10th Urban Mobility India Conference & Expo 2017

CODATU 2017

Welcome to a presentation

# PUBLIC BICYCLE SHARING: AN APPROACH TOWARDS SUSTAINABLE TRANSPORTATION
# A CASE STUDY OF CBD IN INDIAN CONTEXT


**Sardar Vallabhbhai National Institute of Technology,surat**
Civil Engineering Department

**PRESENTED BY :**

SAMIR J PATEL
RESEARCH SCHOLAR
SVNIT,SURAT

# Contents

# Introduction

# Concept of PBS


- Public Bicycle Sharing (PBS) is a high quality bicycle based public transport system that include:
  - Bicycles;
  - Key locations;
  - Closely spaced network of stations;
  - GPS based Tracking of bicycles;
  - Allows short-term shared use of bicycles.


- Mechanism
  - A user checks-out the bicycle from one location, rides to destination, and drops the bicycle to another location.
  - The operators coordinate the redistribution of bicycles and ensure availability of cycles at locations with the highest demand at any given time.

# Global Practice


- More than 600 cities around the globe have operational bicycle share systems, and more programs are starting every year.

- The largest systems are in
  - China (Hangzhou, Shanghai and others)
  - Paris
  - London
  - Washington, D.C. to name a few

2001 the city of Vienna

various cities of Cyprus

Brussels in 2009

Velo'v in Lyon, France in 2005

In late 2013, Copenhagen

Helsinki went live in 2016

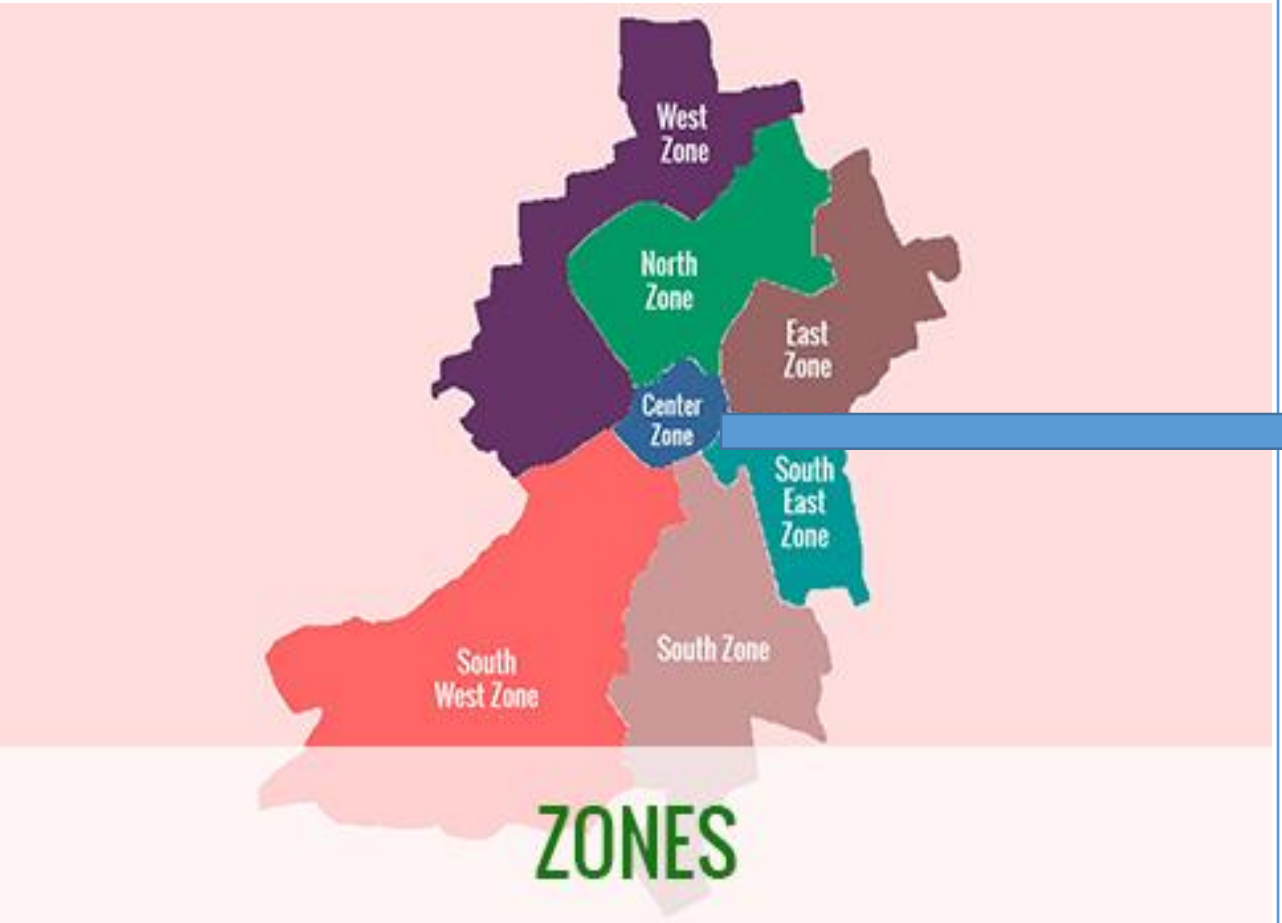
# Indian Practice

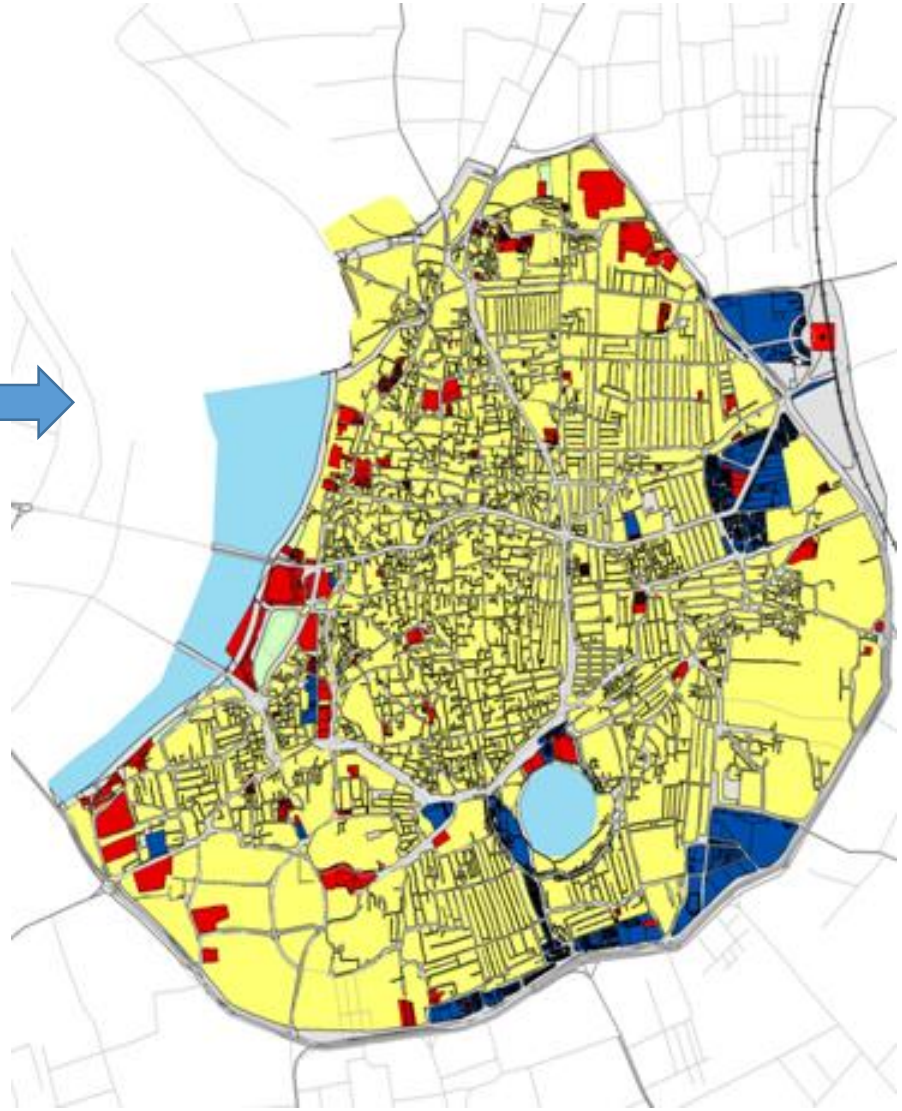

- Mumbai
  - •Mumbai operates two schemes as part of its "Mission for Sustainable Habitat".
- Bengaluru (Bangalore)
