MODE CHOICES

Creating Alternative Mobility Options for Private Mode to Public Transport Mode A Case of Gandhinagar

10TH UMI Conference, 2017

Need for Study

Gandhinagar being a planned city has good infrastructure facilities but lacks good public transport facility

Increase in private transport dependency create congestion, safety issues and adverse impact on environment

Hence it is important to understand the transport dynamics of the city, to change the mode choice of people from private to public mode of transportation

Aim

To Propose Feasible Public Transportation Network Which Provide Alternative Mobility Option For Private Mode Of Transport Users.

Objectives

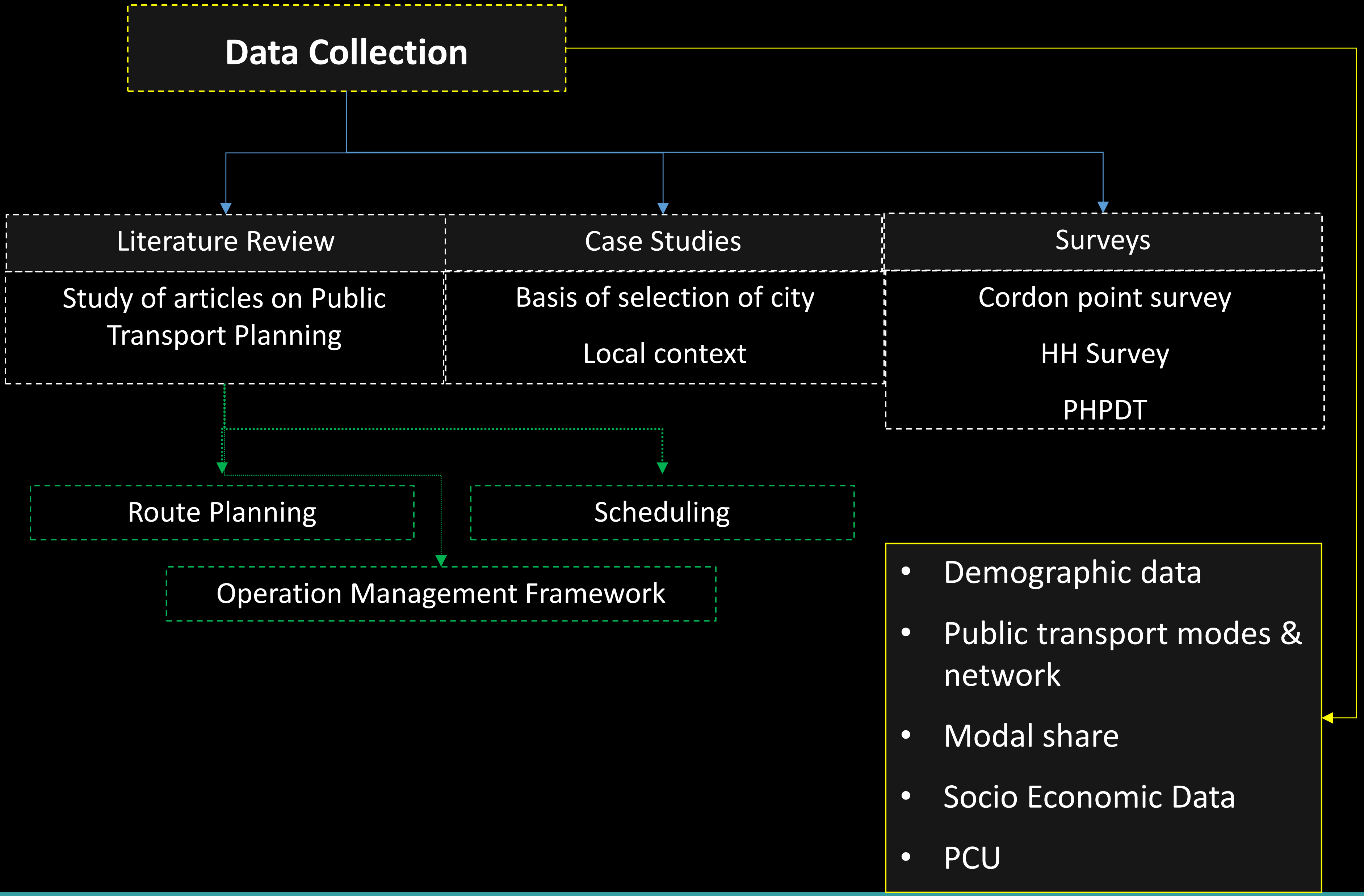
- To understand the transport dynamics of the city.
- To develop public transportation network within city.
- To propose institutional framework for operation and management of public transport system.

Scope & Limitation

The scope of the study is limited to the GMC area and does not cover the entire GUDA area.

Research Design

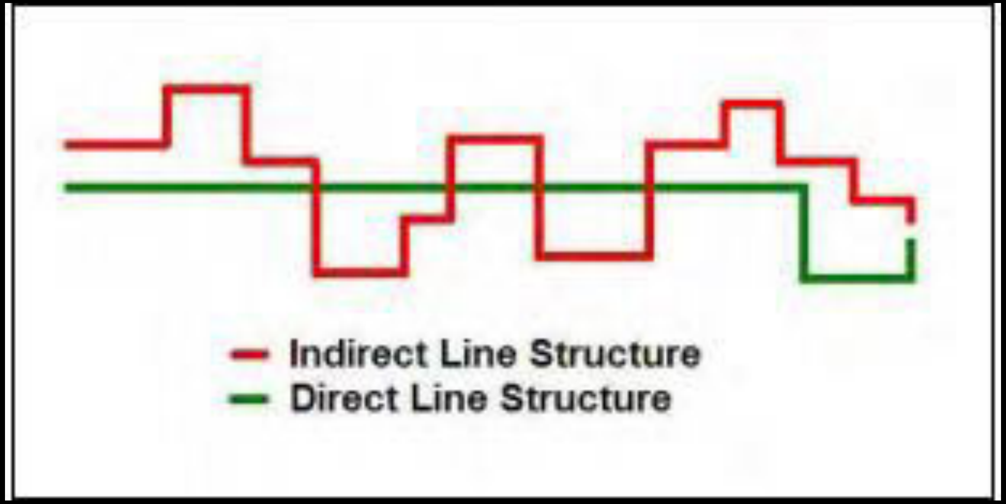
Methodology



* GIS: Geographic Information System, PHPDT: Peak Hour Peak Direction Traffic

- **Design principles for the public transport network effect**
  - Simple and direct network structures
  - Plan a hierarchy of lines into a network
  - Plan for speed, consistency and reliability
  - Coordinate convenient transfers
  - Provide clear, ubiquitous and consistent information and marking

- **Route Planning Service Type**
  - Trunk-Feeder Services
  - Direct Services



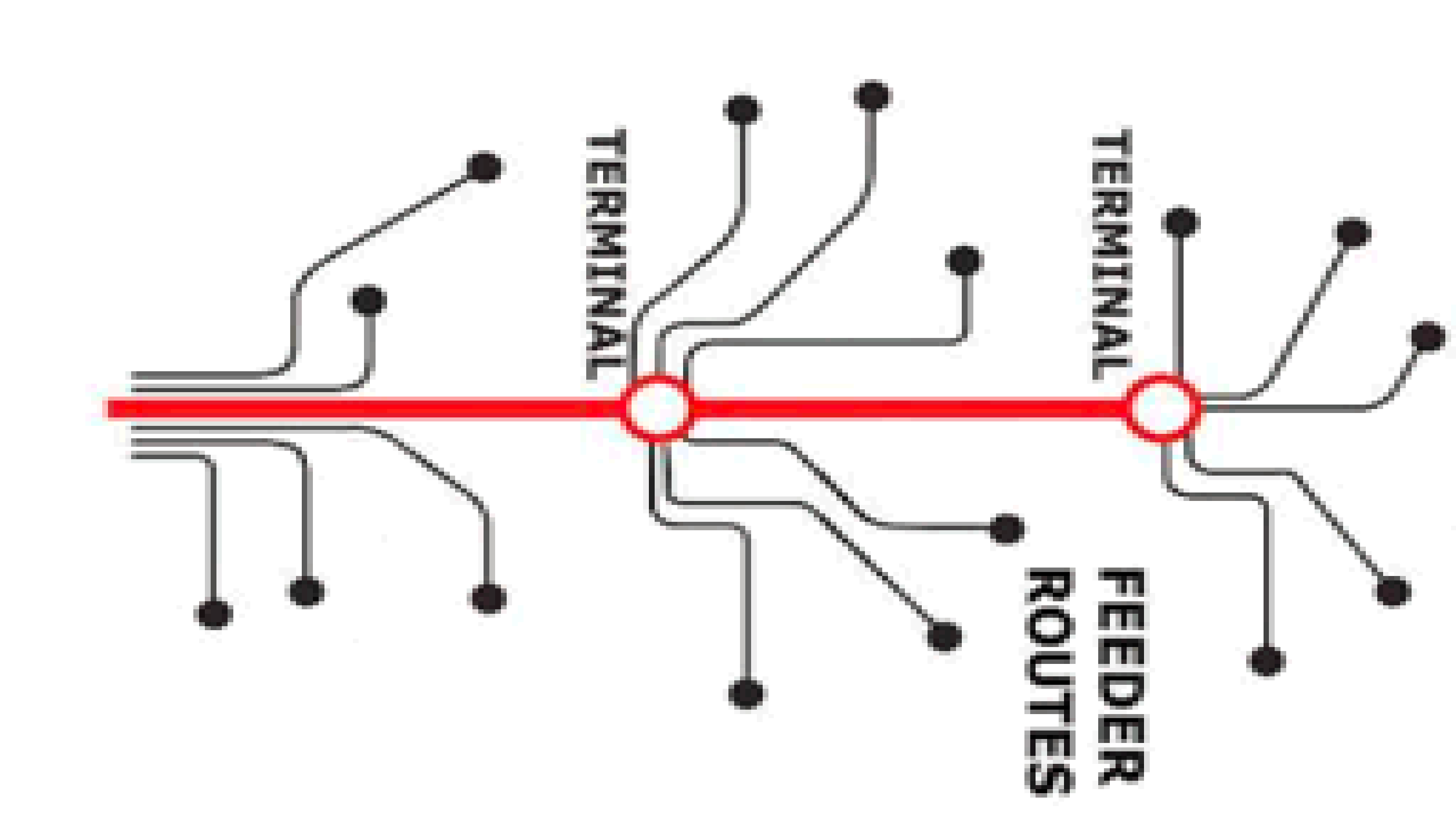
Direct and indirect line structures

Literature Review

Source: Adapted from Mees (2000)

▪ Trunk-feeder services

- Larger vehicles in high density corridors; smaller vehicles in low density corridors feed them (Bogota, Pereira)
- Transfer required

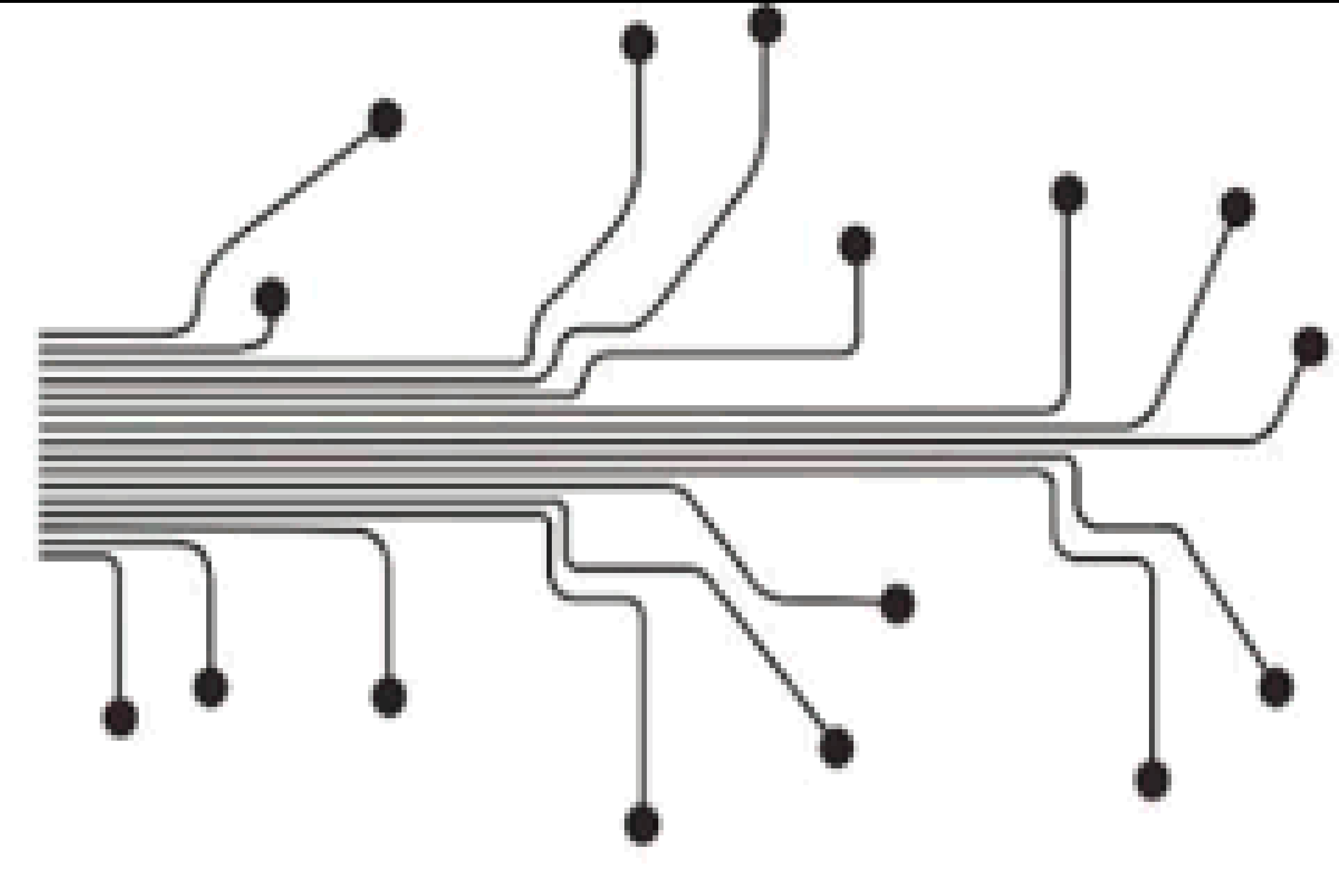


Literature Review

- **Advantages**
  - Ability to closely match supply and demand
  - Increases the number of passengers per vehicle (load factor)
  - Feeder buses are smaller and cheaper to procure
  - Usually accompanied by bus sector reform (concessions, contracting and operational control)

- **Disadvantages**
  - Requirement of transfer
    - Customers with baggage, children find transfers difficult
    - Customers tend to penalize "waiting time" more severely than "travel time"
    - Occasionally, transfers may imply a detour
  - Infrastructure costs to build transfer stations and maintaining them

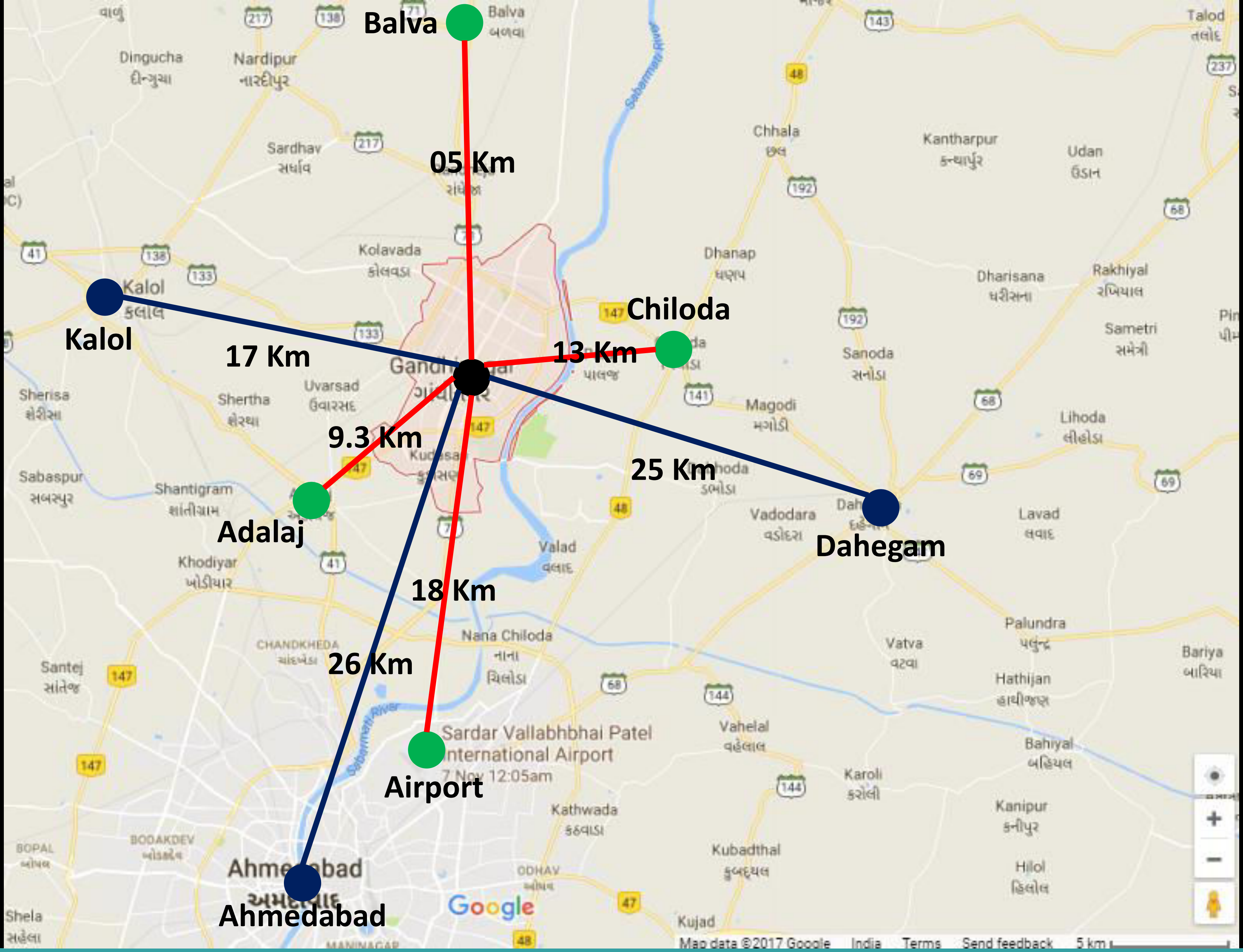
- Direct services
  - Take passengers directly from origin to destination; no need of transfer (Pune, Delhi)



Literature Review

- **Advantages**
  - Time savings
    - Minimum transfers required
    - More direct routing to destination
  - Infrastructure costs savings
    - Interchange stations may not be constructed
- **Disadvantages**
  - Operational efficiency
    - Same bus is used throughout the route
    - Lower load factor; more vehicles
  - Lesser average speeds/ more travel time
    - Congestion outside segregated corridor
  - Additional vehicle costs
    - Same vehicle may need to have doors on both sides or
    - Bus stops on corridor may double if curb side bus stops are built
  - Complicated junction and signal phase design

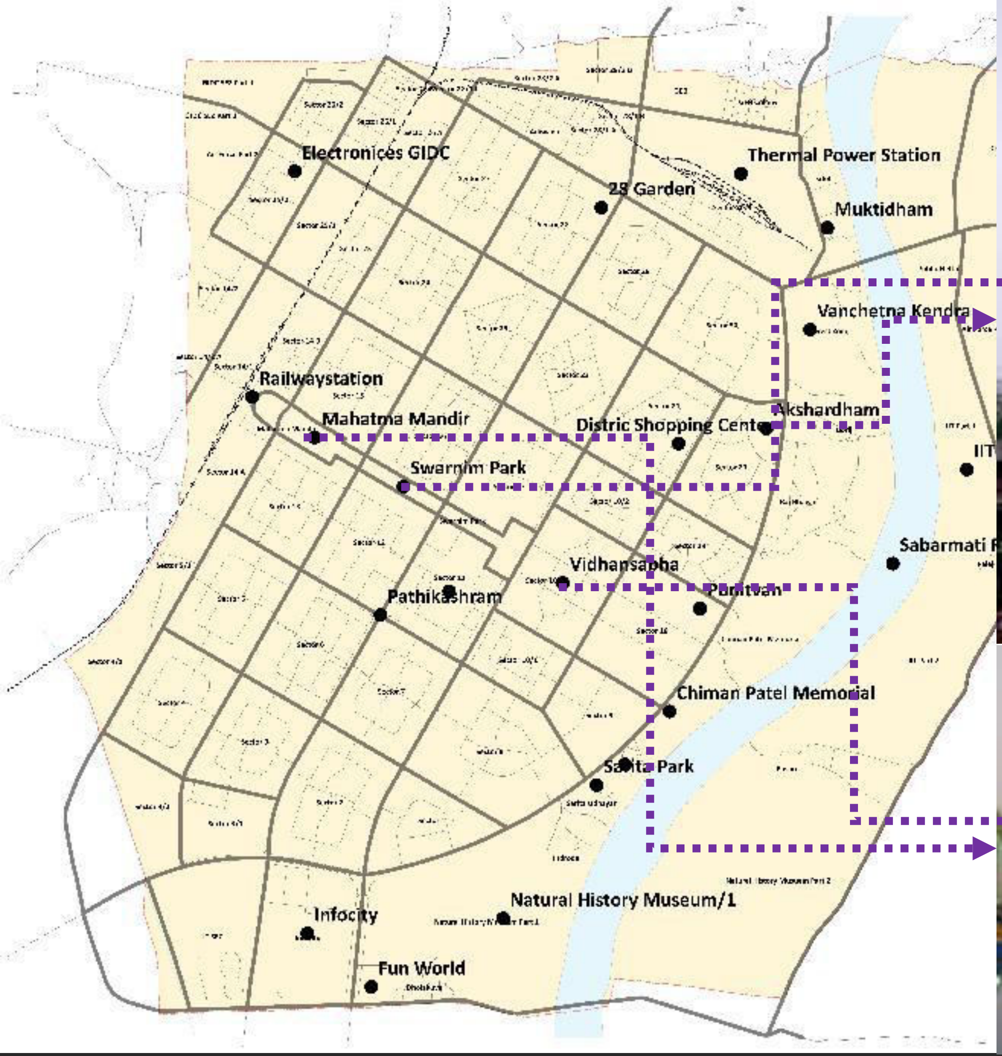
Study Area



Study Area (Regional Context)

