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

CapaCITIES
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About the team

ICLEI - Local Governments for Sustainability *is the world's leading association of more than 1000 metropolises, cities, urban regions and towns. ICLEI South Asia - the South Asian arm of ICLEI - Local Governments for Sustainability, aims to build and serve a regional network of local governments to achieve tangible improvements in regional and global sustainability through local initiatives. Over 13 years, ICLEI South Asia has emerged a strong and vibrant local government association with a membership base of over 70 cities.*

S G Architects *was established in 2006, and provides consultancy services in the field of sustainable urban transport including public and non-motorised transport. We provide expertise in research, planning and implementation for all forms of sustainable urban transport projects, including developing toolkits, guidelines and other resource material.*

SNZ *is an experienced and independent engineering, planning and consulting company . We are successful in traffic planning, traffic management, environmental planning, civil engineering and road construction, railway technology and railway systems, supply and disposal buildings, structural engineering, basic and specialist foundation engineering, building conservation, project management and construction management. Our company is divided into three departments - traffic planning, configuration and construction / value retention. SNZ has been ISO 9001 certified since 1997 .*

Objective: Identify a feeder solution to increase the ridership and explore electrification of the BRT network

Feeder Plan

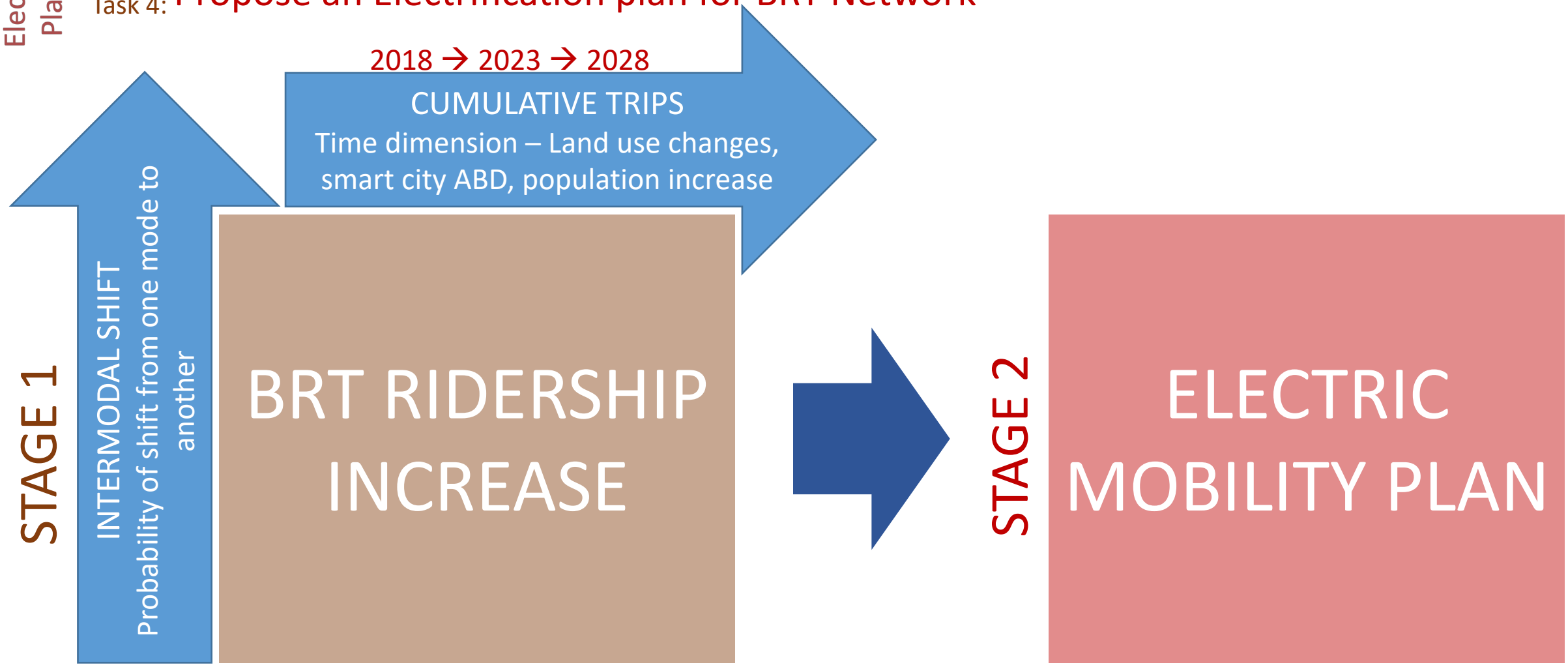
Task 1: Compare the potential of different feeder modes to attract ridership in favor of BRT

Task 2: Plan the selected feeder network

Task 3: Plan the BRT Operations for resultant increase in ridership

Electr. Plan

Task 4: Propose an Electrification plan for BRT Network



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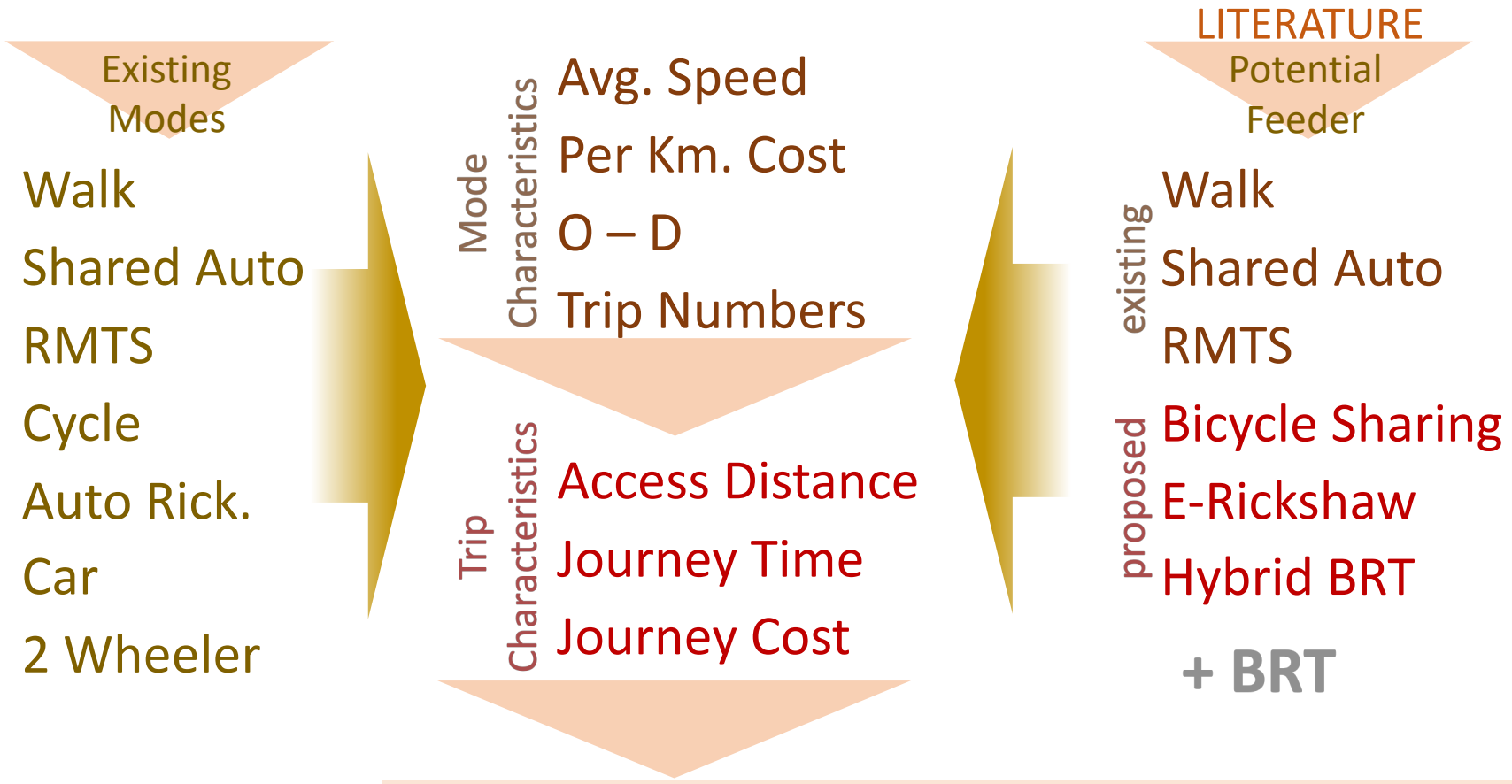
STAGE 1



Zones & Modes of Interest → Network Plan → BRT Ridership

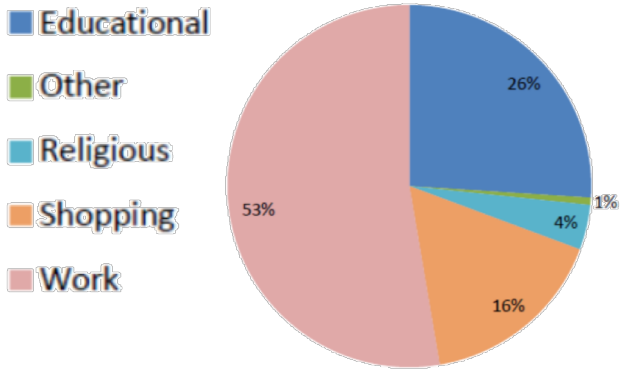
About Rajkot City

- ***Fourth largest city*** *in the state*
- *Managed by* ***Rajkot Municipal Corporation (RMC)***
- ***RMC Area -*** *104.85 sq.km;* ***Population of RMC*** *- 1.29 million (1.75 metropolitan 2018)*
- ***Population Growth Rate*** *– 3.3%*
- ***Rajkot Urban Development Authority (RUDA) Area -*** *686.30 sq.km*
- ***Per Capita Trip Rate*** *(including walk) - 1.30 trips/day*
- ***Per Capita Trip Rate*** *(excluding walk) - 0.81 trips/day*

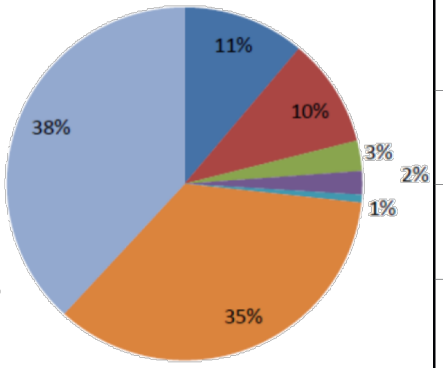
Administrative boundary of RUDA

- ***Average Trip Length (ATL)*** *- Within 4 km*
- ***Trip Purpose*** *- Work 53% Education 26%*
- ***High mode share of NMT*** *- 48% & **Motorized two wheelers** – 35%*
- ***Trips in the city are made largely by*** *walking and two-wheelers*
- *City has informal though very* ***strong IPT presence***.

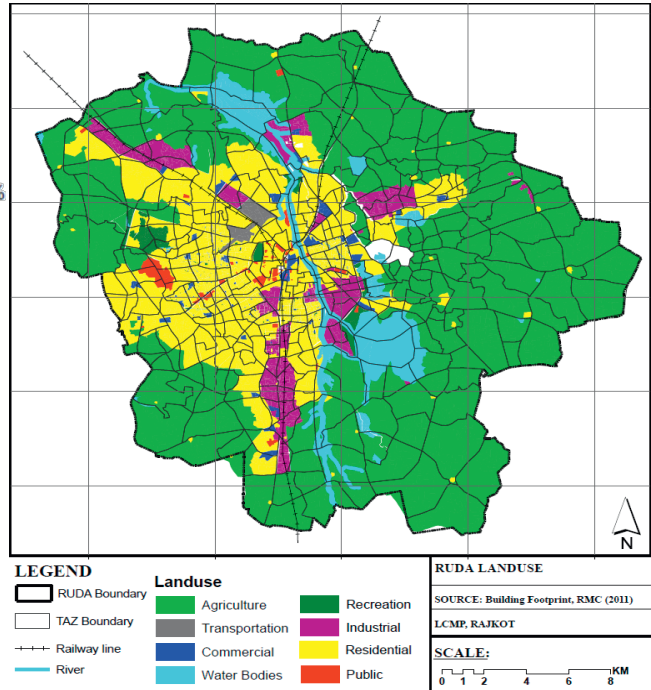
Trip Purpose



Mode Share



RUDA Land use map



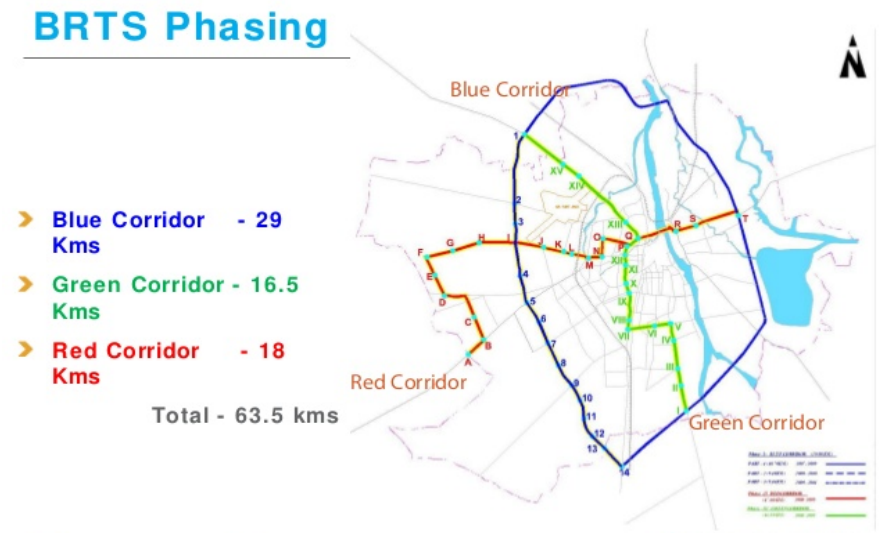
About BRTS

- ***Rajkot** is proposed with **BRTS network of total 63.5km***
- *Out of 63.5kms, **10.7 km BRTS** corridor i.e. **from Gondal Road to Jamnagar road is operational along a section of ring road.***
- ***Rajkot BRT** was planned in **2007-09** by Urban Mass Transit Corporation (UMTC), SGArchitects (SGA) and BPS Architects for Rajkot Municipal Corporation (RMC).*
- *First BRT in the country, designed with **semi-signalised roundabout junctions***

Corridor Details

- ***Closed BRTS, Length - 10.7km, ROW -** 45m*
- ***No. of Stations -** 18, **Daily Ridership -** 11000 - 24000 (August 2017)*
- ***The corridor is designed with :***
  - *2 vehicular lanes,*
  - *A parking lane,*
  - *Dedicated bus lanes*
  - *Continuous cycle track*
  - *Continuous and barrier free footpath along the length of the corridor.*

