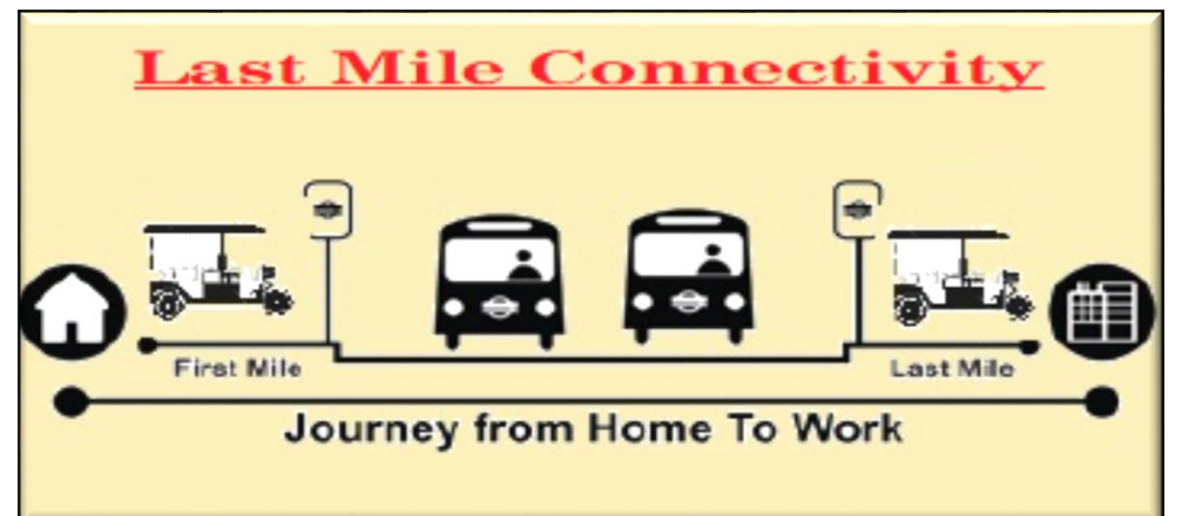


Leaders Program in Urban Transport Planning & Management - 7

LAST MILE CONNECTIVITY FOR RAJKOT BRTS PROJECT : EXPLORING ELECTRIC 3 WHEELER AS AN OPTION

Prepared By : Manish I. Vora
Asst. Manager,
Rajkot Municipal Corporation

Under Guidance of
Mr. Gautam Patel (CEPT)



Contents

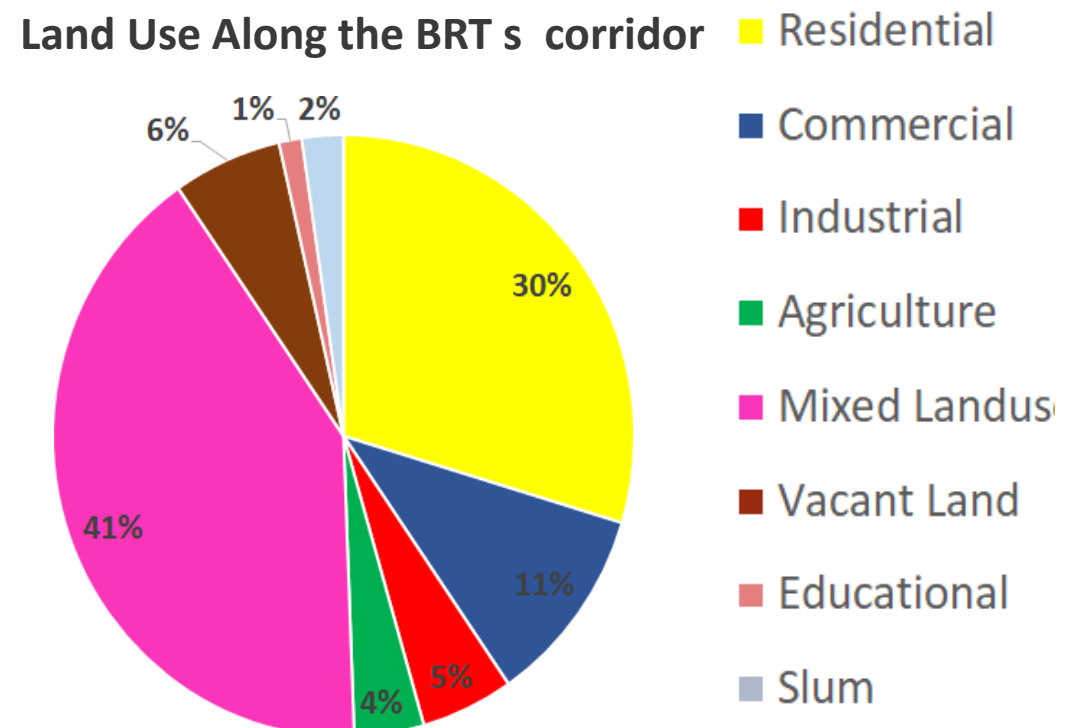
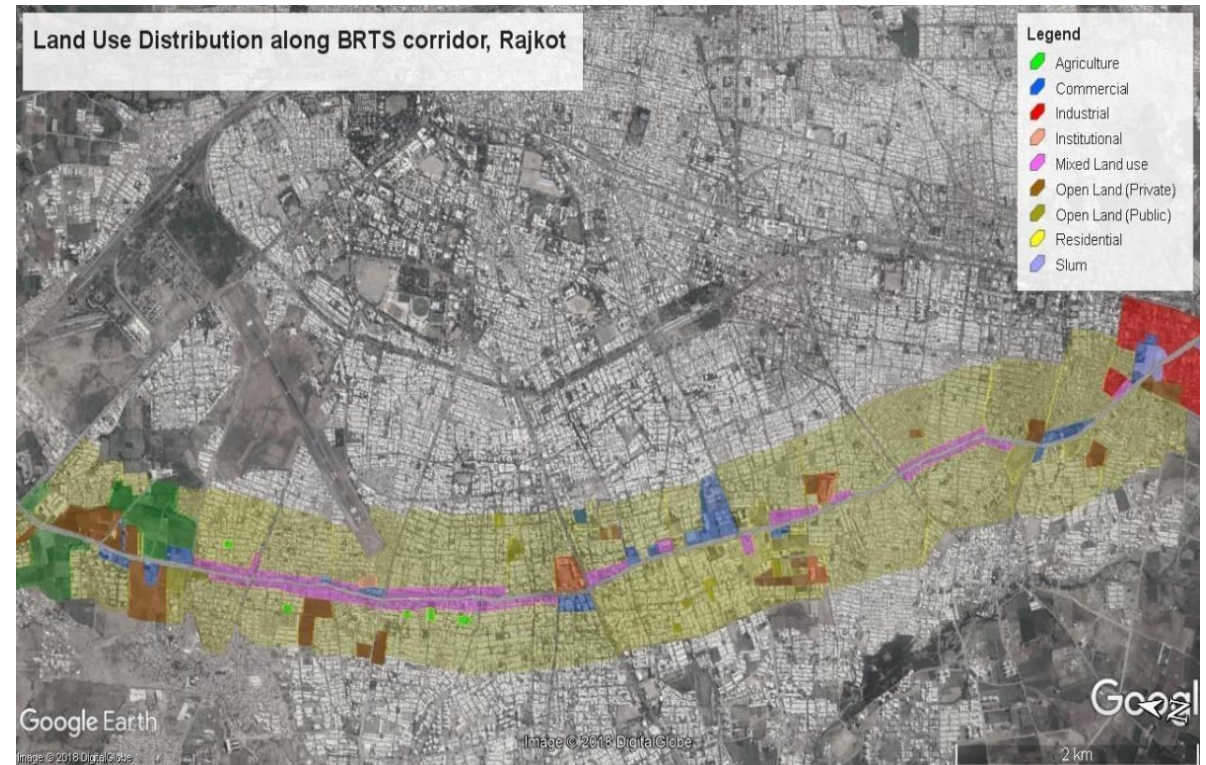
- Objective of the Study.
- Why Last mile connectivity needed for Rajkot BRTS ?
- About Rajkot BRTS
- Studying Best Practice Projects of E3W in other cities.
- Strategy for roll out of E-auto project.
- Defining Sectors and Selecting a Sector for pilot.
- Proposed locations of Charging & Parking sites.
- Evolving different Business Models.
- Evaluating Financial Viability of Selected Business Models.
- Identifying Stakeholders & it's Roll.
- Vehicle Configuration .
- Phases of Implementation with timeline .
- Challenges for E-auto project