Source: GUDA, 2015

Study Area Demography



AREA 57 SQKM

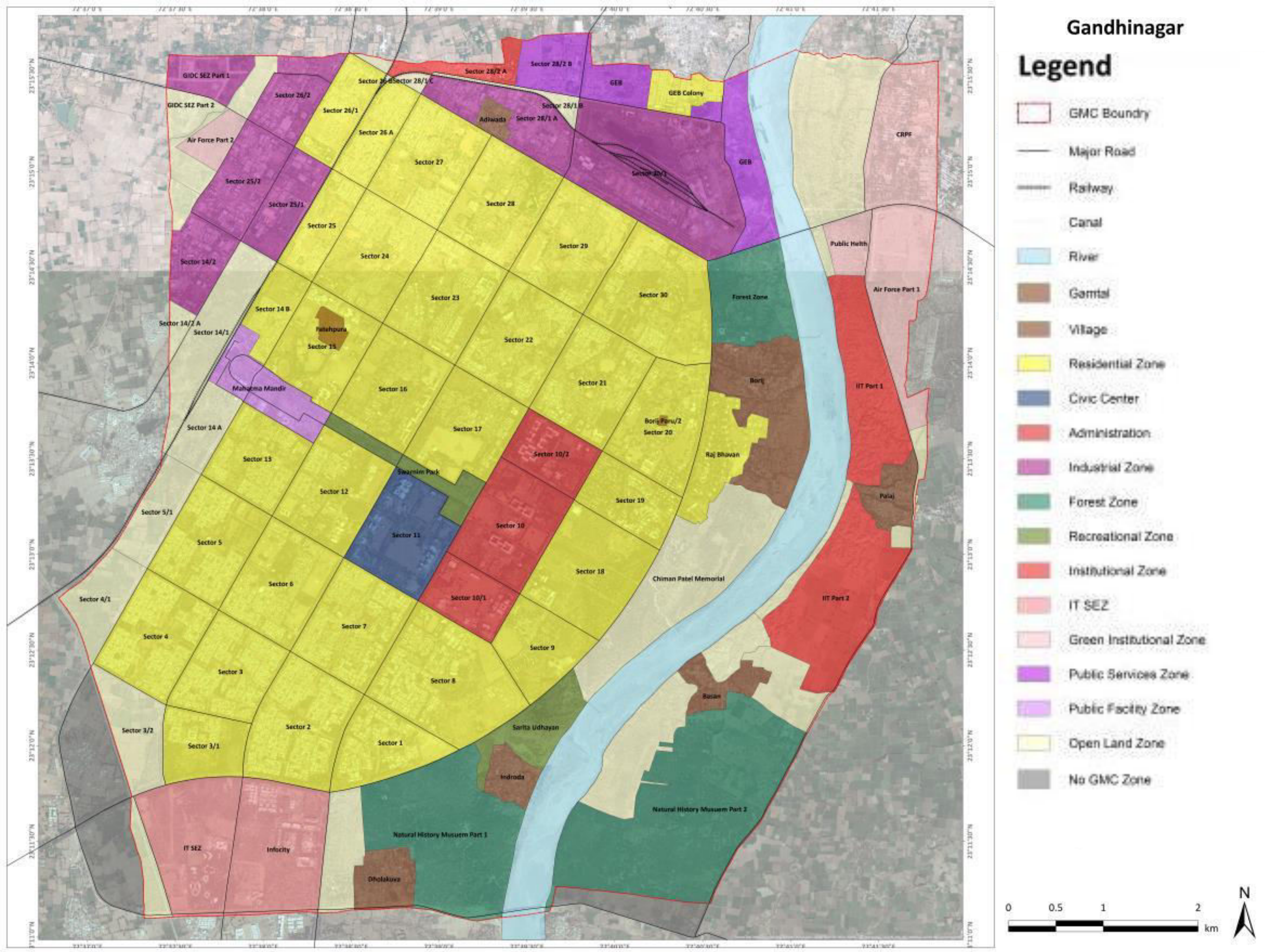
POPULATION 2,06,167

M=1,07,492

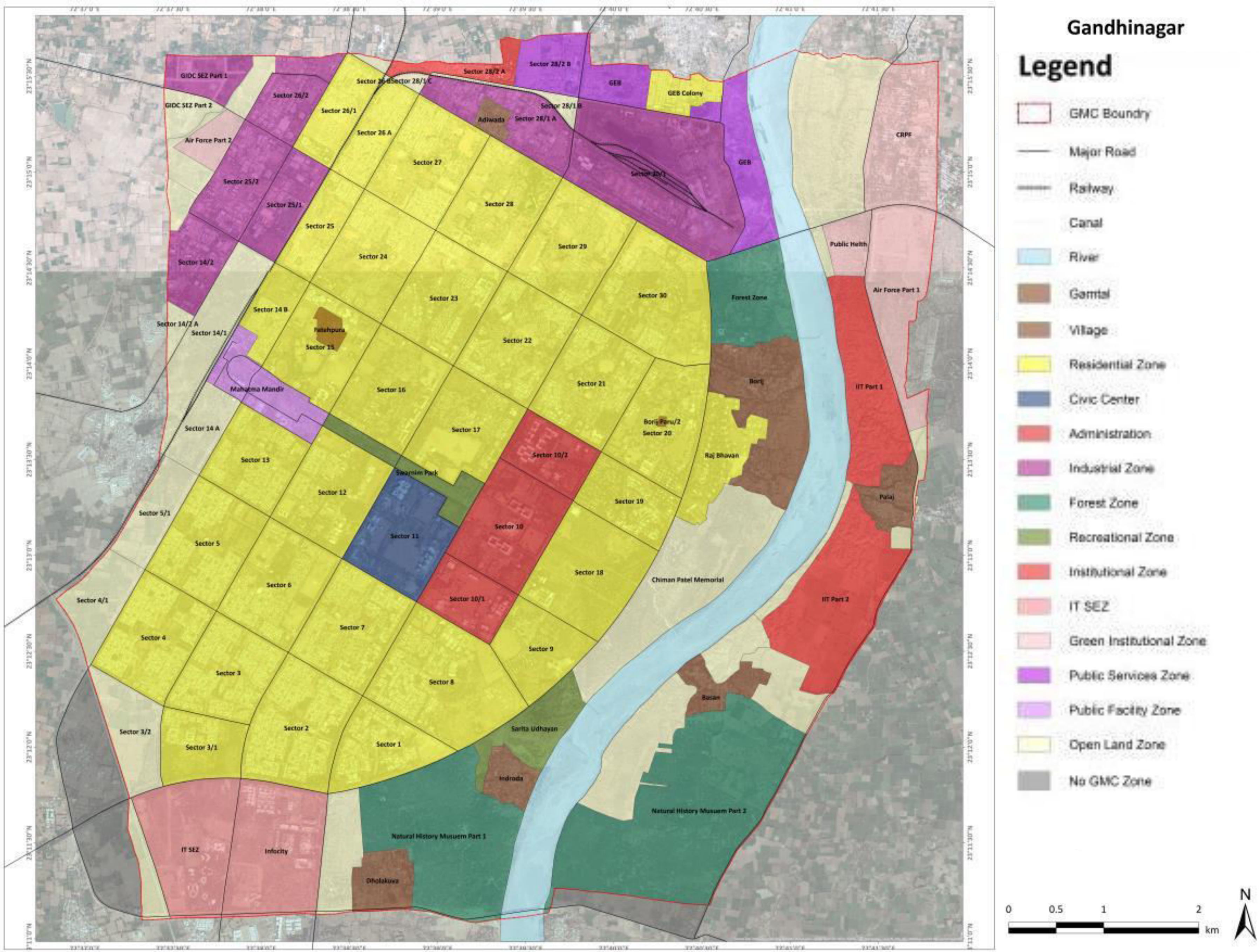
F =98,675

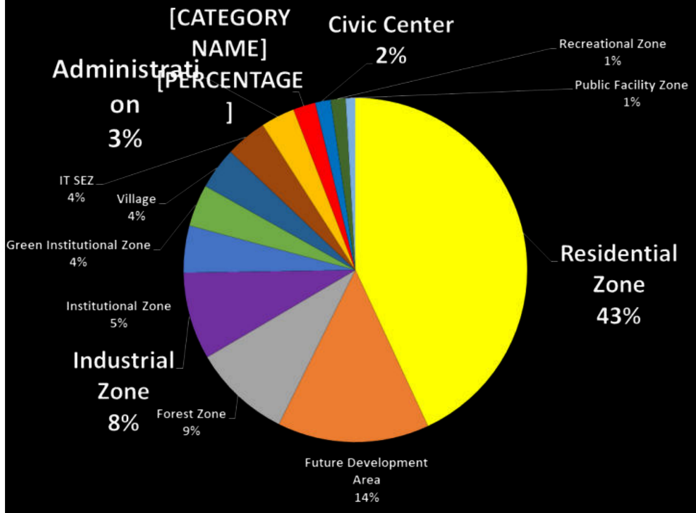
SEX RATIO 918:1000

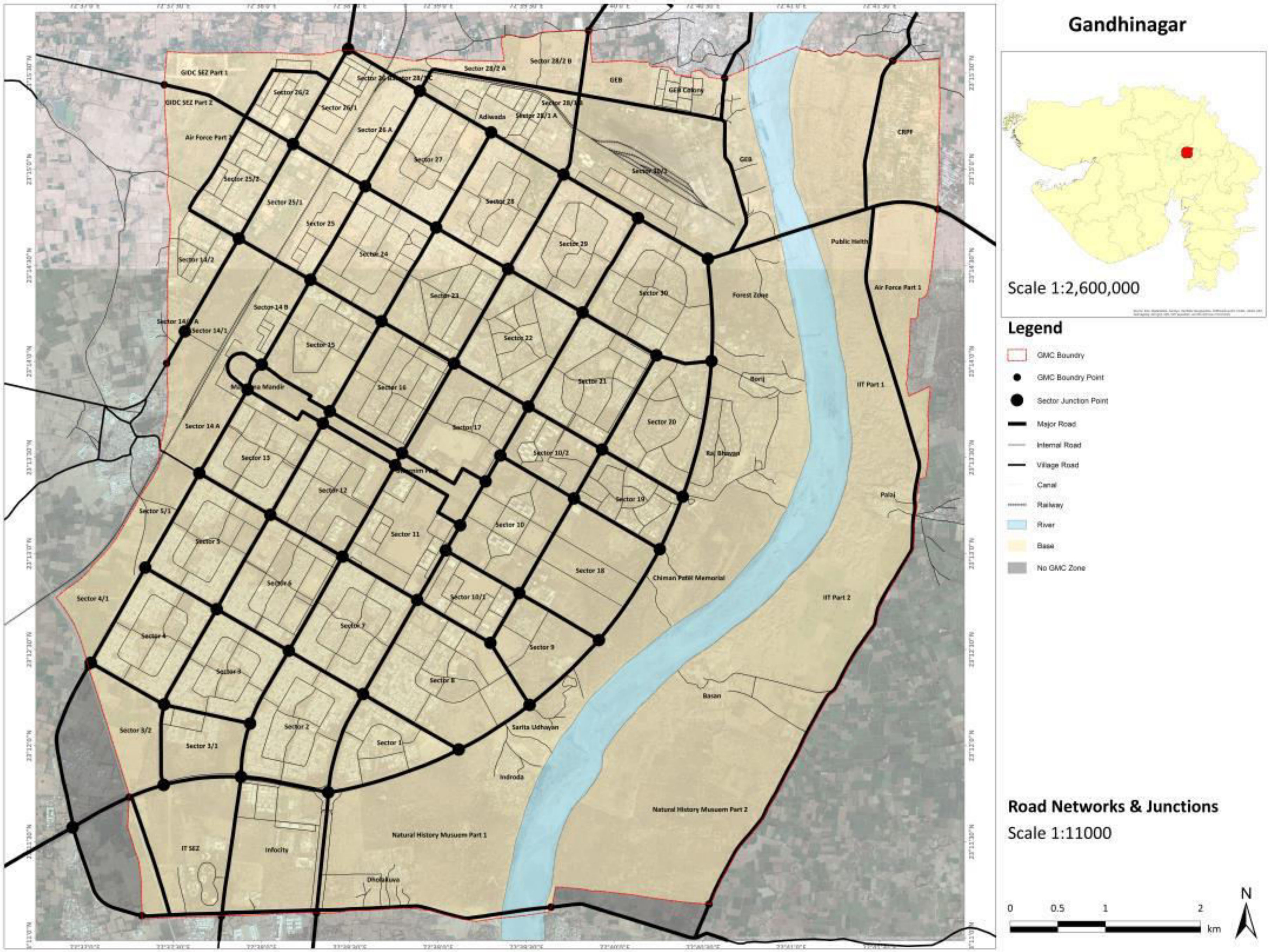
DENSITY 36 PPH



Study Area (Land Use Pattern)


Gandhinagar
Legend
GMC Boundry
Major Road
Railway
Canal
River
Gamtal
Village
Residential Zone
Civic Center
Administration
Industrial Zone
Forest Zone
Recreational Zone
Institutional Zone
IT SEZ
Green Institutional Zone
Public Services Zone
Public Facility Zone
Open Land Zone
No GMC Zone
0 0.5 1 2 km
N


[CATEGORY NAME] [PERCENTAGE]
Civic Center 2%
Recreational Zone 1%
Public Facility Zone 1%
Administration 3%
IT SEZ 4%
Village 4%
Green Institutional Zone 4%
Institutional Zone 5%
Industrial Zone 8%
Forest Zone 9%
Future Development Area 14%
Residential Zone 43%



Study Area (Street Patterns and Junctions)

SWOT Analysis

S

- Capital of the State
- Availability of proper IPT connectivity
- Majority of roads are lined with Tree Plantation
- Presence of Traffic Monitoring Infrastructure
- Use of Renewable energy

W

- Less usage of Public transportation
- On-street Parking
- Lack of Mixed use development

O

- Selection among 100 Smart cities.
- Upcoming MEGA project.
- GIFT city and Institutional Zone
- Improving traffic regulatory mechanisms
- Cycle sharing projects
- Development of IT SEZ

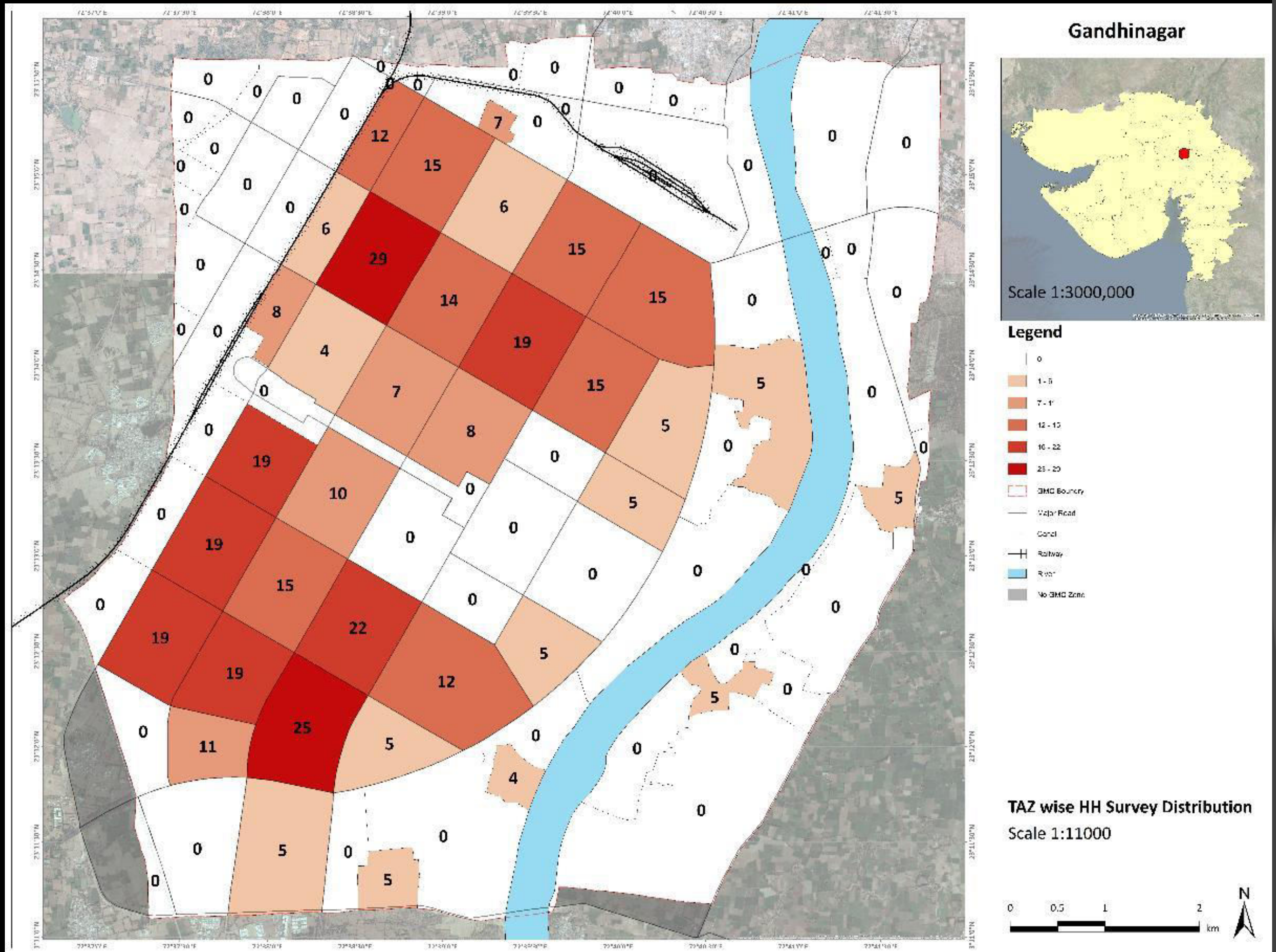
T

- Use of contemporary fuel leading to increase in pollution
- Increasing dependency on Private vehicles
- Tag of "Green City" at stake
- Dependency on other cities for employment

Total Population of City
2,06,167
Avg. HH Size 5
Total HH of City
41,933

Total sample size ~ 1% of the total households
419HH

Distribution among sectors according to the number of households in the sectors.

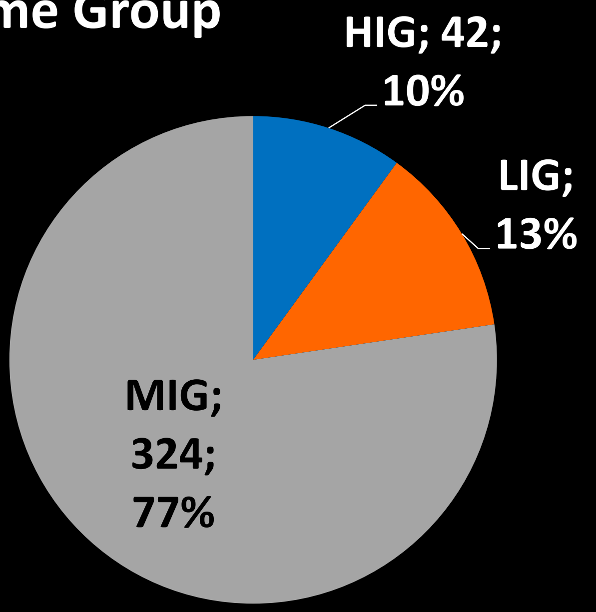


Sample Size Selection & Survey Covered

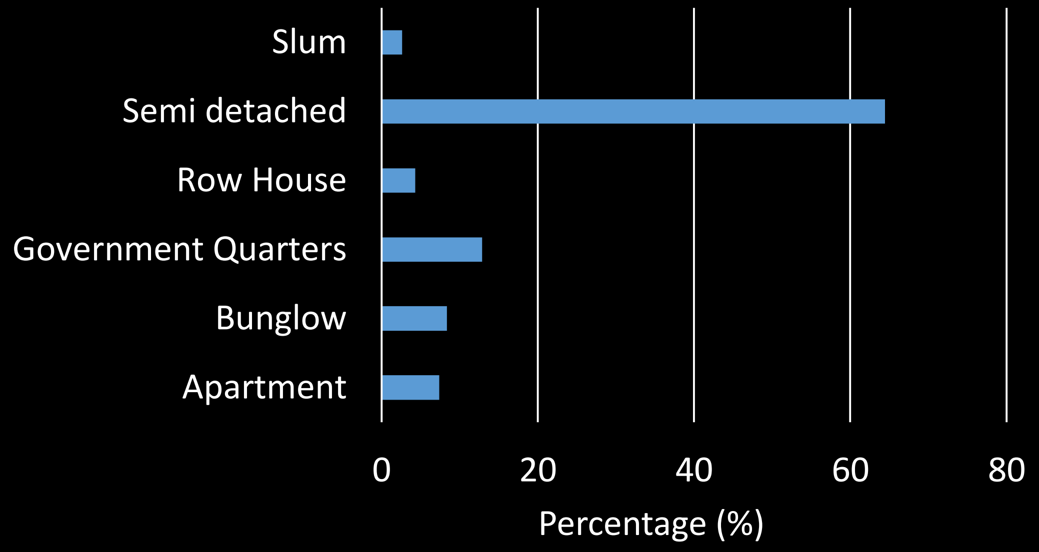
Total Households surveyed = 474 (419 within sectors + 55 surrounding villages)

