CapaCITIES

Technical Study of the existing BRTS corridor for the last mile connectivity and pre-feasibility of potential electrification of the corridor

Executive Summary
13 September 2018

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Executive Summary

Background

Swiss Agency for Development and Cooperation (SDC) is supporting the CAPACITIES project in 4 Indian cities including Rajkot .The project aims at strengthening the capacities of Indian cities to identify, plan and implement measures for achieving lower greenhouse gas emissions growth path and enhancing resilience to climate change in an integrated manner. CAPACITIES project is offering to assist the city improve the reach of BRT corridor.

ICLEI Local Governments for Sustainability ,South Asia (ICLEI South Asia) on behalf of Rajkot Municipal Corporation and CapaCITIES implementation team invited proposal for involvement of national as well as international mobility expert for “technical study of the existing BRT corridor for the last mile connectivity and pre-feasibility of potential electrification of the corridor” Under CAPACITIES Project supported by SDC.

The project aims to appraise options for effective last mile connectivity at Rajot Bus Rapid Transit (BRT) corridor. Additionally, it aims to explore potential of electric mobility i.e. electrification of existing BRT buses in the city, to reduce its carbon footprint and to make it more sustainable. To achieve this, aim the primary objectives which are required to be addressed are:

- Improvements in the existing BRT system to help reaching out to larger population for each available BRT station based on demand assessment
- Provide last mile improved connectivity between different modes (existing and envisaged) as well as safe pedestrian and non-motorized access to public transport.
- Propose enhancements, add on for improving the system including new technology aspects and looking at the feasibility of scaling up such initiatives more widely in the city.
- Delineate influence area over which ridership enhancement measures need be considered.
- Identify various last mile connectivity modes such as E-rickshaw /Auto rickshaws as well as
- NMT modes that need promotion.
- Identify implementation pattern to promote the finalized modes for last mile connectivity improvement including the financial aspects such as cost, revenue etc.

The findings of this study were presented to the team from Rajkot Rajpath Limited (RRL), Comissioner Rajkot Municipal Corporation, ICLEI, SA team and Swiss Development Corporation (SDC) representatives on August 13, 2018 at Rajkot. This was followed up by a detailed technical dscussion on the study findings and recomendations with RRL team and RMC city engineers on August 20 and 21, 2018 at Rajkot. Basis these discussions the study findings and the recomendations have been finalised and included in the final report.

Introduction to Rajkot and its BRT system

Rajkot is the fourth-largest city in the state of Gujarat. Managed by Rajkot Municipal Corporation (RMC), the area of Rajkot city is around 104.85 sq.km. The larger metropolitan region, which is under the jurisdiction of Rajkot Urban Development Authority (RUDA), has an area of about 686.30 sq.km. As per Census 2011, the population of RMC is 1.29 million. The city has a dense road network. The city is regionally connected with National highway NH-8B, State Highways (SH-26, SH-27, and SH-42) and district roads. Rajkot is the biggest city in terms of population in the Saurashtra-Kutch region, and is bustling with commercial activity spurred by new global economic and industrial policies.

It was observed that passenger trips in the city are comprised largely by walking and two-wheelers, i.e. 38 per cent and 35 per cent respectively. The share of non-motorized mode is high, which is 48 percent including walking and cycling. Like most medium-sized cities of India, Rajkot also has a very high combined mode share of non-motorized transport and public transport, i.e. 60 percent. The per capita trip rate including walk trips is 1.30 trips/day, and when walk trips are excluded it is 0.81 trips/day. The city has a very low average commuter trip length (inclusive of walking trips) of under 4 km. Trip distribution by purpose shows that most commuting trips are made for work and education, i.e. 53 and 26 per cent respectively.

