24,33,785
2001*	326.51	28,77,241
2011	326.51	44,61,026

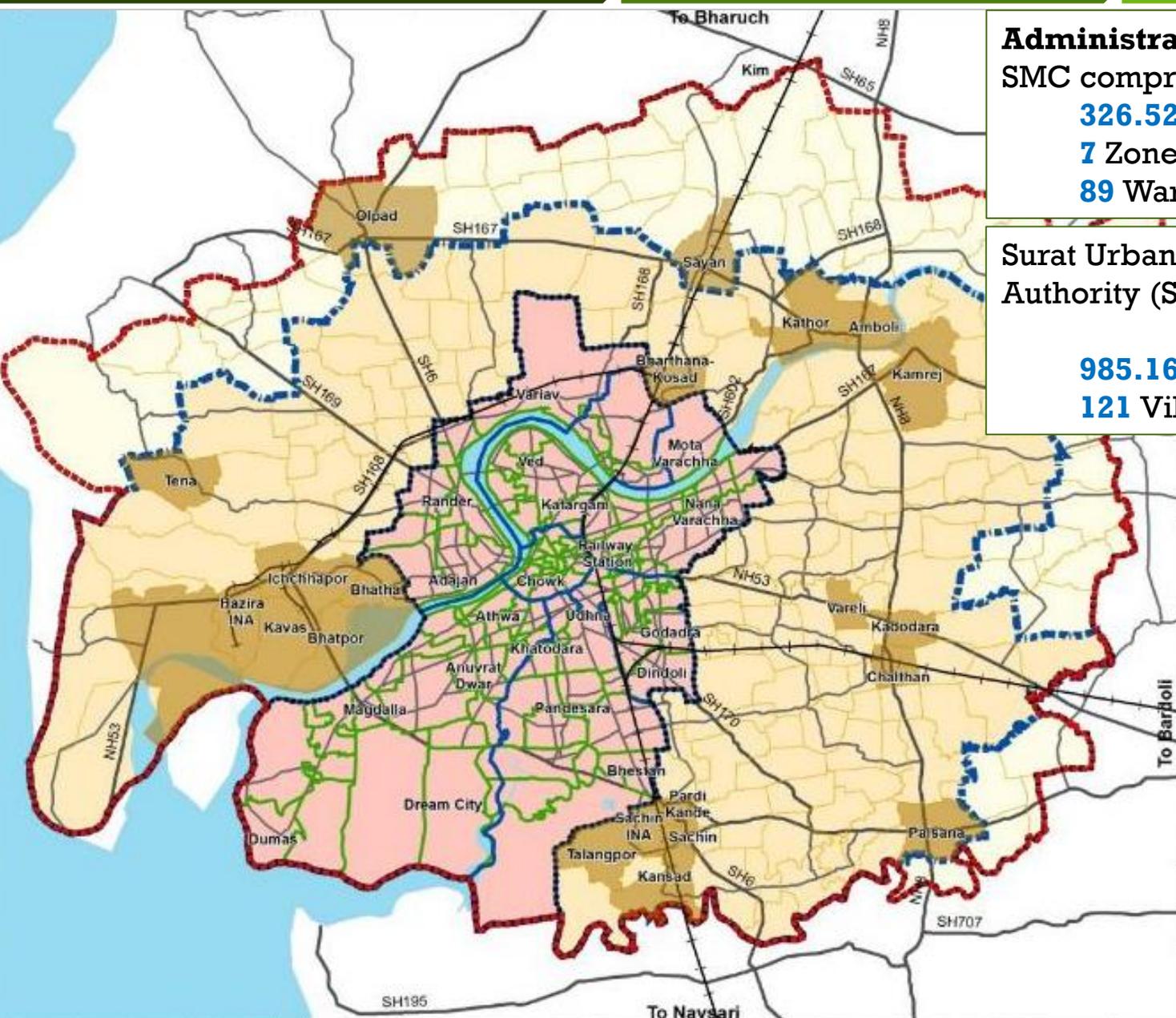


POPULATION GROWTH



- Unprecedented growth in last four decades
- Decadal Growth - 60-80%
- In 2006 with the expansion of city limits, city area increased to three times

SURAT CITY



Administrative Boundaries:
 SMC comprises of :
 326.52 Sq. km area
 7 Zones
 89 Wards

Surat Urban Development Authority (SUDA) comprises of :
 985.16 sq km area
 121 Villages

Legend

- RAILWAY
- Major Road
- Urban Area
- SMC Zone
- SMC Ward
- Village Boundary
- SMC Boundary
- SUDA Boundary
- Study Area
- Waterbody

Source: SMC & SUDA

Map Title: Study Area Delineation

Scale: 1:50,000

CEPT UNIVERSITY
 Centre of Excellence in Urban Transport
 CEPT University, Karamba, Lakhad Campus
 University road, Navrangpura, Ahmedabad 380015,
 Gujarat, India
 Telephone No : 079-26302470/26302480/26306652

SURAT - URBAN TRANSPORT STATUS

Population* – 5.92 Million (SMC)

Employment* – 2.5 Million (SMC)

Density – 376 pph (SMC)

Vehicles Registered – 2.9 Million

Major Road Network – 664 km (SMC)

**Major Road Network congested – 14%
(72 km)**

Public Transport (PT) Network - 376 km

- BRTS : 102 km | City bus: 274 km

Intermediate Public Transport Network

- 38000 registered auto
- 0.86 Million trips
- 52 shared auto routes

Average Travel Speeds

- 2 wheeler 30 kmph
- 3 wheeler 25 kmph
- PT 20 kmph

Air Quality

- 1618 tons of emission every day
(Transport sector)
- 0.32 kg/day Per capita CO₂

PT Network coverage - 87% (SMC)

Accidents – 273 Fatal | 327 Serious | 190 Minor

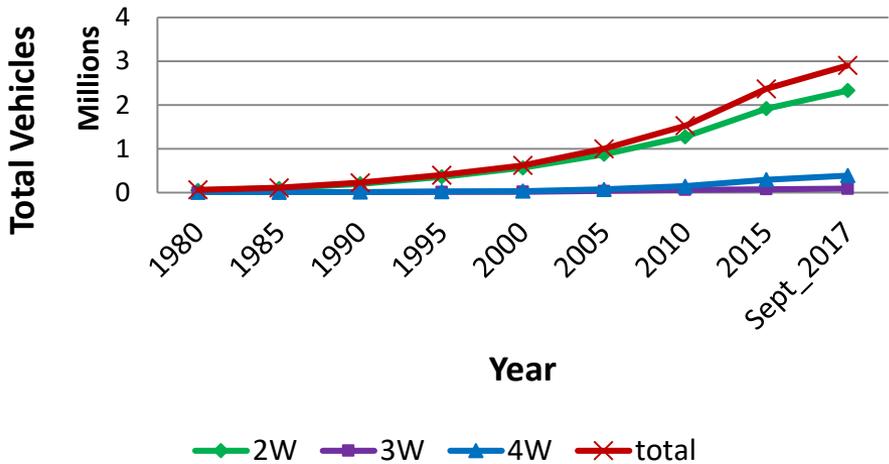
POPULATION PROJECTIONS

Year	Population	CAGR
2011	50,81,856	-
2016	59,29,821	3.13%
2021	73,00,000	3.69%
2026	85,50,000	3.53%
2031	98,00,000	3.34%
2036	110,00,000	3.14%
2041	118,50,000	2.86%
2046	125,00,000	2.60%

By **2036**, Surat will be **1 Crore** people city

- Year 2011 - Census
- Year 2016- Estimated population
- Year 2036- Projected population DP
- Year 2046- Projection