Objectives of the Study

- **Assessment of Last Mile connectivity options for Rajkot BRTS and identifying gaps**
- **Exploring Electric Three Wheeler Auto as a possible solution**
- **Assessing Electric Three Wheeler experience in other cities in the country.**
- **Working out strategy for roll out of Electric Three Wheeler for Rajkot BRTS**
 - Evaluating different technologies of Electric three wheeler in market as they are evolving.
 - Pilot project at one selected area / sector
 - Scaling up the Project
 - Suggesting locations for Charging Station & Parking Infrastructure.
 - Business Model and Stakeholder Roles
 - Evaluating Financial viability of the selected business model.
 - Timeline for Implementation

Why Last Mile Connectivity Needed for BRTS ?

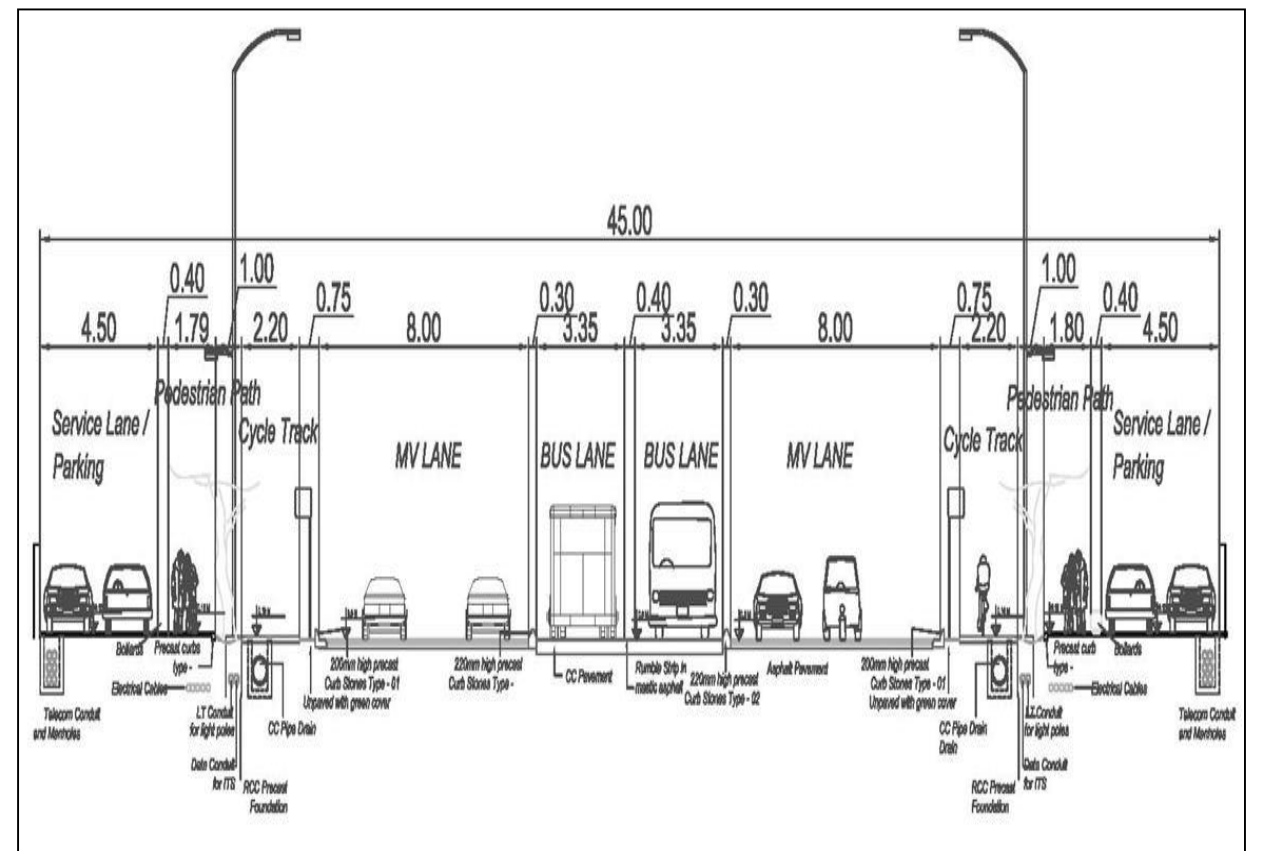
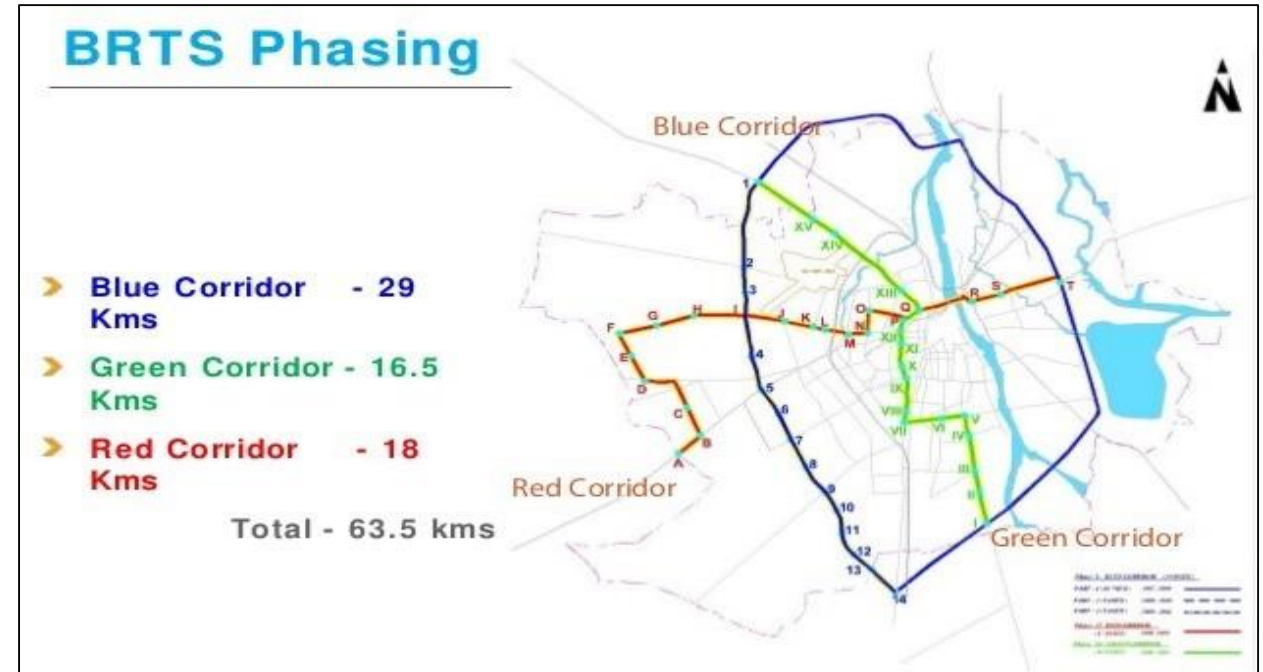
- ❖ Corridor developed on both sides of BRTS due to rapid urbanization as Rajkot is 7th Fastest Developing City.
- ❖ **0.5 additional FSI provided on 250 mt on both side of the corridor.**
- ❖ Large number of **affordable housing and high rises buildings constructed on both side of the corridor.**
- ❖ More than **80% land used by Residential , Commercial & Mixed use** along the corridor.
- ❖ Current Ridership is high even through only 10 buses are used (22,000 per day). **RRL is augmenting the fleet from 10Std. Buses to 20 to 25 midi E-buses in near future.**