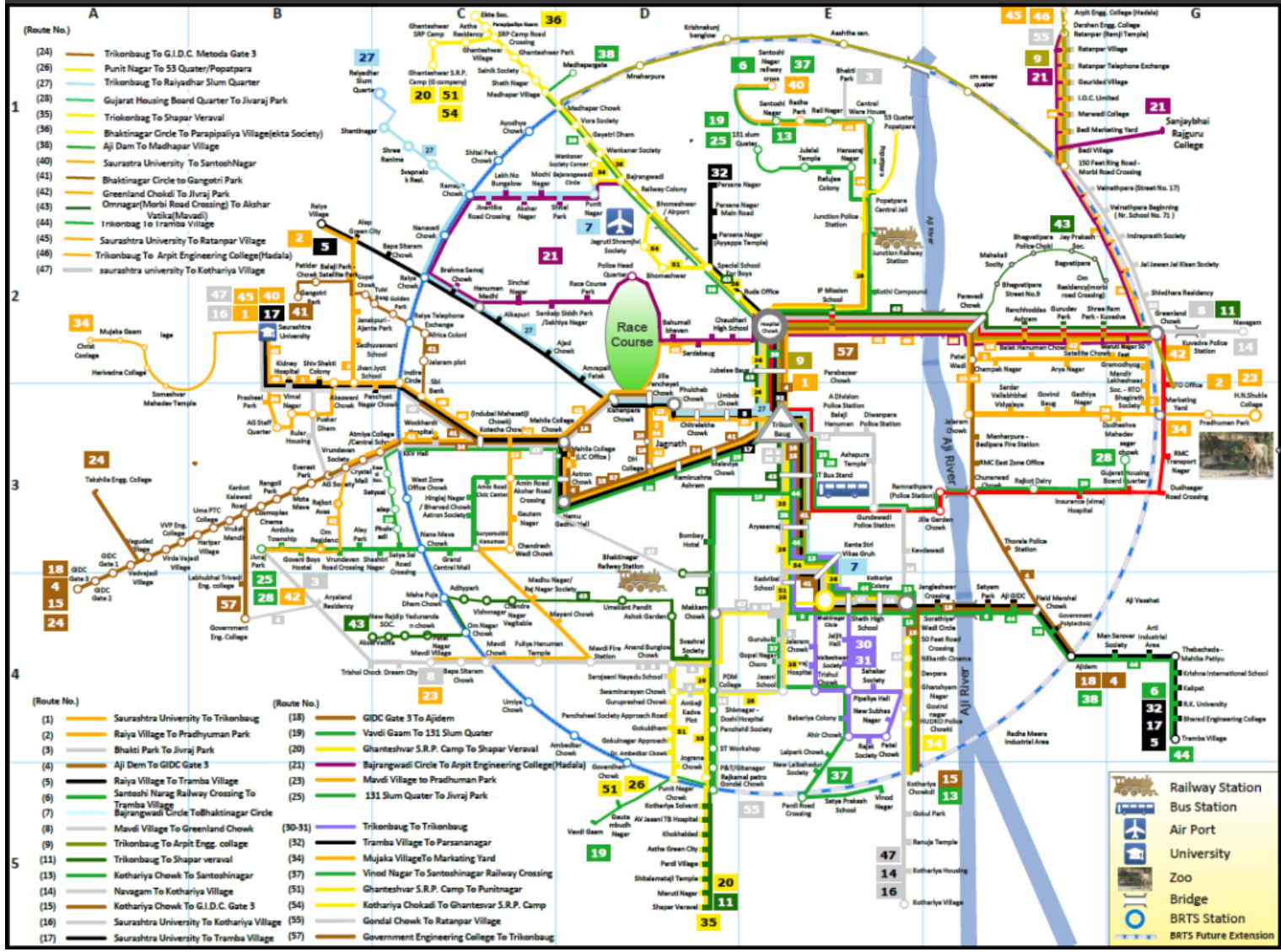
Rajkot BRTS



About RMTS

- ***Rajkot*** *has a city bus -* ***Rajkot Municipal Transport Service (RMTS)***
- ***Rajkot Municipal Corporation (RMC)*** *started city bus service on 10th Oct'2013.*
- *Operated by "Special Purpose Vehicle" (SPV) called* ***Rajkot Rajpath Ltd (RRL)***
- ***60+6*** *Marco Polo* ***Midi Buses*** *with* ***32 seating capacity*** *and*
- ***30+3*** *Tata* ***Standard Buses*** *with* ***42 seating capacity***
- ***57 planned routes (44 operational)***
- *Out of 57 (planned) routes,* ***31 routes*** *are* ***intersecting BRTs corridor***

RMTS Bus Tube Map of Rajkot City



Literature Review

- ***Last Mile Connectivity Study.*** *Author: Gresham Smith and Partners in collaboration with Sprinkle and vhb for PCID, Atlanta city.*
- ***First Last Mile Strategic Plan & Planning Guidelines.*** *Authors: Los Angeles County Metropolitan Transportation Authority & SCAG, Los Angeles.*
- ***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*
- ***Best Practices: First-Last Mile Strategies.*** *Article-Mass Transit, August 15, 2016.*
- ***First mile-Last mile, Intermodalism, And Making Public Transit More Attractive.*** *Author: Steven Polzin, Blog Post, PLANETIZEN.*
- ***First/Last Mile Strategies Study.*** *Author: FEHR & PEERS and NELSON NYGAARD*
- ***Access-egress and other Travel Characteristics of Metro users in Delhi and its Satellite Cities.*** *Author: Rahul Goel and Geetam Tiwari, TRIPP, IIT Delhi.*
- ***Case studies and best practices of electric mobility in developing countries:***
  - *Electric bus market in India*
  - *Electric bus market in other developing countries*
- ***Case studies and best practices in electrification of last mile modes***
  - *PubliBike (bike sharing)*
  - *Mobility (car sharing)*
- ***Case studies and best practices in electrification of BRT fleet***

Data Collection

- ***Study Area:*** *limited to the BRT corridor – Data collected on corridor and on routes intersecting the corridor*

- ***Secondary Data:*** *operational data for RMTS and RRL*
  - *Route-wise Ticketing Information: Origin, Destination, Boarding, Alighting – RMTS, RRL*
  - *Speed Analysis Data – RMTS, RRL*
  - *Fare Matrix – RMTS, RRL*
  - *Route wise time schedule – RMTS, RRL*
  - *Route length, bus stop location and spacing – RMTS, RRL*
  - *Fleet Operational Characteristics: Bus length, Fleet size, Daily distance per vehicle, Operating hours and Frequency, EPK, CPK - RMTS, RRL*
  - *Present and future electricity sources and distribution infrastructure*

- ***Primary Data :*** *surveys were conducted on the corridor including junctions and BRT stations*
  - *Sample Size: 833 O-D at junctions and 196 O-D on BRT Corridor*
  - *This included origin-destination (O-D) surveys through interviews,*
  - *Traffic surveys through videography and*
  - *Average speed data (on Rajkot Road network) by different modes using hand held (mobile) GPS devices*
  - *Willingness to use BRTS - Perception survey*

Secondary Data Findings (RMTS & RRL)

Particulars (31 RMTS Routes, 1 BRT Route)	RMTS (City Bus)		RRL (BRT)	
	Average	Range	Average	Range
Route length (Km)	16.28	6.29 (R 27) to 31.76 (R 9)	10.7	--
Dist. between stations (m)	560	370 to 918	638	350 to 1140
Passenger trip length (km)	**6.43**	3.34 (R 27) to 11.44 (R 9)	**3.83 (6.04)**	2.86 to 6.03
Occupancy	**18.30 (0.57%)**	1.58 to 46.79	**33.7 (0.75%)**	13.0 (0.29%) – 47.6 (0.99%)
Routes per station	2.7	1 to 27 (Tikon Bagh)	1	--
Boarding per day	44.6	0.35 (53 quarter) to 1886 (Tikon Bagh)	1225	131 (Umiya Station) to 3577 (Indira Circle)
Alighting per day	46.6	0.35 (53 quarter) to 1603 (Tikon Bagh)	1225	331 (Ayodhya Chowk) to 3703 (Indira Circle)
Boarding per trip	1.43	0 to 22.11 (Ghanteshwar R 20)	5	1 (Ayodhya) – 15 (Indira C.)
Alighting per trip	1.39	0 to 25.81 (Ghanteshwar R 20)	5	1 (Ayodhya) – 16 (Indira C.)
Average op. speed (Km/h)	**18.32**	11.86 (R 41) to 21.57 (R 9)	**18.48**	15.3 to 22.9
Fare Structure (Rs./km)	1.0	0.7 to 5.0	1.5	0.7 to 4.0
Route Headway (minutes)	**70(26 at stop)**	38 (R 1,27) to 136 (R 20)	**7.9**	5 to 10
Fleet Size	99		11	

Primary Data Findings

Traffic count estimation for Peak hour and daily traffic data

- *Peak traffic period (on BRTS corridor) – 7:30 AM to 8:30 AM*

Average Speed of Modes other than Bus

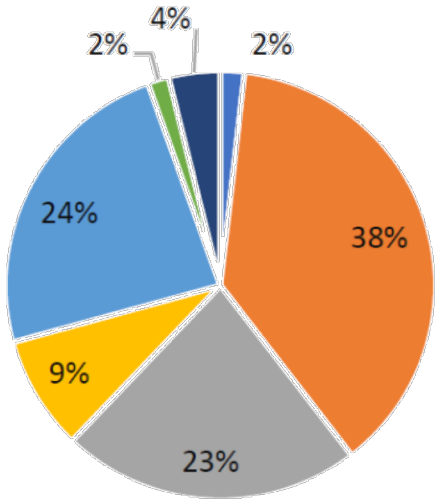
- *Peak traffic period (on BRTS corridor) –7:30 AM to 8:30 AM*

Traffic volume intensity on BRTS corridor

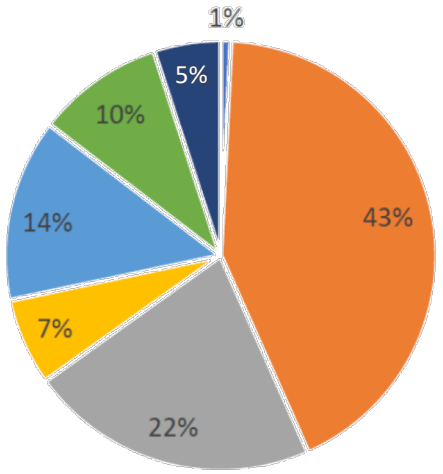
Primary Data Findings

Composition of Traffic and Trips by Mode on the BRT Corridor

Maximum PCU observed at Gondal Junction

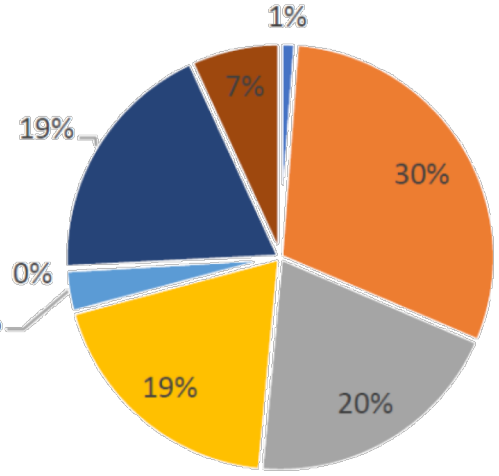


Mode-wise trip in peak hour

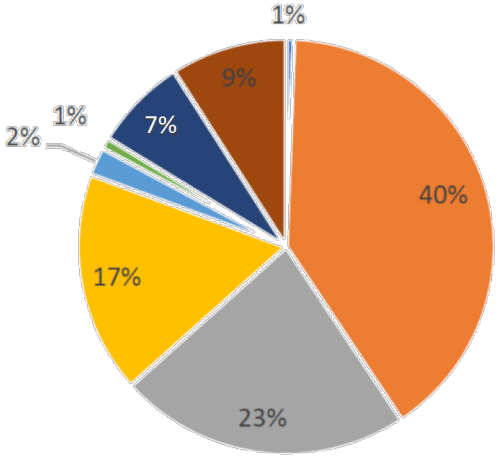


Minimum PCU observed at Ayodhya Chowk

Cycle | 2 wheeler | 4 wheeler | Auto | Bus | BRTS Bus | Pedestrians



Mode-wise PCU in peak hour



Cycle | 2 wheeler | 4 wheeler | Auto | Bus | BRTS Bus | LMV | Trucks

Willingness to use BRTS Perception survey

- *61% - **'BRTS station is far** from their origin and destination' - **not** preferring BRTS as a mode of transport.*
- *36% - **'High Speed – low journey time** than other mode' - **they prefer** BRTS as a mode of transport.*
- *More than 50% - more people can use BRTS **if waiting time for BRTS is reduced**.*

For preferred last mile connectivity option:

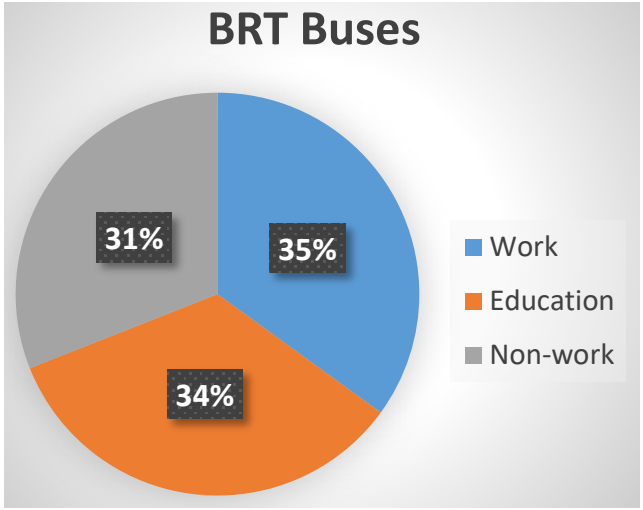
- *About 44% - opted for **RMTS** as the most preferred last mile connectivity mode.*
- *19% each - **for walk and auto rickshaw***
- *11% - **cycling** as the preferable last mile connectivity mode.*

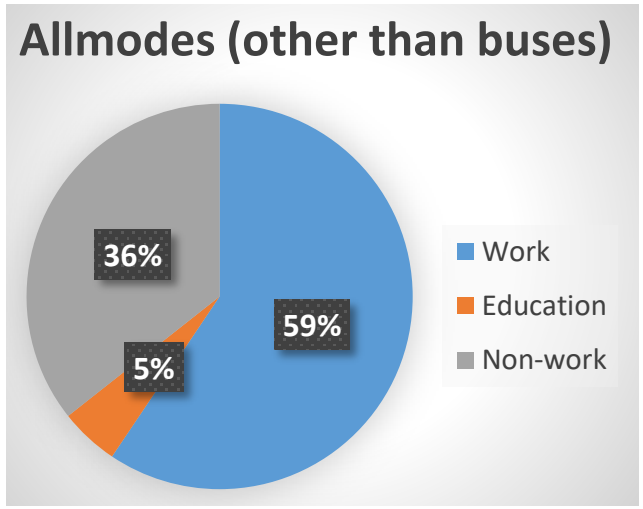
Primary Data Findings

Last mile connectivity modes used by current BRT commuters

- *Majority of commuters -77% (first mile) & 71% (last mile) – walk to BRT station*
- *10% commuters use city bus as the mode for first mile connectivity*
- *11% commuters use shared auto as the mode for last mile connectivity*

Trip Purpose for Modes other than RMTS bus





Mode	Speed on corridor (km/h)	Speed off corridor (Km/h)
Share Auto	14.8	14.8
2W	22.5	22.6
Car	36.7	39.2

S.No	Modes	Avg. Occup.
1	*Walk*	*1.00*
2	*Bicycle*	*1.02*
3	*Shared Auto*	*1.61*
4	*Auto*	*1.57*
5	*2W*	*1.26*
6	*Car*	*1.70*