Vehicle Registrations

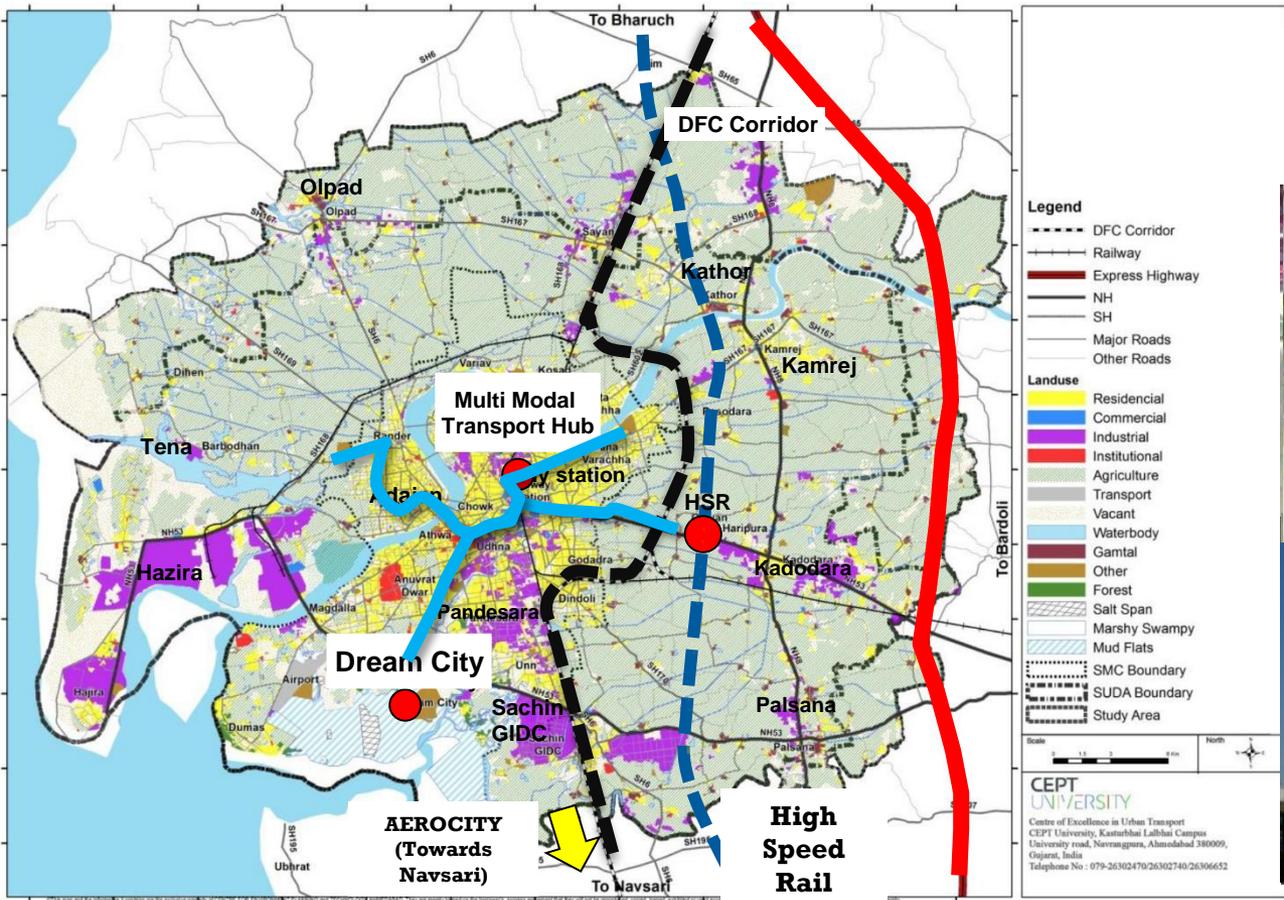


Vehicles registered per day-604	
2W	481
4W	97
3W	3
Goods	5
Bus	1

- Total Vehicles Registered in Surat till 2017 - **2.9 Million**
- **1.67 Million** Vehicles added in the last 10 Years.

If this trend continues the total vehicles will grow by 2.9 times (2.9 Million to 8.4 Million) in 2046

FUTURE DEVELOPMENT/PROPOSALS - SUDA DP 2035



AeroCity



EFFECTS OF FUTURE PROJECTS

PROJECTS

High Speed Rail

DFC

Ring Roads

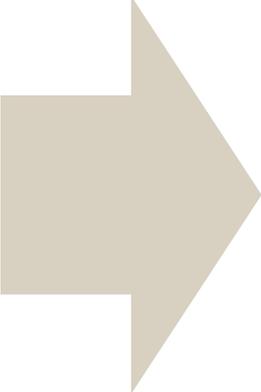
Metro

Dream city

Aero city

Logistic Park

Multimodal Transit Hub



EFFECTS

**Improved Regional connectivity
(intra / inter)**

Rapid Growth in Economy

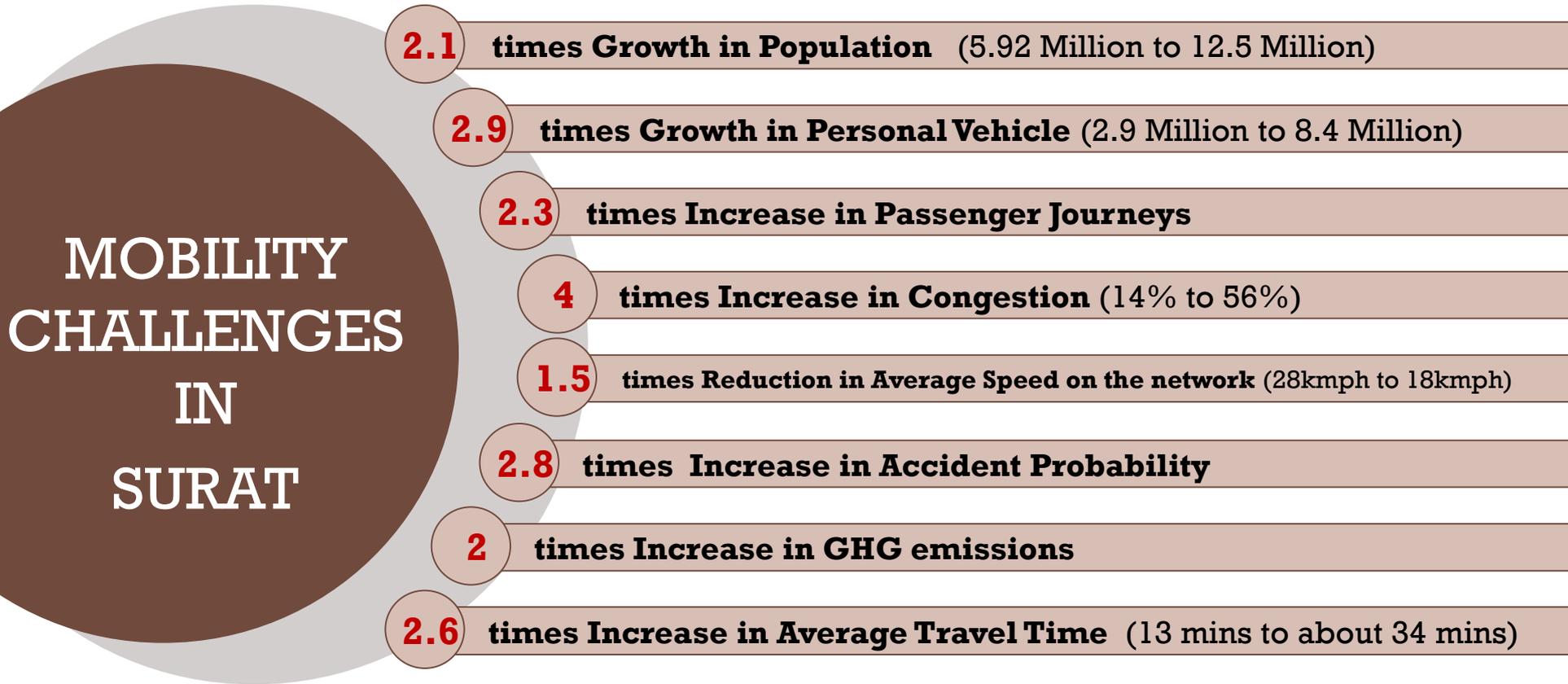
Improved and Efficient trading activities

Improved Standard of Living

Faster , Safe and Seamless connectivity

FUTURE MOBILITY CHALLENGES IN SURAT

Growth in the next 30 Years- Business as Usual Scenario 2046



VISION, STRATEGIC GOALS AND POLICY DIRECTIONS

The vision SARAL in Indian languages means “Simple” which also implies mobility being Easy, Convenient and Accessible aimed towards a healthy living environment.