Bus Rapid Transit System (BRTS) is a high capacity bus based public transit system. It is a total/complete system; is safe, fast, comfortable, and comparatively affordable and makes the best use of the available road space. The system is designed and engineered with dedicated bus lanes on which no other vehicles encroach. Likewise, there are separate lanes for cyclists, motorized vehicles and pedestrians. The segregated bus lanes make for faster travel of commuters in the BRTS; it improves traffic management in general and as such, improves the driving conditions of all other vehicles on the road as well. This system leads to reduced pollution. Security, cleanliness, easy access, customer comfort, and minimal stoppage time, all are qualities of the system which result in increased efficiency and attractiveness both for the passenger and the operator. In India, BRT system is adopted in many cities such as, Ahmedabad, Surat, Rajkot, Pune, Jaipur, Indore, Bhopal, Vijayawada and Vishakhapatnam.

Rajkot BRT was planned in year 2007-09, by SGArchitects (SGA) for Urban Mass Transit Corporation (UMTC), who were contracted by Rajkot Municipal Corporation to plan and implement the project under funding from Ministry of Urban Development (MoUD) as a part of its flagship program, known as the Jawahar Lal Nehtu Urban Renewal Mission (JnNURM). RMC had identified the two potential BRT corridors:

1. One on the Ring Road around the city
2. Other bisecting it and linking the city to the periphery.

Rajkot has proposed BRTS network of total 63.5kms. Out of which 10.7 km BRTS corridor i.e. from Gondal Road to Jamnagar road became operational in 2010.

Rajkot also has city bus service named as Rajkot Municipal Transport Service (RMTS). Rajkot Municipal Corporation (RMC) started city bus service on 10th October, 2013. In order to run and to operate RMTS Bus Service, RMC has incorporated "Special Purpose Vehicle" (SPV) called Rajkot Rajpath Ltd (RRL). There are 60+6 Marco Polo Midi Busses with 32 seating capacity and 30+3 tata standard busses with 42 seating capacity which are plying on 57 routes. Of the total, 31 routes are passing through or crossing the currently operational BRT corridor.

Electric Mobility for Rajkot city

Among all urban service sectors, the transport sector is the most energy intensive sector in Rajkot. For 2015-2016, road transport accounts for 49% of the total energy consumption and results in 27% of the total greenhouse gas emissions in the city (CapaCITIES, 2018). In 2015-2016, greenhouse gas emissions accumulated to more than 0.5 Million tons of CO_2 equivalent. According to the Low-Carbon Comprehensive Mobility Plan (LCMP, 2014), carbon monoxide levels at many places are higher than the prescribed standards of 4000 $\mu g/m^3$. Besides the negative health effects of air pollution, semi-arid areas such as the state of Gujarat are particularly vulnerable to climate change. This stresses the importance of mitigating greenhouse gas emissions furthermore.

Besides improving the existing BRT- corridor and thereby increasing the ridership of public transit, the electrification of the BRT- corridor can also help to reduce Rajkot's carbon footprint and make the city more sustainable.

Literature Review

To build an understanding of the importance of Last Mile Connectivity (LMC) planning for Public Transport (PT) systems like BRTS/Metro, following literatures have been referred to:

1. Last Mile Connectivity Study. Author: Gresham Smith and Partners in collaboration with Sprinkle and vhb for PCID, Atlanta city.
2. First Last Mile Strategic Plan & Planning Guidelines. Authors: Los Angeles County Metropolitan Transportation Authority & SCAG, Los Angeles.
3. Last Mile Connectivity (LMC) For Enhancing Accessibility of Rapid Transit Systems. Author: Chidambara, Department of Urban Planning, School of Planning and Architecture, New Delhi, India
4. Best Practices: First-Last Mile Strategies, Article-Mass Transit, August 15, 2016.
5. Fist mile-Last mile, Intermodalism, And Making Public Transit More Attractive. Author: Steven Polzin, Blog Post, PLANETIZEN
6. First/Last Mile Strategies Study. Author: FEHR & PEERS and NELSON NYGAARD
7. Access-egress and other Travel Characteristics of Metro users in Delhi and its Satellite Cities. Author: Rahul Goel and Geetam Tiwari, TRIPP, IIT Delhi.
8. Case studies and best practices of electric mobility in developing countries.
9. Case studies and best practices in electrification of last mile modes.
10. Case studies and best practices in electrification of BRT fleet.