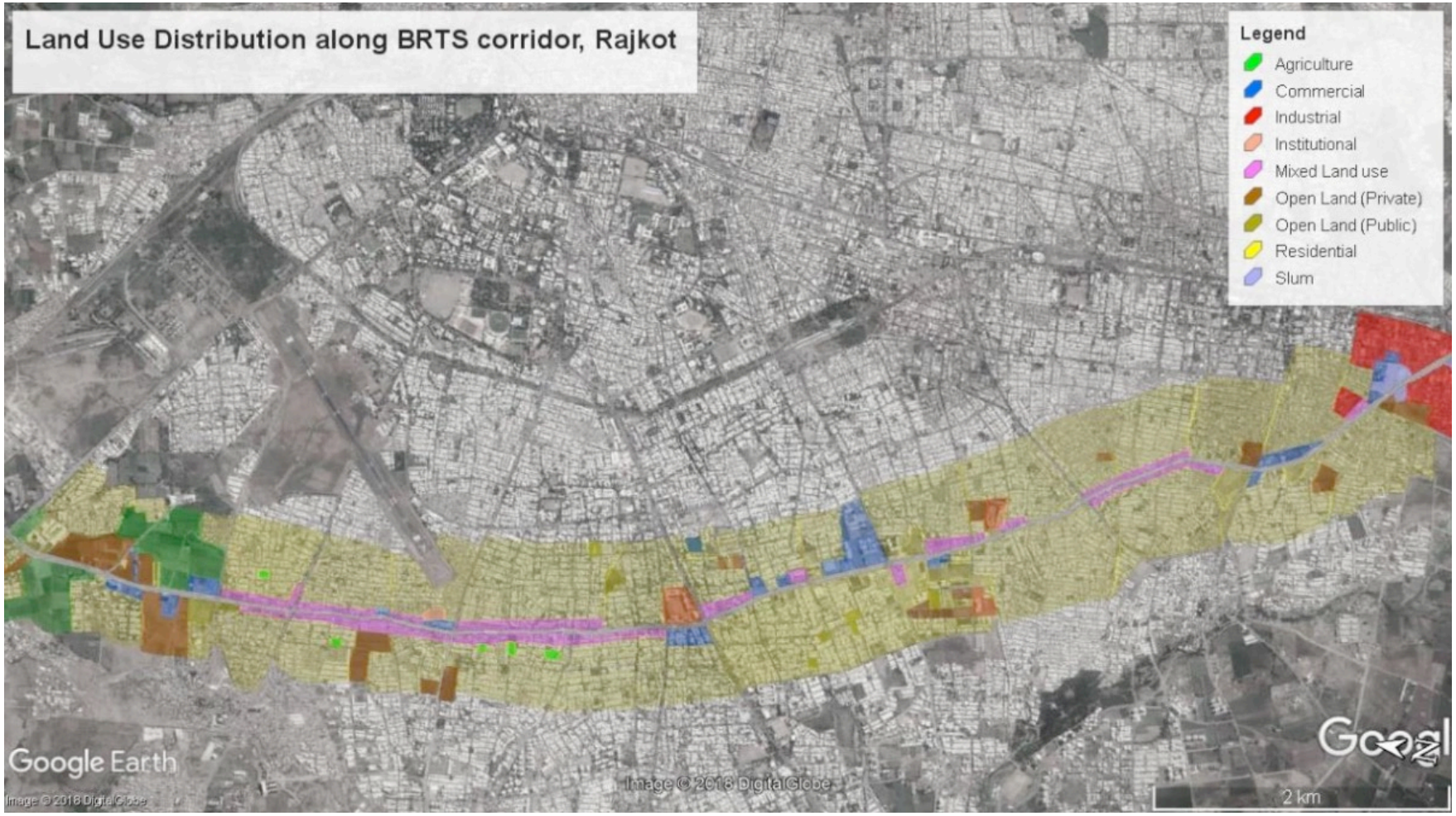
Avg. Speed ***Occupancy***

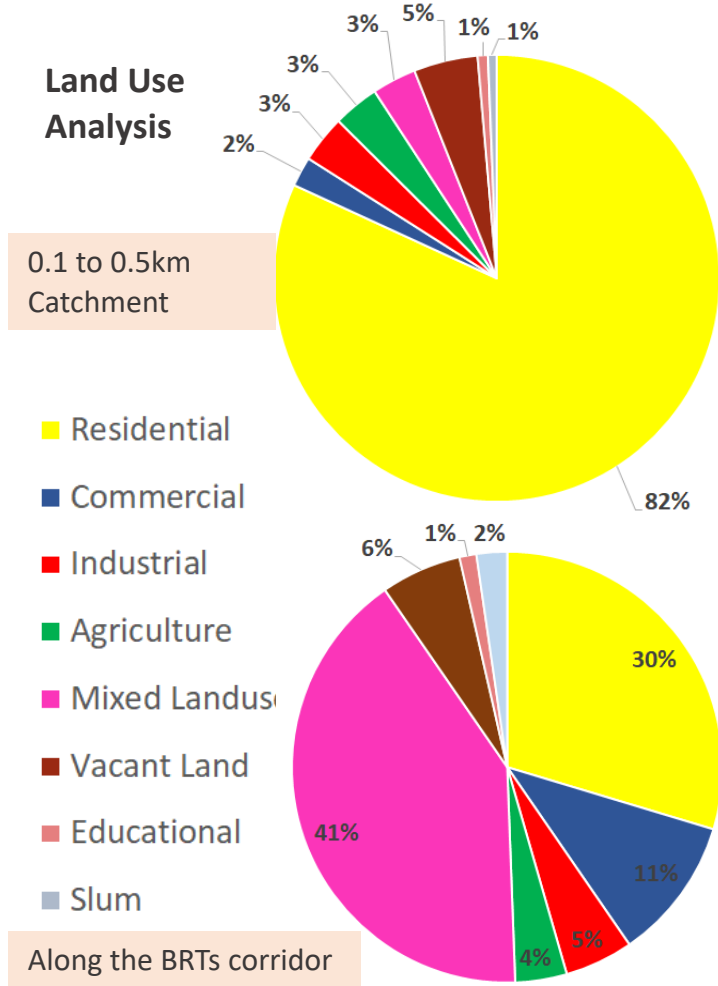
Mode/ Feeder	Average Trip length (ATL) - Modes other than Bus	Average Trip length (ATL) - BRT Commuters
Walk	*2.24km*	*5.6 km*
Bicycle	*4.37km*	*--*
Shared Auto	*9.06km*	*7.1 km*
Auto	*7.19km*	*6.67 km*
Car	*8.01km*	*6.6 km*
2W	*6.98km*	*6.47 km*
Average trip length of BRT commuters is 6.04 km		

Primary Data Findings

Land use analysis

- *Majority of land use - Residential - nearly 80% (500m both side of the corridor)*
- *Land use along the corridor - nearly 40% - majorly Mixed (residential + commercial)*
- *The land use along the corridor is favorable for shorter and non-motorized trips.*



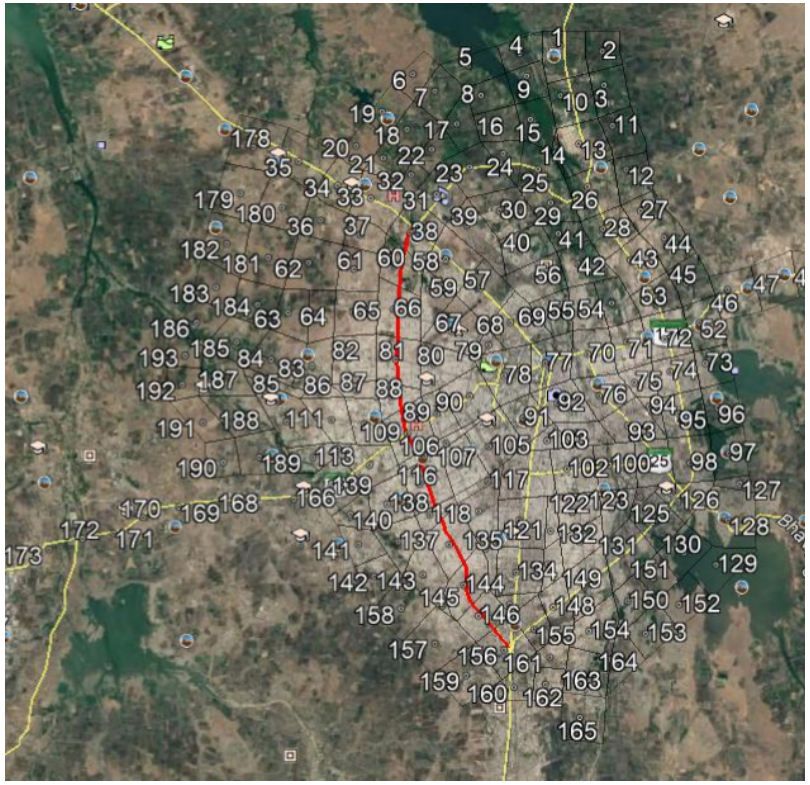


Primary Data Findings

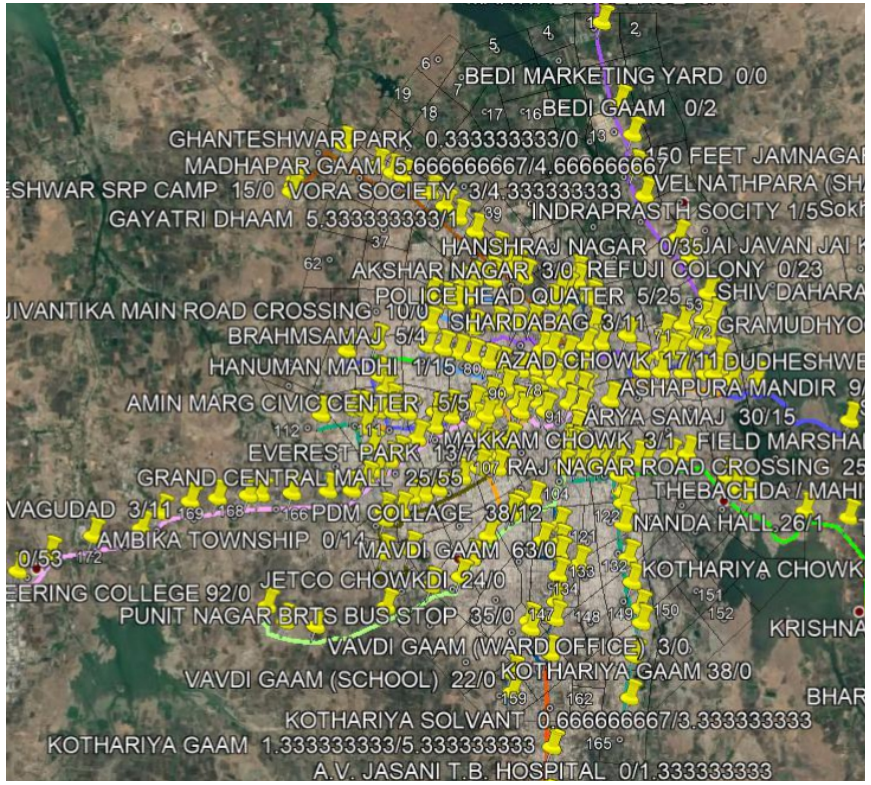
Locational Data

- *TAZ with approximately - 600m-1200m x 600m-1200m, Total zones - 193 zones*
- *O-D Other than bus – Min. data points - 0; Max. data points - 88 (zone 109)*
- *BRT O-D - at all 18 BRT stations interviewed – Minimum data points from a zone - 0, Maximum data points from a zone – 23 (from zone – 66, 81, 88, 109 and 144)*