The vision “SARAL Mobility 2046” is achieved through five strategic goals defined as:

1. Improving quality of life of people by providing for a Safe and Sustainable transport system
2. Supporting the economic growth in the city by enhancing Accessibility for people and goods to major activity centres.
3. Ensuring efficient connections by providing Reliable multi-modal travel options
4. Optimising transport system operations and enhancing travel experience of people through Advanced Technological Applications in transport.
5. Contributing to the environment by promoting Low carbon mobility

Vision, Strategic Goals and Policy Directions

'SARAL Parivahan, Samridh Janjivan'



SARAL – Safe Accessible Reliable Advanced and Low-carbon mobility in Surat

COMPREHENSIVE MOBILITY PLAN 2046- PROPOSALS

The plan bases, in line with NUTP, its proposals on two important lessons from cities around the world.

No single mode is adequate to serve the mobility needs of the city, and Sustainability in cities can only be ensured, only if collective modes in general and buses in specific are provided with on-street priority.



Proposals

1

Improving Street Network

2

Integrated Multi Modal Public Transport System

3

Transit Oriented Development

4

Pedestrians and Cyclists

5

Safety and Security

6

Adopting Smart Management Tools

PROPOSAL 1: IMPROVING STREET NETWORK

- Proposed to ensure connectivity, enhance accessibility and improve the efficiency.
- The ring radial network proposed to resolve the issues identified above by completing the network, improving hierarchy and adding second and third level network.



Road widths $\geq 18\text{m}$ are proposed as **“Transit Streets”** with central bus stops and public transport given priority along the network.

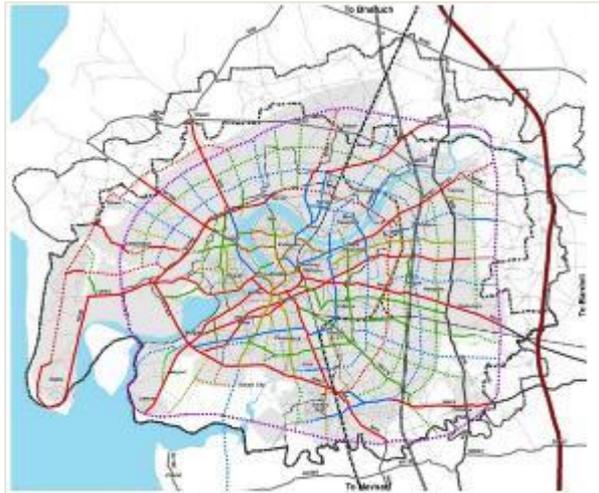


Figure 4 Proposed Street Network

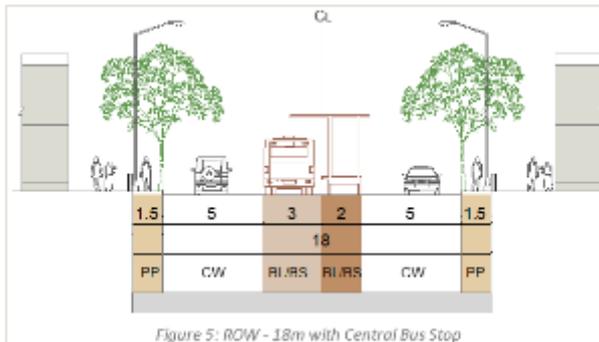


Figure 5: ROW - 18m with Central Bus Stop

Sr. no.	Proposed Character	Values
1	Street Network (in Kms)	
	New Network	513
	Improved Existing Network	308
2	River Bridges (in numbers)	7
3	Rail Over cum Under Bridges (in numbers)	37
4	Transit Streets ($\geq 18\text{ m}$) (in Kms)	889

PROPOSAL 2: INTEGRATED MULTI MODAL PUBLIC TRANSPORT SYSTEM

Develop a Multimodal Integrated public transportation to Surat system which provide seamless connectivity



Alternative Analysis was done to identify the actual mass transit corridors

A 240Km network identified as strategic network, part of a higher order road network, connecting the main city to existing and upcoming regional centers.

Figure 6 Proposed Strategic Network



Figure 8 Proposed Public Transport Network



The proposal also identifies 36 interchanges for seamless transfer through physical integration; the Surat Railway station, Majuragata and High-Speed Rail station are the major ones.

PROPOSAL 2: INTEGRATED MULTI MODAL PUBLIC TRANSPORT SYSTEM

A. City Bus and BRTS	B. BRTS	C. Surat Metro
<ul style="list-style-type: none"> Existing city bus network 274 km and additional 430 km by 2046 All roads 18 m and above to be developed as transit streets. 	<ul style="list-style-type: none"> Existing BRT 102 km another 100 km proposed as a part of the Plan. The 201 Km of BRTS and 740 Km of City Bus network is expected to cater 24% of road network by rapid transit network and 76% by the city bus network. This will increase the accessibility to transit by 23% thereby predicting a public transit ridership of 36 lakhs per day by 2046. 	<p>A 73 Km of metro network is being proposed connecting the existing and proposed major economic centers.</p> <p>The alternative analysis identifies three potential corridors as metro corridors.</p> <ul style="list-style-type: none"> a) Dream City to Kamrej (28.9 Km) b) Bhesan to Umbhel (26.3 Km) c) Majuragate to Karamala (15.8 Km)
D, High Mobility Corridor	E. Feeder System	F. Fare Integration
<p>A 12-km. high mobility corridor is also proposed and Operational along the inner ring road of Surat, with BRT/LRT as the preferred mode to cater to the high mobility demand of the core area of the city.</p>	<ul style="list-style-type: none"> To ensure the last mile accessibility a feeder system adopting electric rickshaws or micro buses is proposed as part of the plan. • An initial fleet of 40 rickshaws known as “Pink Autos”, which are operated by women are deployed as feeder system in the old city. 	<p>An Integrated Fare system allows the transfer between multiple public transport modes with a single ticket thereby benefiting the users in terms of reduced travel time, distance, increased comfort while the operators benefit from better fleet utilization and increased ridership.</p>

PROPOSAL 3: TRANSIT ORIENTED DEVELOPMENT



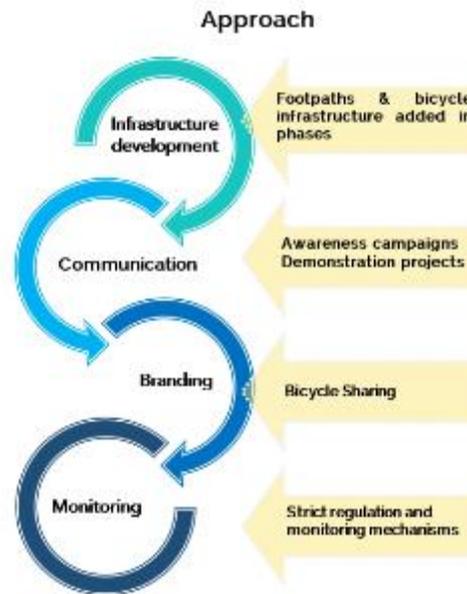
TOD Optimize The Benefits Of Public Transport By Encouraging Higher Concentration Of Activities Around Transit Stations And Along Transit Corridors.