- ❖ **This has led to need for people to travel to the corridor from the corridor area.**



About Rajkot BRTS

Rajkot Rajpath Ltd.

- ❖ Proposed Closed BRTS network of 63.5km.s including Blue Corridor of 29.00 Km.
Green Corridor of 16.50 Km
Red Corridor of 18.00 Km.
- ❖ In First Phase : 10.7 Km of Blue Corridor is Operational. Between Gondal Chokdi to Madhapar Chokdi.
- ❖ **Service Started on 01/10/2012** with Fleet size is **10+1** Ac Standard Buses
- ❖ No. of Stations **-18**, Average **Ridership- 22000**
- ❖ The corridor is designed with 45 mt. ROW including Dedicated bus lane in center and 2 MV lanes , Dedicated Cycle track , Footpath & a parking lane



About Rajkot BRTS

Rajkot Rajpath Ltd.

- ❖ Average Distance between shelters is **630 mt.**
- ❖ Floor **height 900 mm.**
- ❖ Off board Ticketing with **POS.**
- ❖ Online Monitoring of Fare Collected.
- ❖ All Buses Equipped with **GPS and Monitored at Control Room.**
- ❖ **CCTV** Cameras Installed on All Shelters.
- ❖ **Free Wi-Fi** facility for passengers for 10 Min.
- ❖ **PIS and Turnstile Gates** Installed at All Shelters
- ❖ Major Junctions are **Connected with RMTS**
- ❖ **Public Bicycle Sharing** available at All Shelters.
- ❖ **50 % Concession** to Students, Senior Citizen & Disabled people.