Data Collection and Analysis

The study area of data collection was limited to the BRT corridor and its catchment area, traffic demand on the corridor and RMTS routes that intersect or run parallel to the corridor.

For primary data collection,surveys were conducted on the corridor including junctions and BRT stations. Sample size of 833 Origin-Destination (O-D) survey respondents at junctions (on the BRT corridor) and 196 O-D survey responents on BRT bus stations were collected. The data collected included origin-destination (O-D) data through interviews, traffic data through videography and average speed data (on Rajkot Road network) by different modes using hand held (mobile) GPS devices and willingness to use BRTS - perception data.

For secondary data collection, operational data for RMTS and RRL was collected. This included route-wise ticketing information, daily route-wise as well station-wise ridership, daily route-wise ridership, daily ridership, speed analysis data, route-wise fare matrix, route-wise time schedule, fleet size, daily distance covered per vehicle, number of bus stations, bus depot, operating hours and frequency, present and future electricity sources and distribution infrastructure.

Comparative analysis for last mile connectivity options

A total of six last mile connectivity options have been shortlisted based on literature review, as well assessment of city mobility plan, BRT detailed project report (DPR) and experience from other cities in India. These options are:

1. Walk – Improved walkability to BRT corridor from surrounding areas/zones
2. Cycling – Improved bicycling infrastructure on access streets to BRT with or without an integrated biccle sharing system.
3. RMTS buses – Operational, service ad infrastructure planning of RMTS as specifically planned feeder service to BRTS.
4. Hybrid BRT – Overlapping routes, using BRT corridor, but which connect origin and destination outside the corridor. These services may be operated by RRL or RMTS.
5. Auto rickshaw – Organised auto rickshaw based feeder services, with scheduled trips and regulated (and integrated) fare structure.
6. E rickshaw - Organised e-rickshaw based feeder services, with scheduled trips and regulated (and integrated) fare structure.

The city was divided in to more than 190 zones for assessment of passenger trip demand in terms of origin and destination. Based on this mode wise O-D data - daily passenger trips, X (origin + destination), forms the basis of estimating potential demand for the BRT feeder mode options. To help quantify this demand, a spread sheet based model has been developed.

Model Development and Findings

The principle behind estimations in the model is the application of estimated cumulative probability of shift to BRT (from each mode in each zone), on to total estimated travel demand from each zone. The cumulative probability estimate is based on the product of three probabilities – probability to shift because of overalapping passenger trip length on the corridor as well proximity to BRT station, probability of shift because of cost savings and probability to shift because of time saving. The product of cumulative probability and estimates of passenger trips in each zone, provided the number of passenger trips that may shift to BRT. The spread sheet allows this estimation from each current mode to each of the proposed feeder modes.

As an outcome of the modelling exercise is the estimate expected passenger trips shifted to each feeder mode (walk, bicycle sharing, RMTS, RMTS-Hybrid BRT, shared auto rickshaw and walk) in each zone was estimated by aggregating projected numbers of passenger trips expected to be shifted from each of the current modes (Car, motorized two wheelers, auto rickshaw, shared auto rickshaw, RMTS bus, walk and cycle) in that zone. The expected shift of passenger trips in each zone was derived for three time periods – current year, 2023 and 2028.

These projected number of passenger trips expected to be shifted in favour of BRT, from each mode, through introduction of specific feeder mode has been presented on a colour coded zonal map, with four colour gradient representing per day number of passenger trips shifted to BRT in four categories – 1 to 50, >50 to 100, >100 to 150 and >150. An analysis of the colour coded map reveals the zones of interest for each feeder mode.