- Plan focusses to improve walkability in transit area thereby encouraging the use of public transport
- TOD corridor width of 200m long on either side of the public transport will bring about 140sq.km of area within 72 TOD zones.
- A sensitive Local Area Plan (LAP) can incentivize the redevelopment within TOD
- A properly designed Local Area Plan of TOD zones will make the 140 sq.km of area within 2.5 mins of walkable distance from the transit corridor.
- TOD allows increased Value Capture from development along the transit corridors
- FSI of 4 (1.8 base and 2.2 chargeable FSI) is provided in the Transit Zones of Surat
- It is estimated that Rs 20,000 to 30,000 crores will be generated through TOD by 2046.

PROPOSAL 4: PEDESTRIANS AND CYCLISTS



To develop Transit Streets as **"Walkable Streets"** with public plazas. Making the footpaths as **"Complete Streets"** with improved accessibility to public transport facility.



- The plan proposes 488 Kms of footpaths above 1.8m and 288 Km of cycle network is identified with lane marking.
- High priority has been assigned to accident-prone areas and streets with high pedestrian volumes.
- The street network with adequate width but lacking walkability in the city must be renovated.
- The plan proposes introduction of bicycle sharing systems with 1600 cycles, at old city having 40 bike docking points while the Sardar Vallabhbhai National Institute of Technology (SVNIT) has eight major docking stations.
- Awareness campaigns and initiatives that help propagate the idea of walking and bicycling in the city is to be taken up.

PROPOSAL 5: SAFETY AND SECURITY

As part of the mobility management measures proposed, accident management is a key one.

1. Design improvement and Junction Signalisation:

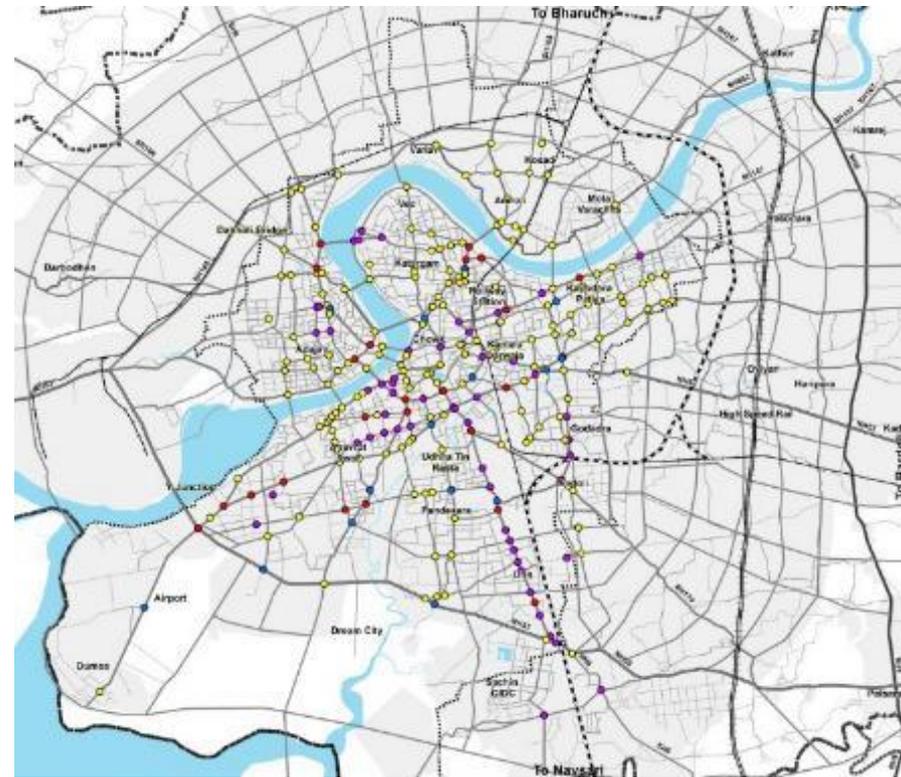
A total of 257 junctions have been identified (79 for improvement and 178 for signalisation).

2. Setting up of speed limits for the city:

To reduce the road fatalities, it is proposed that National Highways have a speed limit of 65 kmph whereas in the case of urban city roads, all major roads should have a limit of 55 kmph, sub-arterial and collector roads 45 kmph. In the case of the old city, local streets and gamtal areas, the speeds are further reduced to 30 kmph.

3. Accident Monitoring Cell:

The Traffic Police Department needs to institute a GIS based accident management cell which would look at analysing accidents, monitoring and devise strategies to reduce the same.



Junction Improvement Phasing

PROPOSAL 6: ADOPTING SMART MEASUREMENT TOOLS

Pan city initiative requires continues monitoring across cities in all vehicles and throughout 16 operational hours. Thus, there is need for a system which maintain levels and increase reliability.

1. Intelligent Transit Management System (ITMS)

ITMS is an urban transit project aimed at providing smooth, reliable, fast and affordable public transport with ease of travel and safety to the citizens of Surat along with real time monitoring of Buses, emergency vehicles and department vehicles. ITMS also provide faster incidence resolution and develop a rapid response for fire and emergency services. It also includes digitization of Depot and Incidence management procedures for quick actions.

2. Automatic Fare Collection System (AFCS)

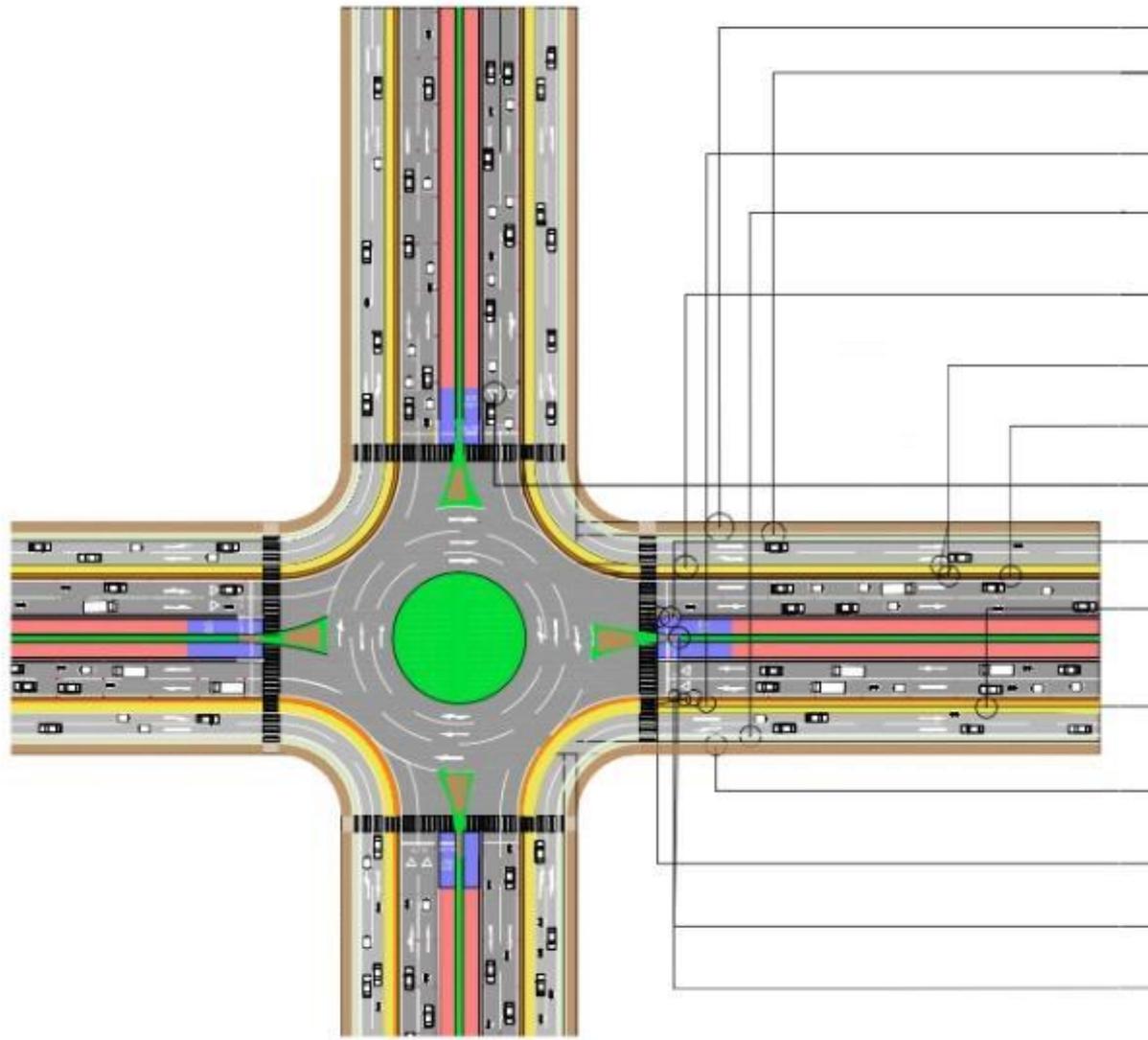
AFCS is an urban transit project aimed to simplify fare policy and ability for smart and integrated pricing, decrease dwell time, and no hassle of queue for ticketing. It will also increase rider experience and ease of use for customers to promote customer self-service. It also includes QR based paper tickets, mobile app for ticketing and Surat Money card (Common Card Payment System (CCPS)).