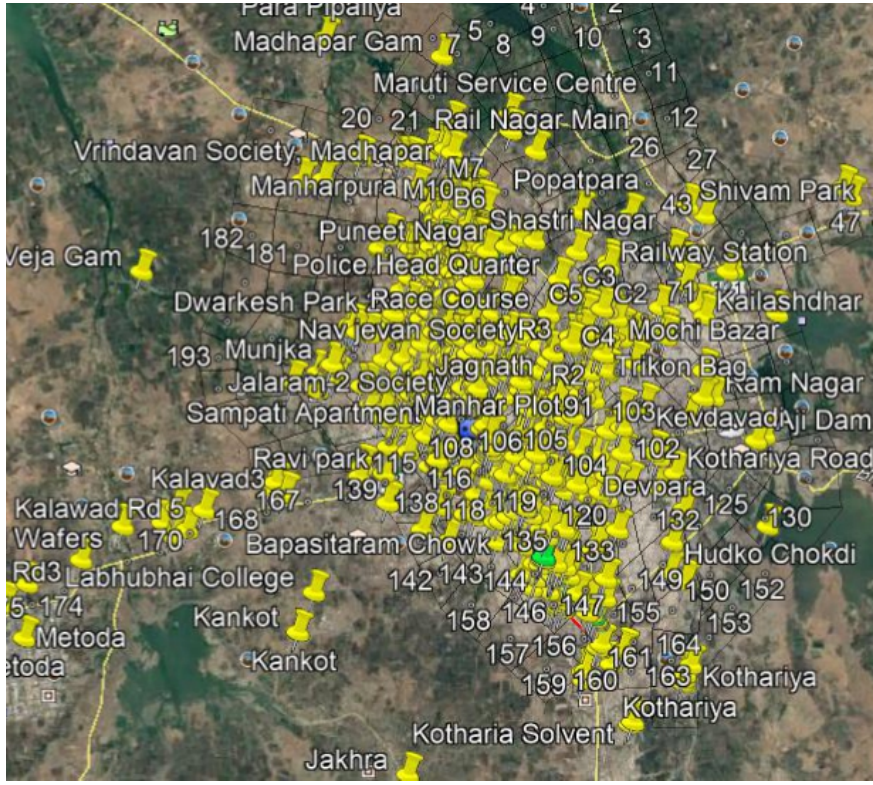
Traffic zone demarcation



RMTS Bus Stops



All other mode O-D



Analysis and Modelling

INTERMODAL SHIFT

Walk
Shared Auto
RMTS
Cycle
Auto Rick.
Car
2 Wheeler

Access Dist.
Journey Time
Journey Cost

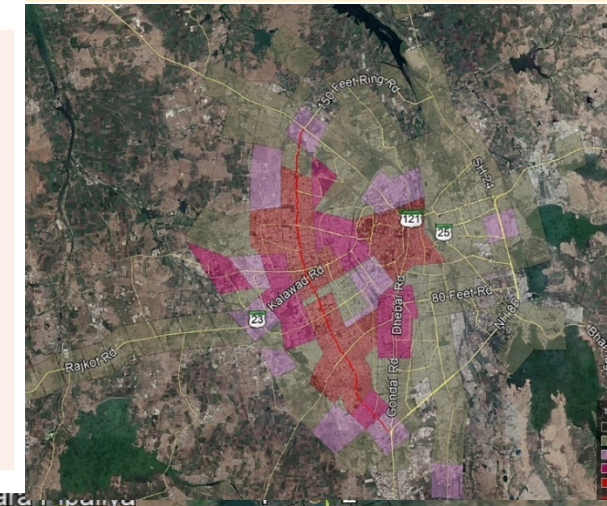
Probability of Shift

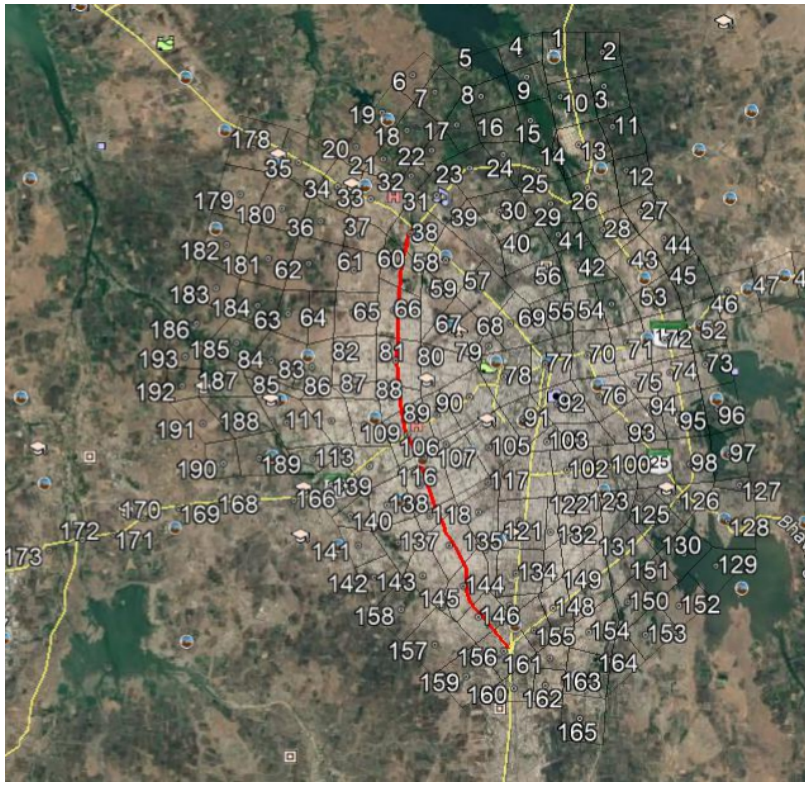
existing
- Walk
- Shared Auto
- RMTS

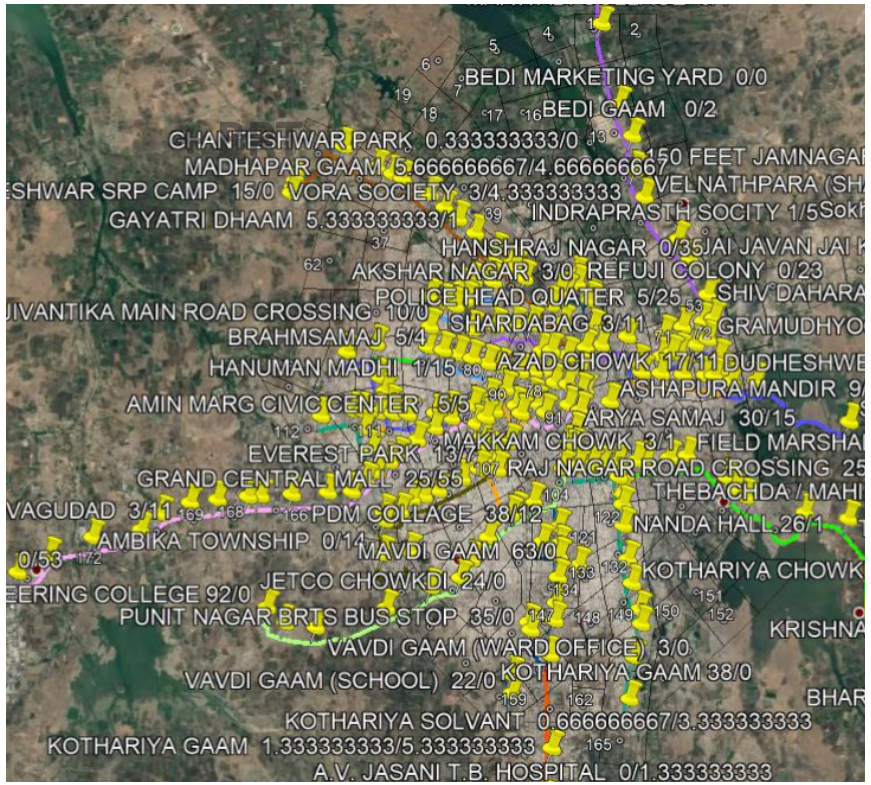
proposed
- Bicycle Sharing
- E-Rickshaw
- Hybrid BRT

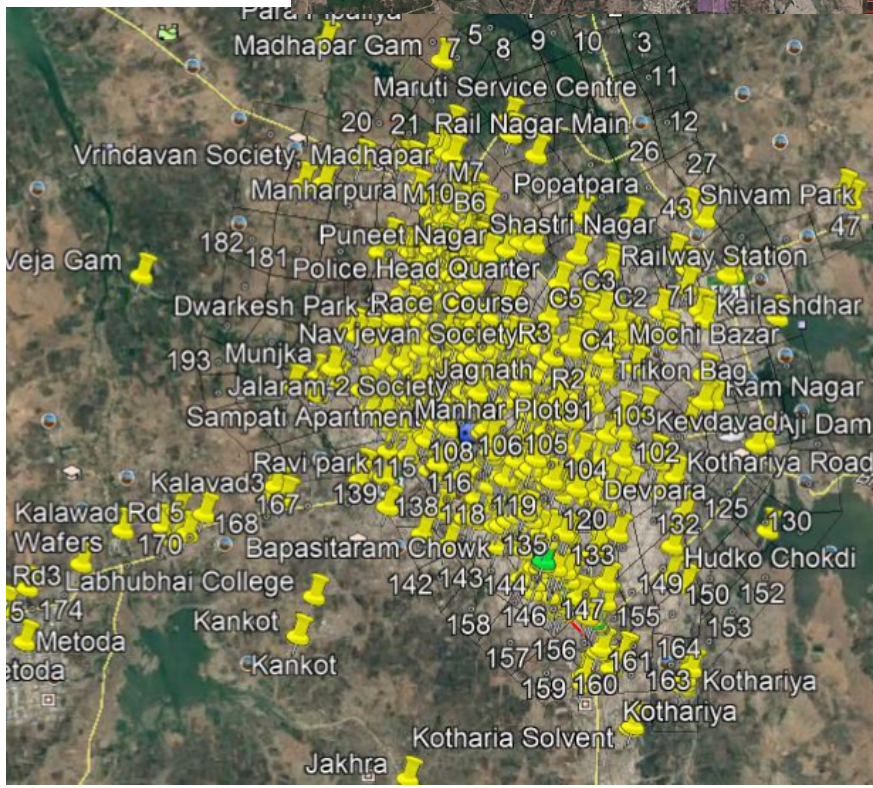
- Distance to corridor
- ROUTE - Ratio of dist. on corridor to total trip length
- Speed
- Wait time
- Access time & cost
- Interchange time & cost

Sample projected to population



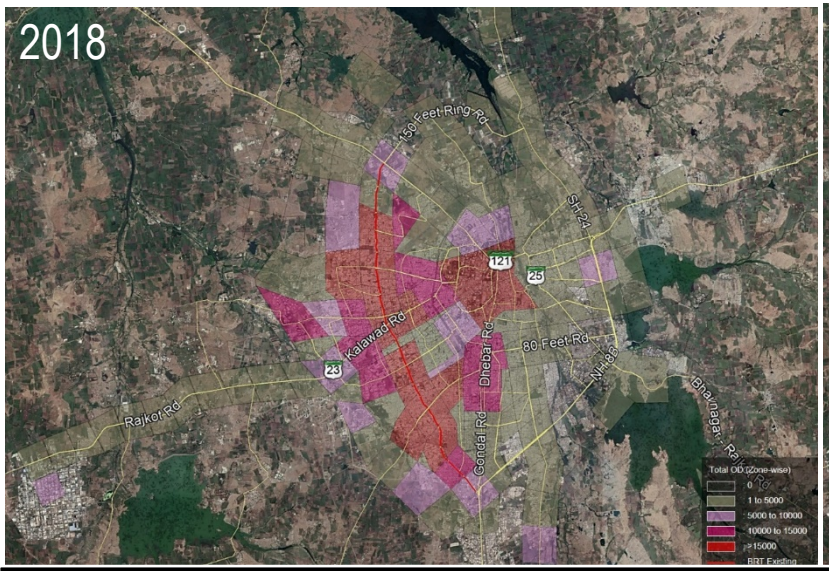


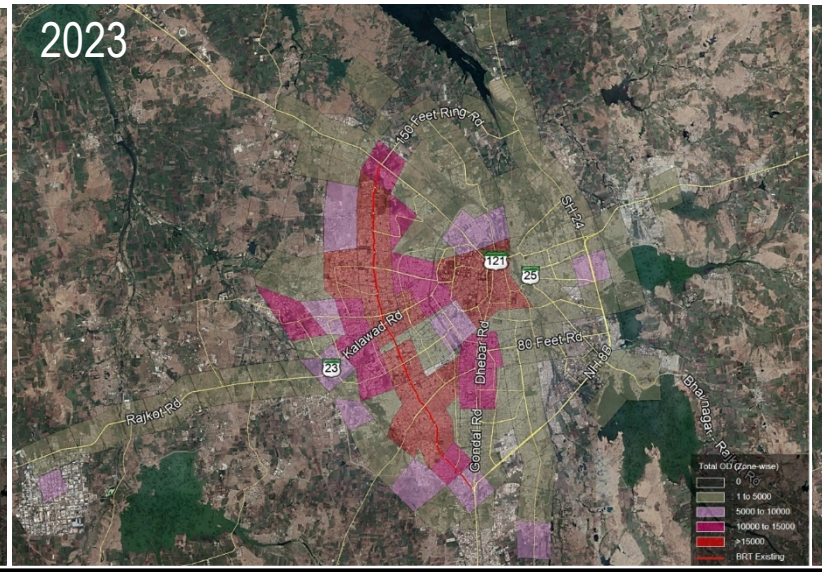


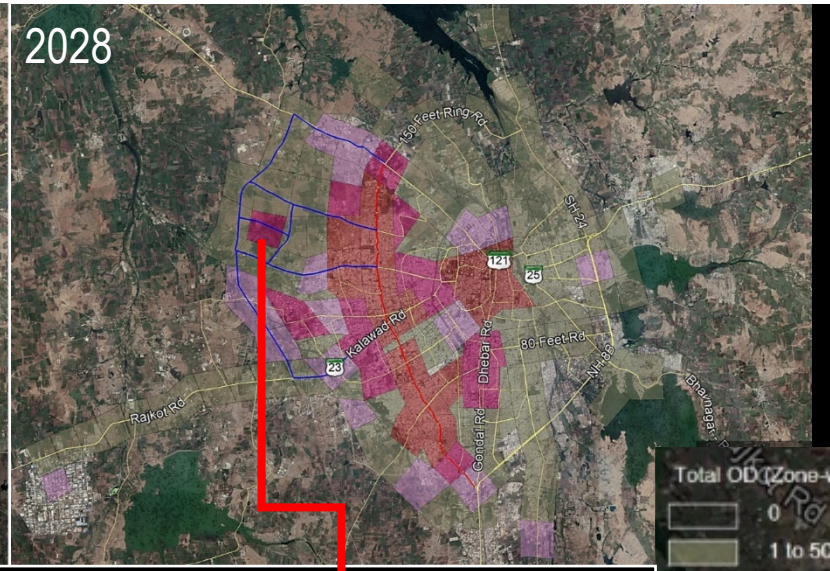


Analysis and Modelling

TEMPORAL GROWTH OF TRIPS



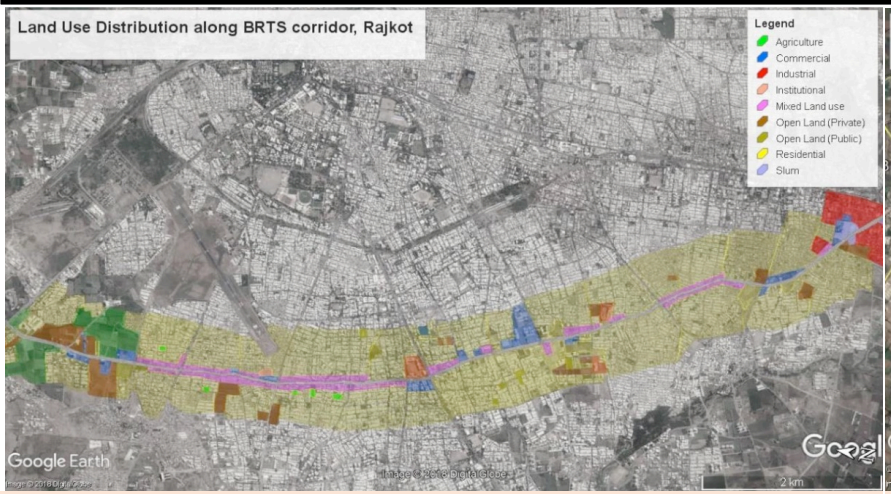




Aggregated O-D

Total OD (Zone-wise)
0
1 to 5000
5000 to 10000
10000 to 15000
>15000
BRT Existing

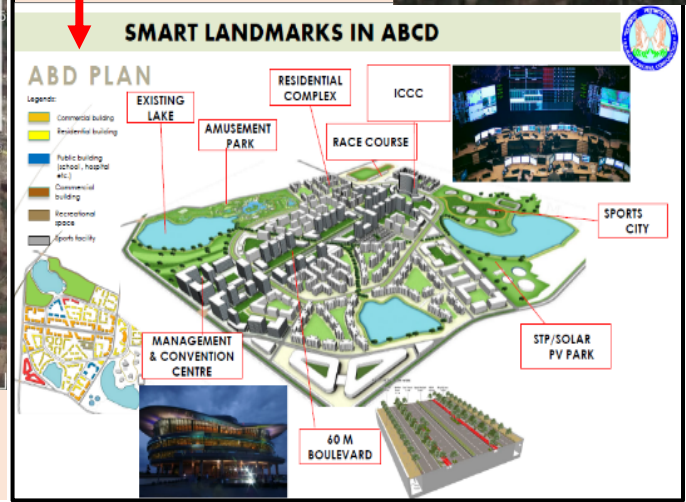
POPULATION INCREASE + GROWTH IN TRIP RATE + LANDUSE