Last Mile Connectivity Plan

Six feeder modes have been evaluated across more than 190 analysis zones in Rajkot for the potential to shift commuter trips on the corridor from seven existing modes, for base year (2018) and horizon year 2023 as well 2028. The number of commuters which are probable to shift to one or more of the feeder modes is dependent on the quantum of passenger trips attracted or generated by these zones and the estimated probability of shift. The estimated probability of shift in turn is dependent on expected utility in shifting, estimated by time and cost saving coupled by percentage of journey length that currently overlaps with the BRT corridor (and on the proposed BRT corridor extension in 2028).

Horizon year projected number of passenger trips that may shift in favour of BRT is effected by the rate of increase of passenger trips in the city, by the expected development and changes in the land use.

Basis these processes, estimate of potential commuting trips that may shift in favour of BRT from each zone has been generated for the three study periods – 2018, 2023 and 2028. Analysis of these passenger trips generates zones of interest (zones with potential of shifting large number of daily passenger trips in favour of BRT, through shift to multiple feeder modes) and feeder modes of interest (modes with the potential of attracting large number of passenger trips to BRT from multiple zones). These can then be used to plan interventions in terms of feeder mode network and operational plan.

Zones of Interest - Base and Horizon Year

The analysis of modelling output in the form of colour coded zonal maps and a review of the total passenger trips expected to be shifted in each of study periods, suggests that the area around, Raiya Road, University Road, Kalawad Road and Race Course have the maximum potential of shifting in favour of BRT through different feeder modes. In addition to this, areas around Metoda, Gondal Chowk and KKV Chowk also appear as zones of interest when it comes to potential for shifting in favour of BRT.

Feeder modes of interest – base and horizon year

Analysis of outputs generated by the spreadsheet model suggests that the shared bicycle or bike rental options coupled with dedicated bicycling infrastructure is amongst the most attractive feeder mode with one of the highest cumulative potential[1] of shifting daily passenger trips in favour of BRT, an estimated 4315 daily passenger trips. This is followed by a hybrid BRT or bus routes using parts of BRT corridor but connecting key locations in the city. The total number of passenger trips with a potential to shift to BRT through this feeder mode is 3448. A total of 2531 number of daily passenger trips have a potential to shift in favour of BRT through the use of RMTS as a feeder mode, provided the average headway by the service reduces to 20 minutes, and if the total transfer distance between RMTS stop and BRT station is less than 100m. It is important to note here that the results of brief desire to shift survey suggest that maximum number of commuters favour RMTS buses as their feeder mode to BRTS with a relatively fewer opting for cycling.

The remaining three feeder modes posess a relatively lower potential to transfer trips on to BRT. Feeder walk has the potential to shift a total of 1983 daily commuting trips, E-rickshaw have the potential to shift a total of 1987 daily passenger trips and shared

[1] Potential is different from estimated shift which is based in the network plan.

auto rickshaw have the potential to shift a total of 1742 daily passenger trips in favour of BRT in 2028.

Proposed phase-wise network and integration plan for feeder modes of interest

Feeder mode wise zonal plans depicting zones with graded potential of shift towards BRT (using a specific feeder mode) have been used to develop feeder mode specific network plan. The analysis suggests that there is limited potential for integrating all feeder modes serving different zones and stretches of the BRT corridor. Thus, two new hybrid BRT routes have been planned, a circular route for e-rickshaw is proposed, junctions with BRT corridors are proposed to be developed, a network of streets are proposed to be upgraded/re-developed with high quality NMT (pedestrian and cyclist) infrastructure and areas/zones to be served by bike sharing stations have been identified. The estimated shift of commuters to the proposed feeder network explained below (in each year of interest has been presented in Table 1.).

Table 1: Estimated shift of daily passenger trips in favour of BRT by introduction of each of the five identified feeder modes.

Feeder Network/Mode	2018	2023	2028
Walk	533	680	841
Cycle	781	1176	2260
Hybrid BRTS	1345	1722	2342
RMTS	884	1260	1573
E-Rickshaw	254	446	552
TOTAL trips shift	3796	5284	7567
Current BRTS corridor	21109	26175	32297
TOTAL Including feeder	24905	31459	39864

The feeder network for each of the modes is proposed as following.