Turn Stile and Surat Money Card



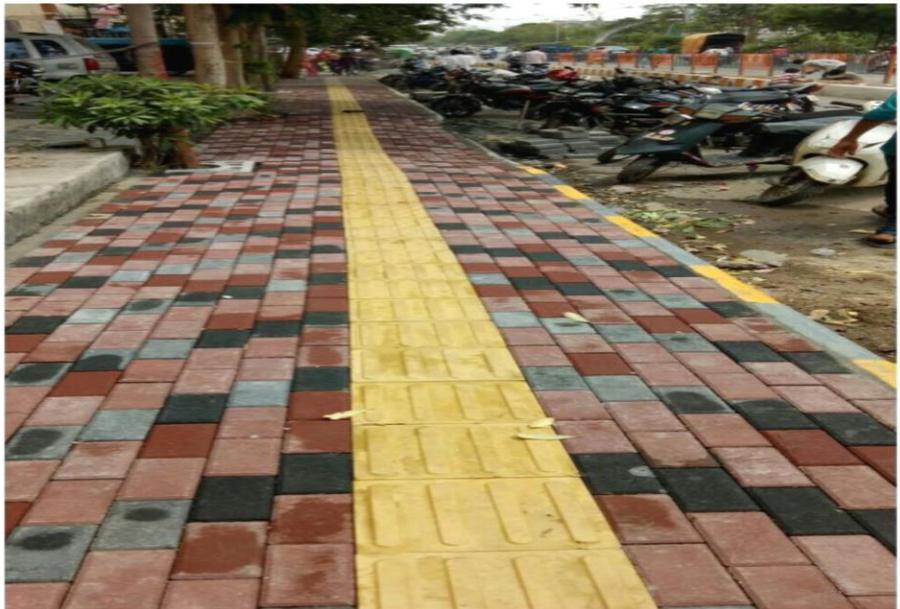
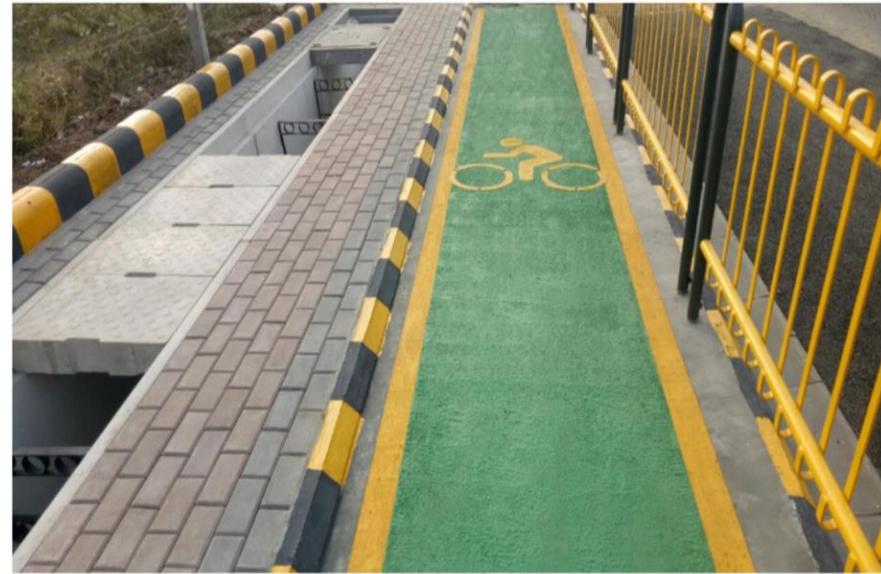
ROAD DESIGN GUIDELINE



TRAFFIC SIGN

	PEDESTIAN ONLY
	CYCLE ONLY
	PEDESTIAN CROSSING
	COMPULSORY KEEP LEFT
	COMPULSORY KEEP RIGHT
	SPEED LIMIT
	NO PARKING
	GIVE WAY
	BRTS SIGNAL
	NO PEDESTIAN CROSSING
	ADVANCE DIRECTION SIG
	ADVANCE DIRECTION SIG
	BRTS BUSES ONLY
	MV KEEP LEFT
	ROAD STUD

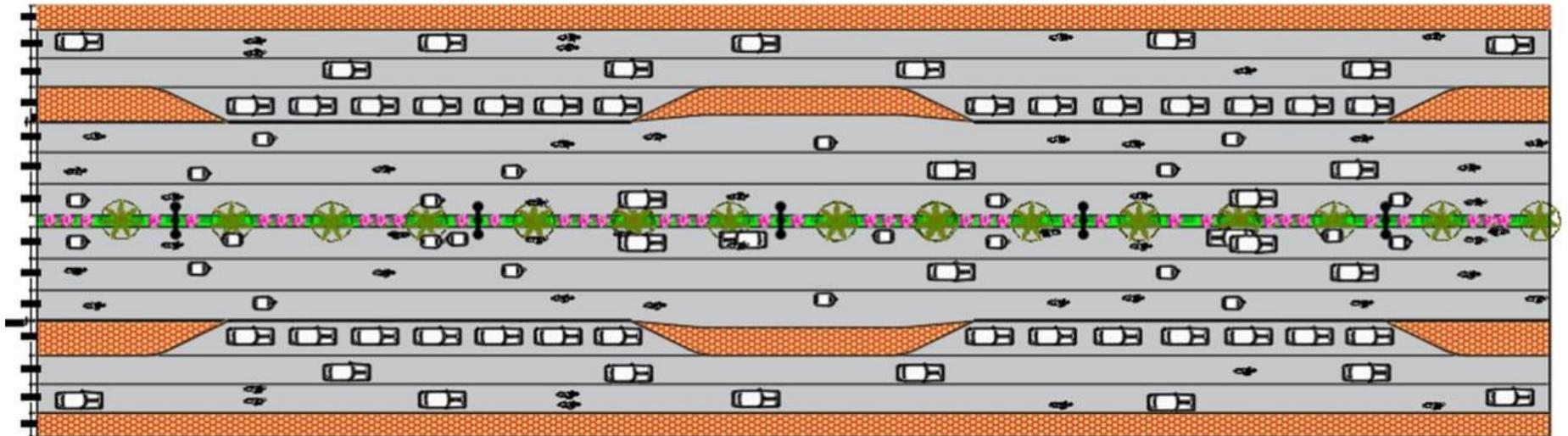
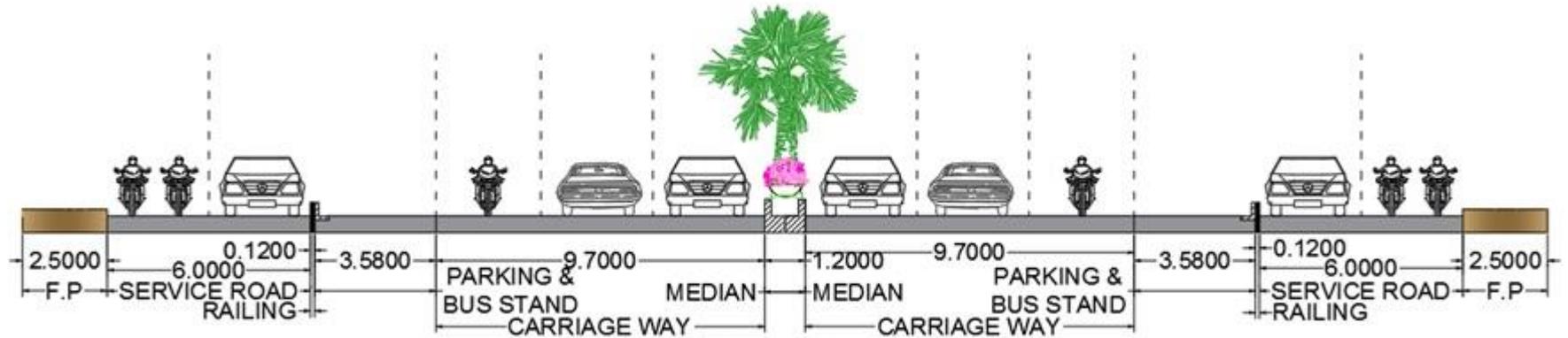
MODEL ROAD & SMART ROAD