Data Collection

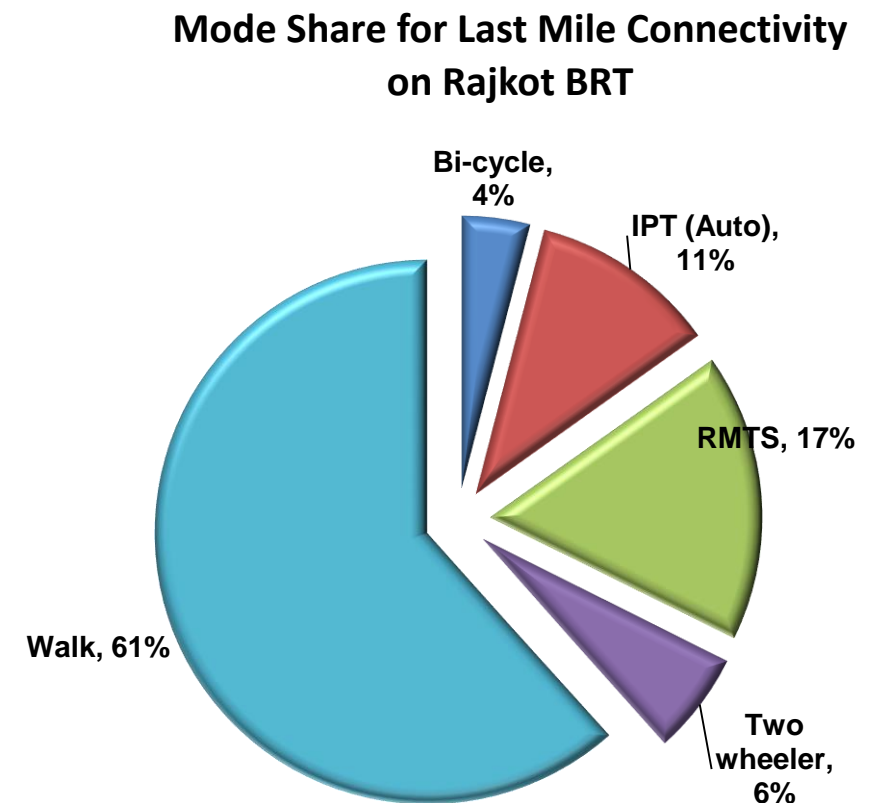
- **Study Area:** limited to the **BRT corridor** – Data collected on corridor and on routes intersecting the corridor
- **Primary Data :** surveys were conducted on the corridor including junctions and BRT stations
 - ❖ **Sample Size:** 50 Passenger interviews, on BRT Corridor
 - ❖ **Interview of 30 Auto Rickshaw drivers** to collect present **operational details** along with **willingness** to operate **E-Auto**
- **Secondary Data:** operational data for BRTS
 - ❖ **Route-wise Ticketing Information:** Origin, Destination, – BRTS



Primary Data Findings

Different modes used by BRT commuters for Last mile connectivity

- **Majority of commuters -61%** preferred to Walk for last mile connectivity
- **17 % commuters use RMTS** as the mode for first & Last mile connectivity.
- **11% commuters use Auto** as the mode for last mile connectivity
- **6 % commuters use Two wheeler** as the mode for last mile connectivity
- **4 % commuters use Bi-cycle** as the mode for last mile connectivity
- Note : IPT users are not satisfy with the service as they charge high, unsafe at night hours etc.



Studying Best Practice Project for Electric Three Wheeler in India – Kochi Case Study

- KMRL has supported introduction of E-autos at Kochi metro stations; the autos operate as a feeder service in the buffer area of 2 km from the metro station on rental basis - Rs. 200 per day.
- Through support of KMRL, six different unions have come together to form an Ernakulam Auto Rickshaw Drivers Co-operative Society (“Society”)
- Agreement signed between KMRL and OEM; another agreement between Society and OEM. Fares fixed as per these agreements.
- Around 14-15 operational E autos at Maharaja station. More autos are in the pipeline.
- **Business Model: Autos are owned by OEM and offered on rent to Society.**

1	Daily Rental paid	Rs. 200 per day (initially Rs. 150 per day)
2	Maintenance	Responsibility of OEM
3	Daily Income per auto	Rs. 700-1300 per day
4	Fare Charged (up to 2 km trip only)	Rs. 10 - Shared basis Rs. 30 – Private hire
5	Charging Location	At Maharaja and Aluva Stations
6	Charger type	2 kw charger operating on 230-240 V mains supply
7	Charging Time	2-3 hours for full charge, 30 min for top up.
8	Hours of operation	6 am to 10 pm
9	Parking at night	At the metro station parking area
10	Capital Cost of Auto in open Market	Around Rs 2,00,000 on road price
11	Auto Type	Fixed Battery of 4 kwh, 4 seater, two speed operation