Data Analysis
HH profile

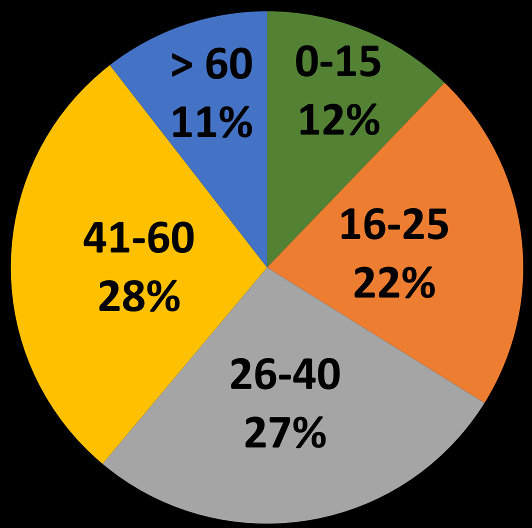
Income Group



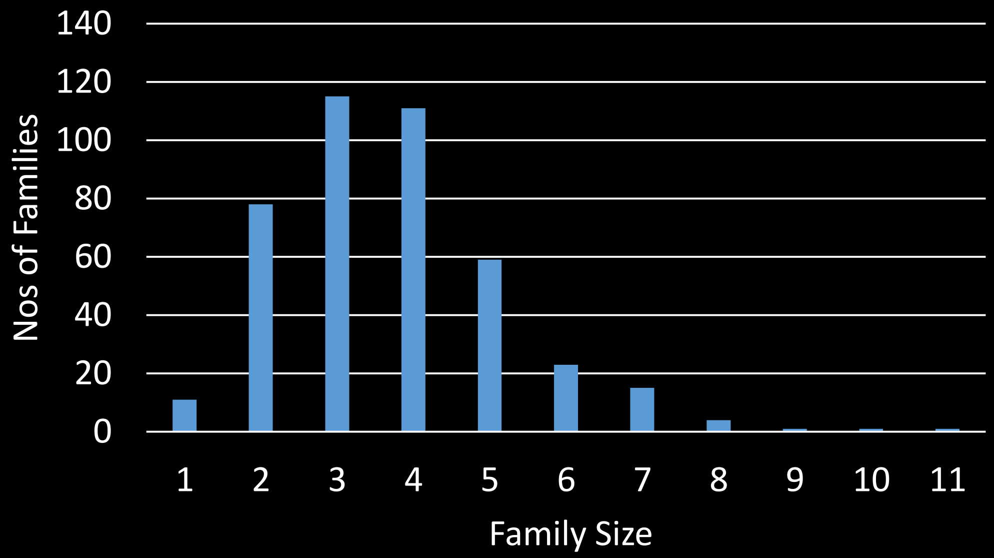
Building Typology



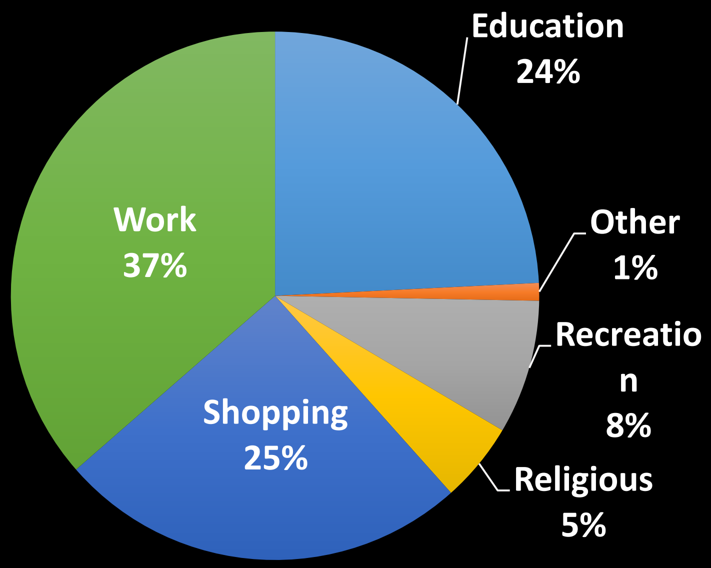
Age Group



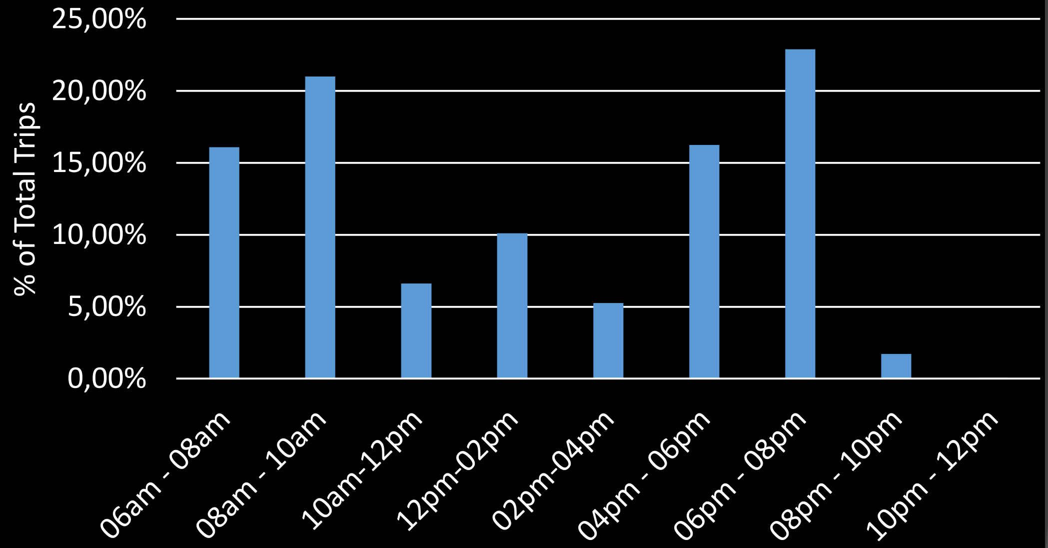
Family Size



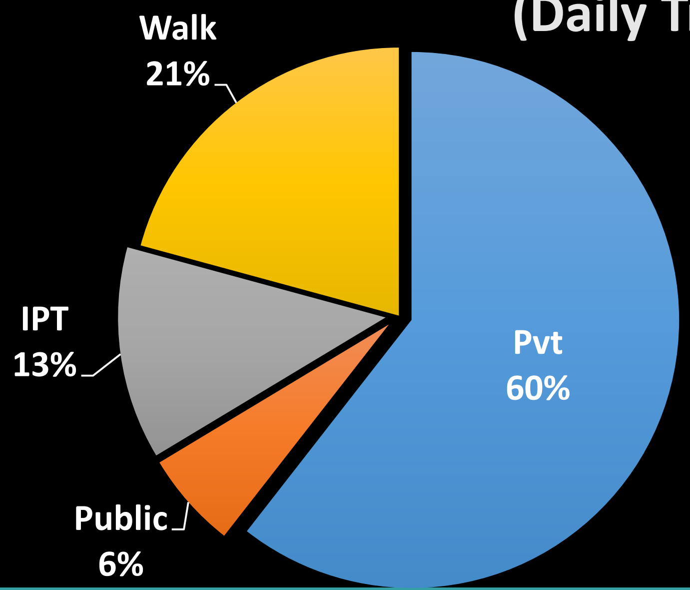
Trip Purpose



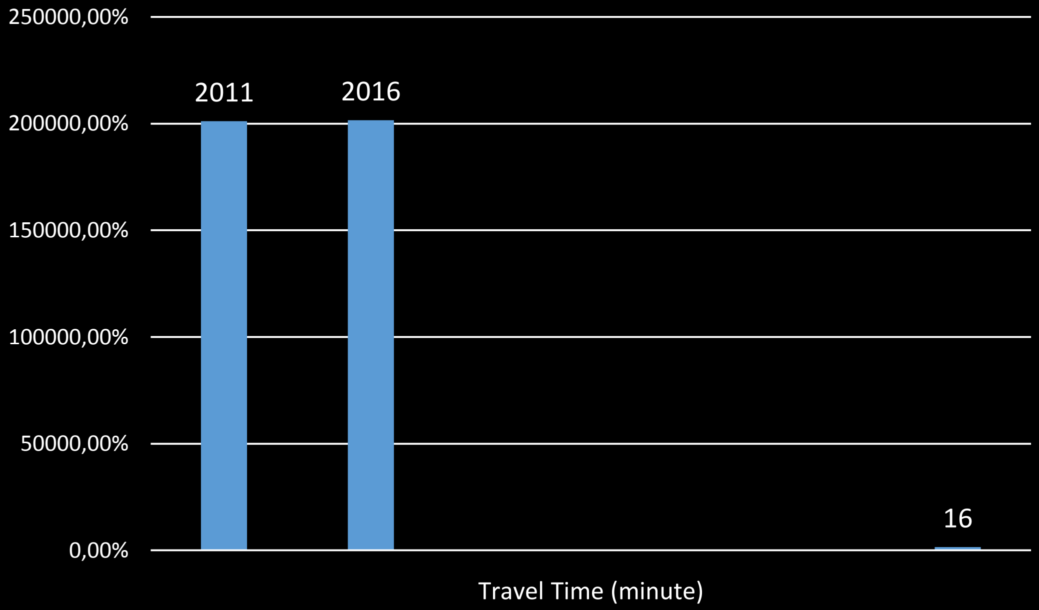
Peak hour



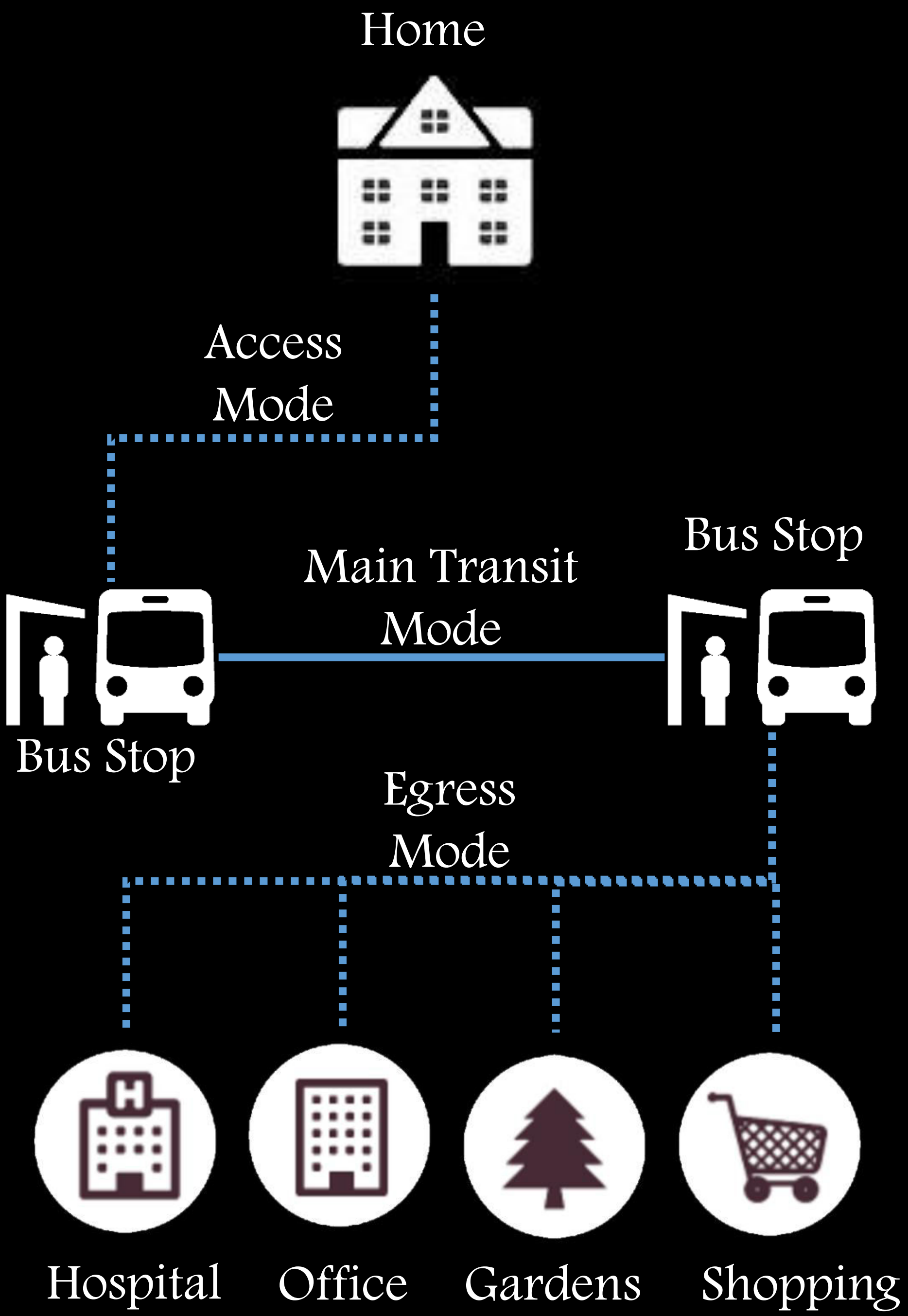
Mode of Transport (Daily Trips)



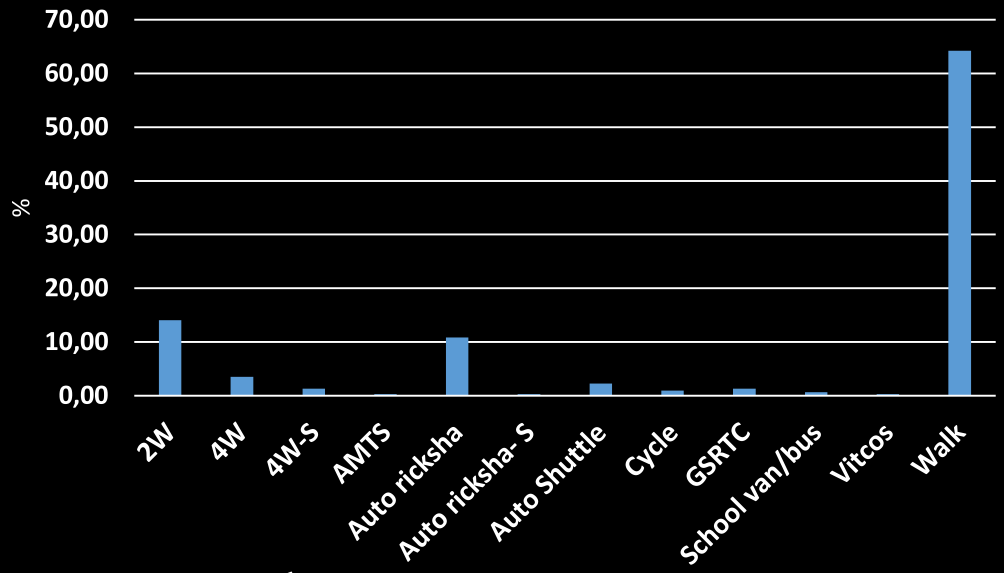
2001



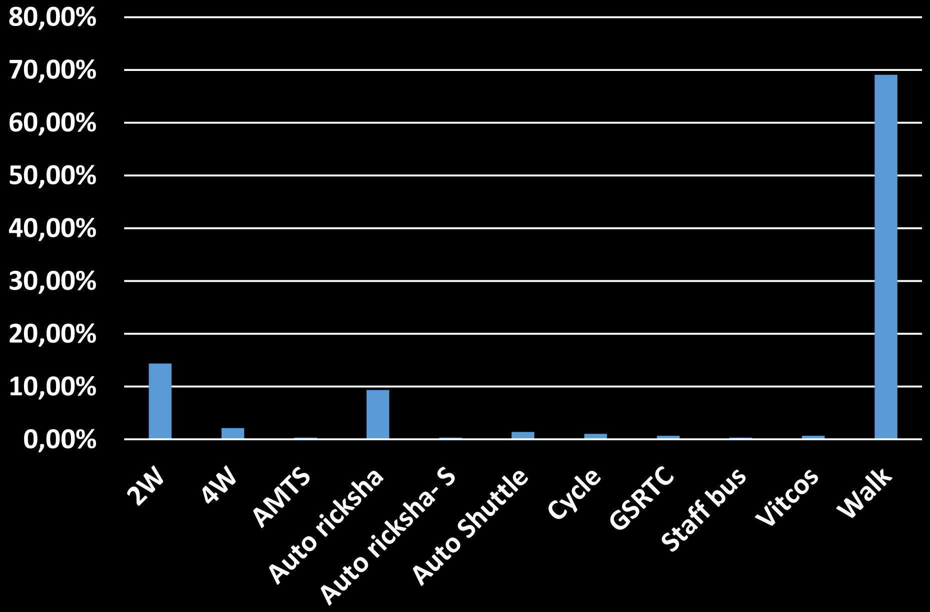
Data Analysis



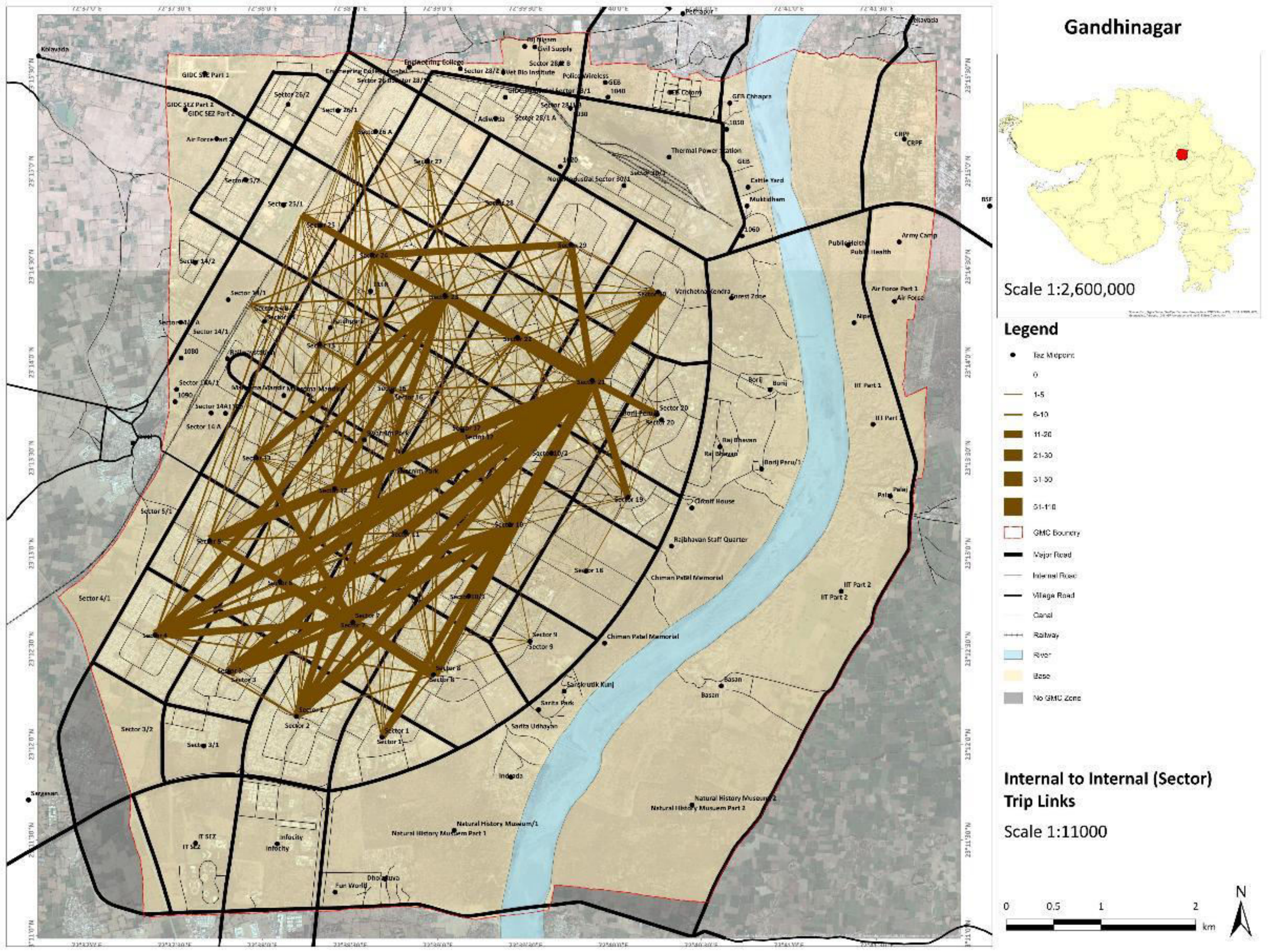
Access Mode



Egress Mode



Data Analysis



Trip Links

(Origin-Destination survey)

Demand

(Internal to Internal within sector)

(Internal to Internal other sector)

Attraction and Production TAZ are

Sector 21, 23, 24. 29, 25 GIDC, 10,16, 2,3,4,5,6,7,8

O – D Survey Analysis

Inferences

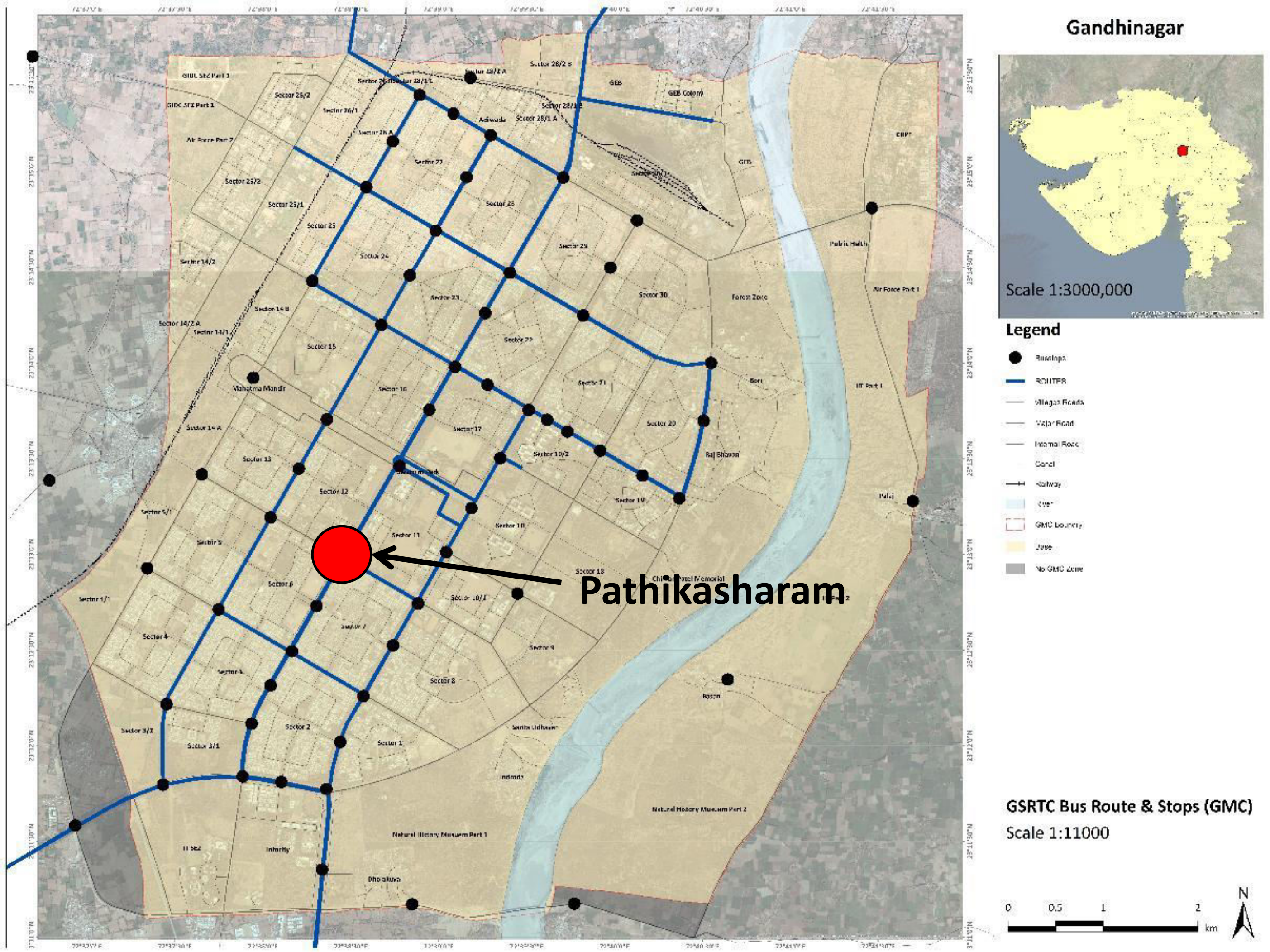
Major trips are towards Sector 21,24,6,7 & 16. Because of agglomeration of Commercial activities.