Smart Road

- Segregated Cycle Track
- Street Furniture
- Parking
- Landscaping
- Signages
- Service Lane

MODEL ROAD & SMART ROAD



Model Road

- Street Furniture
- Parking
- Landscaping
- Signages
- Service Lane
- Integrated City Bus stops

MODEL ROAD & SMART ROAD



MODEL ROAD & SMART ROAD



ENVIRONMENTAL MEASURES

- The 'polluter pays' principle is the commonly accepted practice that those who produce pollution should bear the costs of managing it to prevent damage to human health or the environment.
- SMC is first ULB in India to implement Environment Improvement Charges
- Cross subsidization of charges between Residential and Non-Residential units across city
- Telescopic rate for properties based on size of property

Area (Square Meter)	Environment Improvement Charge	
	Residential	Non-Residential
0 to 25	0	30
25.01 to 50	25	40
50.01 to 100	30	50
100.01 to 200	175	350
200.01 to 400	300	600
400.01 to 500	450	900
500.00 or more	625	1250

SUSTAINABLE URBAN TRANSPORT INDEX (SUTI)

SUSTAINABLE URBAN TRANSPORT INDEX - SUTI

- A comprehensive framework to **measure and monitor urban transport performance WRT SDG**
 - Defines the status of the city transport WRT Indicators
 - Comparison with other cities in the Asia – Pacific Region
 - Monitor Progress
- An ongoing process – periodically to be carried out
 - Collects data for comparative purposes
 - Enables Identification of deficiencies
 - Set targets
 - Enables to identify good practices & lessons
- **To receive feedback on indicators, Max-Min limits, Data base, Strategies**

APPROACH FOR SUTI DATA COLLECTION

- **Extent to which transport plans cover public transport, intermodal facilities and infrastructure for active modes**

Indicator

1

- **Modal share of active and public transport in commuting**

Indicator

2

- **Convenient access to public transport in commuting**

Indicator

3

- **Public transport quality and reliability**

Indicator

4

- **Traffic fatalities per 1,00,000 inhabitants**

Indicator

5

- **Affordability – travel costs as share of income**

Indicator

6

- **Operational costs of the public transport system**

Indicator

7

- **Investment in public transportation systems**

Indicator

8

- **Air quality (PM 10)**

Indicator

9

- **Greenhouse gas emissions from transport**

Indicator

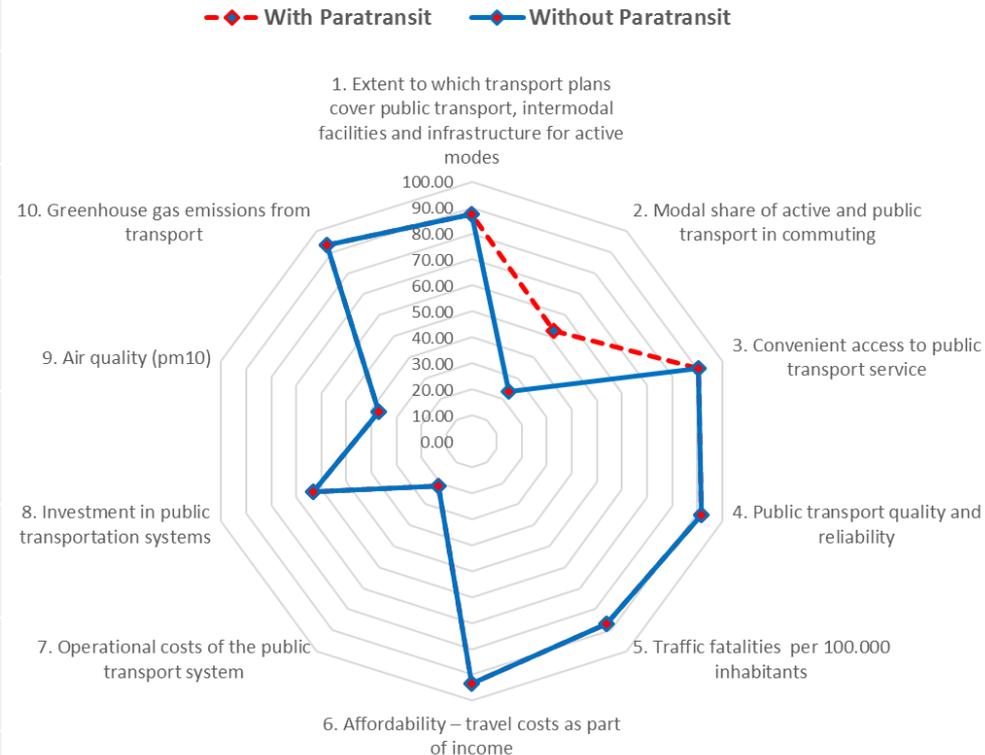
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INPUT

Sr. No.	Indicators	Natural	Weights	Range		VALUE	YEAR	COMMENTS ABOUT DATA SOURCES OR ISSUES RELEVANT FOR INTERPRETATION
		units		MIN	MAX			
1	Extent to which transport plans cover public transport, intermodal facilities and infrastructure for active modes	0 - 16 scale	0.1	0	16	14.00	2046	Comprehensive Mobility Plan - Surat 2046, prepared in 2018, Surat Municipal Corporation and COE-CRDF CEPT
2	Modal share of active and public transport in commuting	% of trips	0.1	10	90	29.0	2016	Comprehensive Mobility Plan - Surat 2046, prepared in 2018, Surat Municipal Corporation and COE-CRDF CEPT ; Total 15777 Household Survey (2016) (1.15% sample)
3	Convenient access to public transport service	% of population	0.1	20	100	92.56	2016	Calculated for SMC area not considered the routes connecting the suburban region
4	Public transport quality and reliability	% satisfied	0.1	30	95	89.70	2018	Performance Assessment of Public Transport in Surat – Quarterly reports 5 (2018)
5	Traffic fatalities per 100.000 inhabitants	# fatalities	0.1	35	0	4.58	2015	Service level Benchmarking for Indian Cities, 2016 CoE-UT, CEPT
6	Affordability – travel costs as share of income	% of income	0.1	35	3.5	5.57	2018	Performance Assessment of Public Transport in Surat – Quarterly reports 5 (2018) ; Household Survey, 2016 (average household income within SMC)
7	Operational costs of the public transport system	Cost recovery ratio	0.1	22	175	54.77	2018	Performance Assessment of Public Transport in Surat – Quarterly reports 5 (2018) ; Revenue and Expense sheet, Surat Sitilink Ltd.
8	Investment in public transportation systems	% of total investMent	0.1	0	50	31.68	2014-18	sources: https://www.suratmunicipal.gov.in/Departments/Accounts/Budget
9	Air quality (pm10)	µg/m3	0.1	150	10	98.26	2016-17	GPCB Annual Report 2016-17
10	Greenhouse gas emissions from transport	Tons/cap	0.1	2.75	0	0.18	2016	GHG emissions were calculated for study area
	MUST SUM TO 1		0.0					