1. Bicycle and Walk as Feeder: Feeder bicycle is proposed to be planned by providing bike sharing stations and/or parking at identified BRT stations along with high quality segregated bike paths on streets connecting the corridor to attractors and generators of passenger trips in favour of BRT throught the use of this feeder mode. Sturdy and comfortable bikes with carriers are proposed for bike sharing service. Developing bike paths on streets also entails developing high quality pedestrian infrastructure which together contributes to overall street development proposal on the network. Analysis of feeder mode zonal plan suggests that the zones of interest for bicycle and walk feeder modes overlap. This implies that the street development proposal in these zones will actuate shift from both these feeder modes. Thus a street improvement network plan and a plan for potential zones with bicycle stations has been proposed.
2. Hybrid BRTS as Feeder: Analysis of zones of interest for Hybrid BRT suggests that, provision of routes using parts of BRT (in order to eliminate any

changeover time and cost penalty) and connecting main passenger trip generators and attractors outside the corridor, is likely to contribute to increased usage of the corridor. This mode in effect adds two more routes to BRT which are both feeder and main modes on the corridor. The two proposed routes are:

Route A – Starting from Trikon Bagh Station, Passing through Jawahar Road, Dr. Yagnik Road, Gaurav Path and Kalawad Road, then turning on to BRT corridor at KKV junction (towards Raiya Circle), turning off the corridor at Raiya Circle, continuing on Raiya road towards Raiya Dhar and then terminating on Sadhu Vaswani Road.This route will have a total length of 8.9 km. Of this approximately 5.9km is off the BRT corridor, 1.8 km is on the current BRT corridor, and 1.2km is on the proposed extension to the BRT corridor on Raiya Road.

Route B – Starting from Gondal and using the corridor till KKV junction and then turning on to Kalavad Road and terminating at Metoda. This route will have a total length of 18km. This route is approximately 6km length of the existing BRT corridor, 3.5km length of proposed BRT extension (on Kalawad Road expected to be operational in 2028) and 8.5km length is outside the BRT network.

3. RMTS as Feeder: Analysis of zones of interest with potential to shift passenger trips to BRTS using RMTS services as the feeder network has been under-taken. This analysis identified a total of 8 routes out of the 31 routes crossing the BRT corridor, as having the maximum potential to shift passenger trips in favour of BRTS if conducive conditions exist. These routes were identified as they were connecting the BRTS corridor to the zones of interest for RMTS feeder (passenger) trips (to BRT). These routes are route no.'s, 2, 5, 7, 16, 26, 27, 40 and 57. Of these routes, route no. 27 has the potential to be converted to a third hybrid BRTS route.
4. E-Rickshaw as Feeder: Analysis of zones of interest with potential to shift pas-senger trips to BRTS using E-rickshaw as the feeder network has been under-taken. Using this analysis, a 7.8km route, looping across the BRT corridor has been proposed. This loop passes through Kishanpara chowk, Mahila college chowk, Kotecha chowk, Indira circle, Sinha`r school, Sadhu Vasvani schoold for girls, Pramukh swami auditorium, Salus hospital and Khodiyar dairy farm and uses Gaurav path, Kalawad road, University road, Sadhu Vasvani road and Railya road. This loop has been selected because it has the highest po-tential of serving as an efficient BRT feeder system. It is estimated that this loop will effectively shift 254 passenger trips per day to BRTS in 2018, 446 passenger trips in 2023 and 552 passenger trips in 2028.

Impact on Current BRTS Corridor Ridership and Fleet Requirement

If all four means for developing BRTS feeder network are implemented, then it is expected that the city would have shifted a total of 3796 daily passenger trips in favour of the current BRTS corridor in 2018, 5284 daily passenger trips in 2023 and 7567 daily passenger trips in 2028. In addition to this the BRTS ridership is expected to grow with the increasing population (affecting an increase in passenger trips from each zone), development around the corridor and the passenger trip rate in the city. This rate is estimated to be 24% in 2023 and 53% in 2028 (over current year ridership). Basis this the current number of daily passenger trips by BRT i.e. 21,109, are expected to increase to 26,175 in 2023 and 32,297 in 2028, in a BAU scenario - provided BRTS fleet is expanded to accommodate the same. This means that the cumulative demand on BRT after introducing the feeder network (as explained above) is estimated to be be 24,905 by the end of 2018, 31,459 in 2023 and 39,864 in 2028.