Trips towards Sector 10 are also high, due to Institutional zone.

Data Collection (Existing Transportation Modes)

Public transit

Para transit

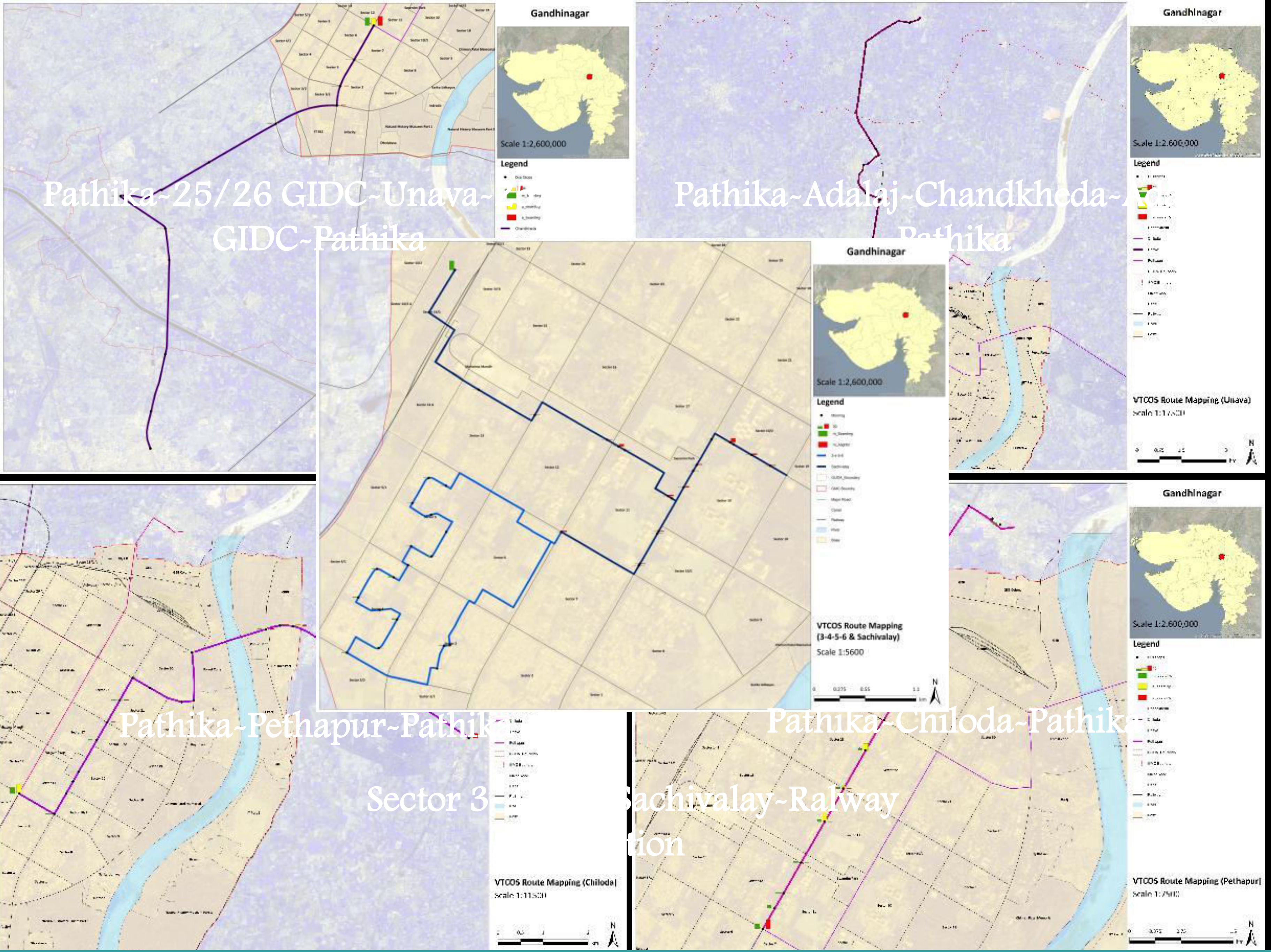


Main bus station at Pathikashram (Gh-3),

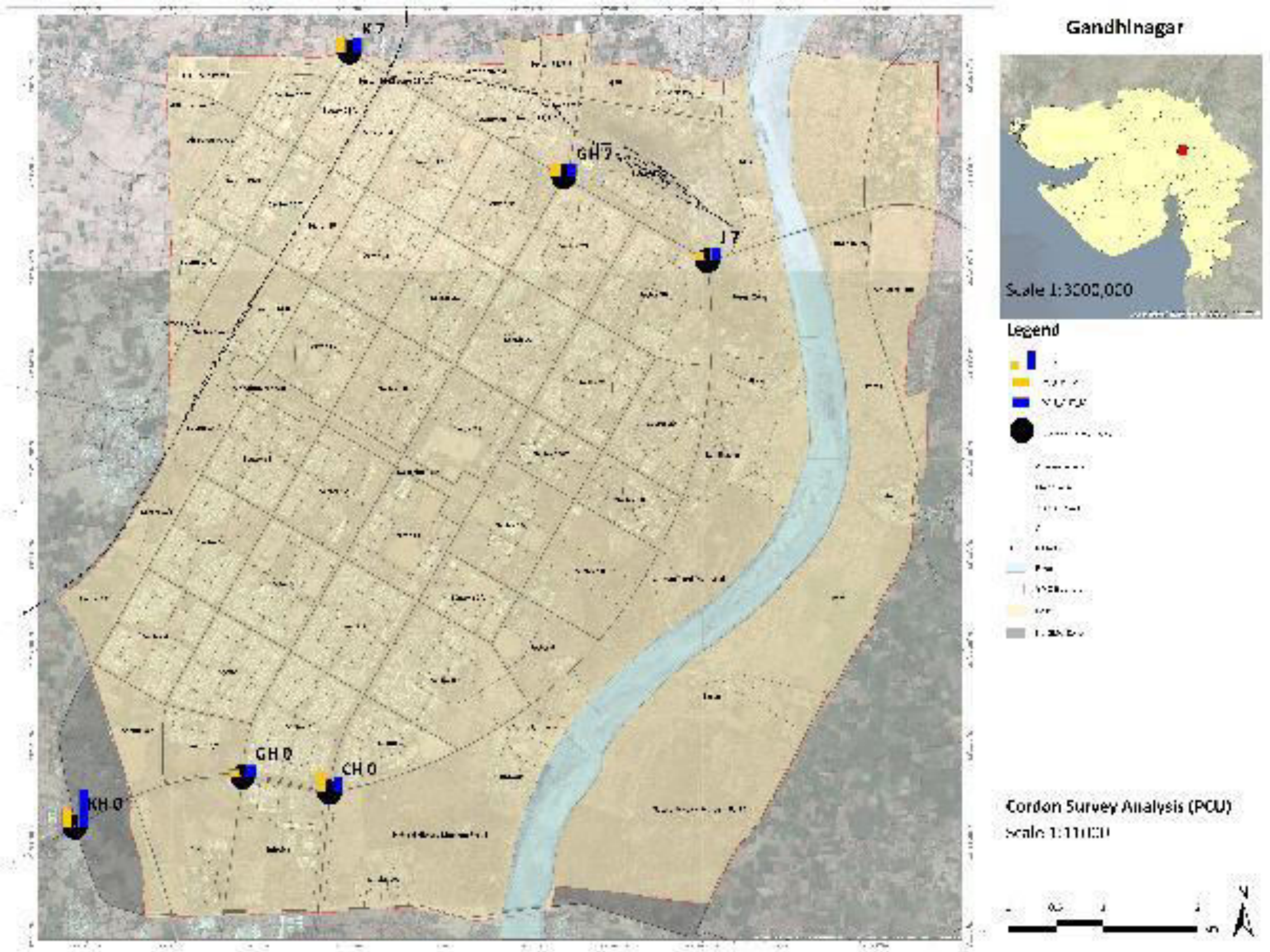
Start from Gh-6,

Other pick up stand at Sachivalay.

Data Collection (GSRTC route and bus stop mapping)



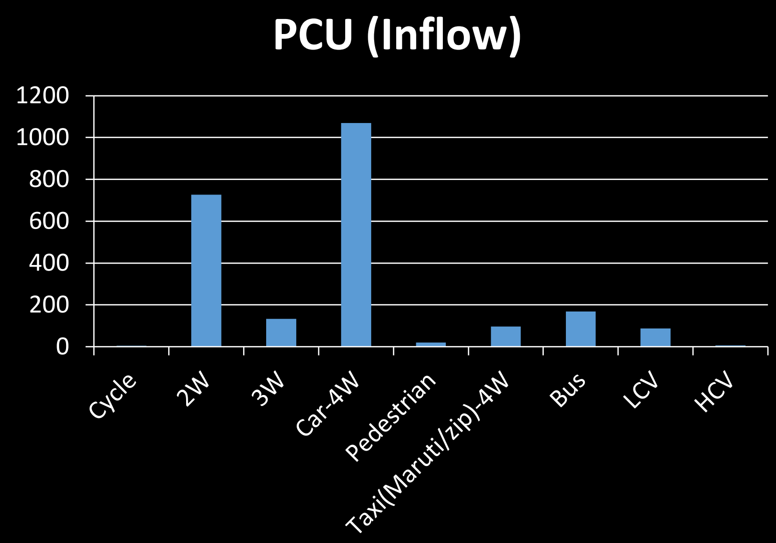
Data Collection (VTCOS route and Bus stop mapping, PHPDT survey)

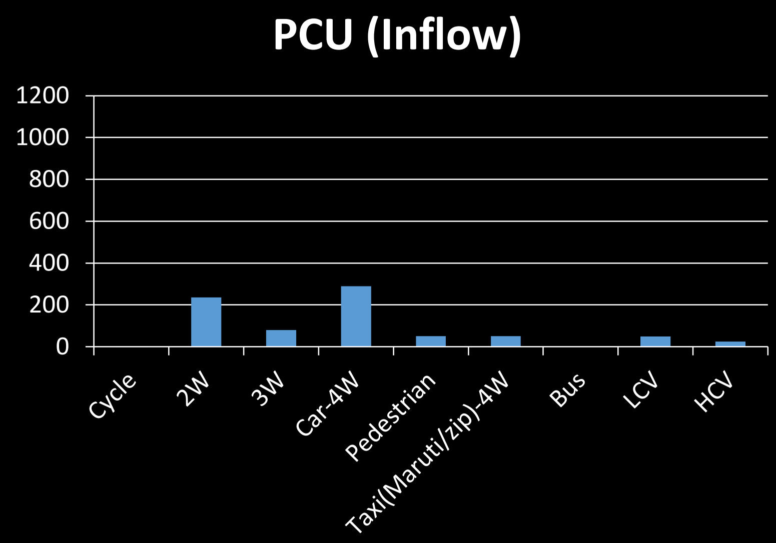


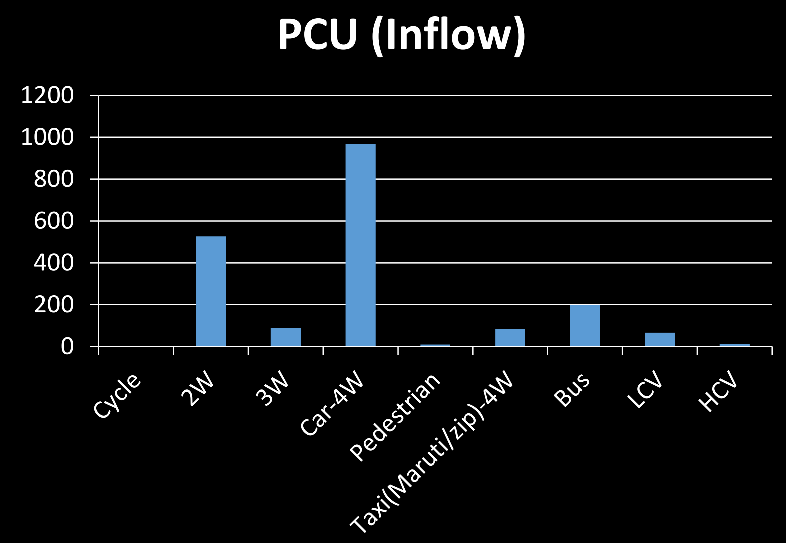
In pick hours

Data Collection (Cordon Point Survey)