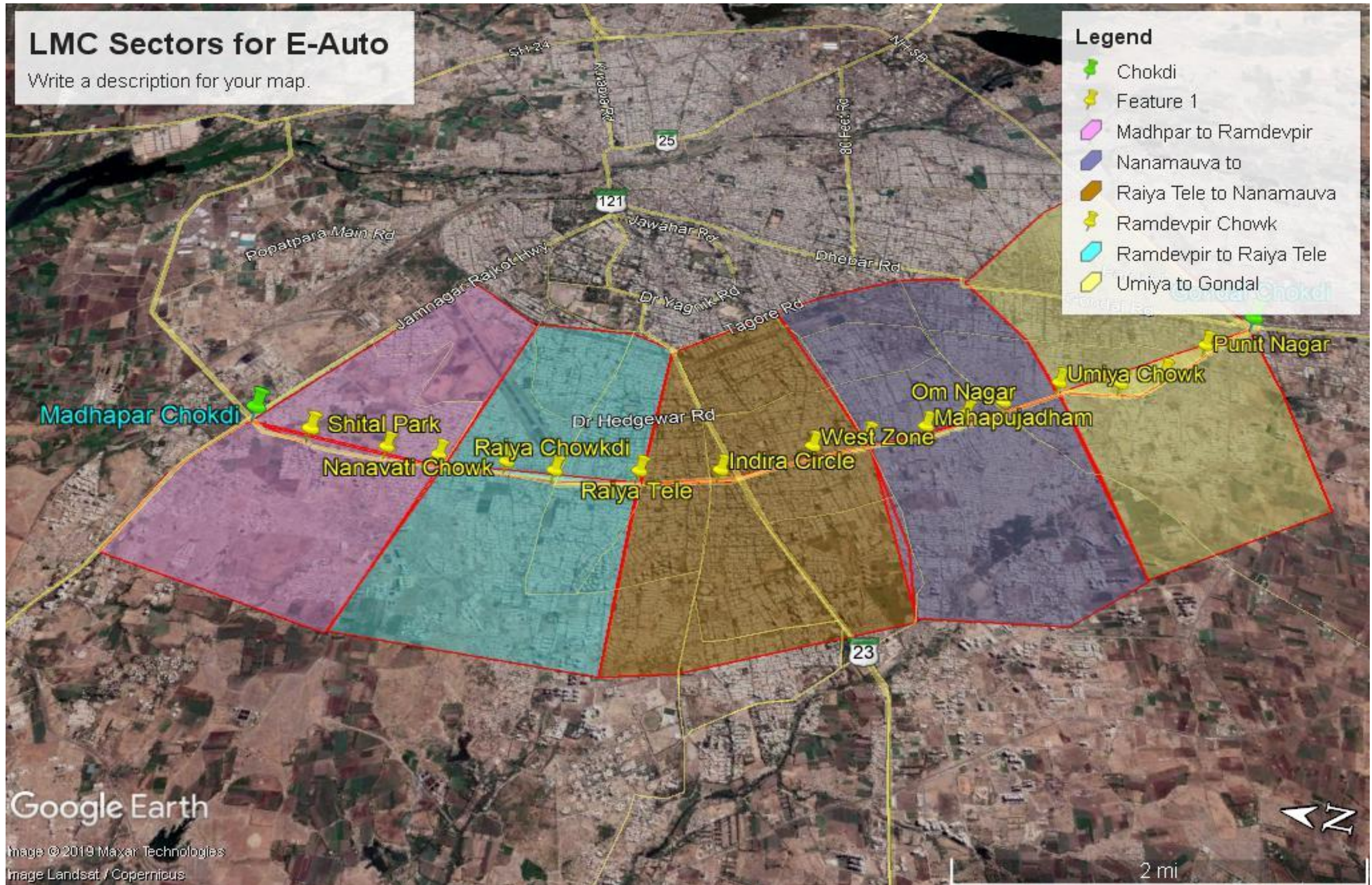


Overall Strategy for Roll out of E-auto service

Criteria for Defining Sectors

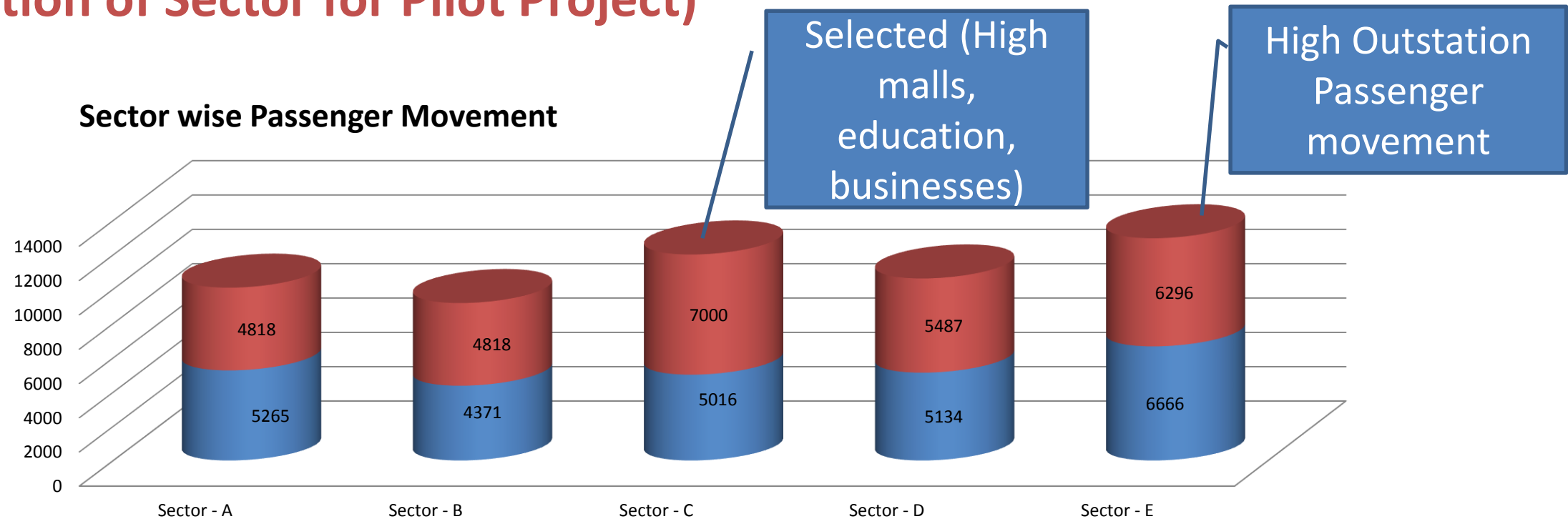
- BRTS corridor of 10.7 Km length divided it into **5 sectors with approx. 2 Km length each** and 1.5 - 2 Km stretch on both sides of the Corridor.
- So each **sector having 6 to 7 Sq. Km of area** which can easily served by **20 to 25 Nos. of Electric Three Wheelers**.
- Based on present commuters data there is around **10 to 12 thousand passengers movement** observed in each sector, so OEM/Aggregator/operator of E-auto can easily get sufficient commuters.