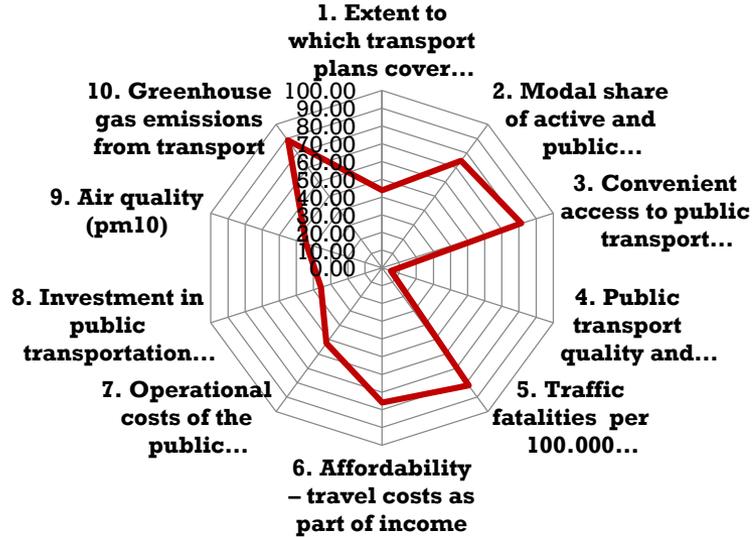
OUTPUT

C1 RESULT SPIDER DIAGRAM		With Paratransit	Without Paratransit
1	Extent to which transport plans cover public transport, intermodal facilities and infrastructure for active modes	87.50	87.50
2	Modal share of active and public transport in commuting	52.77	23.71
3	Convenient access to public transport service	90.70	90.70
4	Public transport quality and reliability	91.85	91.85
5	Traffic fatalities per 100.000 inhabitants	86.90	86.90
6	Affordability – travel costs as part of income	93.42	93.42
7	Operational costs of the public transport system	21.42	21.42
8	Investment in public transportation systems	63.37	63.37
9	Air quality (pm10)	36.96	36.96
10	Greenhouse gas emissions from transport	93.29	93.29

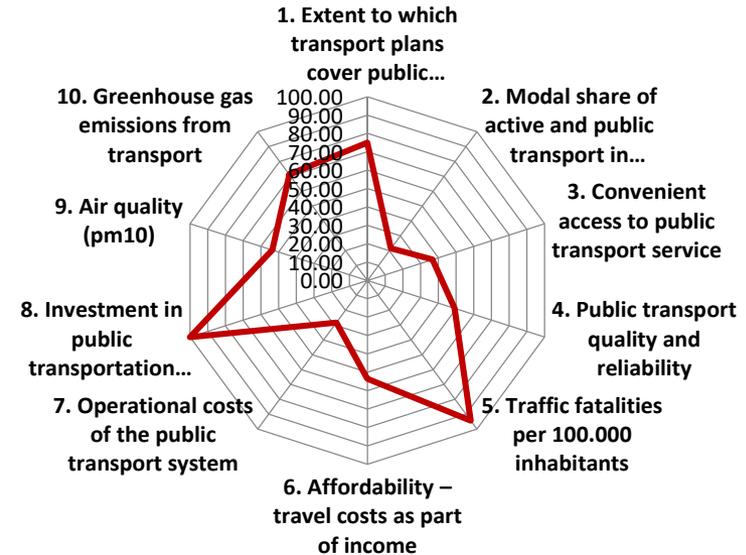


SUTI INDEX RESULT
Geometric mean – 60.50

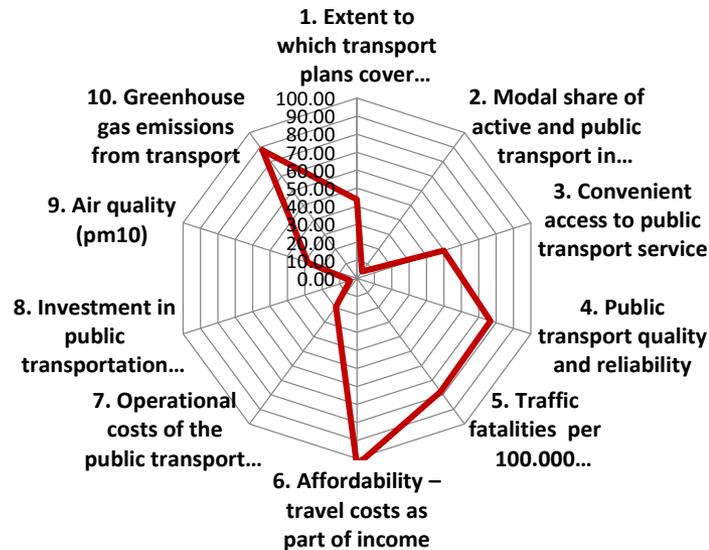
COMPARISON WITH OTHER CITIES



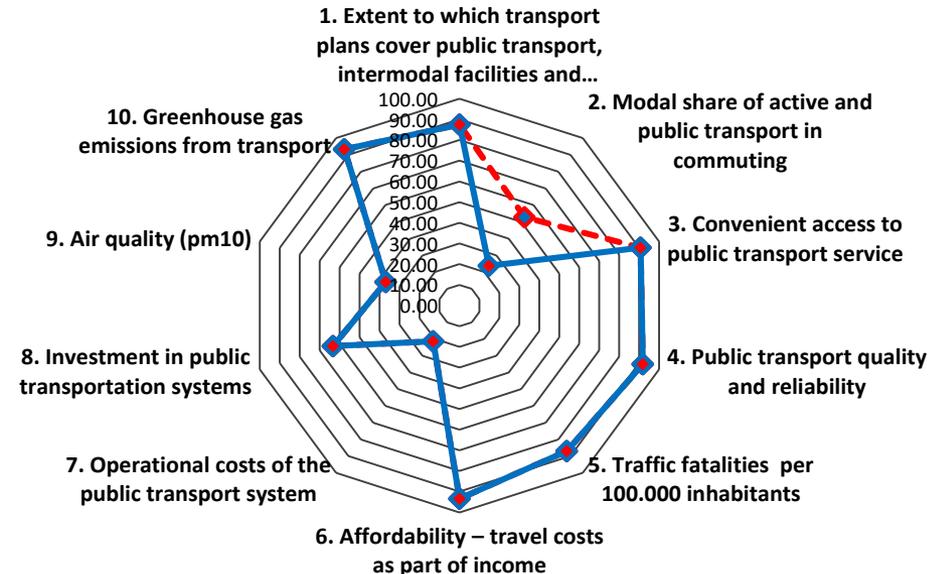
Kathmandu



Greater Jakarta



Hanoi



Surat

TOWARDS A SMART AND SUSTAINABLE TRANSPORT SOLUTION

'SITILINK' – **Surat Bus Rapid Transit System**

**A journey from limited public transport to a world
class public transport system**

SURAT THAT DEPENDED ON IPT...BEFORE 2007



40,000 auto rickshaws operating as public transport!