In flow





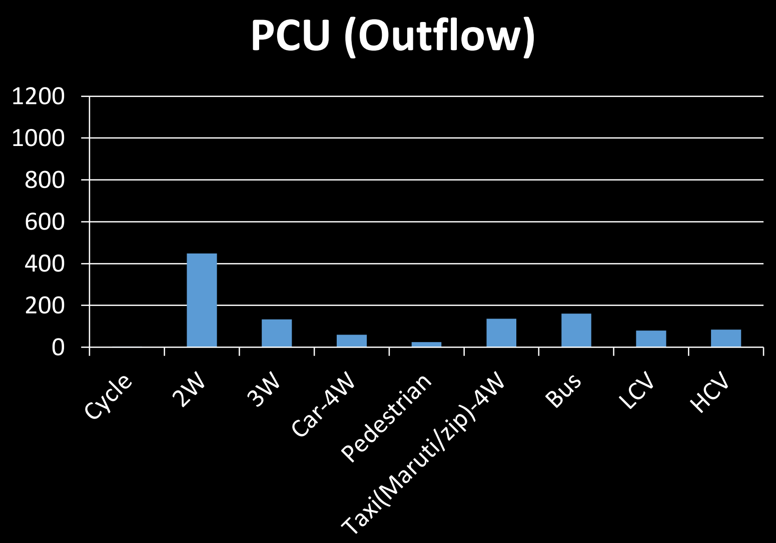


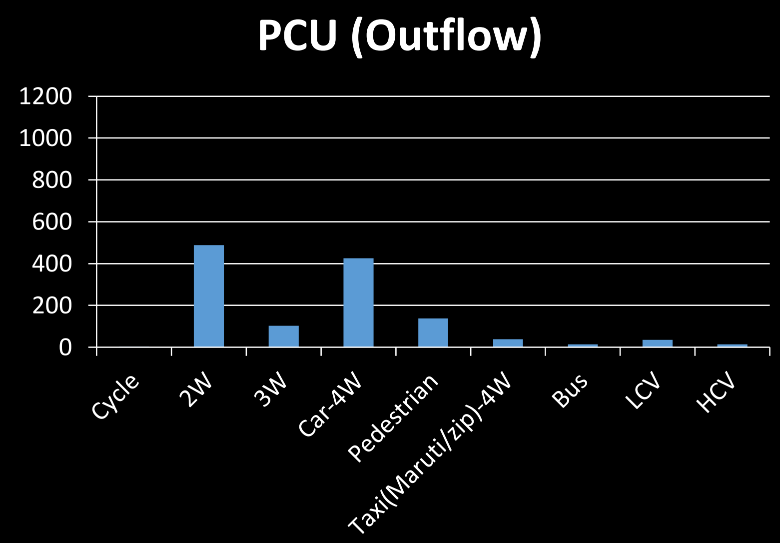
J 7

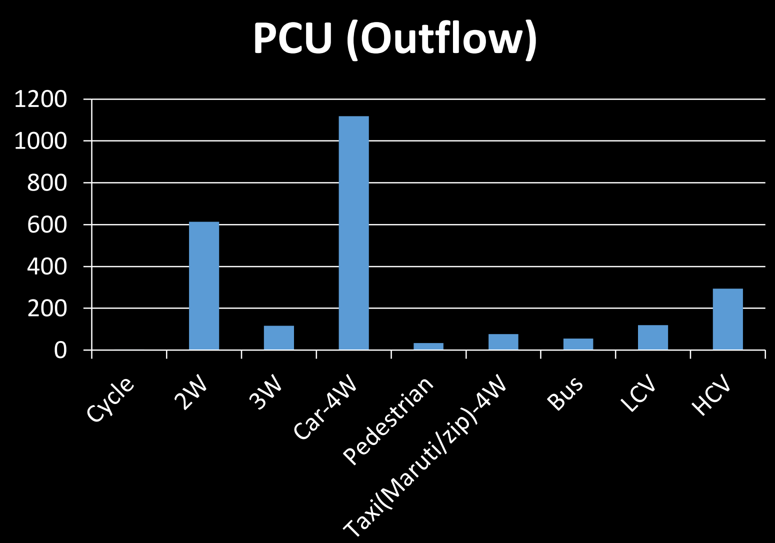
GH 7

K 7

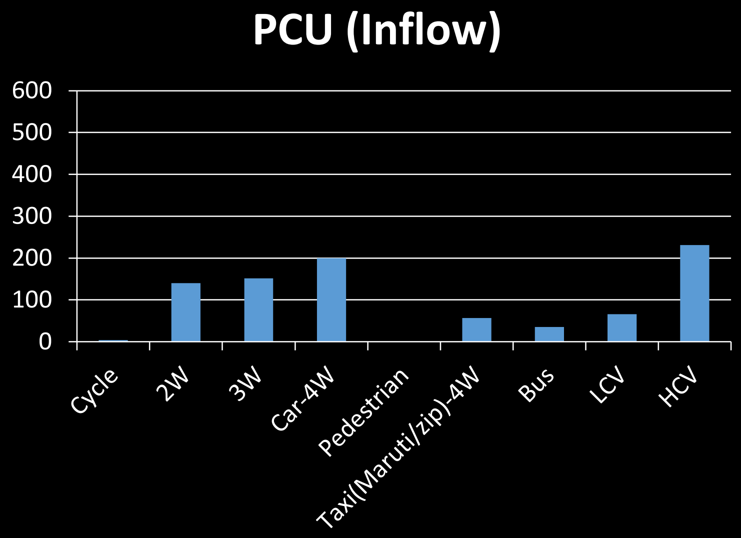
Out flow

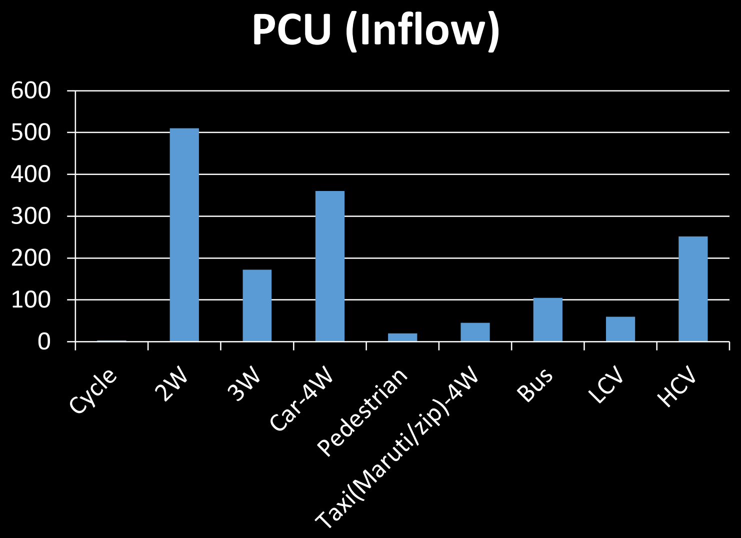


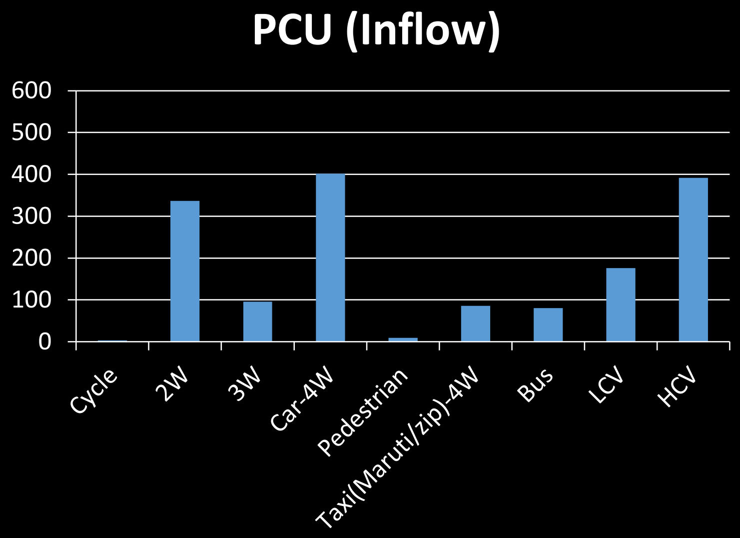




In flow





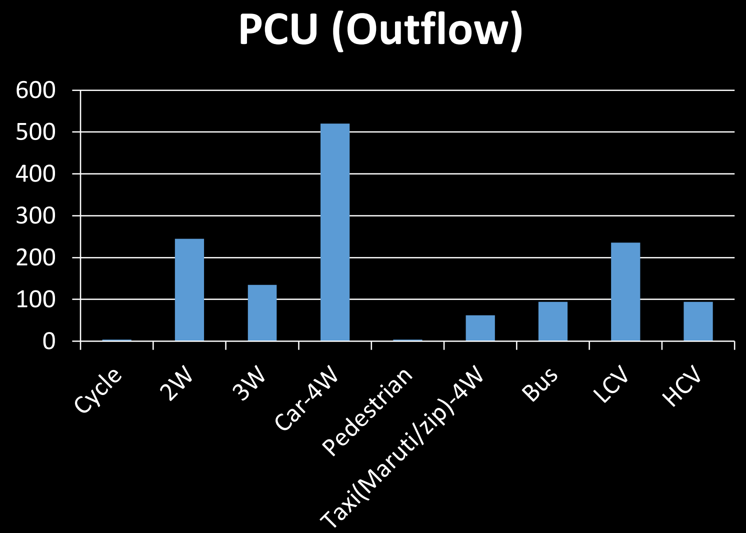


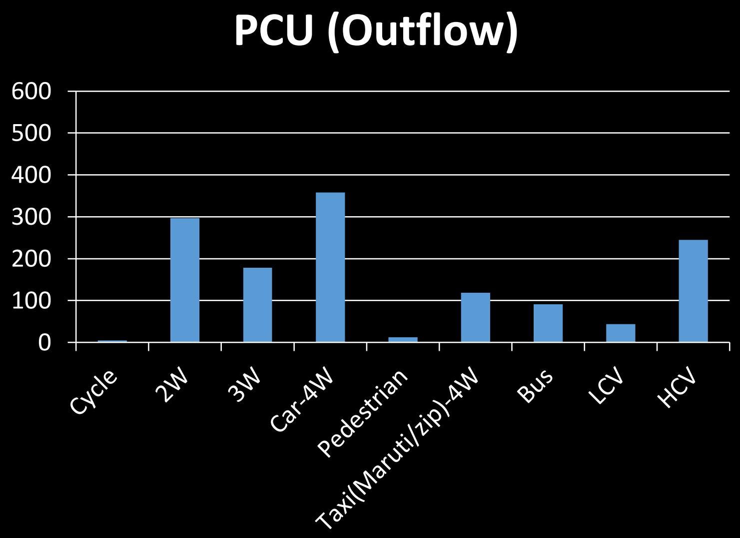
Ch 7

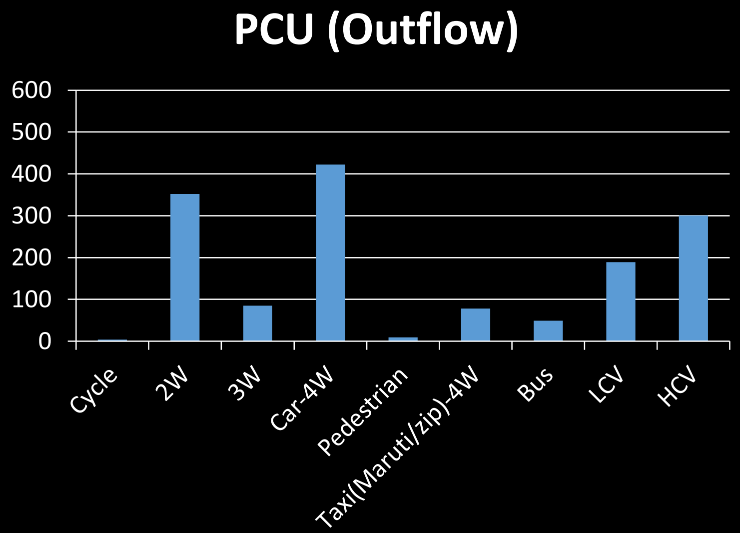
GH 7

Kh 7

Out flow







Morning Data~ 9:30 to 10:30

Note: Similar survey was done for afternoon and evening.

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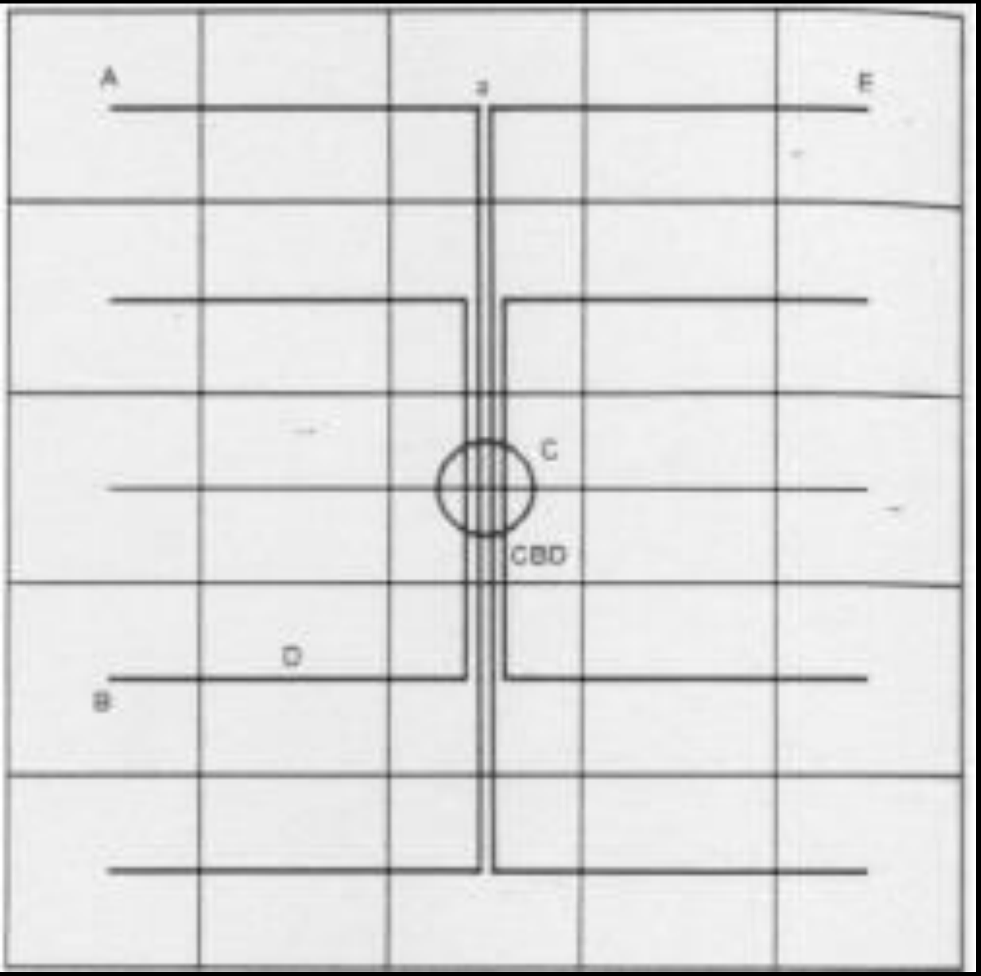
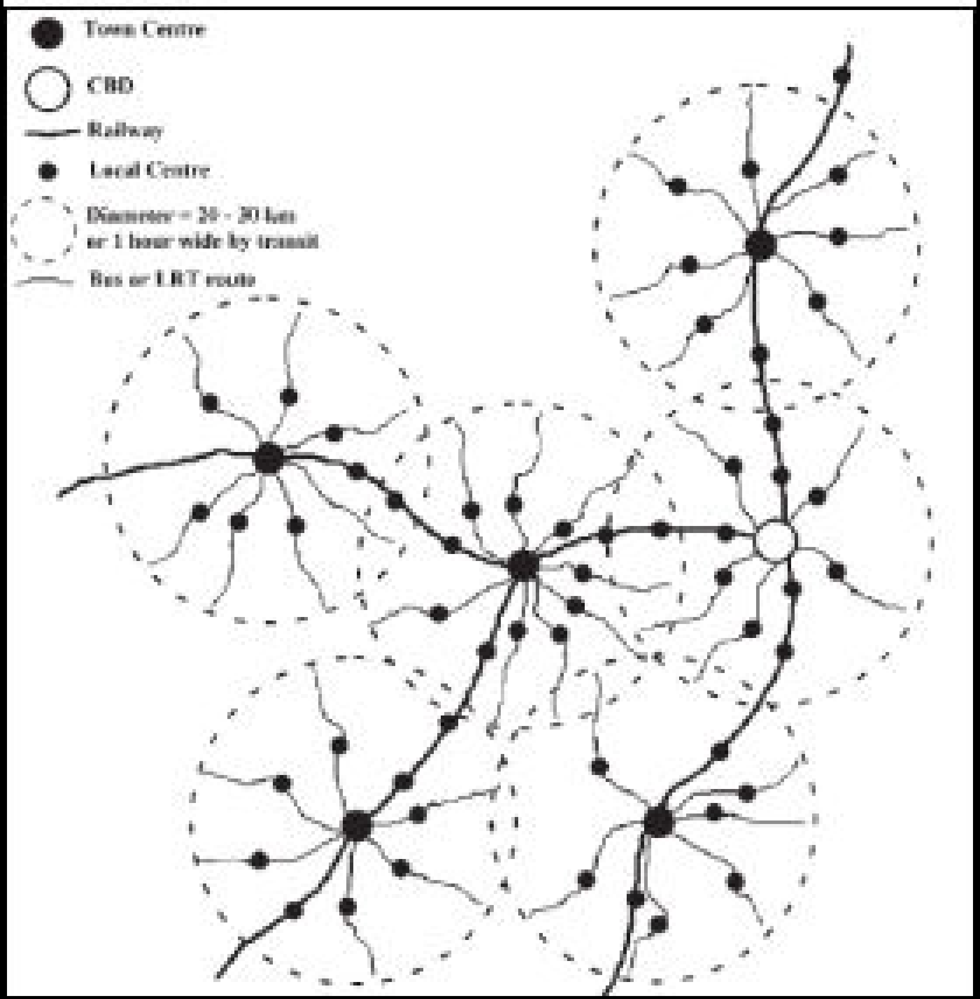
Cordon Point Survey ~ Inference

Dispersed Network Strategies





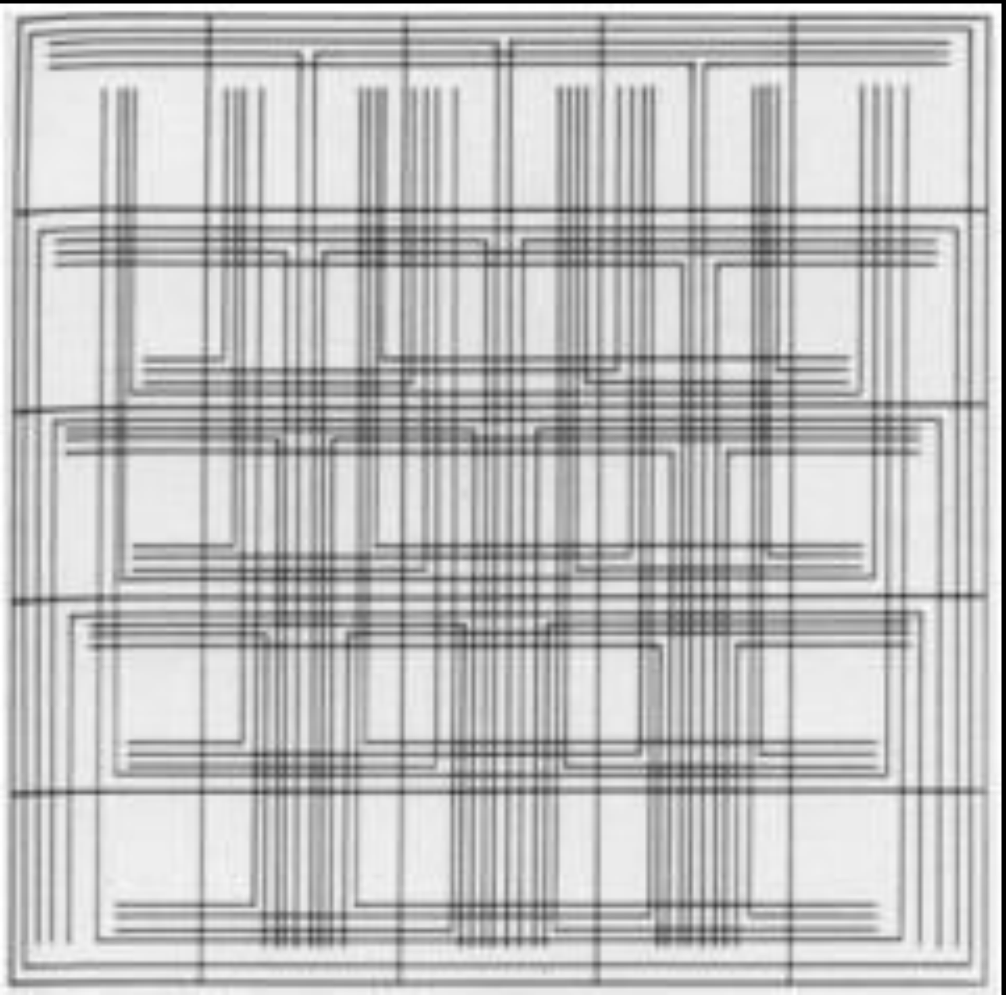
Conceptual radial network strategy

Radial network strategy in a poly centric city

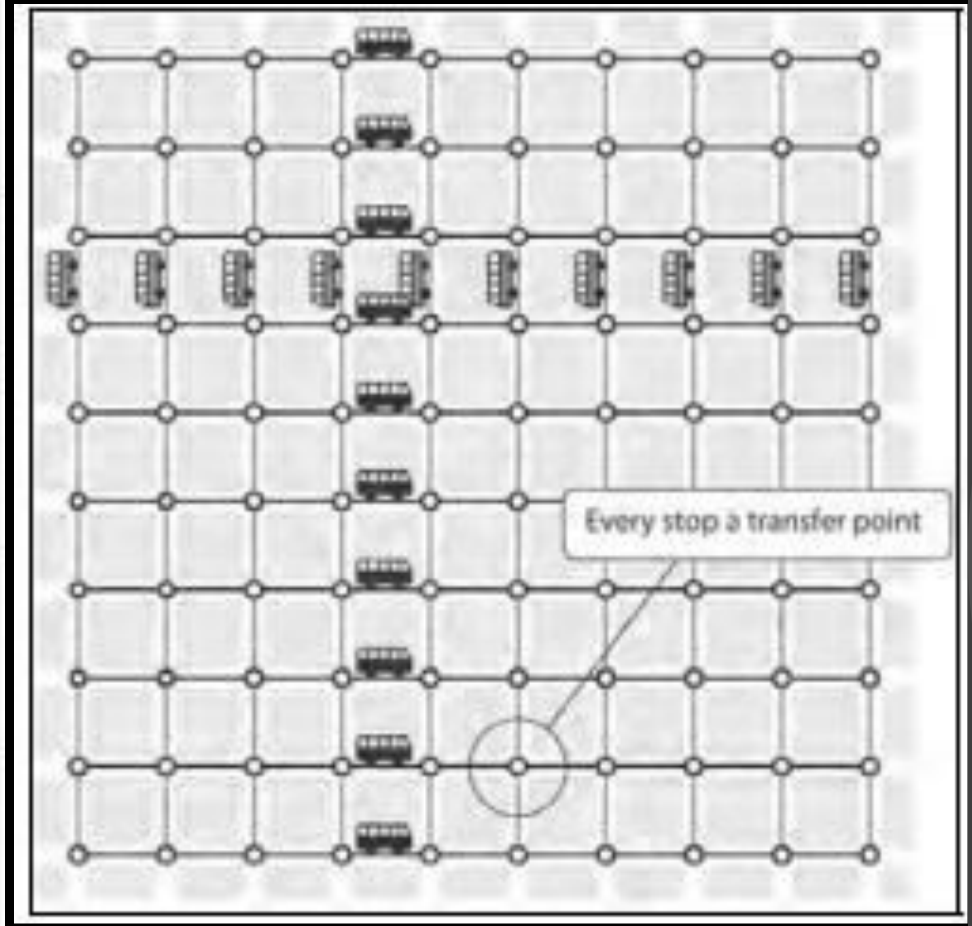
Proposals (Concept of Route Planning)

Source: Thompson 1977 ; Newman and Kenworthy 2006

Radial Network Strategies



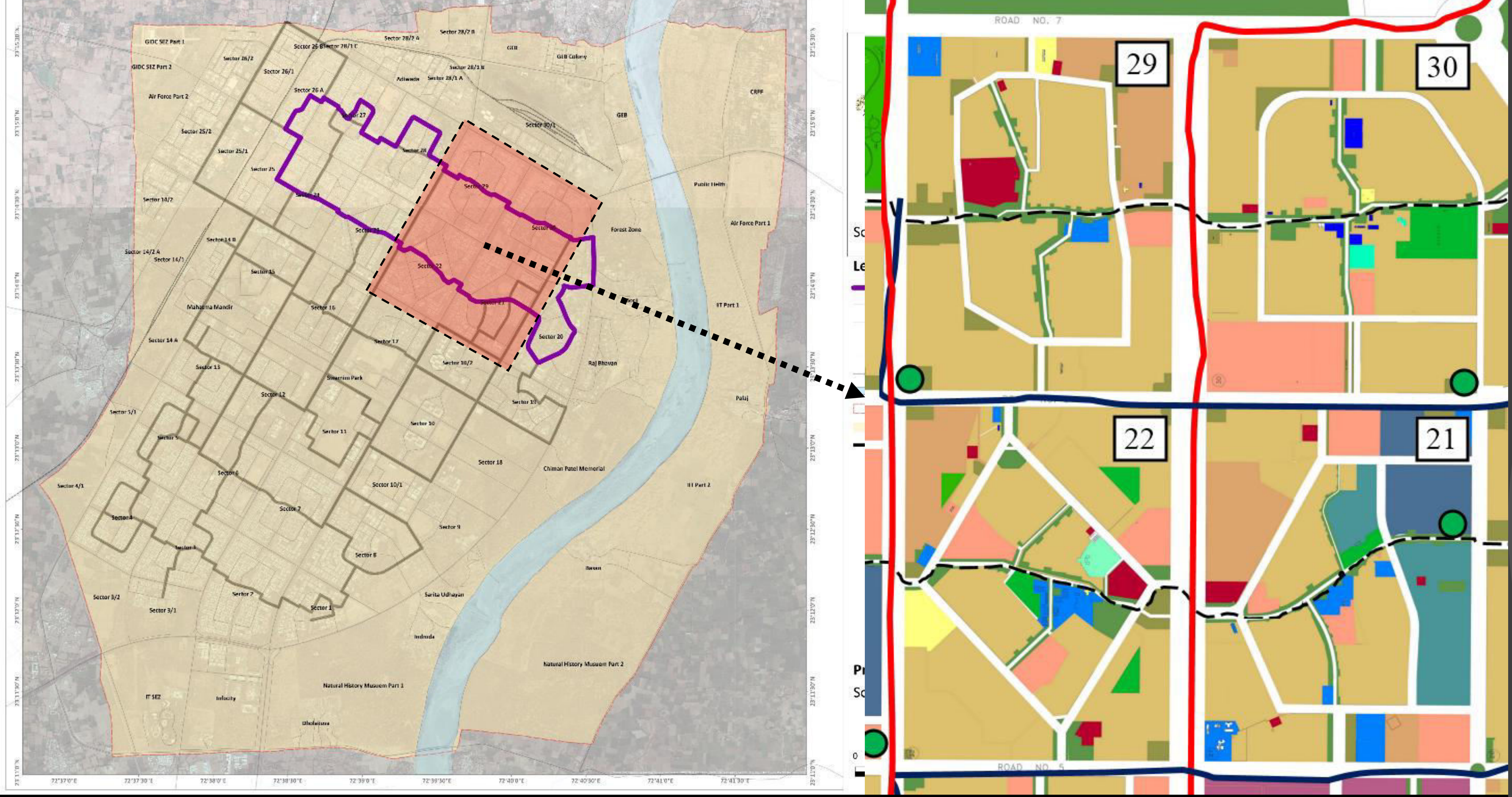
Conceptual dispersed network strategy



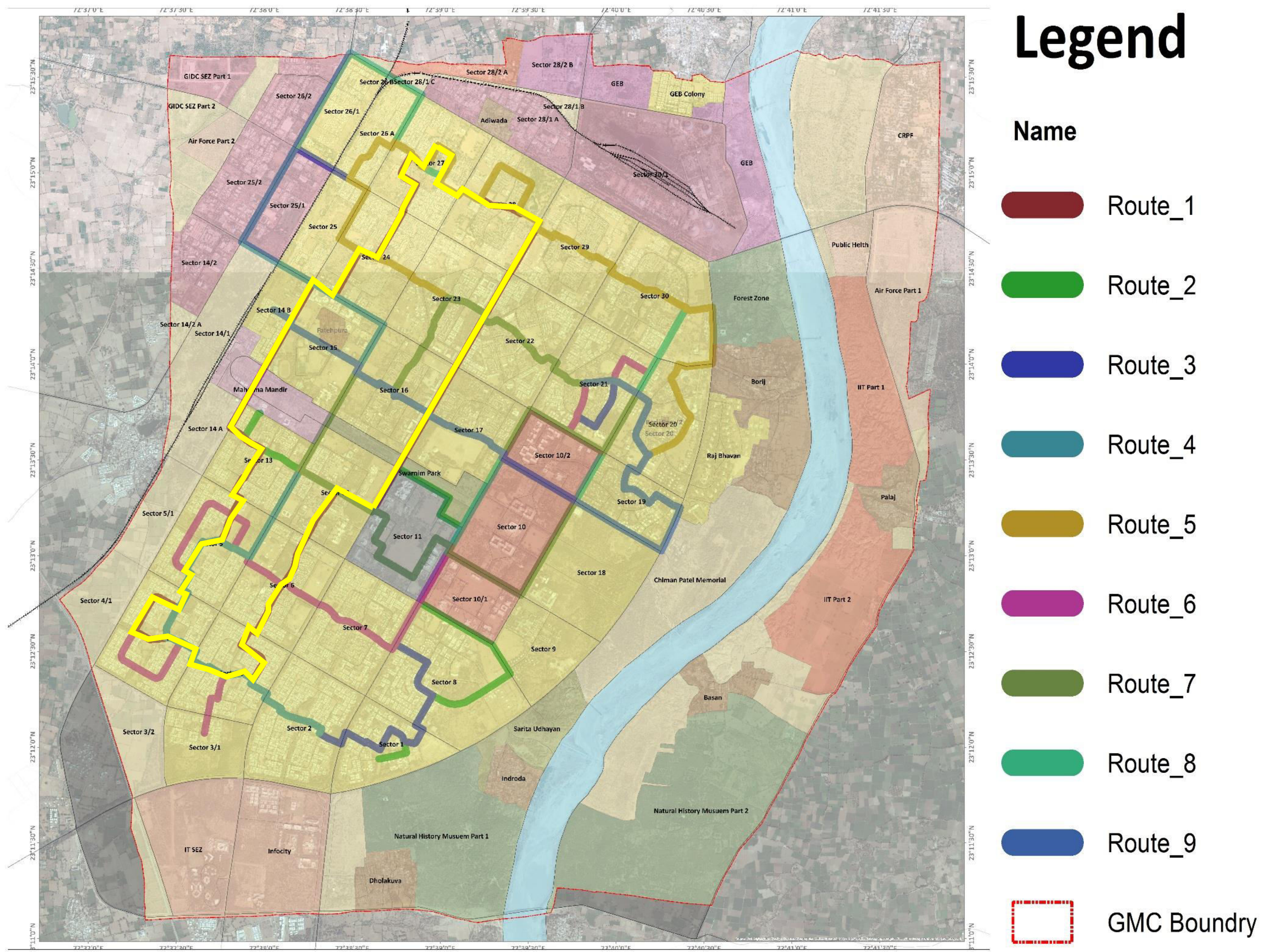
Conceptual dispersed network strategy indicating transfer opportunities