  - •Namma Cycle is a bicycle sharing system at IISc, Bangalore campus and the surrounding neighborhood.
  - •The ATCAG system implements a bicycle sharing program aimed primarily to solve the last-mile problem for users of the Bangalore Metro.
- Ahmedabad
  - •MyByk cycle sharing program in Ahmedabad started with eight stations within the city in 2013.
- Mysuru (Mysore)
  - •Mysore is the first Indian city to initiate cycle sharing in 2009 with 28 locations.
- The trend is catching on in some other cities including
  - Delhi,
  - Rajkot,
  - Bhubaneswar,
  - Vadodara (Baroda), and
  - Gandhinagar

| S. No | City | State | System | Fleet size | Docking station |
|---|---|---|---|---|---|
| 1 | Mysore | Karnataka | Bicycle sharing | 450 | 52 |
| 2 | Bhopal | Madhya Pradesh | Bicycle sharing | 500 | 50 |
| 3 | Bangalore | Karnataka | Bicycle sharing | 45 | 09 |
| 4 | Ahmedabad | Gujarat | Bicycle Rental | 2000 | 9 |
| 5 | Gandhinagar | Gujarat | Bicycle sharing | 1430 | 104 |
| 6 | Chennai* | Tamil Nadu | Bicycle sharing | 3000 | 200 |

# Why it is necessary

- According to bike sharing world map as on 2015, 813 bicycle-sharing schemes operating and 221 being planned in more than 30 countries with approximately fleet size of 240,000 bicycles.
- Cycling seem easier, healthier, convenient, and safer compared to driving
- Urban planners promote cycling as environmentally friendly mode of transportation
- According to studies  about 35% of the vehicular trips in Indian cities are short trips Tiwari et al.(2008)
- Most of the medium and large cities in India has 56% to 72 % trips which are short trips with less than 5 km trip length Dhingra & Kodukula (2010)