Different Area (Sectors) on BRTS



Sector wise Passengers OD Analysis

(Selection of Sector for Pilot Project)



Sector	Shelters with in Sector	Daily Average Passengers Arrives	Daily Average Passengers Departs	Daily Average Passengers Movement
A	Madhapar Chokdi to Ramdevpir Chokdi	5265	4818	10083
B	Ramdevpir Chokdi to Raiya Telephone	4371	4818	9189
C	Raiya Telephone to Nanamauva Circle	5016	7000	12015
D	Nanamauva Circle to Umiya Circle	5134	5487	10620
E	Umiya Circle to Gondal Chokdi	6666	6296	12962

Selection of Sector for Pilot Project

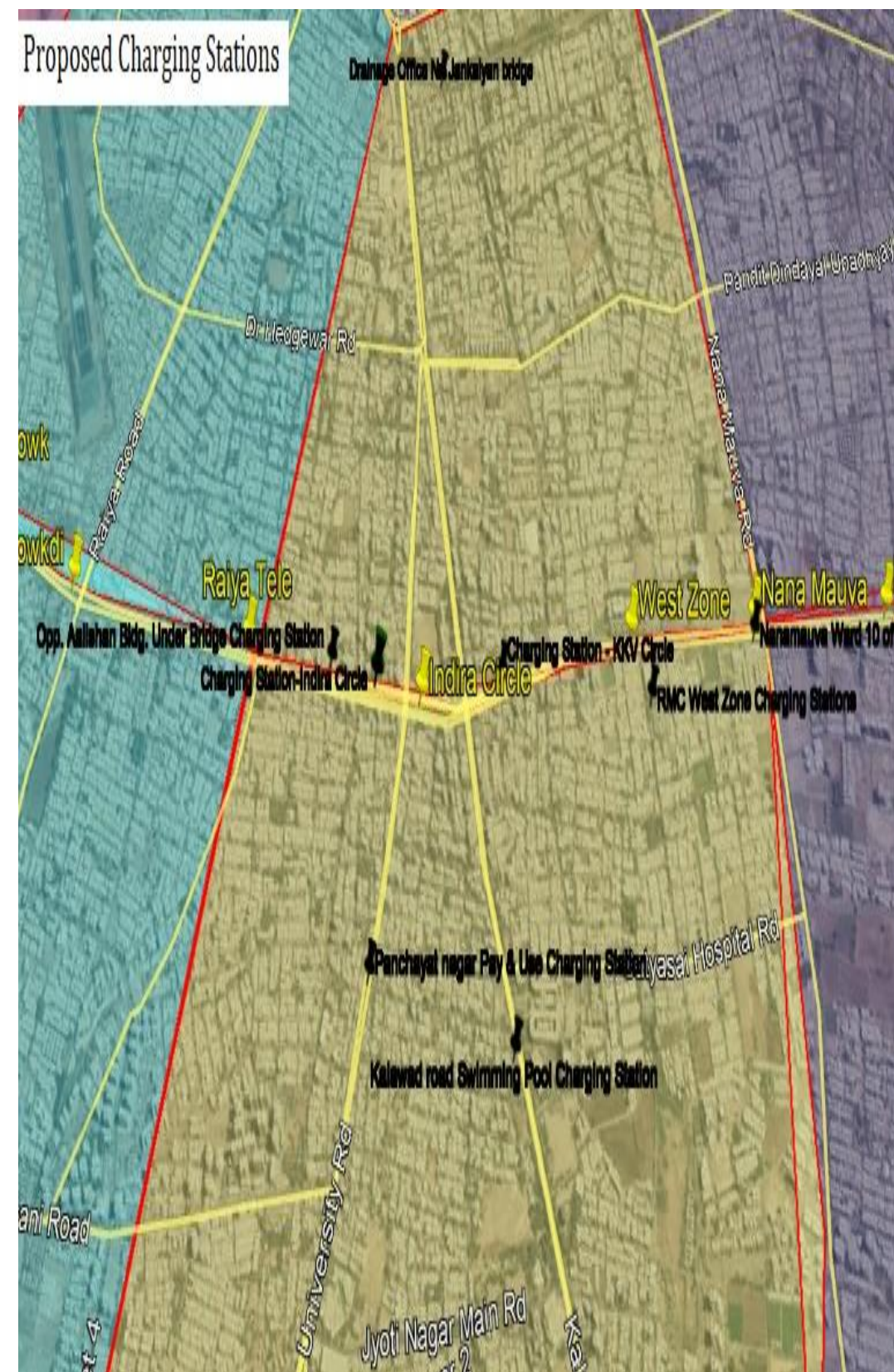
Sector – C (Railya Telephone to Nana mauva Circle) selected for Pilot

- Highest passenger movement observed in Sector E (Mavdi to Gondal chokdi) but arrivals in this sector are from outstation passengers. Hence second highest selected.
- Large number of Educational Institutions in this sector.
- Presence of Malls, Banks, Hotels, Restaurants, business establishments
- Availability of space for Charging & Parking facilities for E-autos.
- Roads are good enough for operation of Electric Three Wheeler.
- Residents of Selected Sectors are educated and skilled enough to use mobile app based transit system.
- Presently 250+ CNG autos are operated within selected sector

Proposed Locations of E-Auto Charging Stations

- Below different 8 Locations are proposed for installing charging stations on selected pilot sector.
- At pilot stage only 2 charging stations are needed to install for 25 E-autos, so it can be installed at Indra Circle and KKV chowk.
- Suggested locations are those where ownership of the site/property is of RMC.
- RMC has submitted EOI for providing incentive for 30 chargers of Electric Autos to DHI which is under sanctioning.

Sr. No.	Location of Charging Station	No. of Chargers
1	Opp. Aalishan Bldg., Under (Pay & Park site)	05
2	Indira Circle ,Nr. Ward No. 10 Office	05
3	KKV Circle ,B/s Pay & Use Toilet	05
4	West Zone RMC office	05
5	Nana Mauva Ward No.11 Office	05
6	Besides Kalawad Road Swimming Pool	05
7	Nr. Panchayat Nagar Pay & Use Toilet	05
8	Jankalyan Over, Bridge B/s Drainage Office	05



Proposed Parking Sites for E-Auto Pilot Project

Sr No	Location Name	For No. of E-Auto at ARP on LHS	For No. of E-Auto at ARP on RHS
1	Raiya Telephone Exc.	05	05
2	Indira Circle BRTS	05	05
3	KKV Circle B/s Pay & Use Toilet	05	05
4	West Zone (Big Bazar)	05	05
5	Nana Mauva BRT (B/s Ward office)	05	05



Prevailing Auto Fare Rate & Proposed Fare Charges for E-Auto

Prevailing Fare Charges of CNG/Diesel Auto

Distance Travelled in Km	Fare for Shared Mode	Fare for Private Mode
Upto 2 Km	10	25
2 to 4 Km	15	50
4 to 6 Km	20	70

Proposed Fare Charges of Electric Auto

Distance Travelled in Km	Fare for Shared Mode	Fare for Private Mode
0 < Km <= 1	03	10
1 < Km <= 2	05	20
2 < Km <= 3	08	30
3 < Km <= 4	10	40
4 < Km <= 5	13	50
5 < Km <= 6	15	60

Evolving Different Business Models



Pure Infrastructure Model

Only charging/ parking infrastructure provided by govt.