Land use plan in 2023

Land use plan in 2028

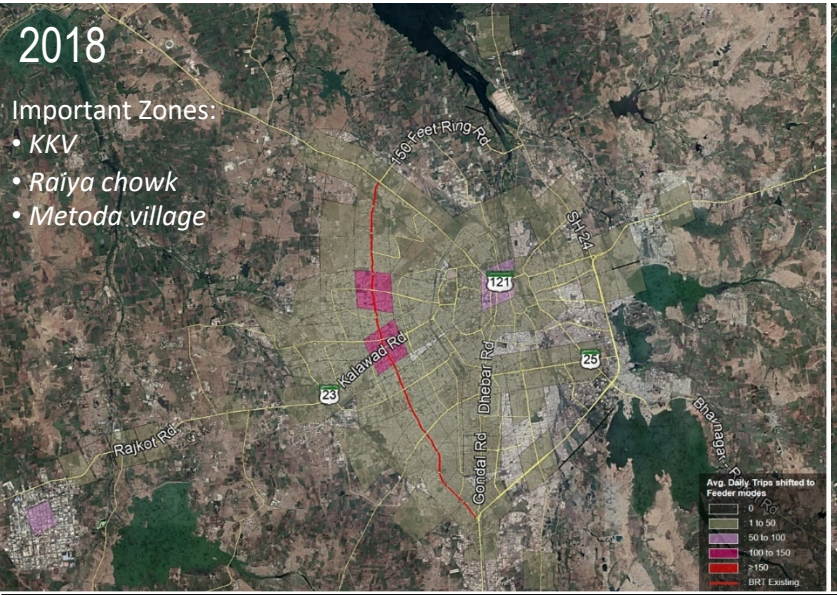
ABD Area

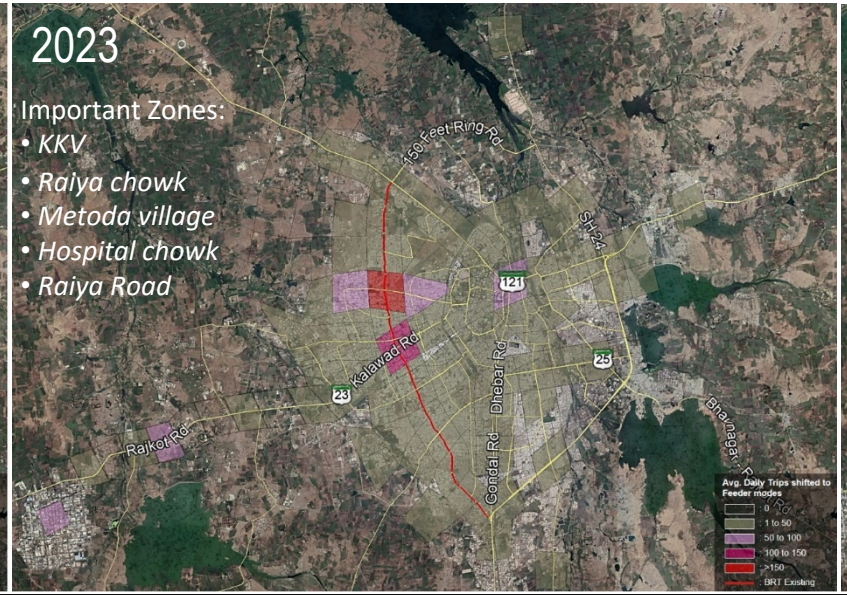


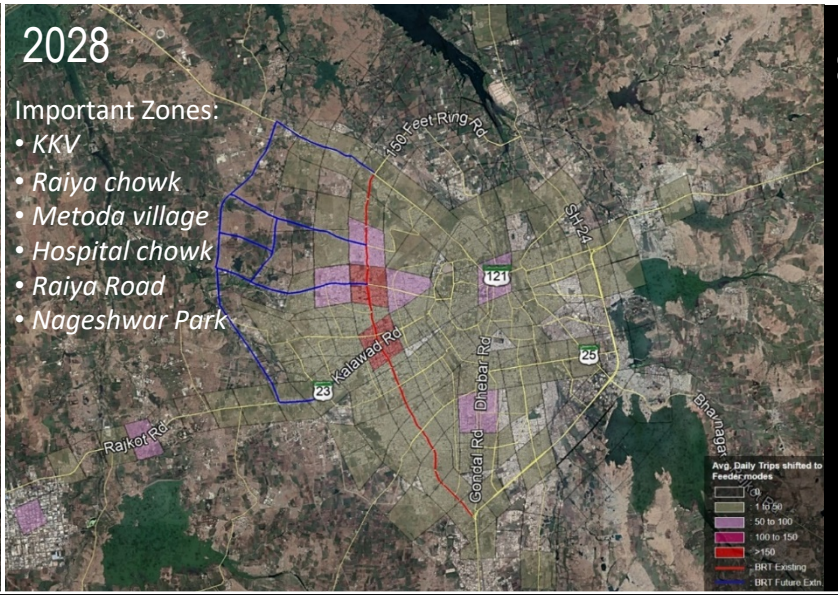
POTENTIAL SHIFT (ESTIMATES)

Mode wise Zones of Interest (Walk and Bicycle sharing)

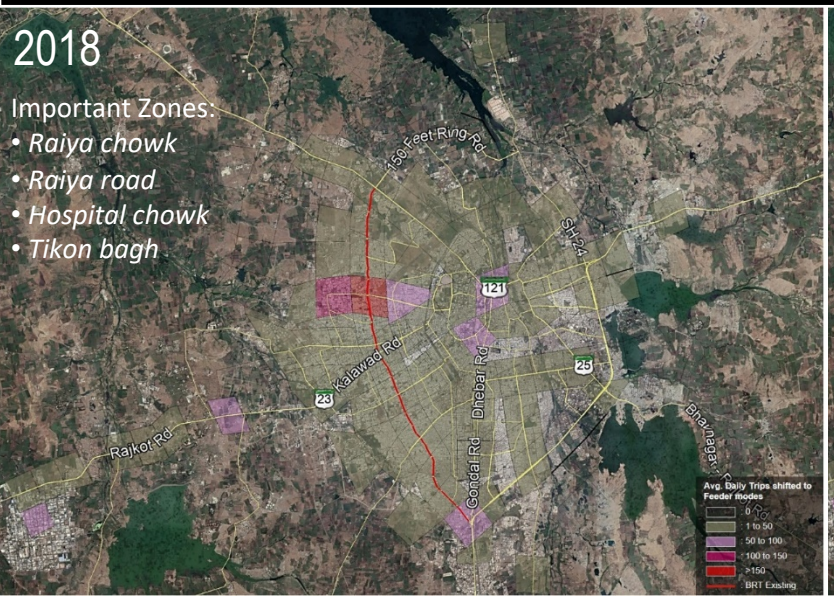
Walk

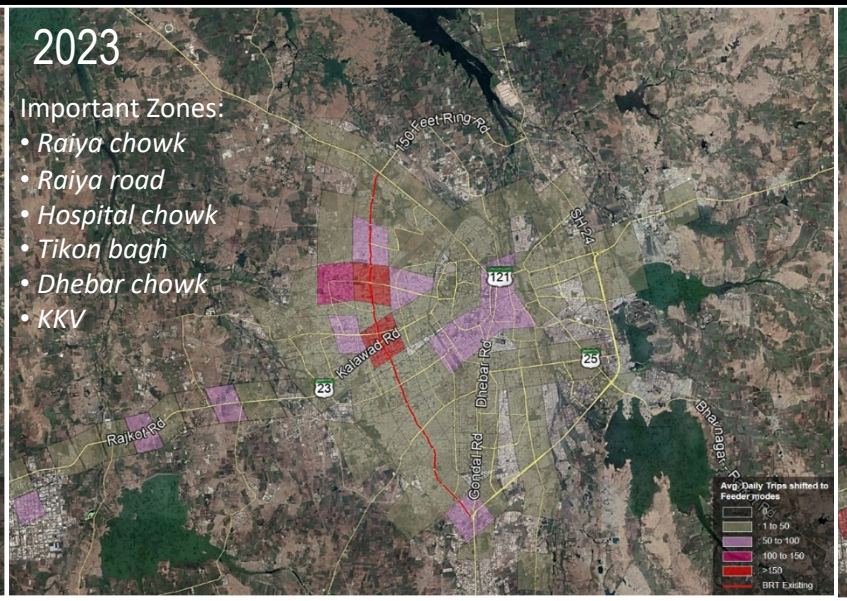


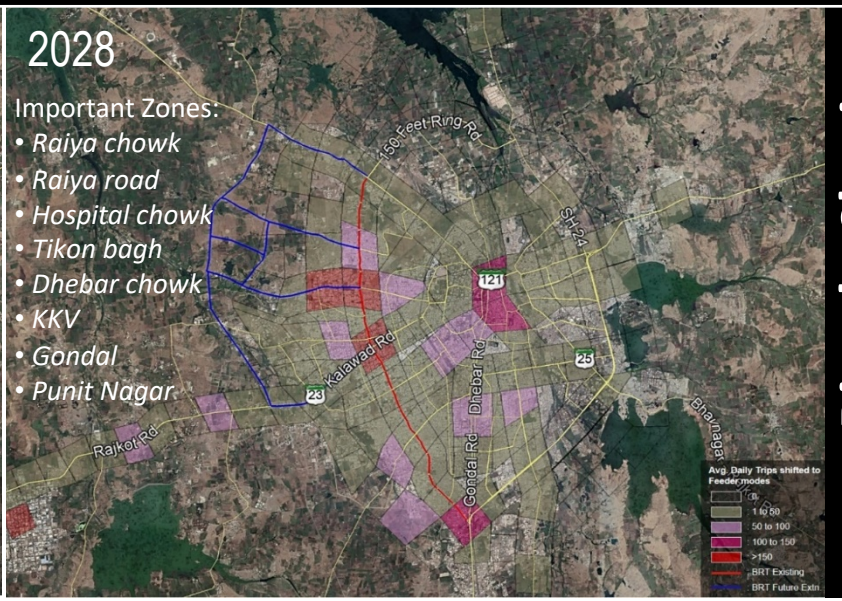




Bicycle Sharing

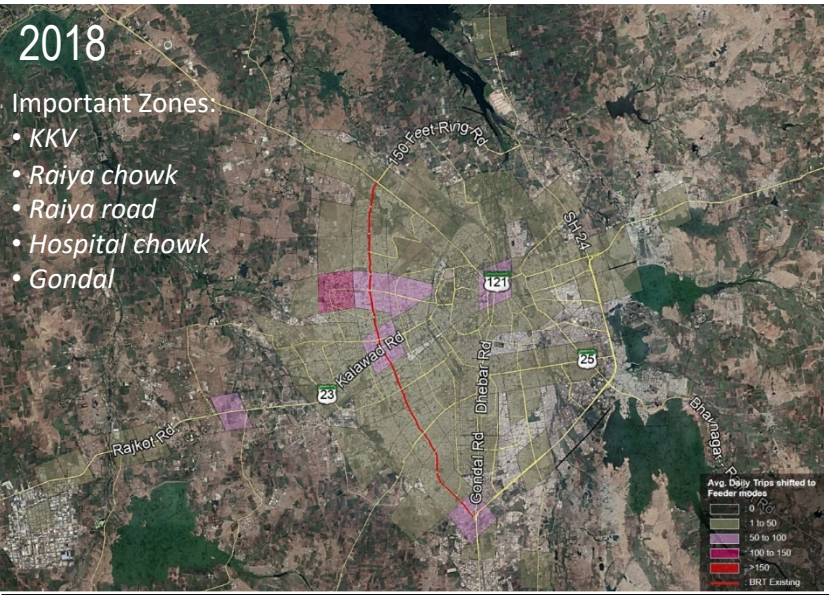


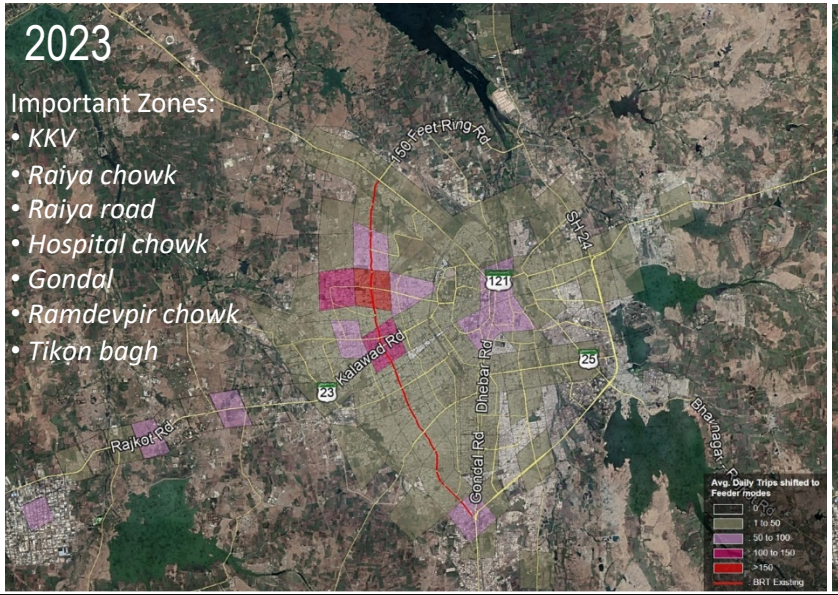


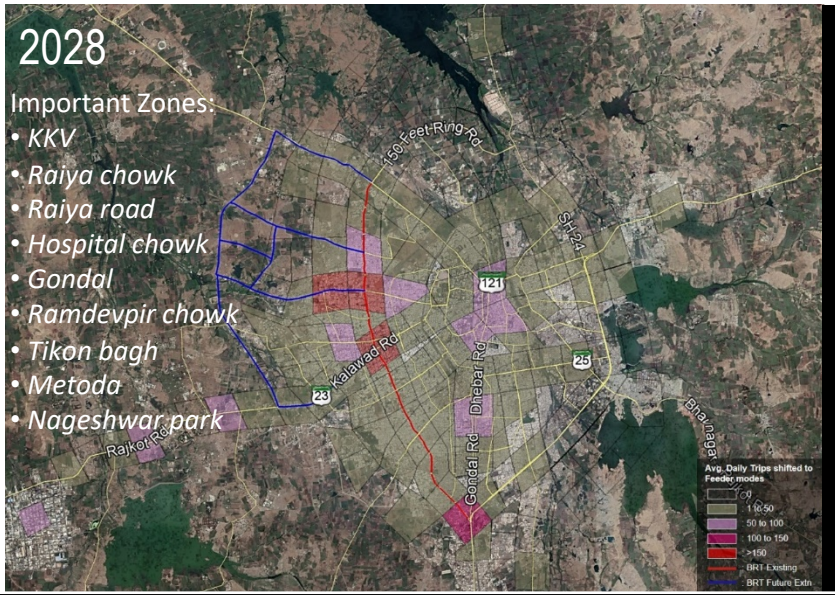


POTENTIAL SHIFT (ESTIMATES)

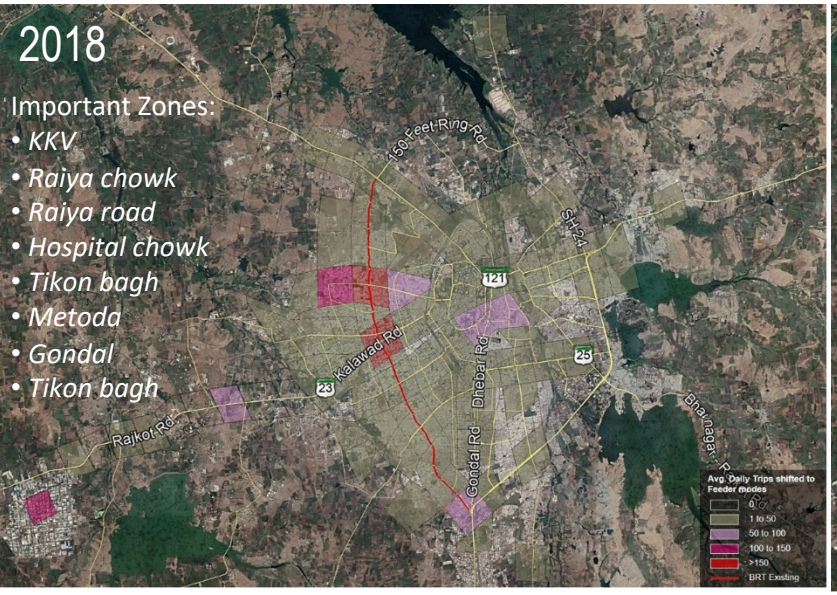
Mode wise Zones of Interest (RMTS and Hybrid)