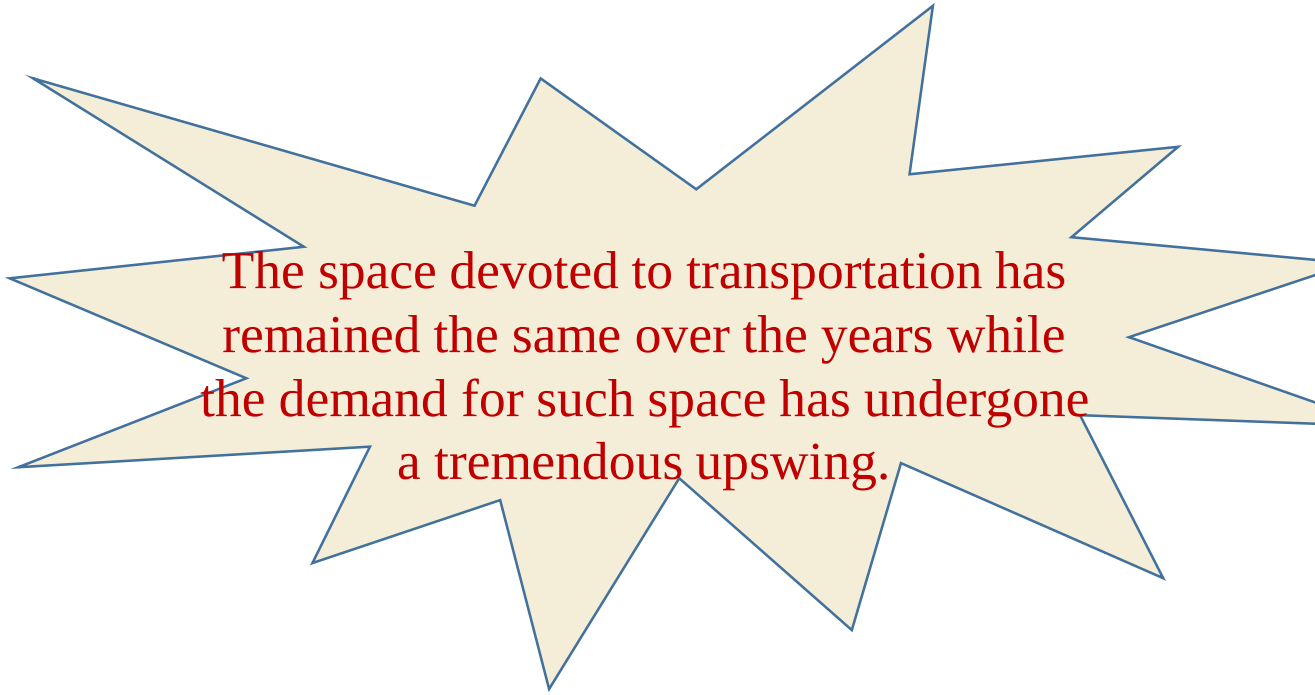


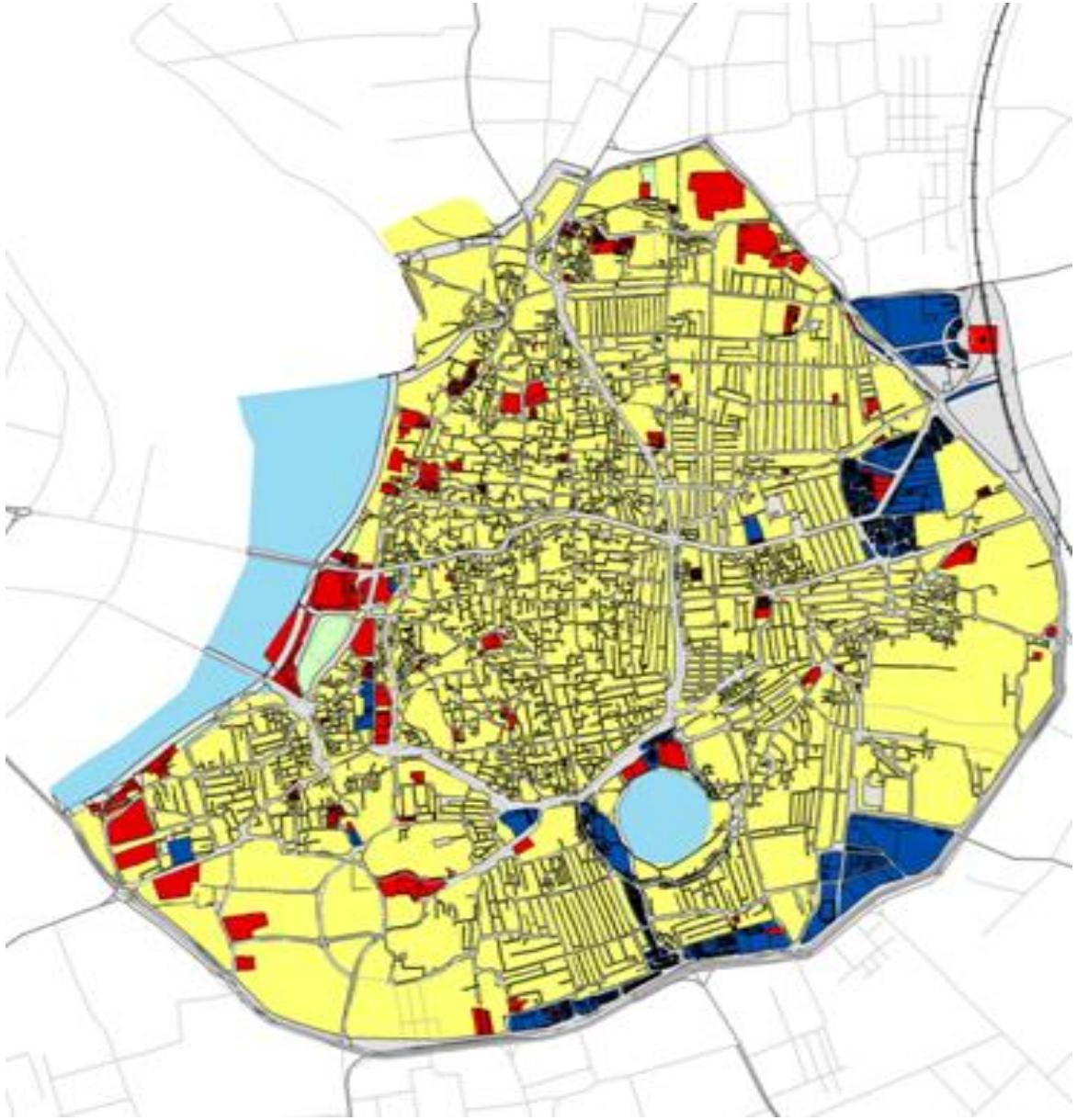
# Study Area Profile

# About Surat CZ

- It has varied land-use
  - Commercial places;
  - Manufacturing locations;
  - Residential and neighbourhood activities;
  - Entertainment and recreation places;
  - Institutional and administration offices;
  - Public spaces like religious places, libraries and community halls;
  - heritage rich locations with potential tourism attraction;
  - Chowk area is having organic growth, having high population density and higher FSI;
  - Important links passing from this Zone which Connect important locations outside of walled city.