Proposals (Concept of Route Planning)

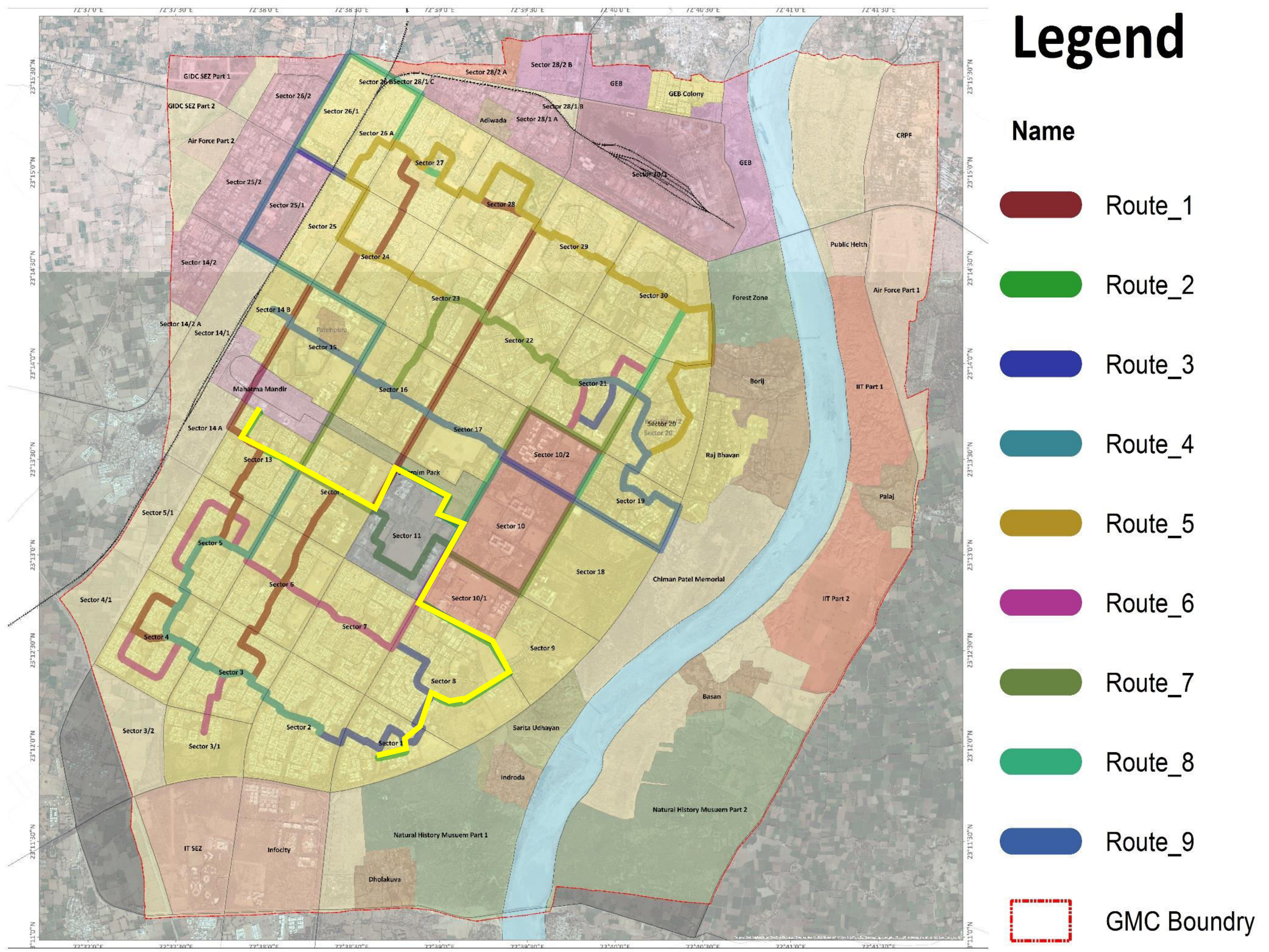
Source: Thompson (1977); Nielsen et al (2005)



Proposals (Concept of Route Planning)



Proposals (Route Planning and Scheduling)



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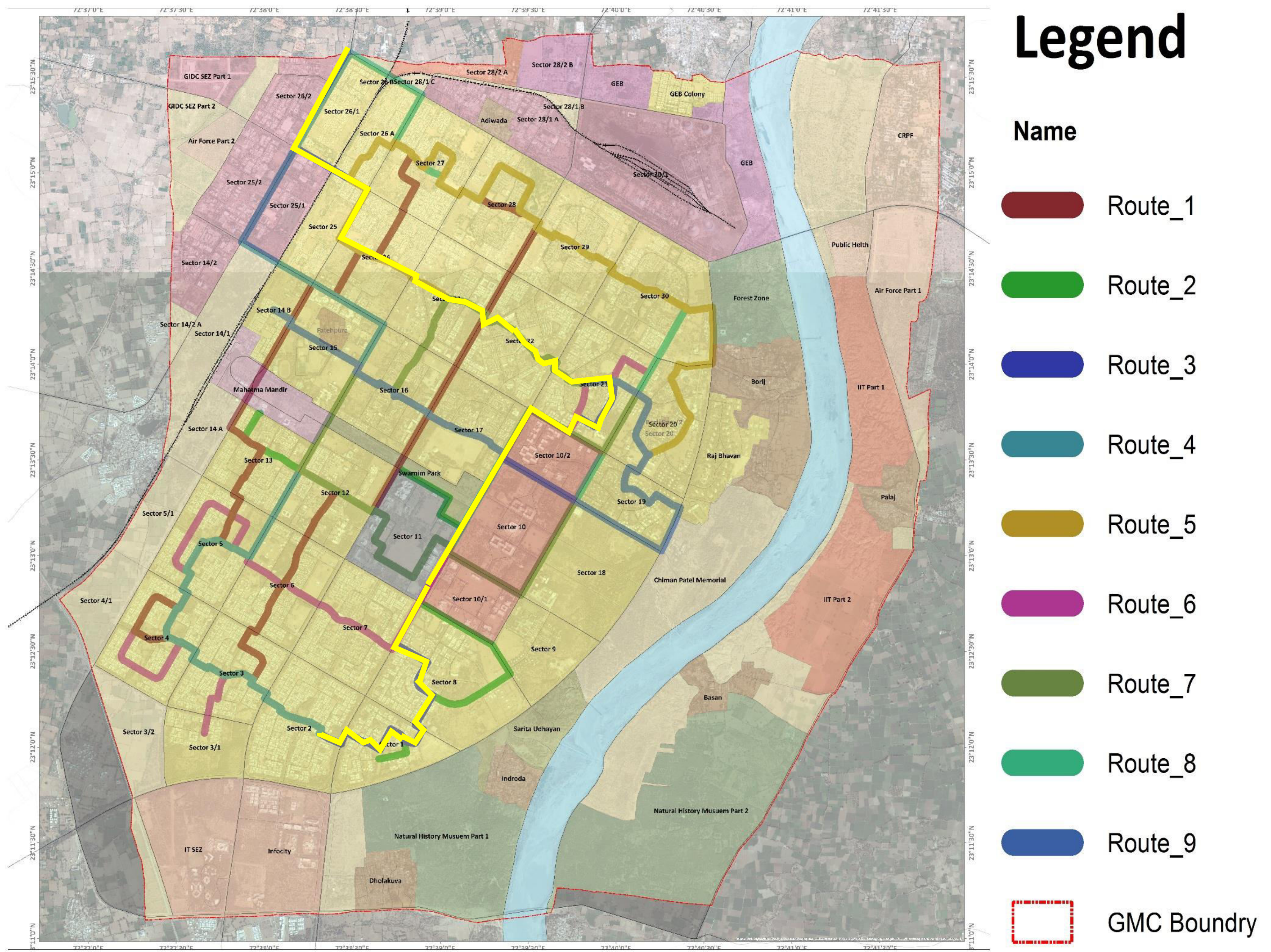

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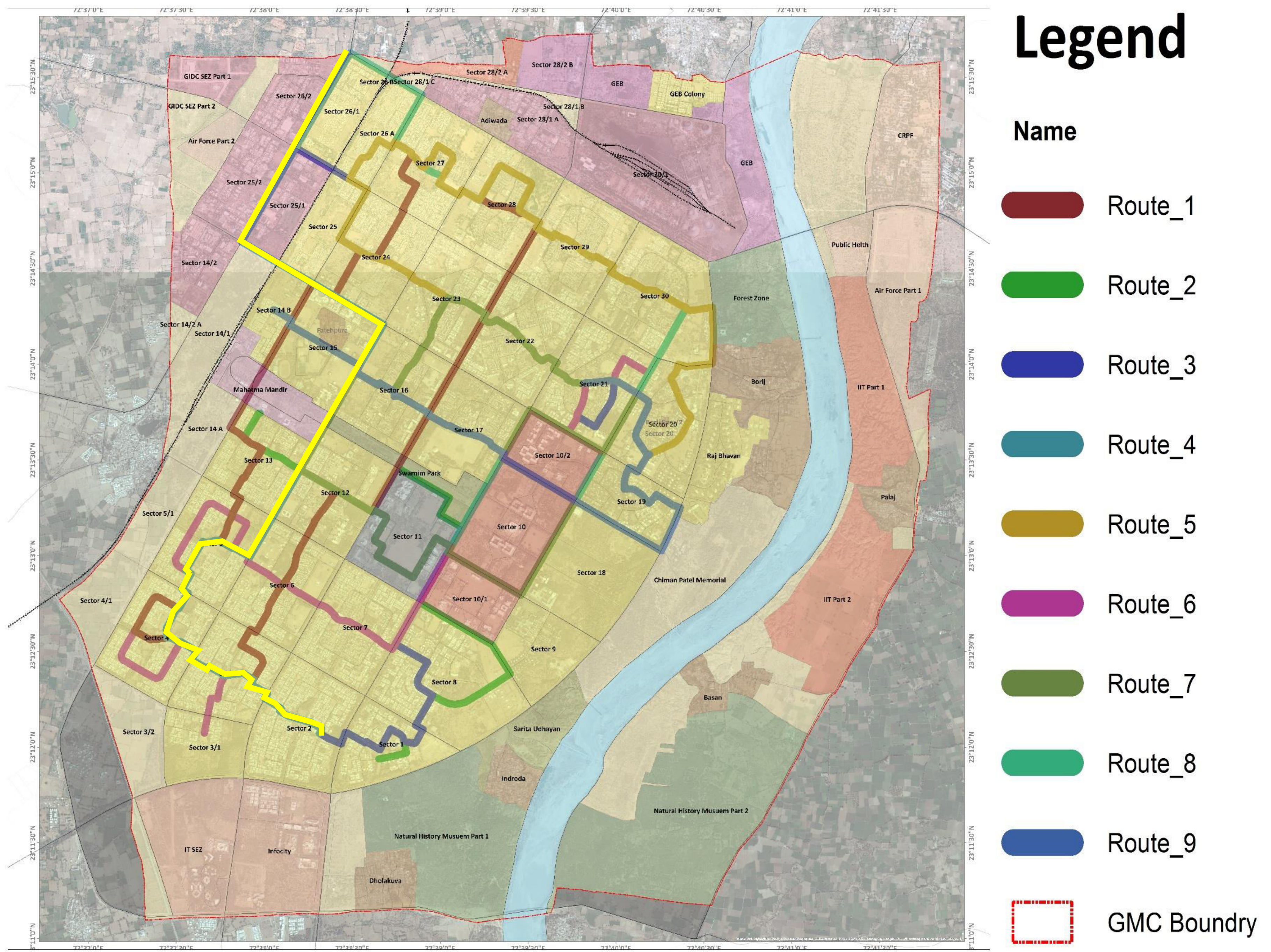
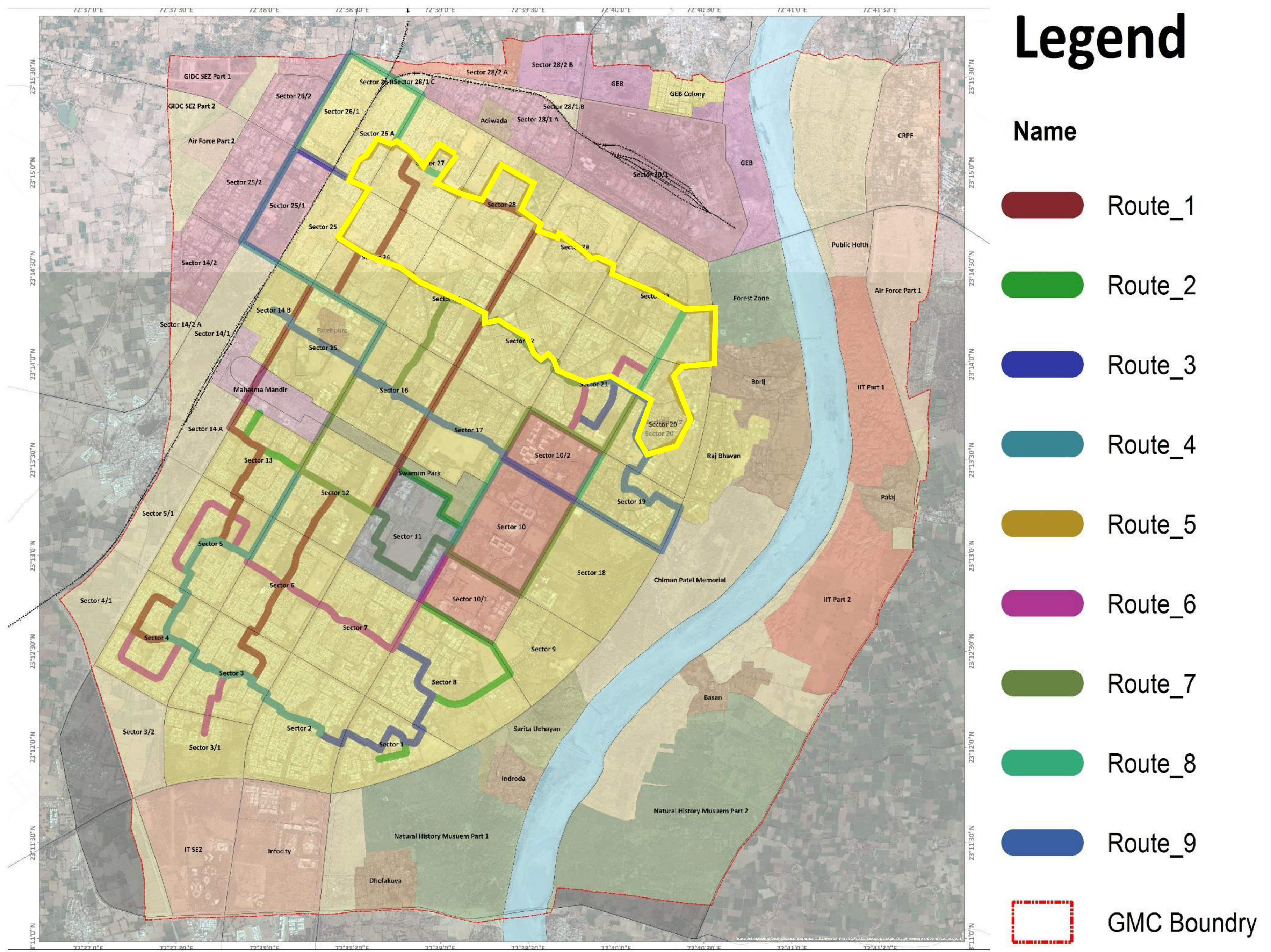
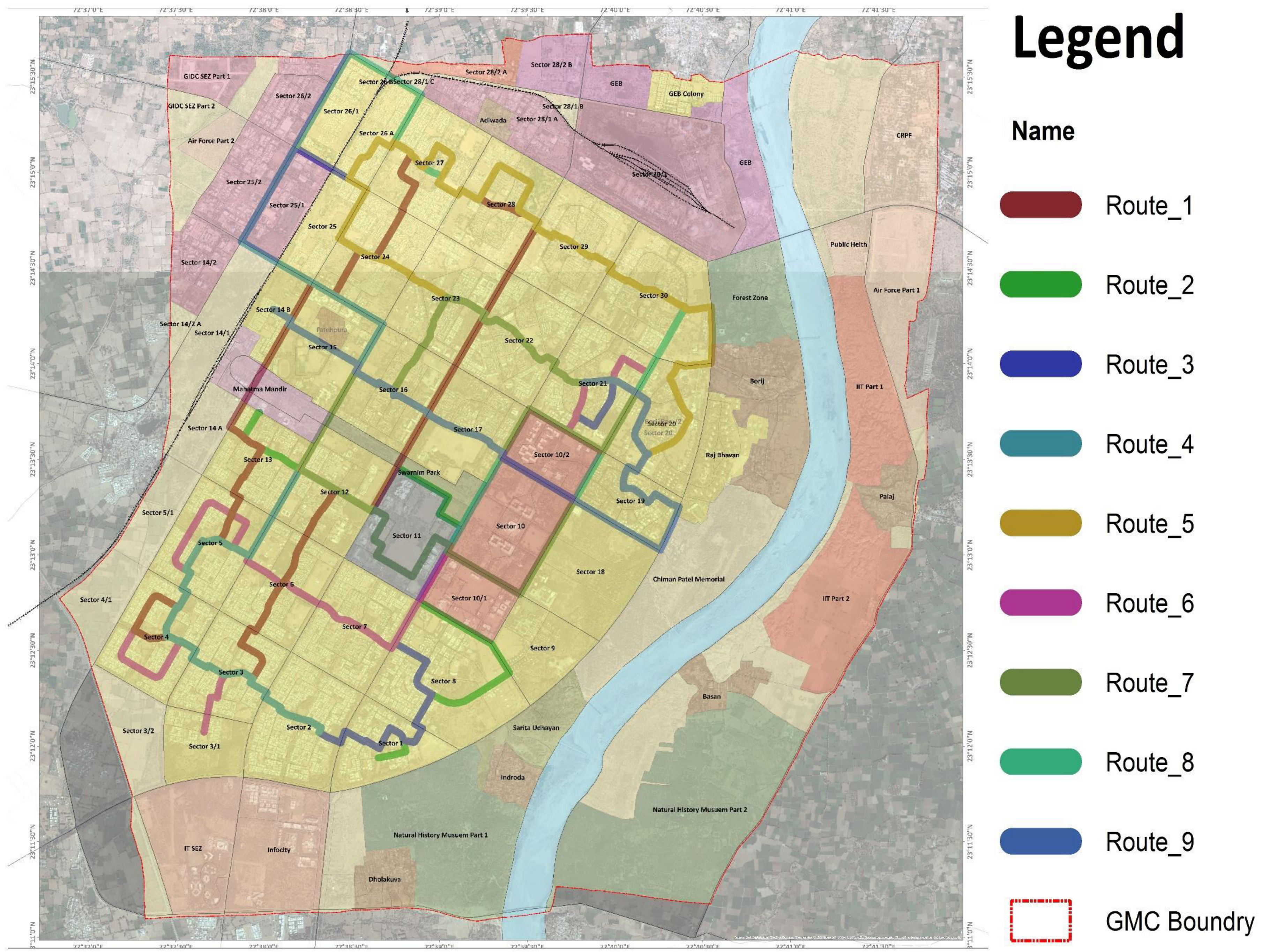