SURAT WITH LIMITED PUBLIC TRANSPORT...2007



Introduction of City Bus services in 2007
Challenge for Surat to create Sustainable High Quality Public Transport

BUS RAPID TRANSIT SYSTEM (BRTS)..2014



Introduction of Surat Sitilink BRTS services in 2014

SITILINK - CITY BUS SERVICE..2016



Introduction of Surat Sitilink City Bus service in 2016

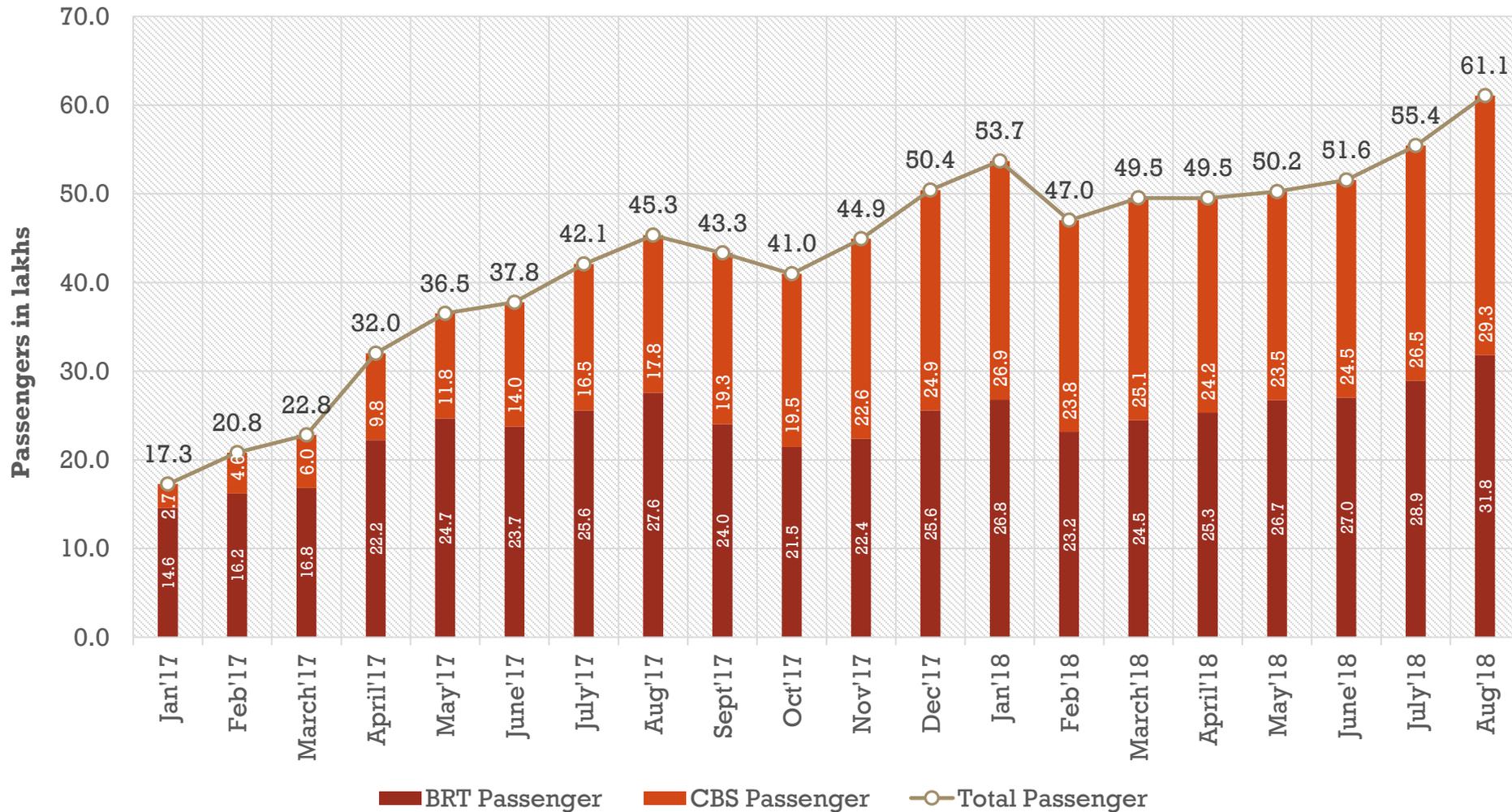
SITILINK - HIGH MOBILITY CORRIDOR..2018



Introduction of Surat Sitilink High Mobility Corridor (HMC) service in 2018

RIDERSHIP (JAN'17 TO AUG'18)

Ridership Jan'17 to Aug'18(in Lakhs)



Highest Combined ridership (2.17 lacs) on 27th July
BRTS: 1.15 lacs and City bus : 1.02 lacs

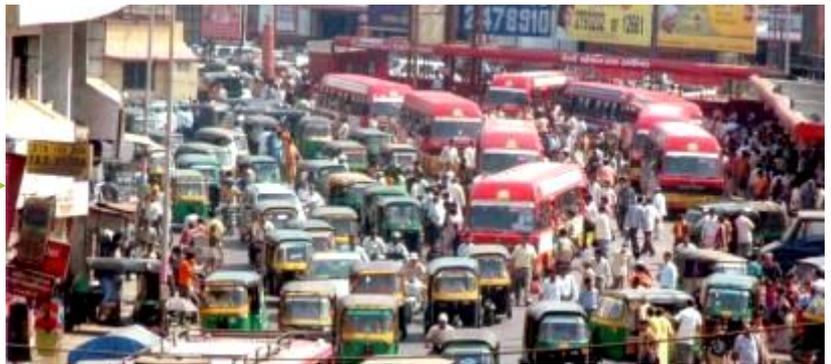
SYSTEM PERFORMANCE INDICATOR

Sr.No	Indicators	BRTS		City Bus		Total	
1	Total network length completed	102 Km		276.13 km (SUDA : 53.56 km)		371.92 km	
2	Total no. of routes	9 (1 Express)		28		37	
3	Total no. of stops / Cabins	160 (156 stops+4cabins)		520 (507 stops+10 HMC stops+3 HMC cabins)		673 operational stops + 7 cabins + 3 terminal + 5 stops not constructed	
4	Operational timings:	6:00 AM to 9:00 PM		6:00 AM to 9:00 PM 3 routes (4:00 Am to 11:30 PM)		6:00 AM to 9:00 PM 3 CB routes (4:00 Am to 11:30 PM)	
5	Peak hours :	Morning: 8:00 AM–11:00 AM Evening : 5:00 PM – 8:00 PM		Morning: 8:00 AM–11:00 AM AM Evening : 5:00 PM – 8:00 PM		Morning: 8:00 AM–11:00 AM Evening : 5:00 PM – 8:00 PM	
6	Number of depots: Capacity of Depots (Approx.)	4 Bhesthan : 75 buses Pal RTO : 60 buses Kosad BRT : 75 buses Puna Gam :		3 L.P. Savani : 80 buses Kosad : 120 buses Bhesthan Garden : 75 buses		7	
7	Average revenue km / bus / day	234		201		218	
8	No. of operators:	3		2		5	
9	Total no. of On road buses: (Total Fleet 438)	Weekday 156	Sunday 143	Weekday 249	Sunday 200	Weekday 405 (FU 92.5%)	Sunday 343 (FU 78.3%)

MOBILITY OF SURAT CITY



IPT in 2007



2007: Rainbow Bus Service

**Integrated
Transport
Service**



**2014: BRTS Service
2016: City Bus Service**

Towards Sustainable Future



BRTS



CITY BUS



HMC



THANK YOU