- Central zone of city is highly congested with population density 48,926 person per $km^2$
- Concentrated activity within 8.18.$km^2$area leads to shorter parking issues for the visitors along with long term parking for employer and employees
- Due to evolved narrow road patterns CZ faces lot of traffic congestion and pedestrian-vehicular conflicts



**Legend**

Railway Line

**Roads**

<all other values>

**fclass**

primary

secondary

trunk

trunk_link

**Name**

Surat Railway Station

**Land Use**

**LU_CLASS**

COMMERCIAL ZONE

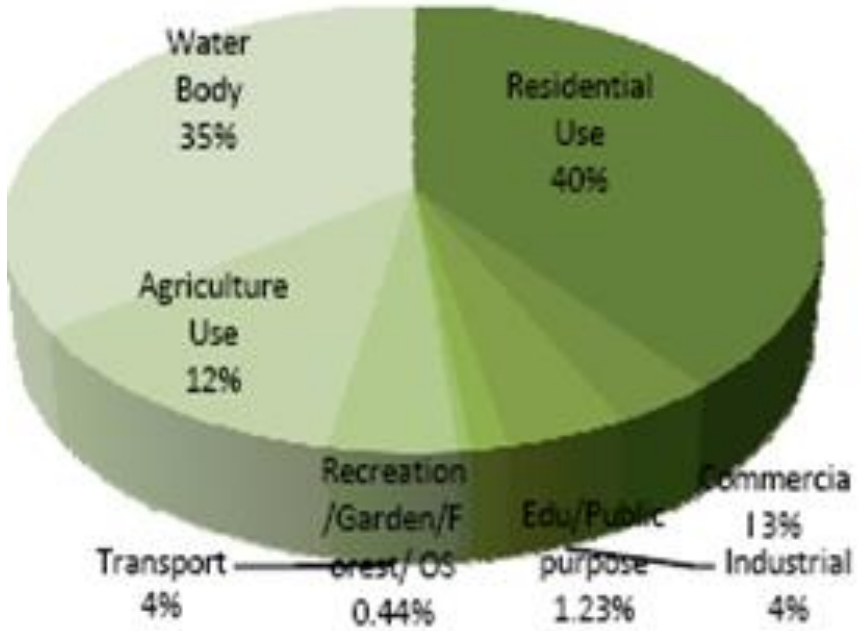
PUBLIC PURPOSE ZONE

RECREATIONAL ZONE

RESIDENTIAL ZONE

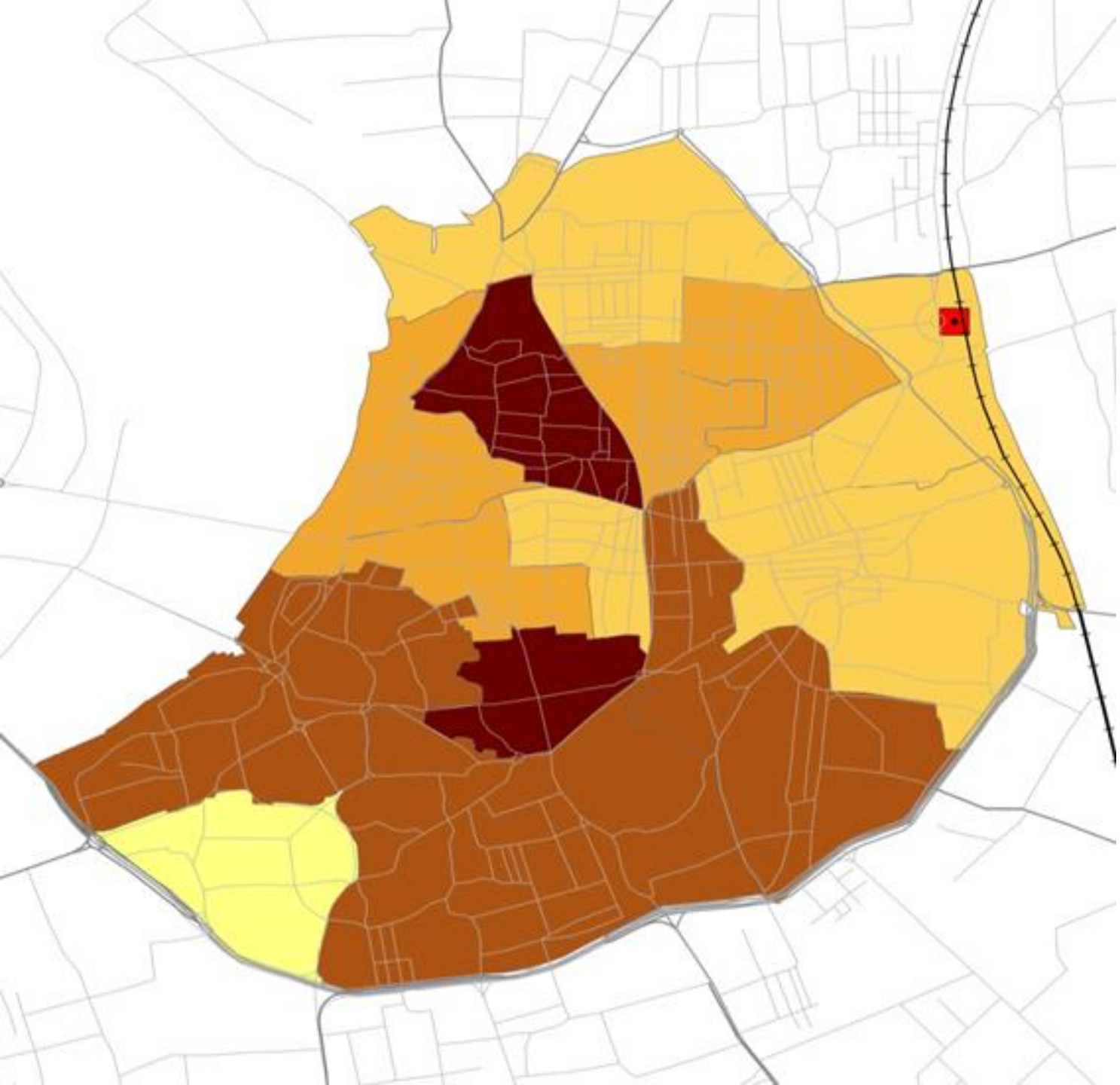
TRASPORT & COMMUNICATION ZONE

WATER BODIES