Upfront Assistance Model

Vehicle use promoted by part subsidising the purchase through upfront assistance



Pure Rental Model

Rent Model where OEM provides autos (as Kochi Metro)



HybridgeModel

A combination of Upfront Assistance with some character of a Infrastructure model

Hybrid Model (Suggested Model)

(Evolving Different Business Models)

A combination of Upfront Assistance with some character of a cluster model looks suitable for Rajkot BRTS as follows:

- **Asset Acquisition:** Upfront assistance to the Auto Driver's Association for purchase of E-auto to the extent of down payment for a loan. The balance of the capital cost can be raised through a loan by the Association.
- **Infrastructure:** Land for charging & parking will be provided by Authority/RMC at selected places. Funds could be provided for setting up the infrastructure under the FAME-II scheme. Responsibility for establishing and maintaining the infrastructure with Association.
- **Operations:** Autos could be operated on rent model or driver with salary model by Association. This choice may be left to the Association.

.

Evaluating Financial viability of the selected Business Model.

Estimate of Financials for Association

Particulars	Estimate(Rs)
Capital Cost of E Auto	2,00,000
FAME-II Subsidy	40,000
Down Payment for loan	25,000
Loan Amount	135,000
Interest Rate for loan (% pa)	10%
EMI on loan (36 months) (A)	4356
Rental per day per auto (Rs)	250
Earning of Society through rentals (Rental per day x 26 days) (B)	6500
Net Surplus to Society (B-A)	2144

Estimate of Financials for Auto Drivers

Particulars	Estimate (Rs.)
Monthly Earnings (800 Rs. /day)	20800*
Charging Cost @Rs. 30 per day (90 km per day will require 6 kwh@FE of 15 km /kwh x Rs 5 per kwh) for 26 days	780
Maintenance cost pm	500
Surplus	19420
Rental @ Rs 250 pd x 26 days	6500
Net Surplus	12920

- In addition to above GEDA provide 40,000 Rs. upfront subsidy, RMC provides 25,000 Rs. Subsidy to shakhi mandal (women self help group) and interest subsidy (above 7%) provided under NULM scheme.
- Association is likely to generate a surplus of around **Rs 2150 per auto per month**. For 25 autos, it could generate about **Rs. 50,000** which could be used to hire a manager and meet other administration expenses of the scheme.
- The cost of O&M of the charging points could be recovered from service charges permitted on sale of electricity as per the new Ministry of Power policy.
- The E-Auto driver will double his income by switching to E Auto.

Identifying Stakeholders & Their Roles

Stakeholder	Roles
Rajkot Municipal Corporation/ Rajkot Rajpath Ltd.- (SPV of RMC)	<ul style="list-style-type: none"> • Government nodal agency for Project • Engaging & Co-ordinating with other stakeholders such as the Association, Motor vehicles department (RTO), traffic police etc • Planning the intervention and roll out strategy for Pilot Launch • Funding the subsidy assistance per vehicle and the charging infrastructure • Providing clear land for charging & parking infrastructure • Supporting for any civic infrastructure like signage and queuing space • Analysing the pilot operations during pilot runs and prepare a performance assessment report • Preparing up scaling plan for introducing E autos in other sectors based on experience of Pilot • Initiate branding and communication strategies • Providing promotion and outreach support and tie up with any special groups like to students/staff of the institutions etc. • Conduct institutional assessment of Association and capacity building for auto drivers/ members
Auto Driver's Association	<ul style="list-style-type: none"> • Arrangement / agreement with RMC/RRL • Tying up with a bank for a loan • Purchasing and ownership of E autos and RTO registration.

Identifying Stakeholders & Their Roll

Stakeholder	Roles
Auto Driver's Association	<ul style="list-style-type: none"> • Identifying up with app/ITS service provider • identification of auto drivers for deployment of autos on salary/rental basis. • Signage inside the vehicle like Fare chart for shared and private mode. • Ensuring operationalization of E autos within designated sectors. • Major maintenance of the E autos • Centralized monitoring and coordination of E-autos • Maintaining a charging and parking infrastructure on land provided by RMC . • Institutional Strengthening of the Association and Capacity Building of Board Members, Staff and Drivers
E-Auto and Charging infrastructure Dealer/Manufacturer	<ul style="list-style-type: none"> • Supplying of e-auto at competitive negotiated bulk rate • Supplying required chargers of 2 KW and if possible of 4 KW. • Establish charging infrastructure at given locations and handing over to Association • Providing training to Association/Drivers for maintenance and servicing e-auto fleet • Establishing service centres and supply spare parts in the city
Bank	<ul style="list-style-type: none"> • Issuing of loans at competitive negotiated bulk rate
Beneficiary/E- Auto operator	<ul style="list-style-type: none"> • Rent/hire E auto from Association and operate at prescribed fares within designated sectors • Minor maintenance of vehicles • Co-operate with Association and civic authority for route discipline, vehicle cleanliness, training

Available Options for Electric Three Wheeler

(Vehicle Configuration)

	E Rickshaw	E Auto
Battery	Lead Acid	Lithium Ion
Battery Life	>12 months	2-3 yrs
Max Speed	25 Km	Higher
Battery Size	4000 w (Earlier 2000 w)	4000 w +
Range in Single Charge	40-50 km	80-100 km
Body	Light body with uncovered or fibre glass top	Hard covered metal body
Licensing for operation	With Municipal Corporation or as per State Policy	With State Transport Dept. like any Auto
Safety Features	Required as per design and safety standards by approved agencies	Higher stability, approved designs by stipulated Agencies for all vehicles
Price Range per Auto	Rs. 1,00,000/- to Rs. 1,20,000/-	Rs. 1,80,000/- to Rs. 2,00,000/-
Battery Warranty	Usually one year	Three years in most cases. (Vehicles taking FAME Benefit must mandatorily have 3 year warranty).