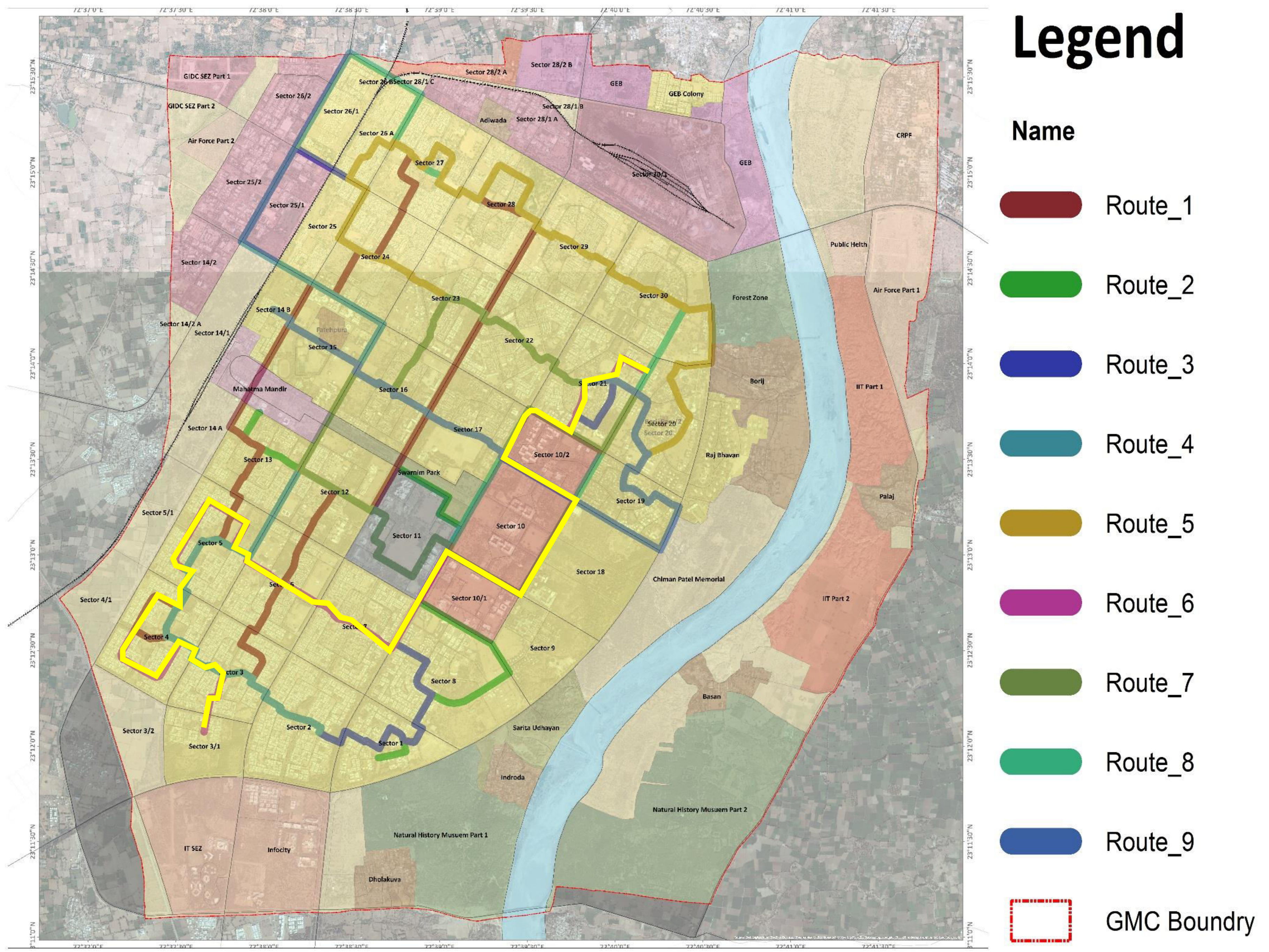
Proposals (Route Planning and Scheduling)



Proposals (Route Planning and Scheduling)



Proposals (Route Planning and Scheduling)



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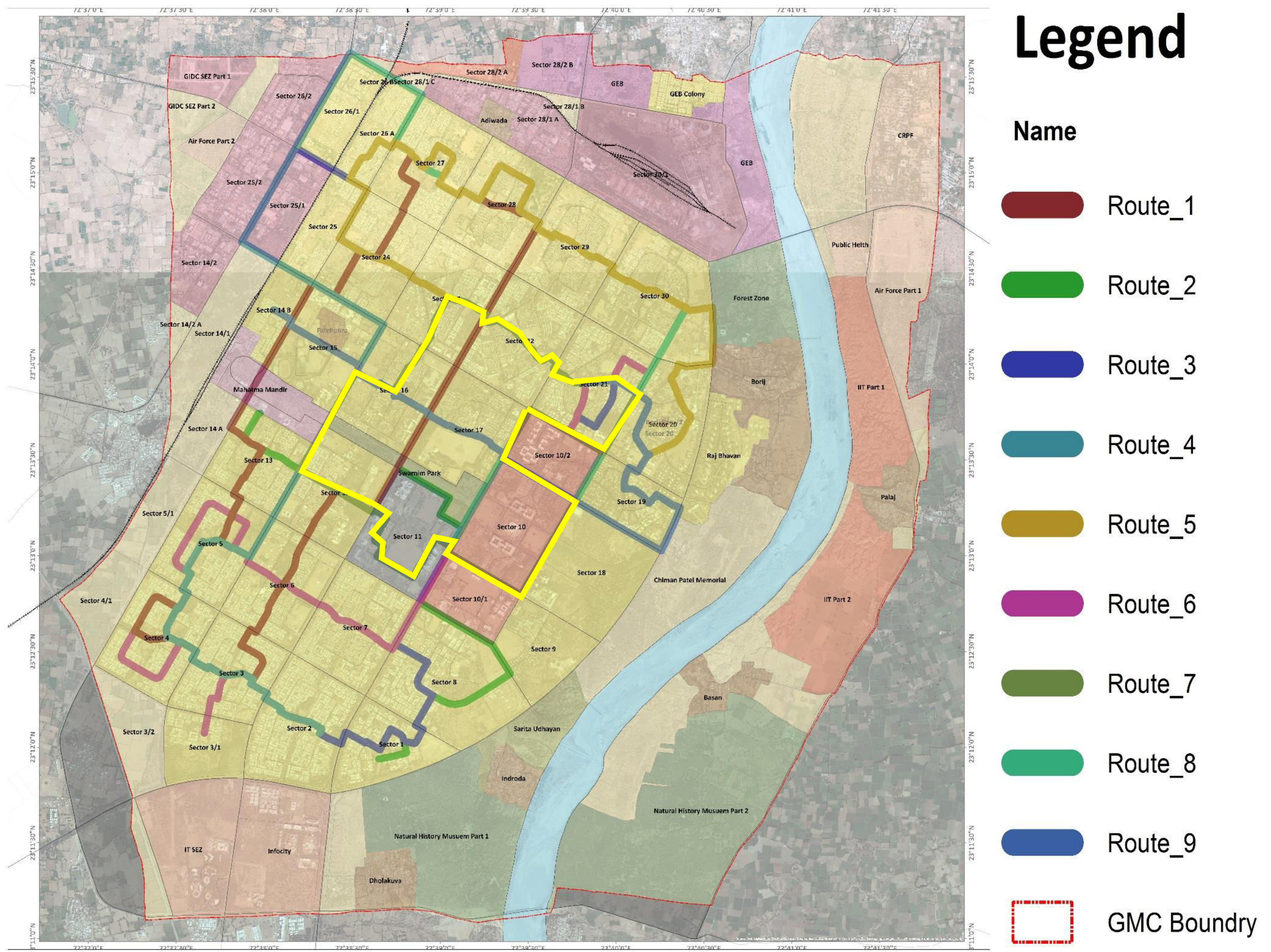
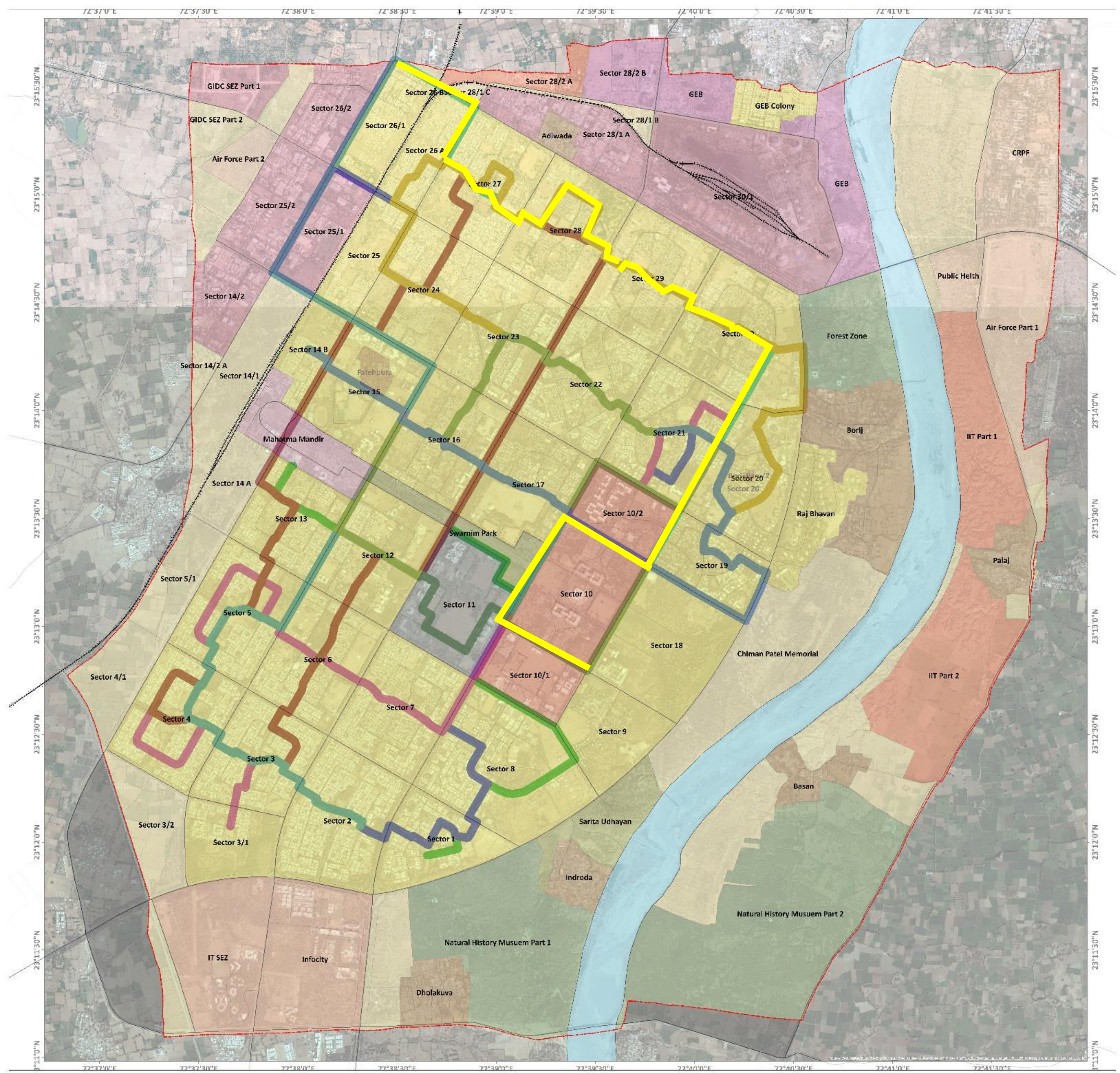


Proposals (Route Planning and Scheduling)

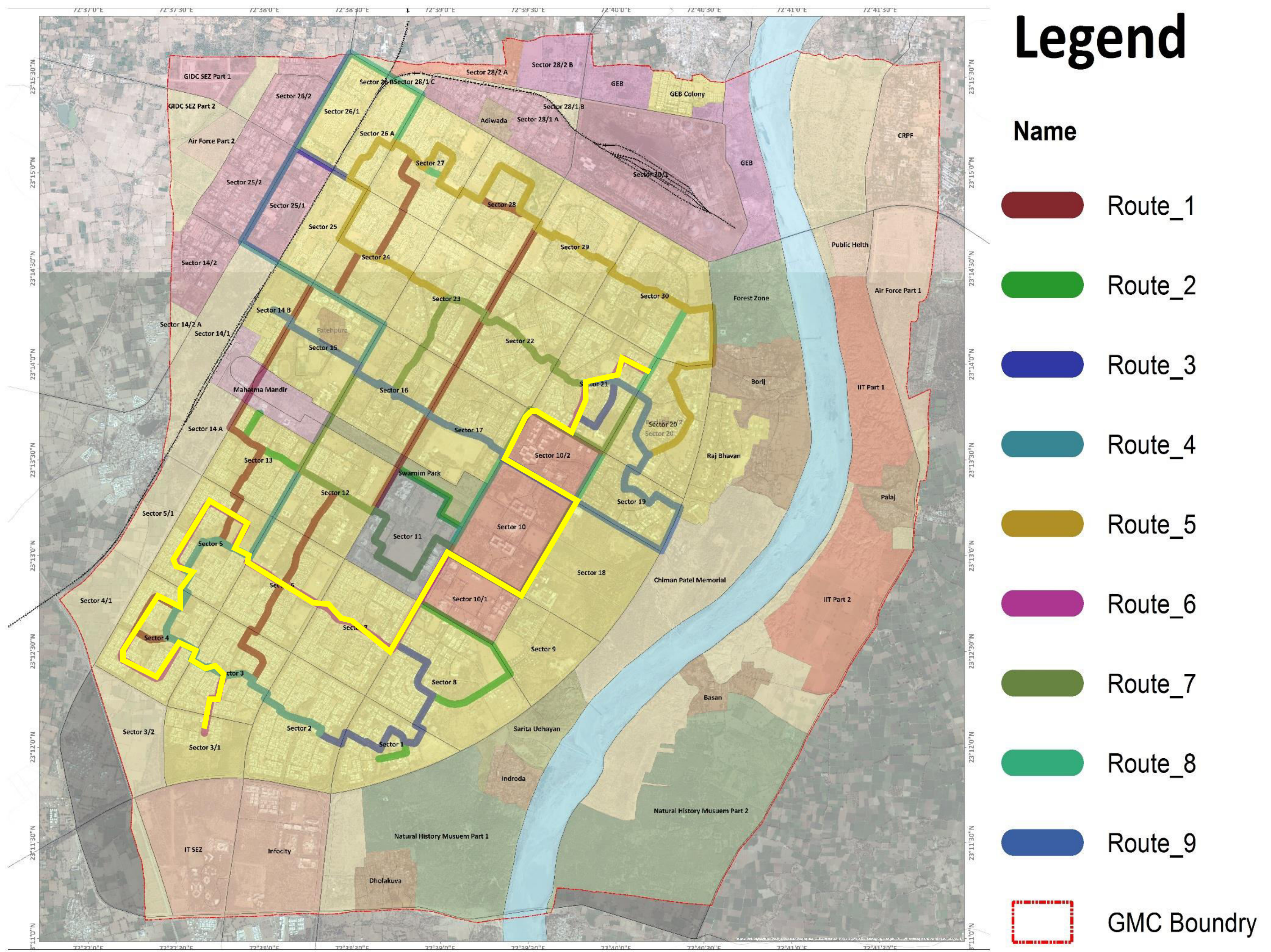


Legend

Name

- Route_1
- Route_2
- Route_3
- Route_4
- Route_5
- Route_6
- Route_7
- Route_8
- Route_9
- GMC Boundry

Proposals (Route Planning and Scheduling)



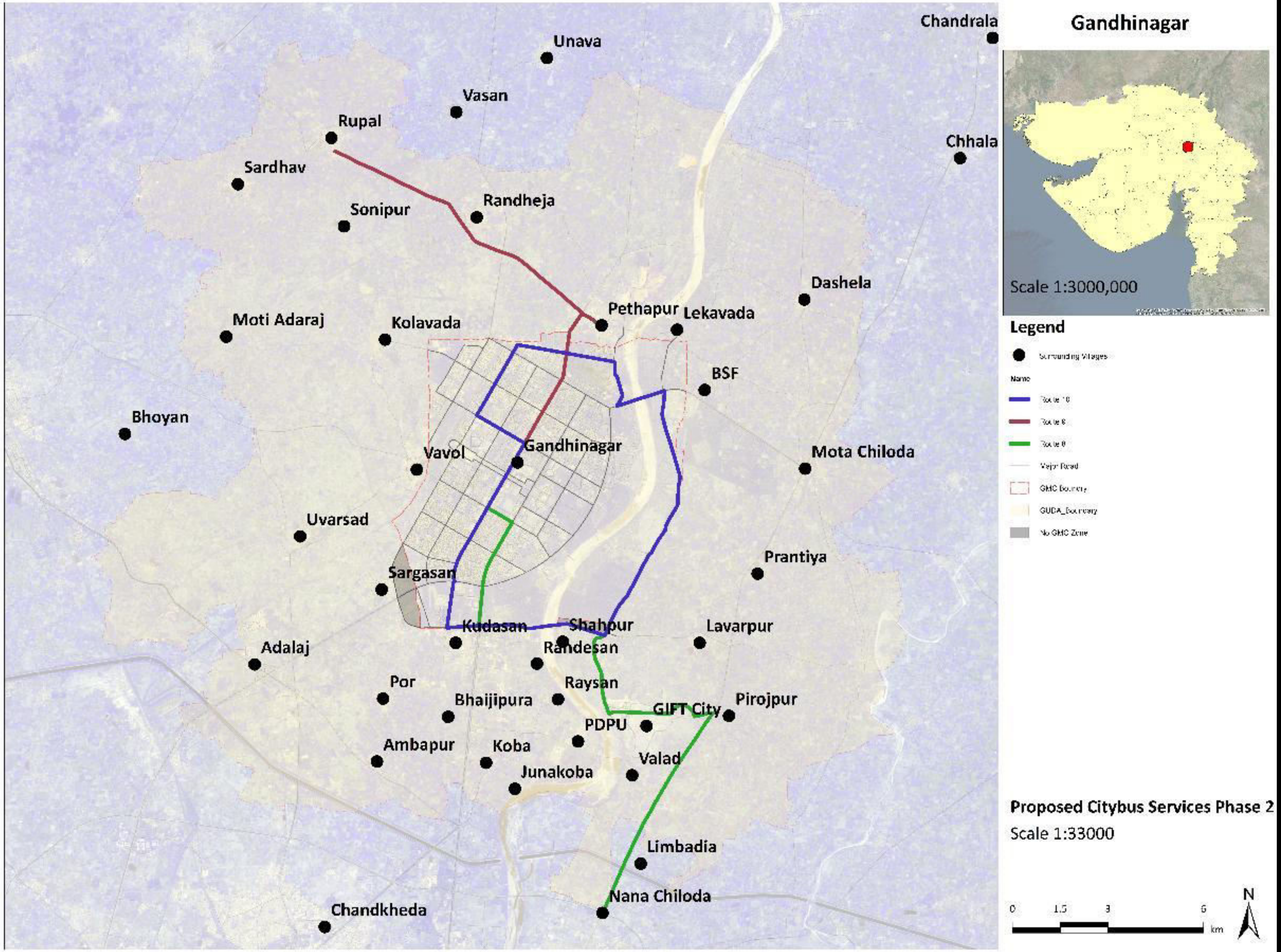
Proposals (Route Planning and Scheduling)

Proposals (Route Planning and Scheduling)

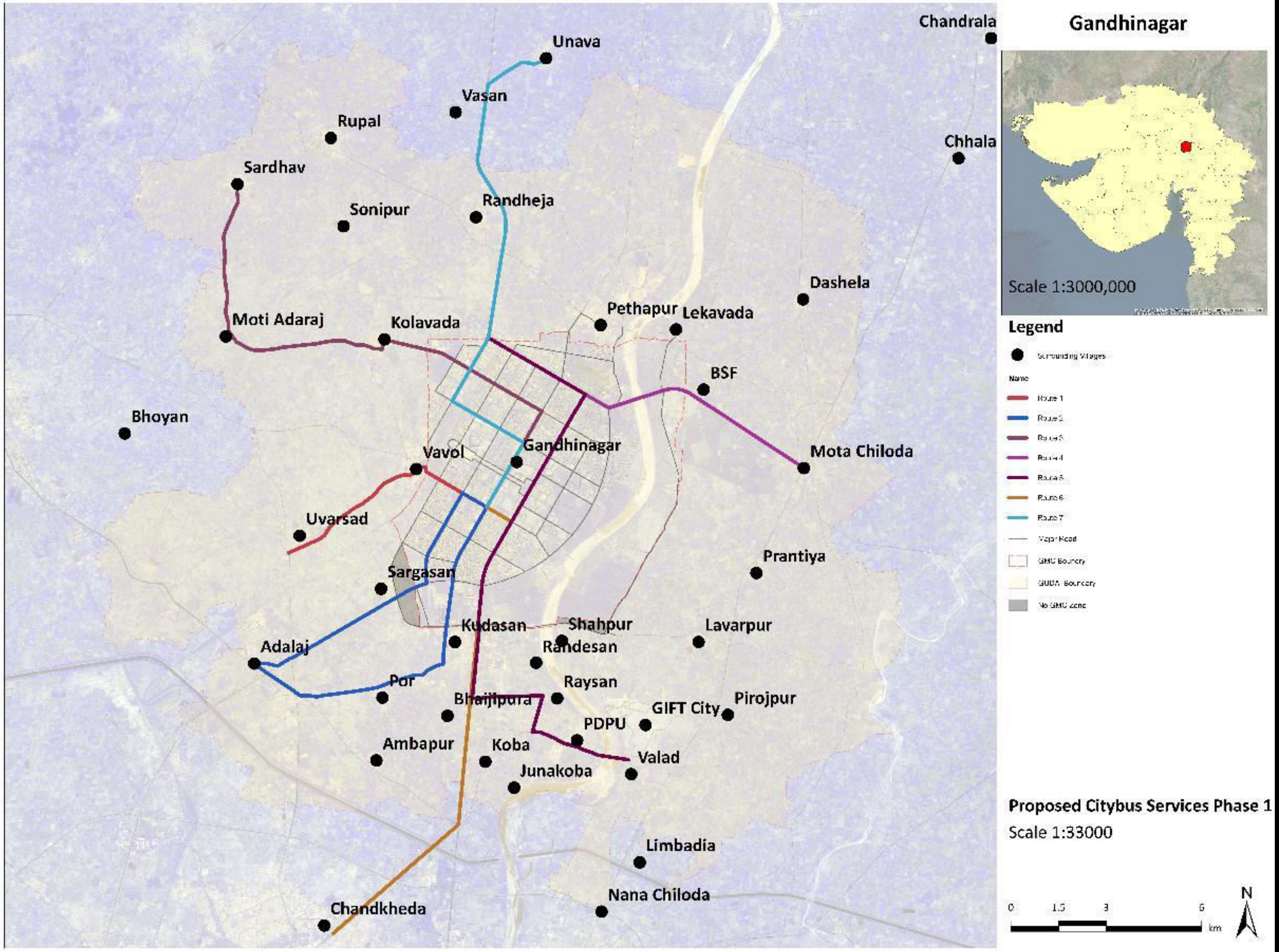
	Route 1	Route 2	Route 3	Route 4	Route 5
Distance (km)	16.6	7.1	12.8	10.9	12.8
Average speed (km/hr)	25				
Type of route	Circular	Two Way	Return	Return	Circular
Number of Buses	2	2	1	1	2
Number of drivers	2	2	1	1	2
Timings: Bus-1	06:15 am 11:30 am 05:00 pm 08:00 pm	08:45 am 10:15 am 01:30 pm 05:55 pm 07:30 pm	07:30 am 09:00 am 10:30 am 01:30 pm 04:30 pm 06:00 pm 07:30 pm	07:30 am 09:00 am 01:30 pm 04:30 pm 06:00 pm 07:30 pm	07:15 am 12:30 am 04:00 pm 07:00 pm
Timings: Bus-2	06:25 am 11:40 am 05:30 pm 09:00 pm	08:45 am 10:15 am 01:30 pm 05:55 pm 07:30 pm			07:25 am 12:40 am 06:30 pm 08:00 pm