Land use Structure _ Central Zone

# Density Map Central Zone



**Legend**

Railway Line

**Roads**

<all other values>

**fclass**

primary

secondary

trunk

trunk_link

**Name**

Surat Railway Station

**Density**

200

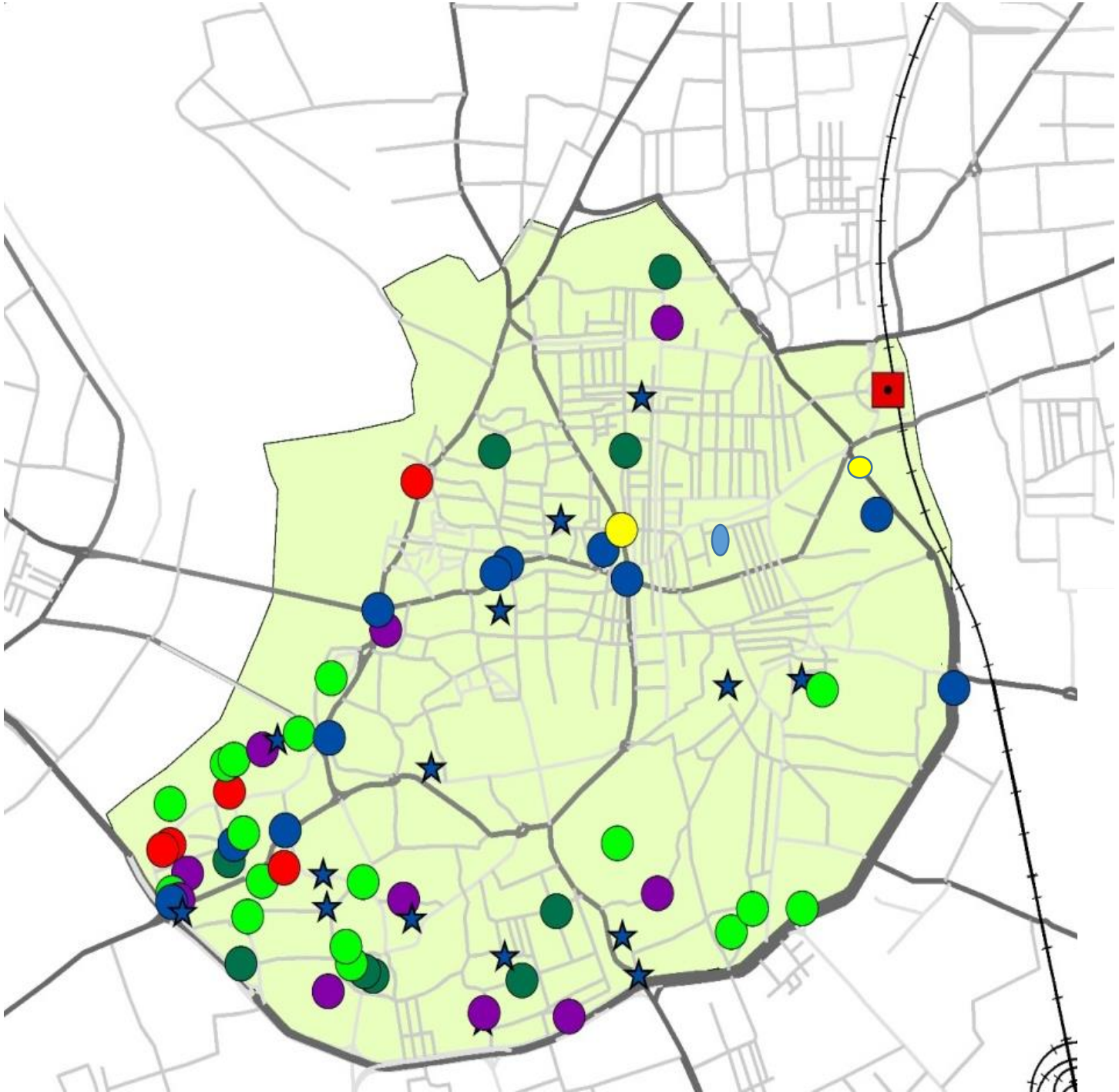
201 - 437

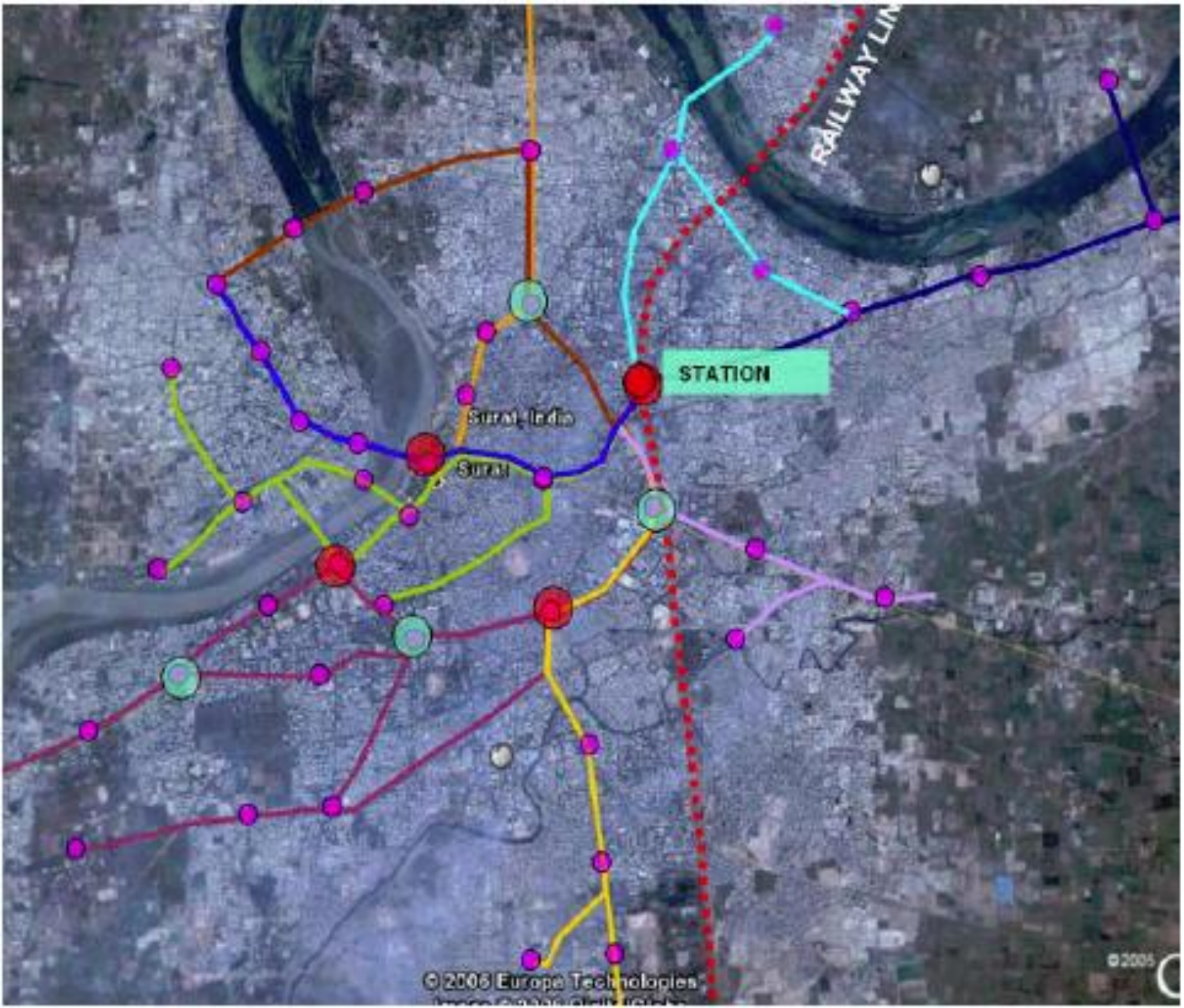
438 - 526

527 - 649

650 - 725

# Major trip Attracted Points






# Existing Auto Rickshaw Routes

# Potential PBS users in Surat CZ

- Daily commuters coming to Jobs and Shopping in Bhagal, Chowk, Mahidharpura, Shahara Darwaja area
- Residents and office employees of Central Zone to run general errands
- Time and budget sensitive tourists coming to heritage walk proposed by SMC
- Citizens visiting the Central Zone for various purposes.