Based on the findings of this study it is estimated that the potential passenger trips that can be shifted from different modes in the catchment area of BRT is in the range of 7400 (in 2018), 10,900 (in 2023) and 16,000 (in 2028). Of these it may be economically and technically practical to shift roughly half the passenger trips to BRT network after the introduction of the feeder network discussed above. It is also estimated that the total shift of daily passenger trips (from different modes) to the five feeder modes discussed is in the range of 32700 (in 2018), 46,700 (in 2023) and 65300 (in 2028). This is 80% of the total passenger trips expected tob e carried by the proposed feeder network in each year of interest. Of this roughly 11.6% are expected to shift to BRT in each year of interest. Thus the proposed feeder network will serve additional passenger trips which will help to improve it's economic viability.

Next Steps

Based on the data collected as a part of this study, a complete picture of potential feeder modes for BRT in Rajkot has been created. The study uses data a host of secondary data and data collected from more than 1000 responses of O-D surveys conducted around the corridor, to generate an areawise (or zonewise) understanding of number of passenger trips that may be shifted to BRT using one or more of the six potential feeder modes - i.e. passenger trips shifting to BRT from the said zones or areas after introduction of feeder modes serving those zones or areas in the city. Of these six feeder modes, five have been found to have potential to attract passenger trips in favour of BRT. Using the understanding generated from models run to estimate potential mode shift in favour of BRT (after introduction of the said feeder modes), a feeder Network and Integration plan has been proposed for Rajkot BRTS. It is estimated that if the proposed feeder network and its integration plan is implemented, a total of 3796 daily passenger trips will be added to BRT in this year, 5284 in 2023 and 7567 in 2028. In order to achieve this the following next steps need to be planned and undertaken:

1. Rajkot city has already conducted studies on the bicycle sharing system. This system coupled with high quality, dedicated bicycle infrastructure has a high potential for attracting passenger trips in favour of BRT. The city should implement the bicycle sharing plans in a phased manner starting from areas around the Raiya Road, University Road, Kalawad Road and the core area around Moti Tanki Chowk.

2. High quality pedestrian and cyclist infrastructure is key to ensure that these modes serve as an efficient feeder to BRT. The study has identified the road network surrounding the core area of Moti Tanki Chowk, along with Raiya Road, University Road and Portions of Kalawad Road for upgradation in order to accommodate a high quality pedestrian and cyclist infrastructure (Section 5.3.1). The planning and implementation of this development should be taken up on priority. This can also dovetail with the proposed planning for BRT network extension on Raiya Road and Kalawad Road.
3. One of the boundary conditions identified in the study for sustained usage of proposed pedestrian and bicyclist network, is institutional and regulatory control on parking on these streets. Like in other cities Rajkot stands to gain by putting in place an over arching parking policy and parking enforcement structure. This is not only in terms ensuring the efficiency of the feeder network but also in terms of shifting passenger trips out of inefficient private modes, and to achieve a city-wide prevention of encroachment of public spaces menat for pedestrians and other purposes. Thus Rajkot should start discussing the framework of the city parking policy as well the details of an enforcement plan.
4. The study identifies that RMTS can serve as an effective feeder to BRTS if the changeover time and cost is eliminated. This is possible if BRTS routes are expanded and the additional routes can link important O-D in the city via. The BRT corridor. Two such routes have been identified, along with fleet and operational requirements of the same, in current year, in 2023 and in 2028. Introducing these routes requires planning extension to the current BRT stations. This extension is also required to accommodate additional fleet of BRTS buses required to accommodate passenger trips attracted by proposed feeder network. The city should initiate detailed operational and service planning of these routes.
5. As a long term strategy, it is recommended that regulation and planning of both RRL and RMTS operations should be integrated. With introduction of Hybrid routes, this becomes even more important. Thus the city needs to initiate a dialogue for the development of road map towards integration of RRL and RMTS as an overarching regulator of all public mode of urban transport in the city.
6. Eight, RMTS routes have been recognised with a high potential to serve as feeder to BRT, provided their stops are integrated with BRTS stations and the waiting time for passengers on the routes is reduced. The city should initiate conduct studies to look at feasibility of increasing services (adding more fleet) on these routes.
7. Higher efficiency of BRTS services, lower delay (as well higher safety) for BRTS commuters, easier changeover between RMTS as well as Cycle sharing network and BRTS, are all the benefits in favour of attracting more commuters to BRTS, that can be realized by improving the current BRTS junctions. The suggested improvements include, singalization (for pedestrians or buses), planned areas for bicycle parking at intersections, countinuous pedestrian