Proposals (Route Planning and Scheduling)

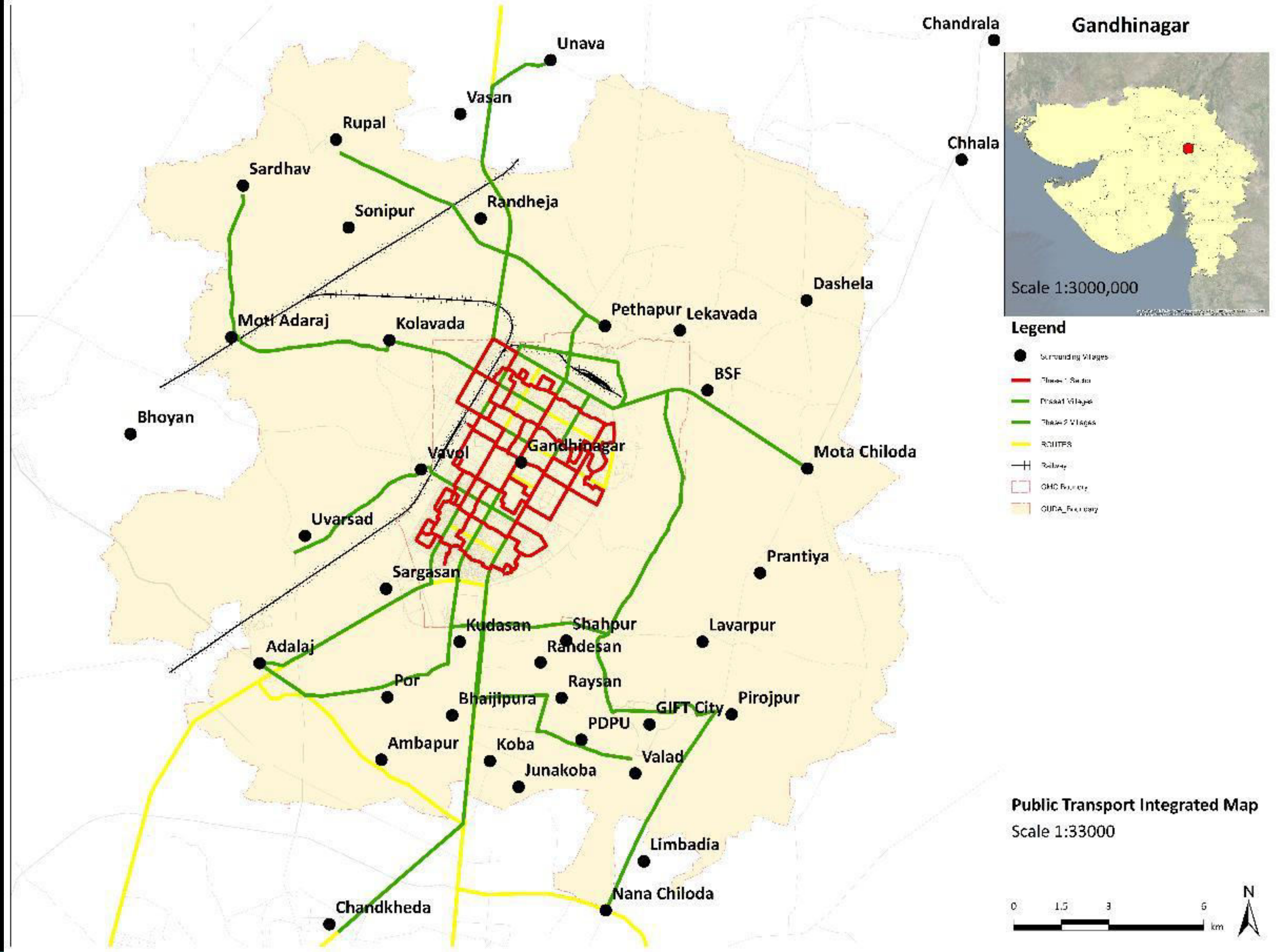
	Route 6	Route 7	Route 8	Route 9
Distance (km)	13	12	9.9	7.5
Average speed (km/hr)	25			
Type of route	Return	Circular	Return	Return
Number of Buses	1	2	2	1
Number of drivers	1	2	2	1
Timings: Bus-1	10:30 am 01:30 pm 04:00 pm 05:30 pm 07:00 pm	06:30 am 07:00 am 08:00 am 09:30 am 10:00 am 11:00 am 12:00 pm	08:15 am, 08:45 am 09:15 am, 10:15 am 01:15 pm, 01:30 pm 02:45 pm, 05:45 pm 06:00 pm, 07:15 pm 07:30 pm	10:00 am 05:50 pm
Timings: Bus-2		01:30 pm 02:45 pm 04:00 pm 05:00 pm 06:00 pm 07:00 pm 08:15 pm		



Proposals (Route Planning for Special Routes)

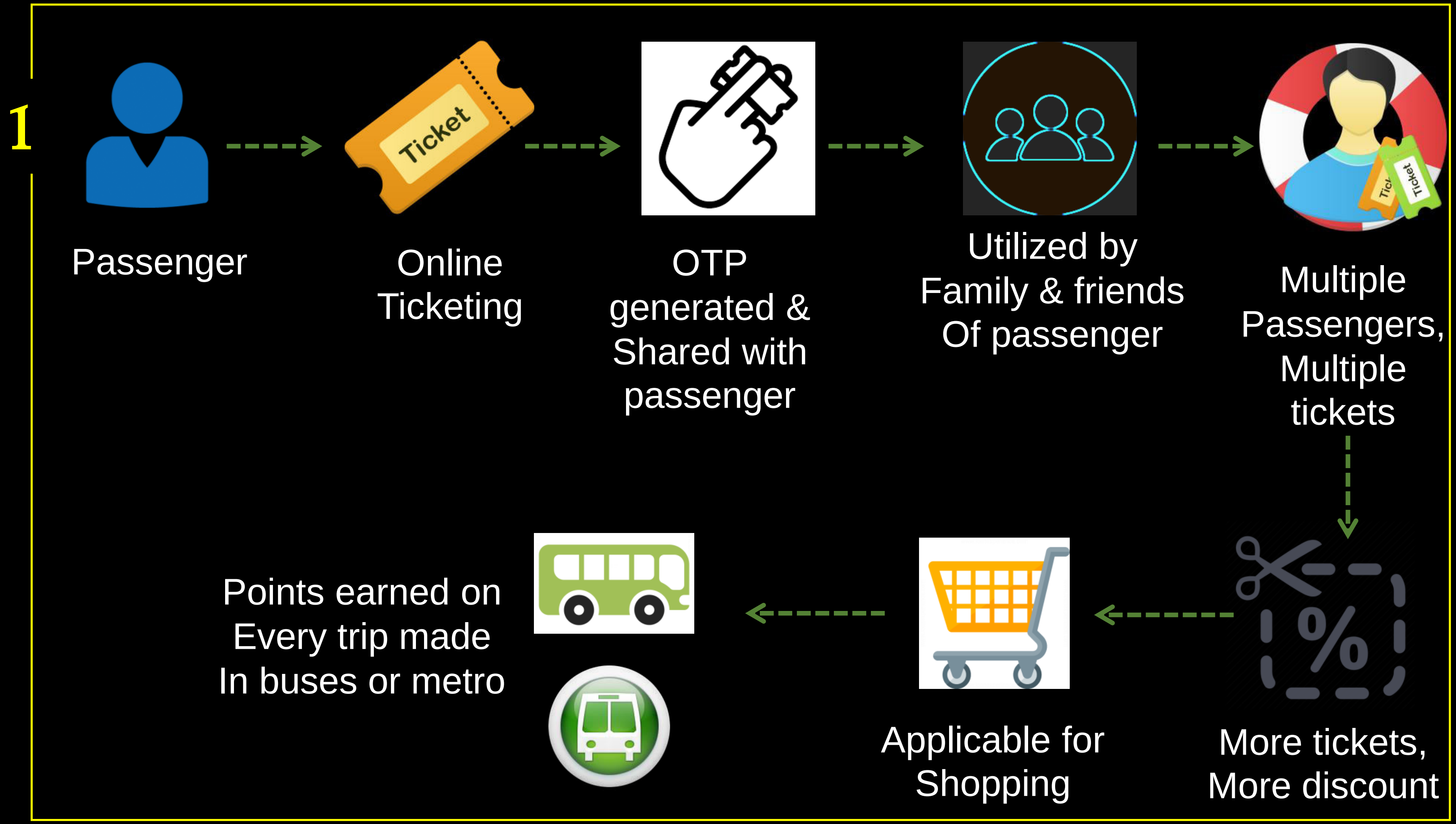


Proposals (Route Planning for GUDA area)



Proposals (Route Planning for Public Transport Mode - Integration Map – GUDA+GMC)

Ticketing System

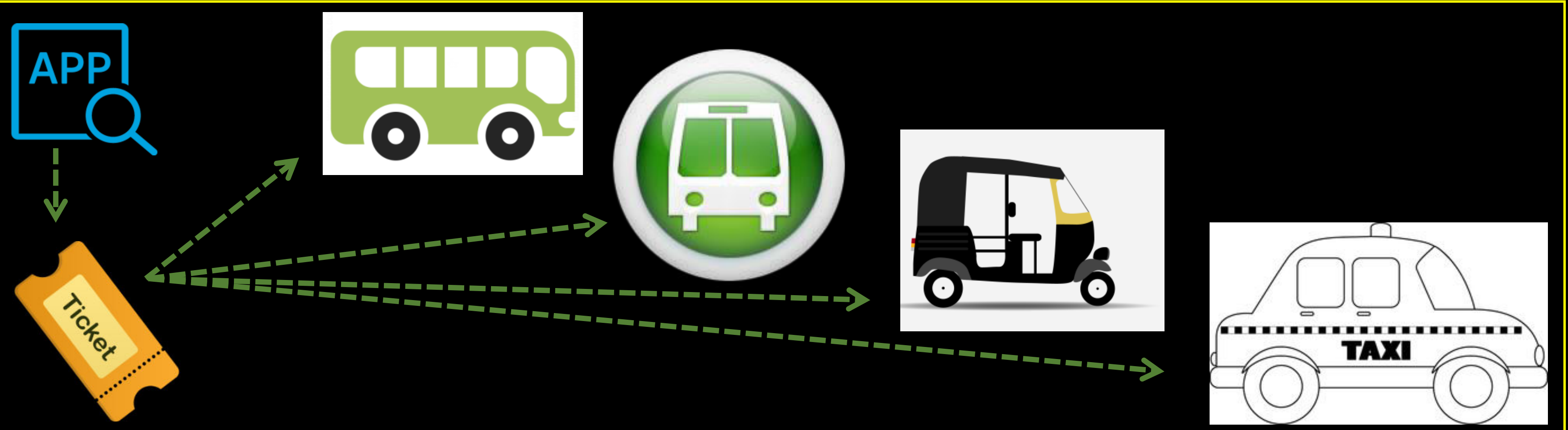


Smart solutions

* GIS: Geographic Information System, PHPDT: Peak Hour Peak Direction Traffic

Ticketing System

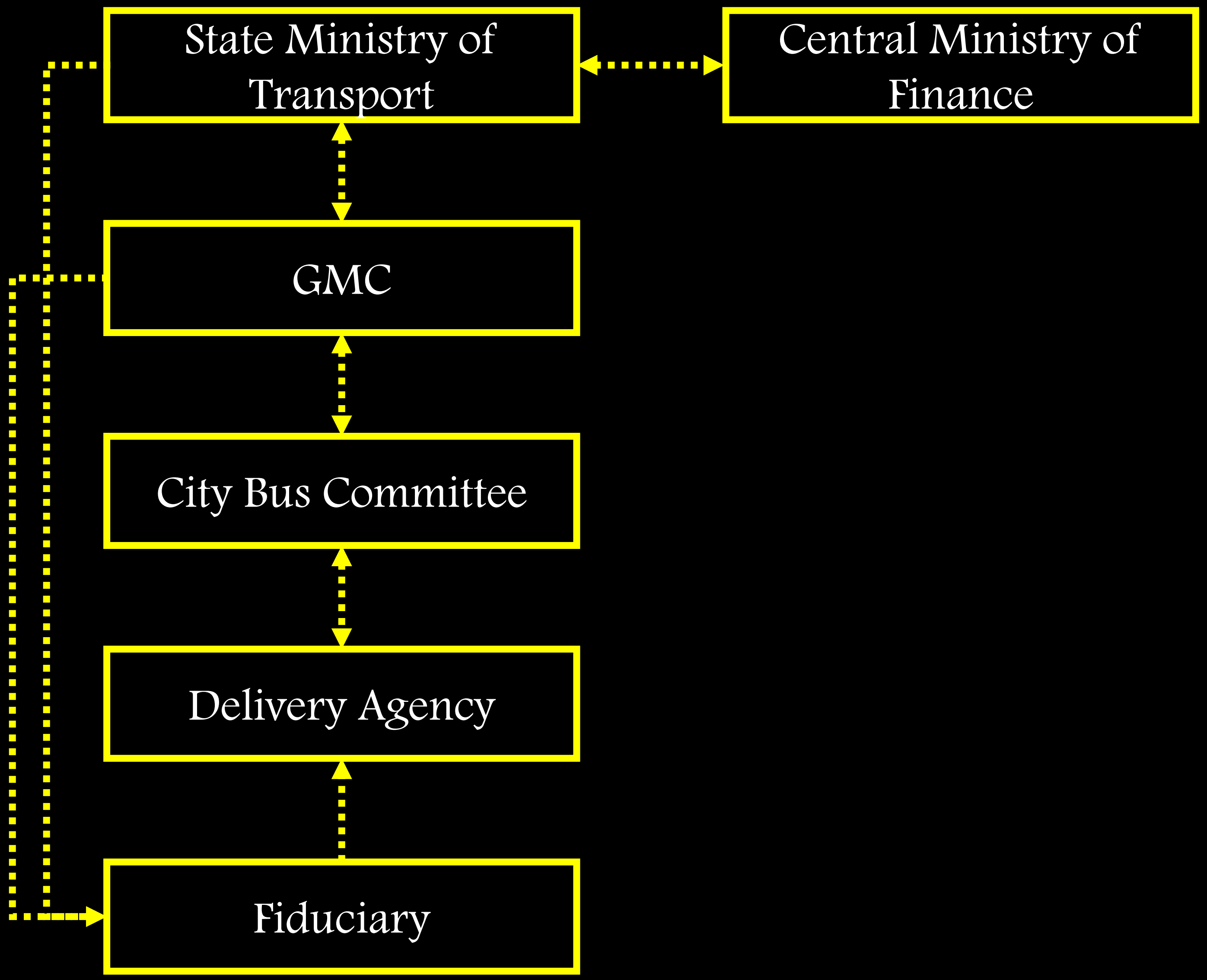
2



A day can be celebrated as a car free day encouraging pedestrians and cyclist. This days can be increased after providing proper cycling infrastructure and this will also help in promoting proper public transport.

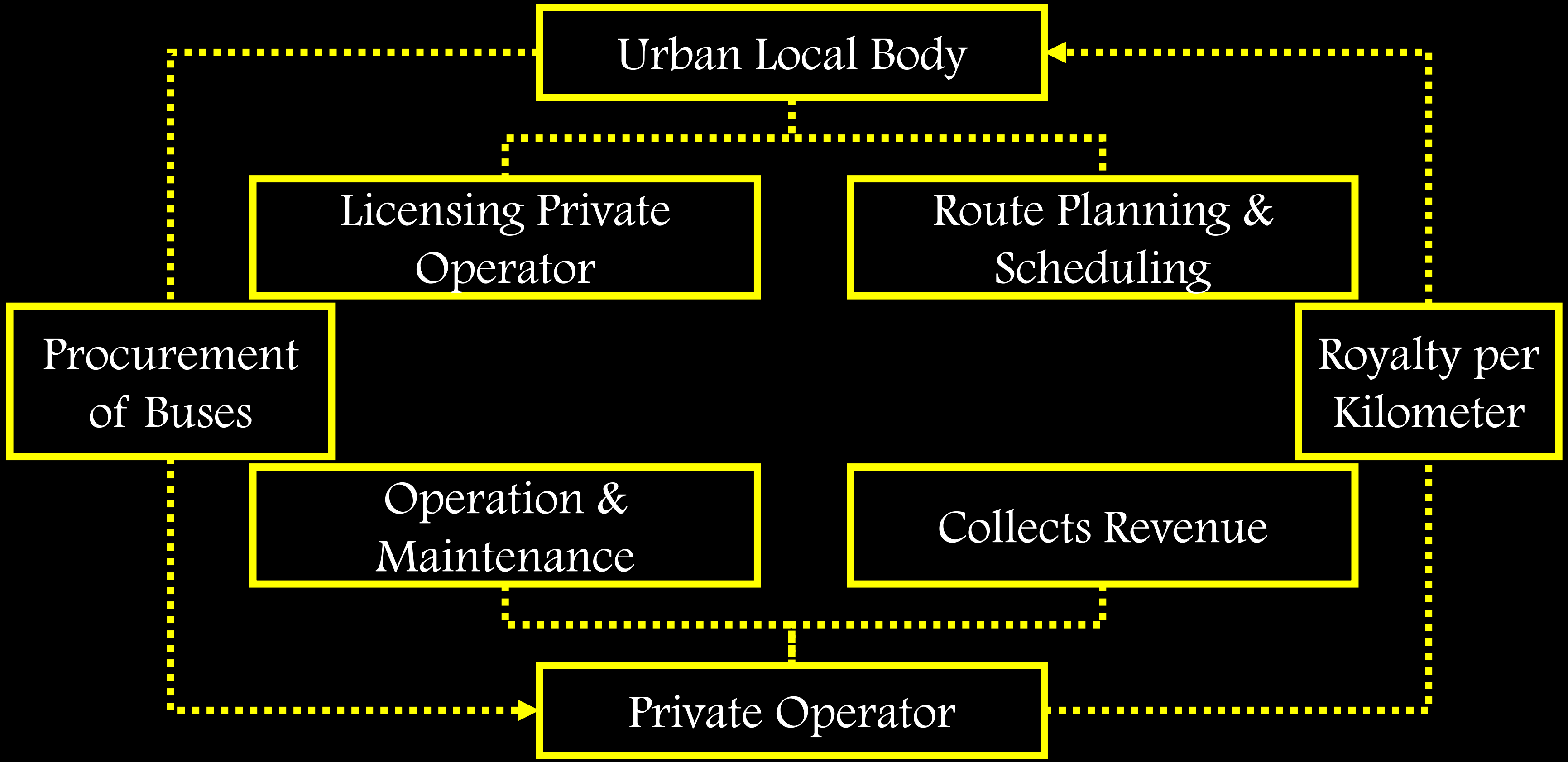
Smart solutions

Institutional Framework

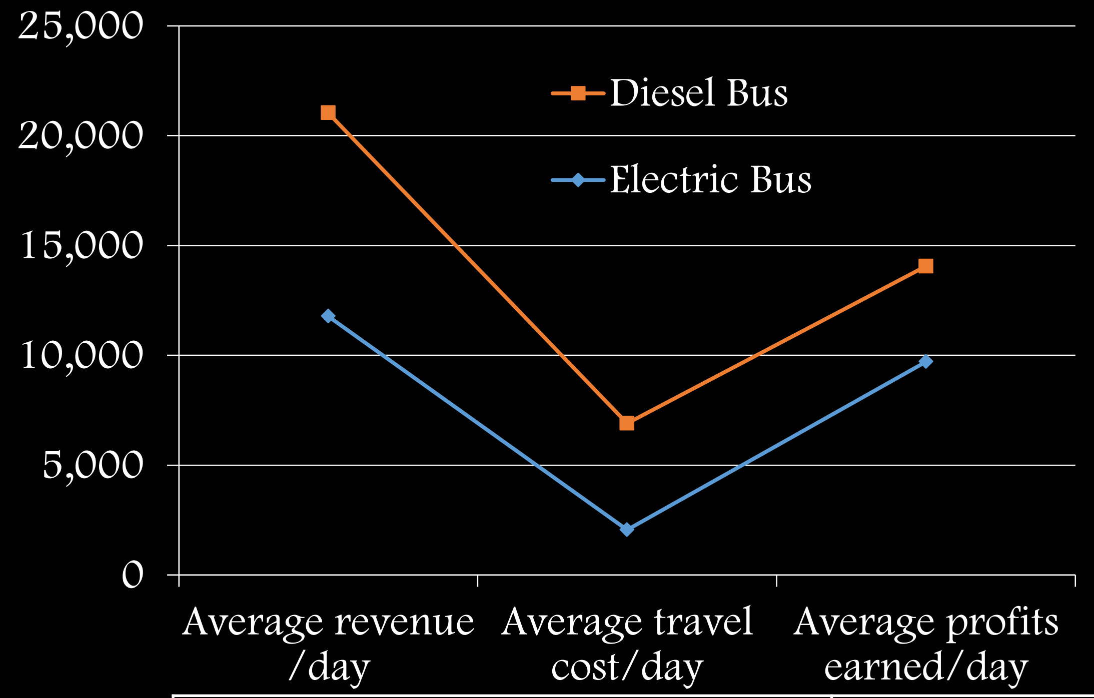


Framework

Licensing (O&M) Contract



Framework



Cost Estimation

	Diesel buses	Electric buses
Cost of 1 bus	85,00,000	300,00,000
Cost of 15 buses	1275,00,000	4500,00,000
Average revenue/ day	9,256	11,781
Average travel cost/ day	4,843	2,064
Average profits earned/ day	4,344	9,717
Annual profits earned	2,077,580	3,793,445
Losses	2,847	0

Functioning buses: 10
Spare buses: 5
Total buses: 15

Inference

Electric buses generate 27% more revenue and 82% more profits than diesel buses per day

Source: http://www.thebetterindia.com/49637/electric-buses-vs-diesel-buses-iisc-study/

Thank You