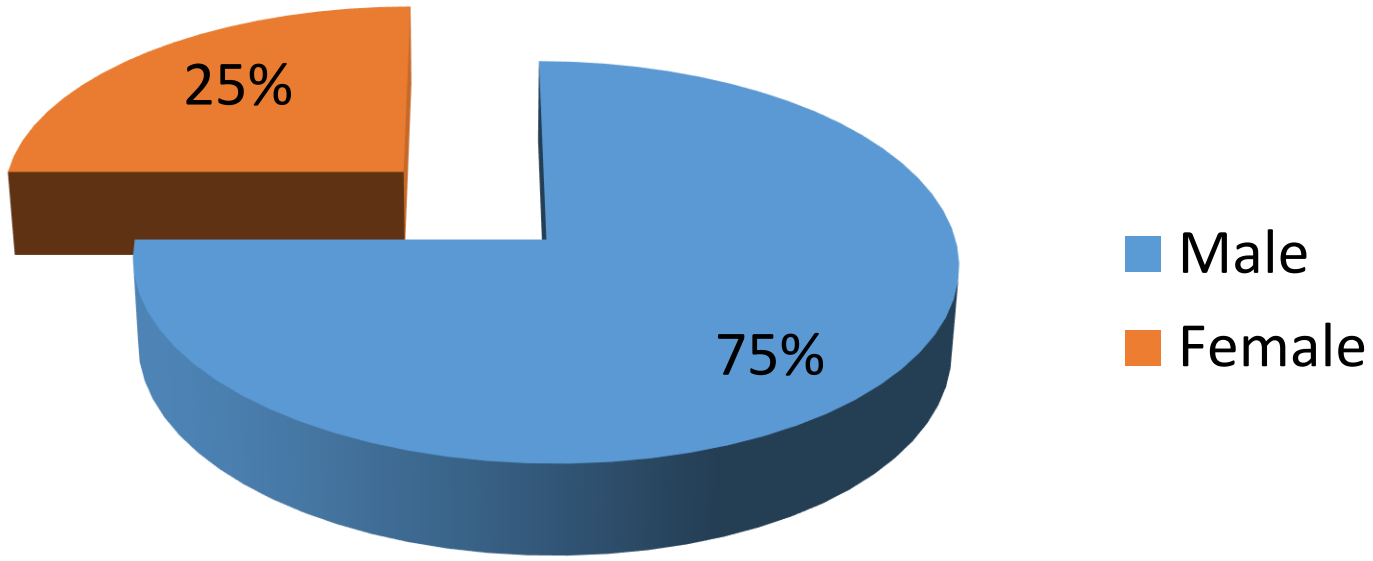
# Readiness for PBS in Surat

# Travel Behavior Study

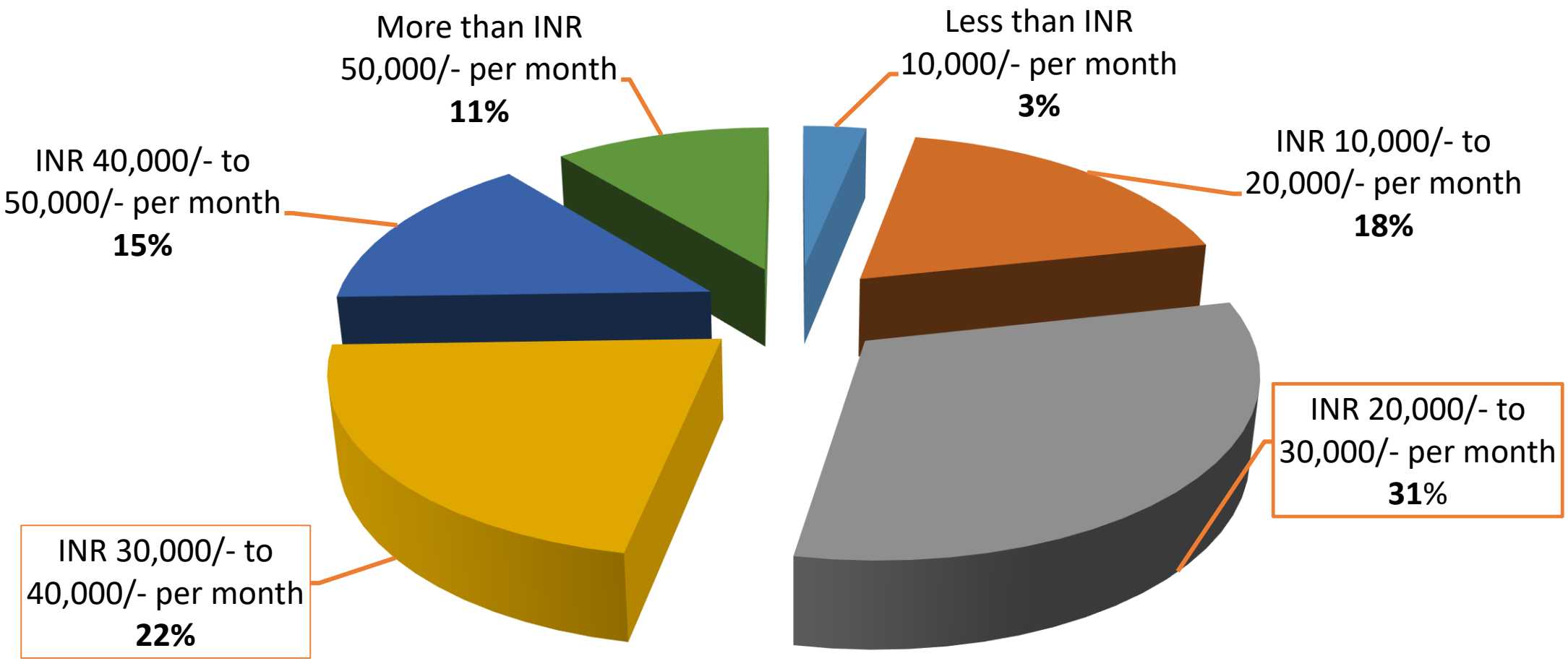
- HH Survey for the Central zone was completed between January to March 2017
- Total 1200 samples collects in 12 wards of CZ out of which 856 are valid HH survey