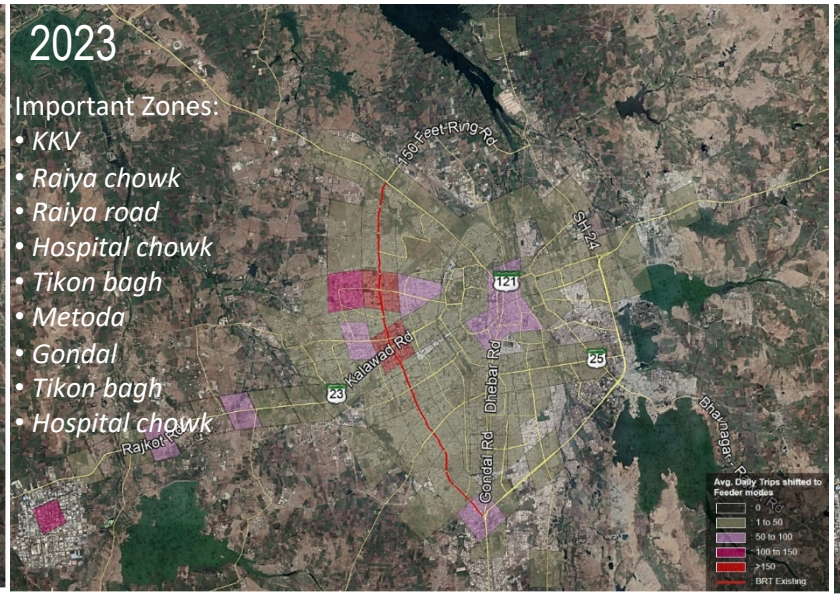


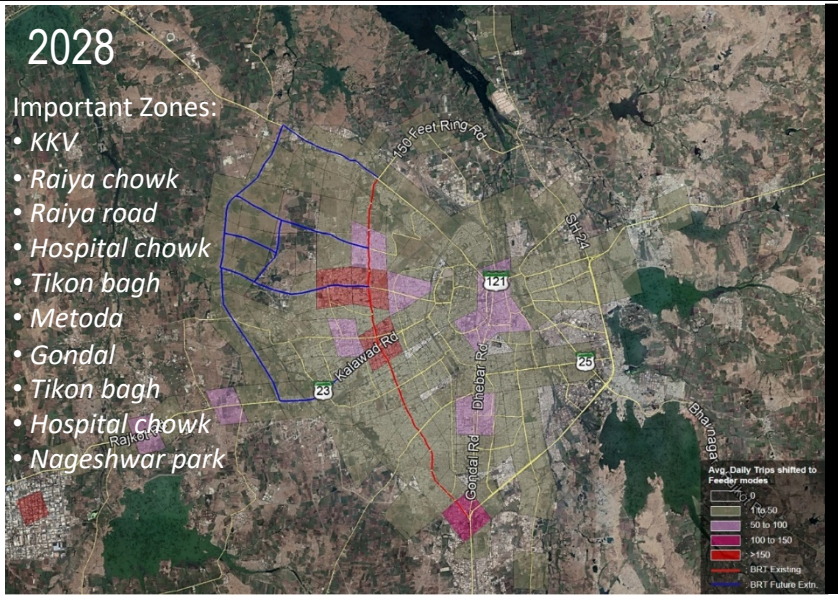




RMTS





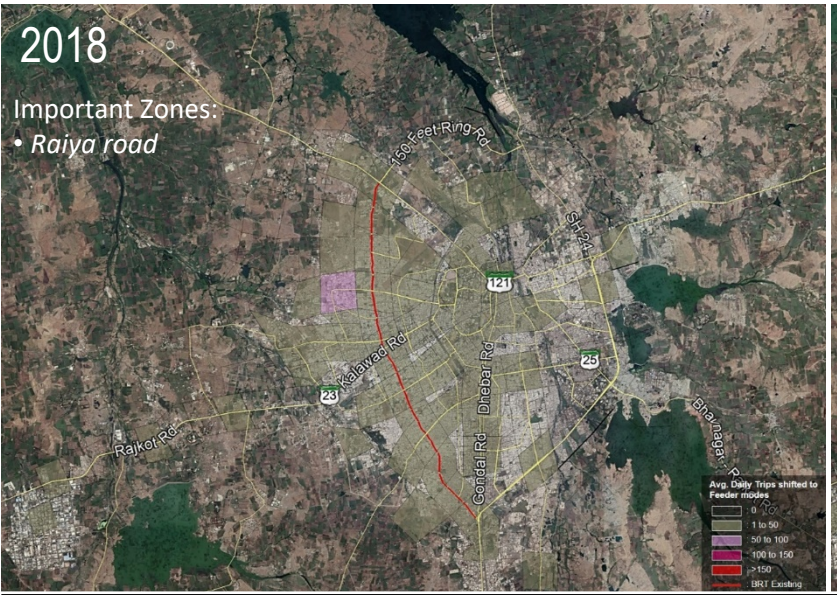


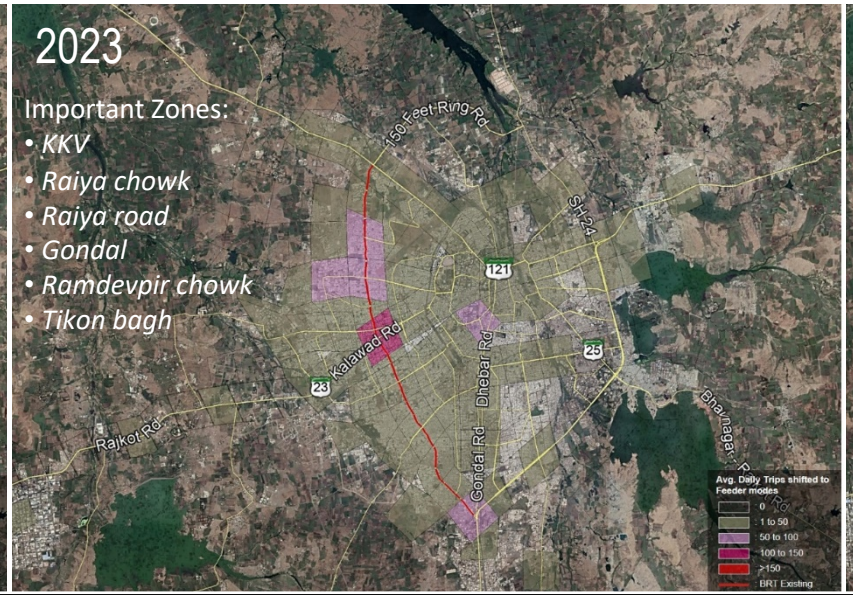
Hybrid BRTS

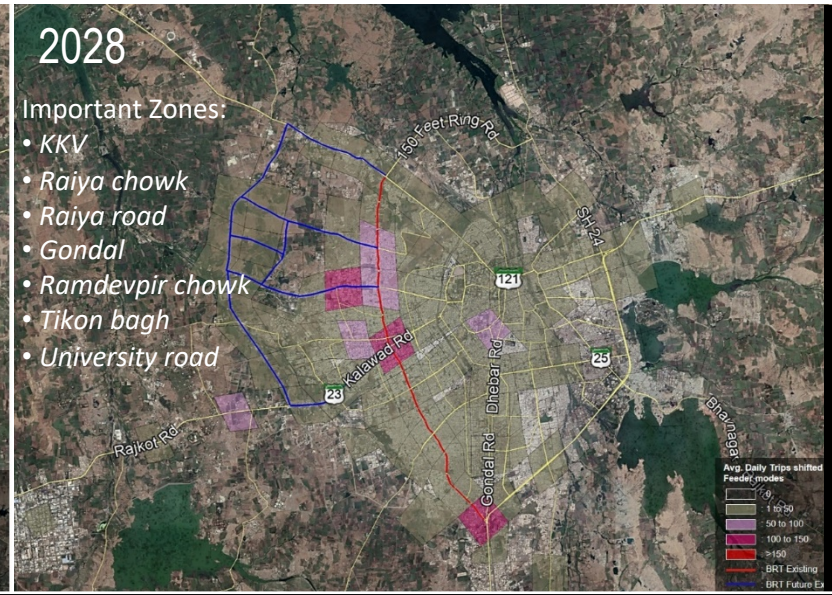
POTENTIAL SHIFT (ESTIMATES)

Mode wise Zones of Interest (Shared 3W and E-rickshaw)