E-Rickshaw



E-Auto



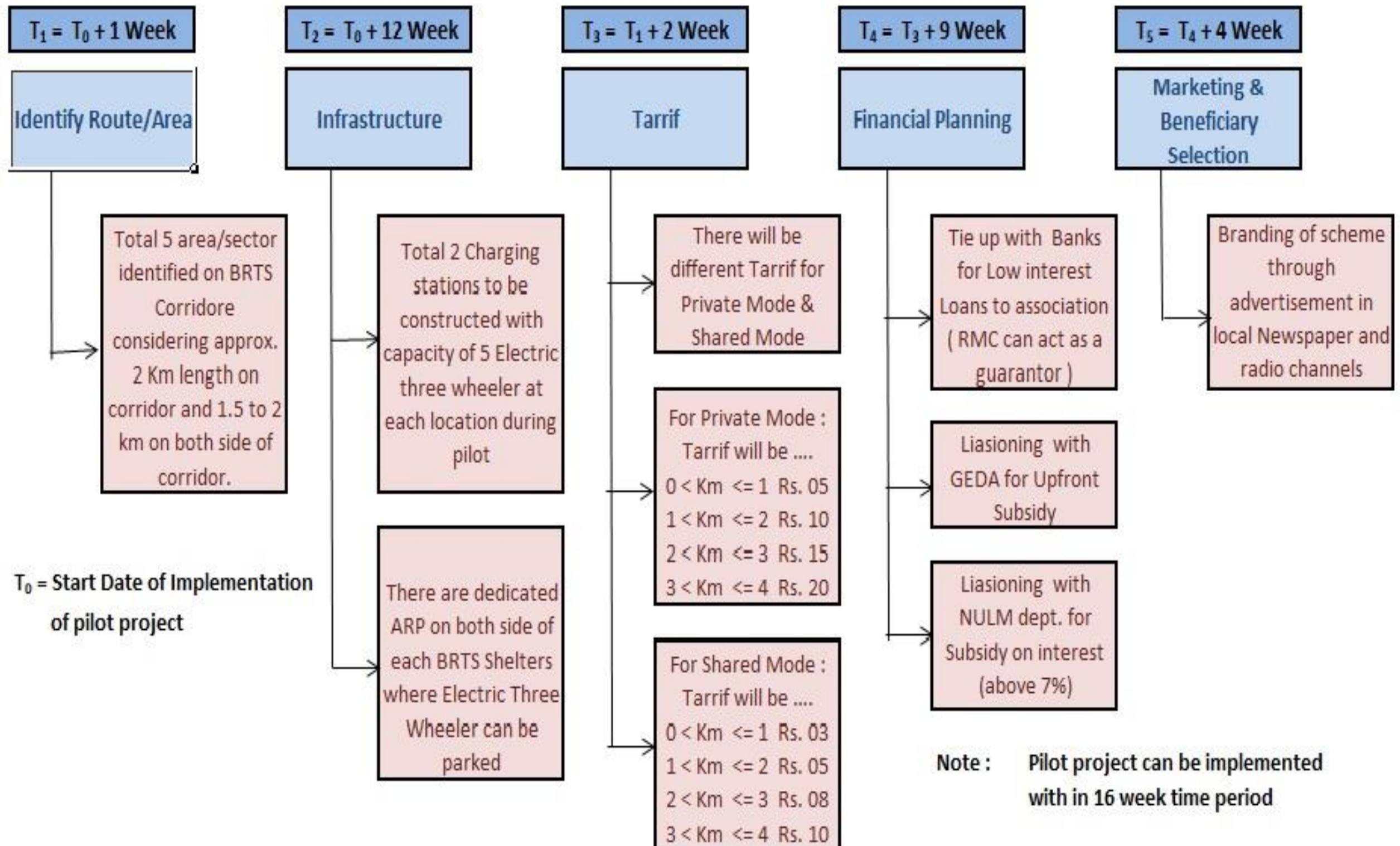
Specification of E-auto

(Vehicle Configuration)

E-autos are recommended over E-rickshaws, as E-rickshaws have limitations in terms of safety, body, battery life, strength and range. Also E-rickshaws use lead acid battery technology which is more polluting than Lithium ion which is used in E-autos.

No.	Attribute	Specifications
1	Battery Type	Lithium Ion 48 V 100 AH
2	Battery Size	Option A : 4 kwh approx. (60-70 km range)
		Option B : 7-8 kwh (110-120 km range)
3	Seating Capacity	Four
4	Width	Narrow body
5	Brakes	Preferably hydraulic
6	Body	Hard top preferred
7	Top Speed (km/hr)	Option A :25 Option B : 45
8	Charging time	Option A : 2.5 hours Option B : 4 hours
9	Warranty including battery warranty	3 years /80,000 km (Whichever earlier)
10	Regulations	As applicable to E-autos under FAME II Scheme of Govt. of India

Phases of Project Implementation with Timeline



Challenges for E-Auto Project

➤ *Policy Related*

- *State Transport Authority needs to issue policy Guidelines/Notification for the E-autos.*
- *Amendments needed in Motor Vehicles Act 2016.*

➤ *Technical Related*

- *Battery Life of 2 to 3 Years (Lithium Iron Battery) with high cost of replacement*
- *Low range of Operation : 70 to 80 Km with full charge*
- *Comparatively New Technology*

➤ *Infrastructure Related*

- *Certified Service Centers for Maintenance*
- *Charging Points , Parking & Halting Locations needed*

➤ *Finance Related*

- *Limited Financing Options available in Market.*

End of the Presentation

*Thank
you*