# Analysis of Survey For CZ

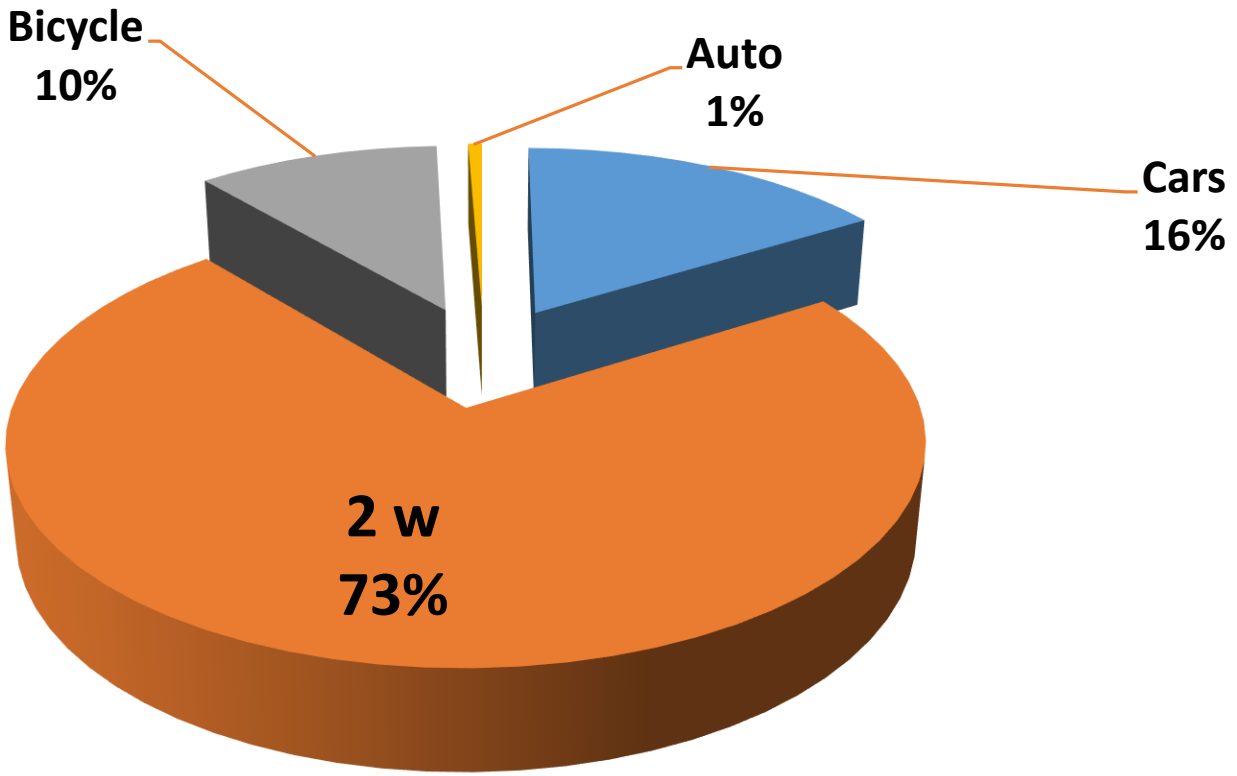
# Gender of respondant In CZ



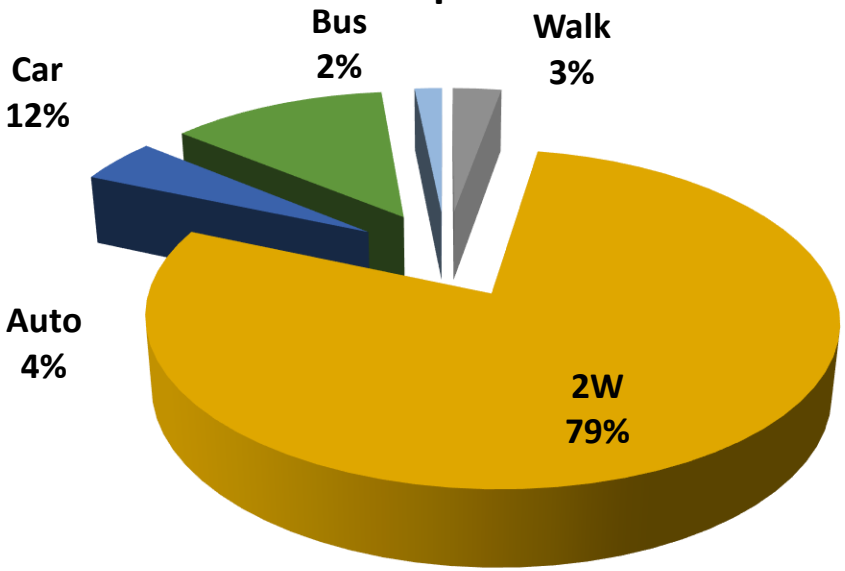
# Overall Household income In CZ



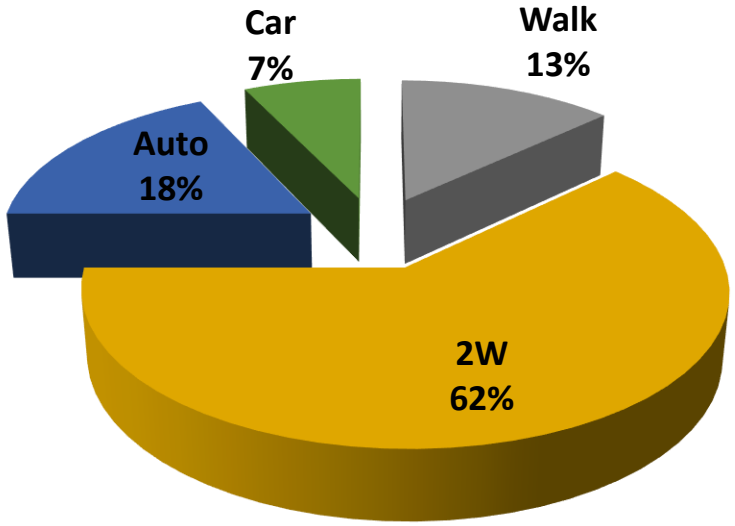