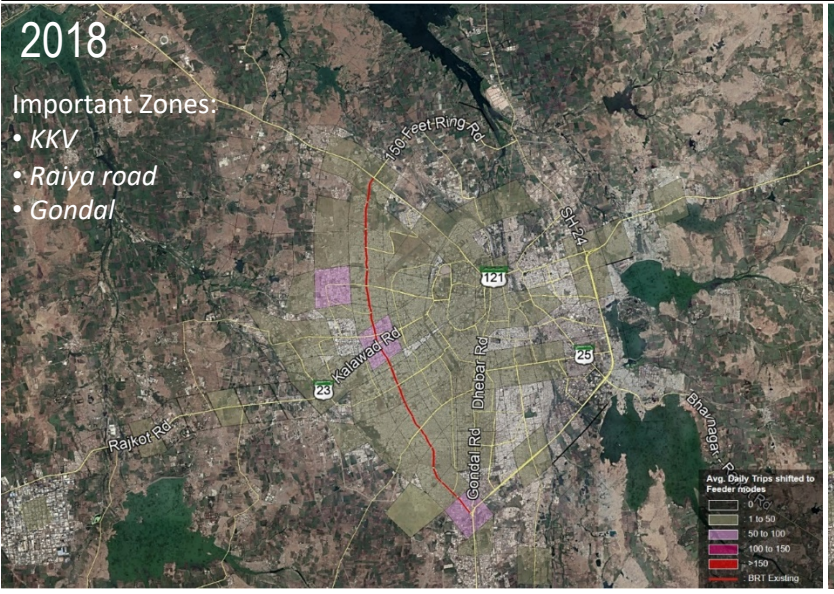
Shared 3 Wheeler

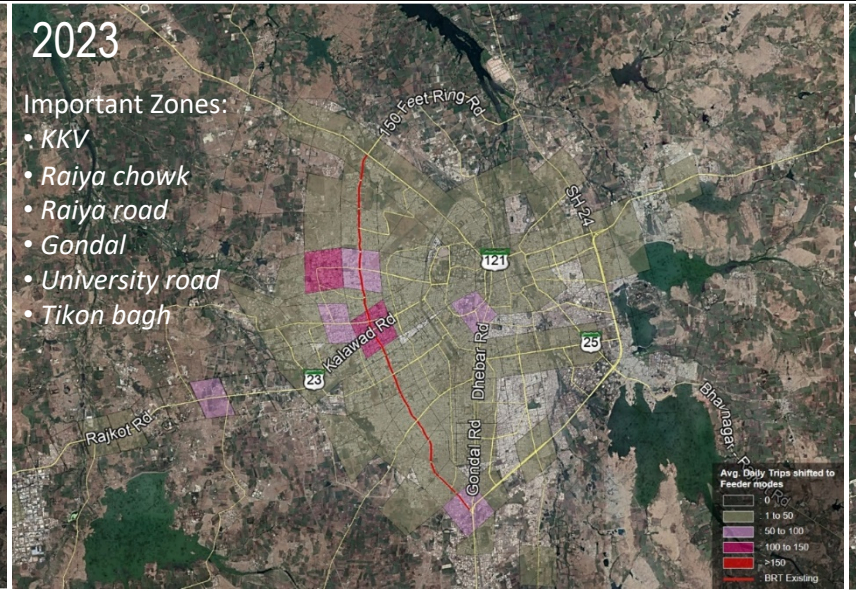


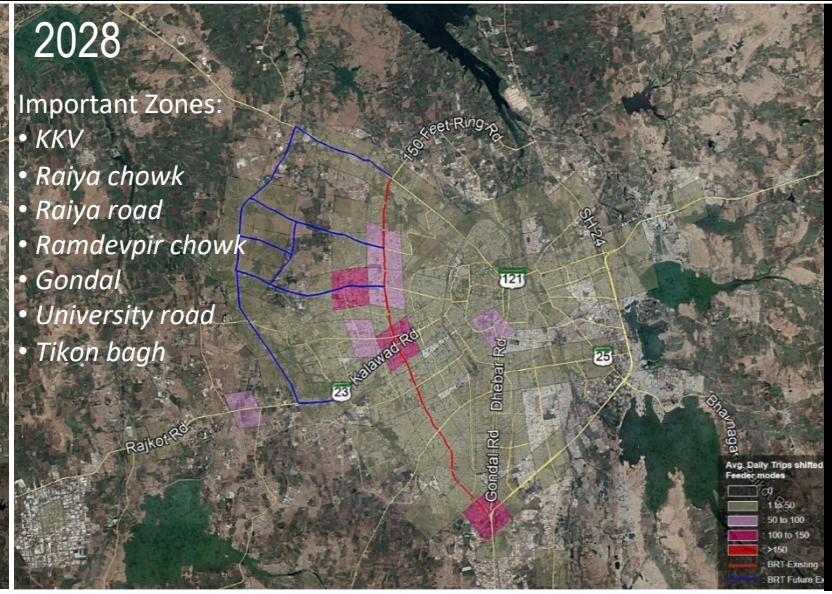




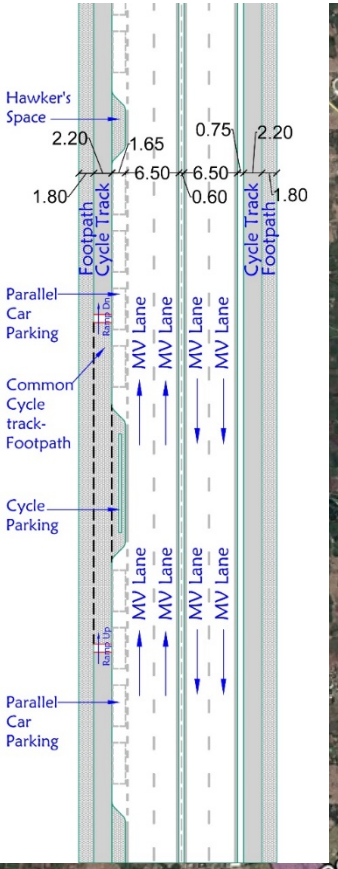
E-rickshaw



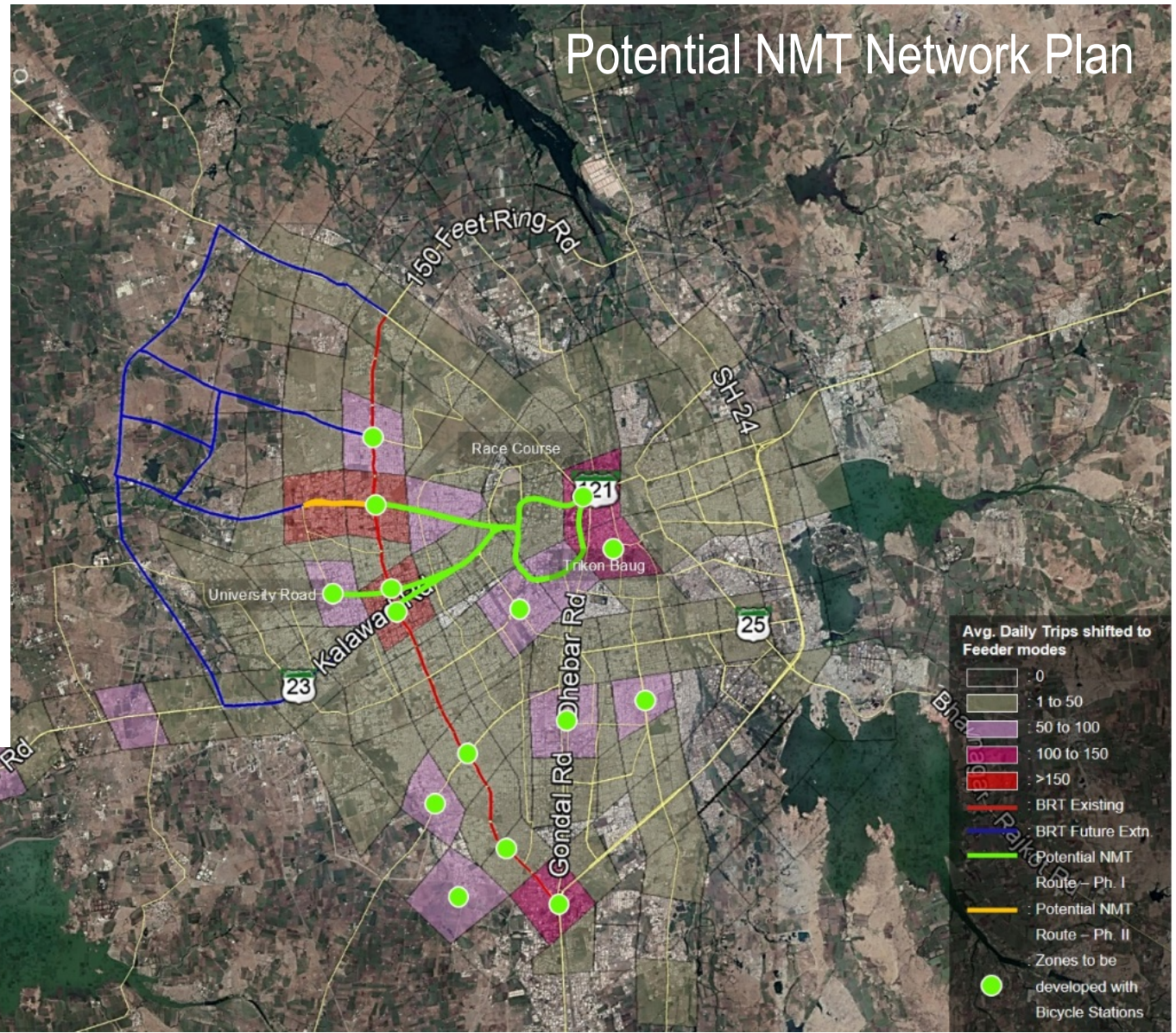




Mode wise Network Plan and Salient Features



Typical Layout plan for 24m RoW

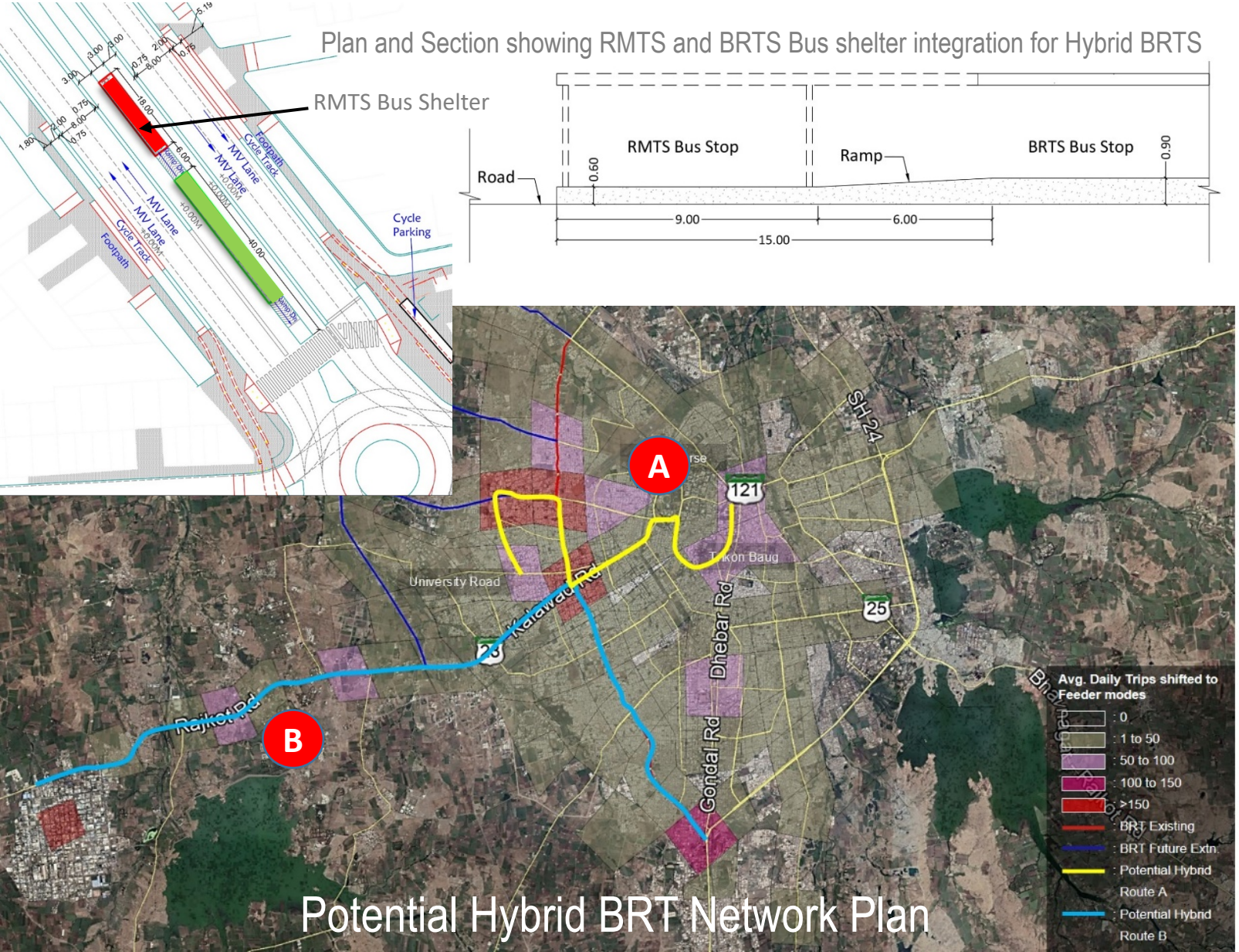


Proposal for Potential NMT Network Plan

- ***Network length*** *–* ***12 km (42km including minor streets)****.*
- ***Right of Way****: Max. –* ***30m;*** *Min. –* ***24m***
- ***Footpath width – 1.8m to 2.5m*** *(either side)*
- ***Segregated cycle track: 2.2 - 2.5m*** *(both side)*
- *Stretches having* ***space constrains –***
  - ***3 to 4m*** *wide* ***common cycle track-footpath*** *or*
  - ***1.2 to 1.5m*** *wide* ***painted cycle lanes*** *along with* ***traffic calming.***
- ***Cycle tracks*** *and* ***Bicycle sharing stations integration****.*
- *Cycles with carriers for bike sharing service*
- ***Total shift*** *to BRTS–*

year	Bicycle Sharing (daily pass. trips)	Pedestrian Infa. (daily pass. trips)
2018	781	533
2023	1176	680
2028	2260	841

Mode wise Network Plan and Salient Features



Potential Hybrid BRT Network Plan

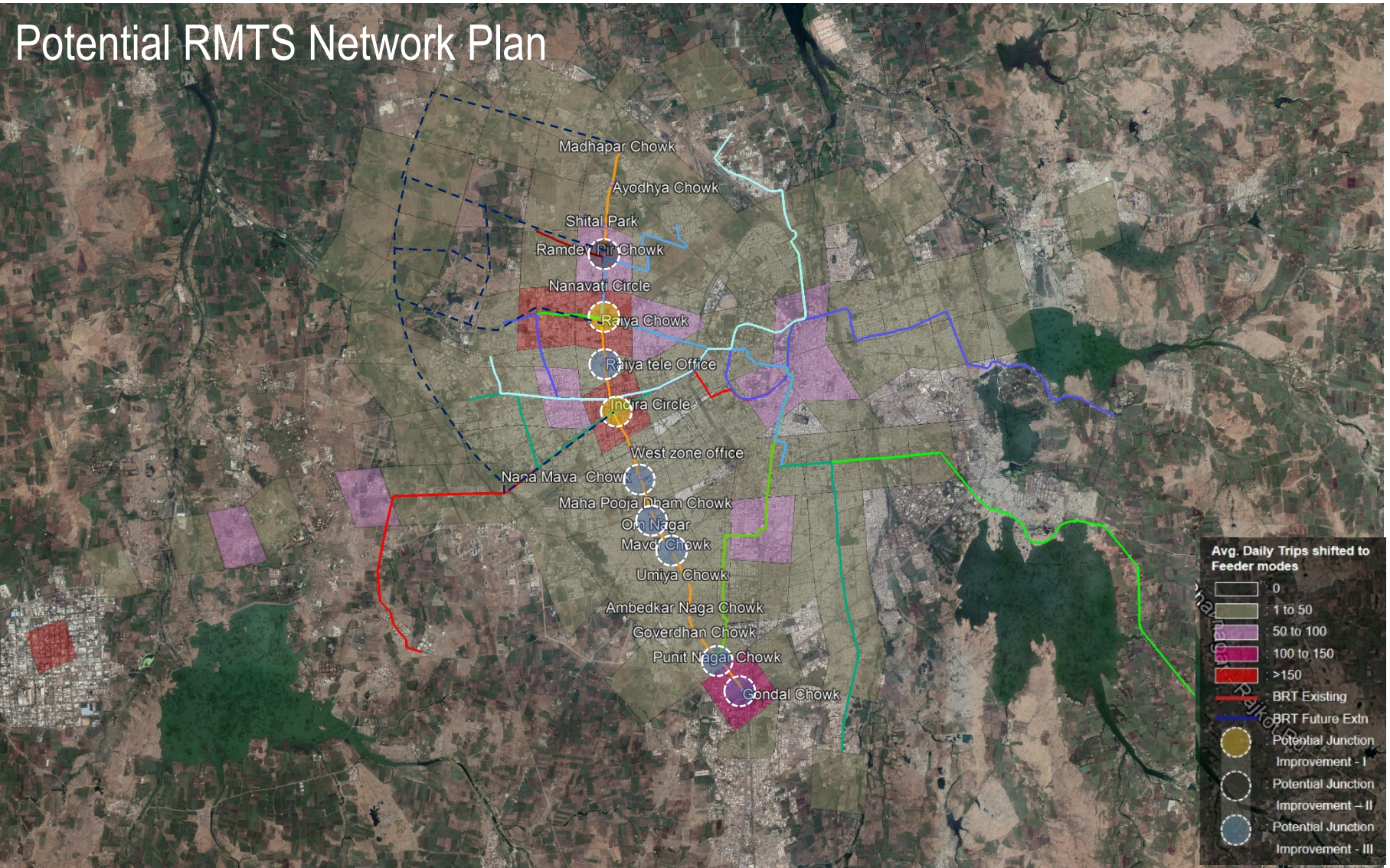
Proposal for Potential Hybrid BRT Network Plan

Two proposed routes:

		Route A	Route B
Route length		8.9 km	18 km
Expected shift: (Passenger trips)	(2018)	840 trips	504 trips
	(2023)	1082 trips	640 trips
	(2028)	1443 trips	899 trips
Avg. Operational speed			
	(2018)	18.35 km/hr	18.37 km/hr
	(2023)	17.62 km/hr	17.76 km/hr
	(2028)	17.2 km/hr	17.6 km/hr
Avg. Occupancy (%)		80%	30-45%
Headway (minutes)		13 to 22 min	24 to 29 min
EPK:	(2018)	Rs. 19.2	Rs. 7.2
	(2023)	Rs. 19.2	Rs. 8.4
	(2028)	Rs. 19.2	Rs. 10.8

Total fleet requirement: 9 (2018), 11 (2023) *and* ***14 (2028) MIDI BUSES (ELECTRIC)***

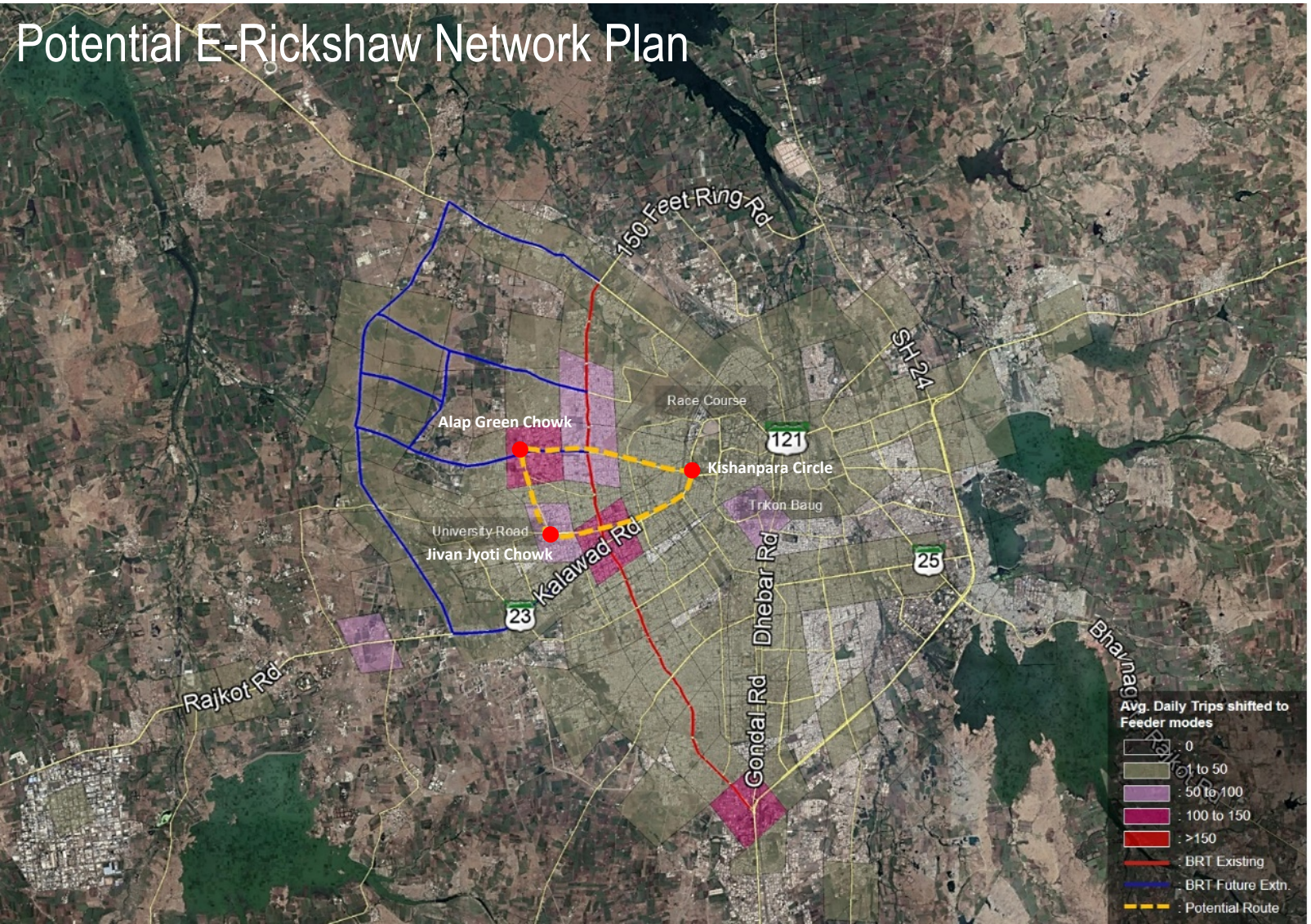
Mode wise Network Plan and Salient Features