paths and cycle infrastructure at junctions, good quality pedestrian connectivity between RMTS and BRTS stations, etc. The city may also initiate redevelopment of 9 identified intersections on BRT corridor, along with atleast 100m length of the cross roads to incorporate these improvements.

8. The study has identified a ring corridor (around BRTS) linking University Road and Raiya road with the highest potential to attract commuters to BRT through the use of E-rickshaw. The city may intiate discussion on a regulatory mechanism for e-ricksahw in order to initiate deployment of the same on the identified corridor. The regulatory and institutional mechanism is intended to finalize mechanism for permit allocation, route allocation, fare structure, etc.
9. It is estimated that the post the development of feeder network as proposed by this study, an increase in daily ridership of BRTS can be expected, provided the system has the capacity to carry these additional commuters. Thus an additional fleet requirement of 2 buses in 2018, 5 in 2023 and 10 in 2018 (taking the total fleet size to 21 in 2018) is expected. The city thus needs to initiate the expansion of its BRTS fleet in line with the rollout of the BRTS feeder network development in the city. Part of this expansion has already been initiated. The city is in the advanced stages of inducting 5, 12m electric buses on the BRT network.
10. It is understood that there is significant potential of, and benefits to be reaped in using electric buses for the proposed two hybrid BRTS routes. Similarly gradual shift of BRTS buses from Diesel to electric technology is also anticipated to reap similar benefits. There is thus a clear potential in using the bus based public transport in the city as the starting point for electric mobility joutney in Rajkot. In order to achieve this the city may initiate development of policy and regulatory framework as well long term road map for electric mobility.
11. As a first step towards electrification of mobility in Rajkot, it is suggested that the additional buses to be procured to cater to increased demand on BRT – as a result of introduction of the proposed feeder network – be electric. It is also suggested that the two hybrid BRTS routes proposed in this study be operated by primarily electric midi buse fleet.
12. It is recommended that daily autonomy requirement of buses may be considered to be reduced by providing fast charging stations at the two ends (terminating points) of each route, while standard chargers numbering approximately 50% of the total fleet of buses may be provided for overnight charging at the depots.
13. Requirement to induct additional vehicles in the current year has been generated in order to capture additional passenger demand in favour of BRT and other modes such as RMTS. The city has an immediate requirement to induct 11 e rickshaw and 29 buses. Of these 29 buses, induction process of 5, 12m electric buses has been initiated. Of the remaining 24 buses, 6 midi electric buses (to be used on Hybrid/Mix BRT routes) and 18 midi diesel buses (to be added to the fleet size of 8 existing RMTS routes) need to be inducted

in the immediate phase. This will increase the total fleet size on the proposed BRT network to 22 buses. Of these 13 (5 new, 12m electric and 8 existing, 12m diesel) buses shall operate on the trunk BRT route while 9 (3 existing, 12m diesel buses – shifted from trunk BRT corridor, and 6 new, 9m midi electric) buses shall operate on the two proposed hybrid/mix BRT routes.