Proposal for Potential RMTS Network Plan

- ***Total 8 routes identified*** *– 2, 5, 7, 16, 26, 27, 40 and 57 (having maximum potential to shift).*
- ***Average headway – 20 minutes.***
- ***Fleet requirement: additional 18 midi buses*** *(includes 10% reserve).*
- ***Locating RMTS bus stops within 75m of the BRTS*** *with good quality pedestrian infrastructure.*
- ***Fare integration*** *between RMTS and BRTS (2023 onwards)*
- *Redevelopment of 9 Junctions*
- *Private vehicle* ***parking regulations*** *and restrictions (for horizon year 2023 and 2028).*
- ***Total shift –***
- ***884*** *daily passenger trips* ***(2018),***
- ***1260*** *daily passenger trips* ***(2023)***
- ***1573*** *daily passenger trips* ***(2028).***

Mode wise Network Plan and Salient Features



Proposal for Potential E-rickshaw Network Plan

- *E-rickshaw **route length – 7.8 km***
- ***Average** commuter **trip length – 1.5km**.*
- ***Average occupancy – 50%** (4 seater vehicle)*
- ***Fleet utilization – 70%***

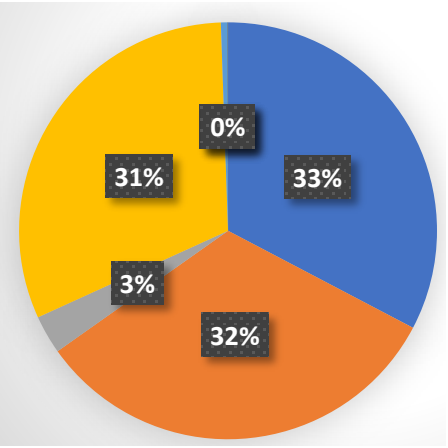
	In 2018	In 2023	In 2028
Total shift to BRTS (passenger trips)	254 trips	446 trips	552 trips
Daily trips by E-rickshaw	1270 trips	2230 trips	2760 trips
Fleet Requirement (nos.)	11	21	27
Avg. Headway (minutes)	14.7 min	8.4 min	6.8 min
Avg. Operational Speed (km/hr)	8 km/hr	7.6 km/hr	7.22 km/hr
EPK (Rs.)	Rs. 7	Rs. 7	Rs. 7

Impact on BRTS Ridership and Fleet Requirement

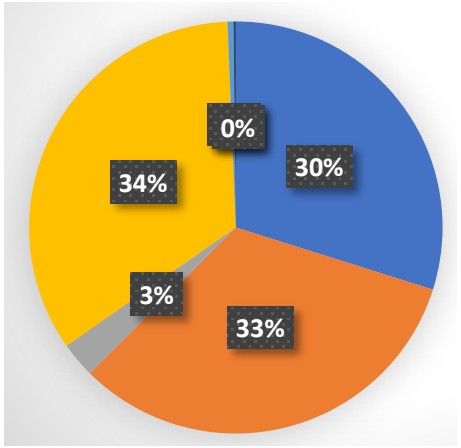
	In 2018	In 2023	In 2028
Total shift to Feeder (daily pass. trips)	3796 trips	5284 trips	7567 trips
Current BRTS corridor pass. trips	21109 trips	26175 trips	32297 trips
Total daily pass. trips (feeder + BRTS)	24905 trips	31459 trips	39864 trips
Fleet Requirement BRTS Buses (nos.)	13	16	21
Avg. Headway (minutes)	6.7 min	5.3 min	4.2 min

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 Passenger trips shift	3796	5284	7567
Current BRTS corridor Pass. trips	21109	26175	32297
TOTAL Including feeder Pass. trips	24905	31459	39864

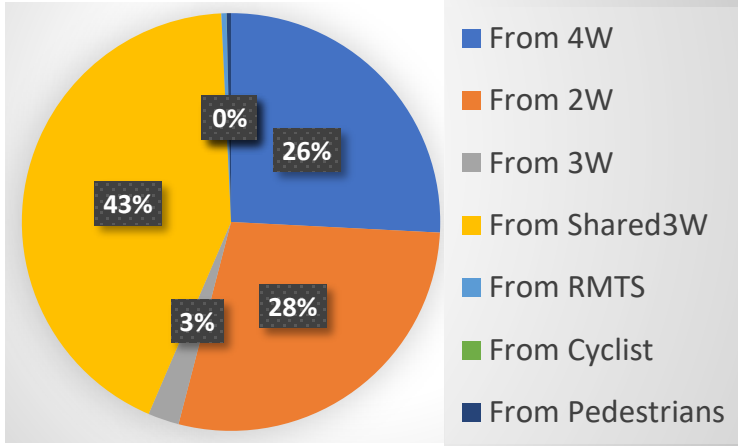
Expected Trip shift in 2018



Expected Trip shift in 2023



Expected Trip shift in 2028



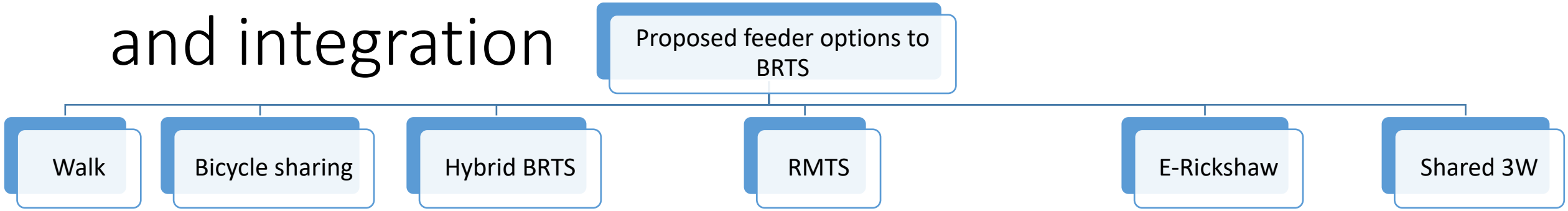
- ❑ *Maximum trips expected to shift from – Shared 3W (in all 3 years)*
- ❑ *Least shift from – RMTS, Pedestrians and Cyclists (in all 3 years)*

- ***Headway** expected to **reduce further – introduction of hybrid BRTS fleet**.*
- ***No change** in **average EPK** – as no change in fare, occupancy or commuter trip length.*
- ***Average per km subsidy** – expected to **remain unchanged**.*
- ***Potential** in exploring **12m long e-buses** in BRT (proposed) fleet*

Feeder Demand – Other Key Findings

- Passenger Trips in the city (million): 2018 2.3 → 2023 2.8 → 2028 3.2
- Passenger Trips crossing BRT (million): 2018 0.8 *(34.5%)* → 2023 1.0 *(36.1%)* → 2028 1.4 *(41.1%)*
- Potential shift (Passenger trips): 2018 7400 *(0.32%)* → 2023 10900 *(0.39%)* → 2028 16000 *(0.48%)*
- Planned shift (Passenger trips): 2018 3800 *(0.17%)* → 2023 5300 *(0.19%)* → 2028 7600 *(0.23%)*
- % of Passenger trips added to BRT: 2018 18.0% → 2023 20.2% → 2028 23.4%
- Total shift to feeder: 2018 32700 *(1.4%)* → 2023 46700 *(1.7%)* → 2028 65300 *(2.0%)*
- % of feeder (Passenger) trips shifted to BRT: 2018 11.6% → 2023 11.3% → 2028 11.6% (2% to 40%)

Financing feeder infrastructure development and integration



Walk and Cycle Feeder –

- ***Estimated cost for only 12 km major streets – 60 Crore***
- ***Estimated cost*** *for 42 km including minor road network development –* ***Rs 130 to 148 crores (@0.6 to 6 crore per km)***
- *Two possible financing mechanisms:*

❑ ***Sale of additional FAR***

❑ ***Increase in property tax***

Hybrid BRTS –

- ***Subsidy required*** *– cost of* ***Rs. 20 to 23/km****.*
- *Operations of routes –* ***Private operator with concession agreement***

RMTS services –

- ***Integrating RMTS and RRL***
- ***Aggregating routes*** *in to a* ***single larger contract*** *(In long term planning).*
- *Shift to hybrid or electric buses –* ***reduce the CPK****.*
- ***Cost*** *of developing* ***junctions – 50 lakh to 1.0 crore****.*
- *Introducing* ***Corporates and public sector undertaking –*** *for* ***maintenance of the junctions***

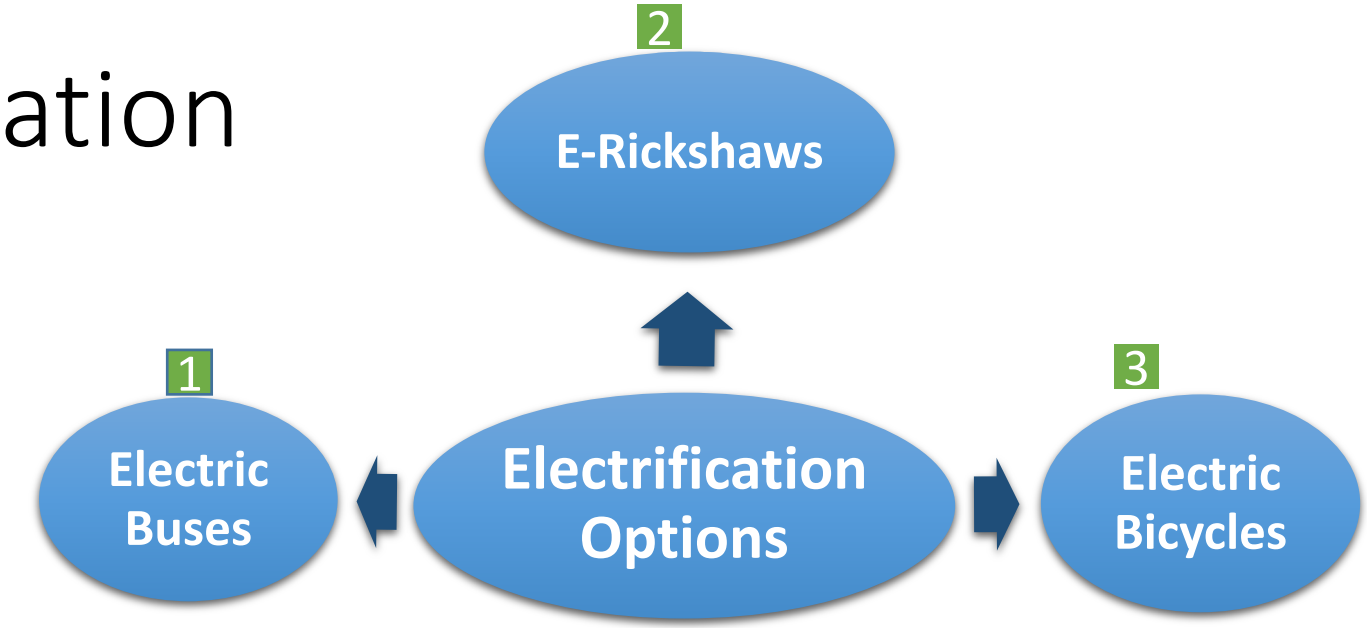
E-rickshaw –

- ***No finance required*** *from government.*
- *Provide land for* ***charging stations*** *with* ***subsidized electricity and parking*** *required from government.*

Shared 3W –

- ***No significant potential***

Electrification Plan



Electric BRTS/City Buses	E-rickshaws	Electric Bicycles
• ***Electrification of BRT*** *corridor and* ***City Bus Service*** *is feasible – Combination of fast and slow charging (end of trip and overnight) can help reduce cost* • ***Multiple synergetic effects*** *in collaboration of electrifying the BRT corridor and city buses, such as:* - *Shared use of* ***charging infrastructure*** - *Shared use of* ***bus maintenance*** - *Joint procurement -* ***less expensive costs per unit***	• *Electrification of rickshaws promoted by* ***providing parking & charging infrastructure closer to BRT stops*** *and main attraction points* • ***Flat topography*** *– added advantage* • *"Bharat EV standards" recommends- prioritize* ***AC charging stations*** *in short term –* ***beneficial scheme for low power requirement of e-rickshaws***	• ***e-bike: bicycle with integrated electric motor*** • *e-bike(rechargeable batteries)speed-* ***25 km/h (slow e-bikes) to 45 km/h (fast e-bikes).*** • ***e-bikes integration*** *with* ***bike sharing system*** *is reasonable for :* - ***stations*** *having* ***commuters around 5 - 15km away*** *from the station and* - ***where PT or IPT service not available*** • *Existence of* ***safe and attractive bike routes*** *is a* ***prerequisite***

Electric Bus specifications (BRT)

S.No	Parameter	Description	Value
1	Measure	Length Width Height Door width Seats (passengers + driver) Capacity Height (from ground)	12m 2.55m 3.5m 1.2m 32+1 70 pax 1.2m
2	Performance	Max. speed Reverse speed Deceleration **Autonomy (min.)**	70km/h 5km/h $5m/s^2$ 200km(without fast charge)100km with
3	Electric Motor	Model	Central/hub
4	Electric System Energy	Battery type Capacity Power consumption Lifetime Load capacity (after 5 years) **Fast charge (+ autonomy 17-20km per charge)** **Slow charging (full)**	Lithium 70kWh 1.5kWh/km 5years 8% 5-10min 6h

Electric Bus specifications (BRT)

S.No	Parameter	Description	Value
5	Guarantee	Warranty Electric bus warranty Tires Use without overhaul	15years 500,000km or 5 years 1,20,000km 8years

Charging Station specifications

1	Technical Features	Frequency Power (Fast) Power (Standard) Number of protected poles (Fast) Number of protected poles (Standard) Type (by location) Installation	50hz 40/22kW 22/7.4kW 1 P+N 3 P+N Outdoor/Indoor On ground
2	Dimensions	Exterior dimensions Weight (Maximum)	1500x330x200 45 kg
3	Environmental Conditions	Operating temperature Storage temperature Relative humidity Maximum altitude	- 25 to + 50c - 40c to + 80c < 95% 2000m
4	Guarantee (Warranty)	Disclaimer of warranty	24months

Next Steps

Out of six feeder modes evaluated, five have potential to attract trips in favor of BRT.

Expected shift after integration will result in additional trips on BRT Network:

- *3800 daily Passenger trips (in 2018),*
- *5300 daily Passenger trips (in 2023) and*
- *7600 daily Passenger trips (in 2028).*

***In order to achieve this** the following next steps need to be planned and undertaken:*

1. ***Use of E-rickshaw** - a ring corridor linking University & Raiya road – 11 e-rickshaw to be inducted in the first phase, along with adequate charging infrastructure.*
2. ***Eight RMTS routes - high potential to serve as feeder to BRT and carry additional passengers** – 18 midi diesel buses may be inducted on these routes to reduce the headway to 20 minutes.*
3. ***BRT Routes** - Additional buses to be inducted to cater to Trunk BRT and two proposed hybrid/mix BRTS routes (2018) - **5 electric standard buses (currently under process) and 6 electric midi buses with possible:***
   - ***fast charging stations at one or both terminating ends** of each route/corridor.*
   - ***standard chargers 50%** (of total fleet of buses) - **overnight charging** at the depots*

Next Steps (contd.)

4. ***Redevelopment of intersections on BRT corridor*** *– along with at least 100m length of the cross roads*
5. ***Bicycle sharing plans*** *– Raiya Road, University Road, Kalawad Road and the core area around Moti Tanki Chowk*
6. ***High quality pedestrian and cyclist infrastructure*** *(core area of Moti Tanki Chowk, Raiya Road, University Road and Portions of Kalawad Road)*
7. *Initiate development of* ***parking policy*** *& its enforcement plan*
8. *As a long term strategy,* ***development of road map towards integration of RRL and RMTS*** *as an overarching regulator of all public mode of urban transport – including integrated fare and scheduling.*

Thank you