# Vehicle ownership



## Mode share of Work trip

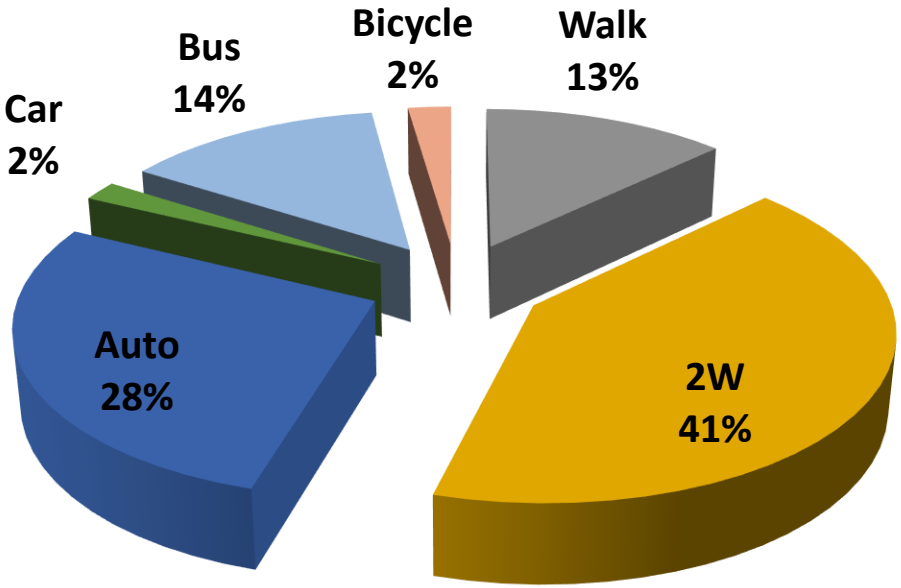



## Mode share for shoping trips

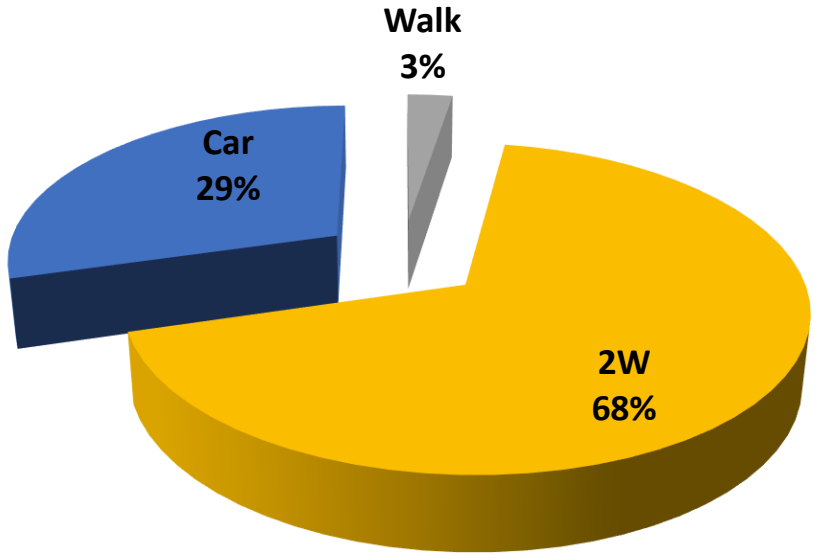



# MODE Share for Various Purpose

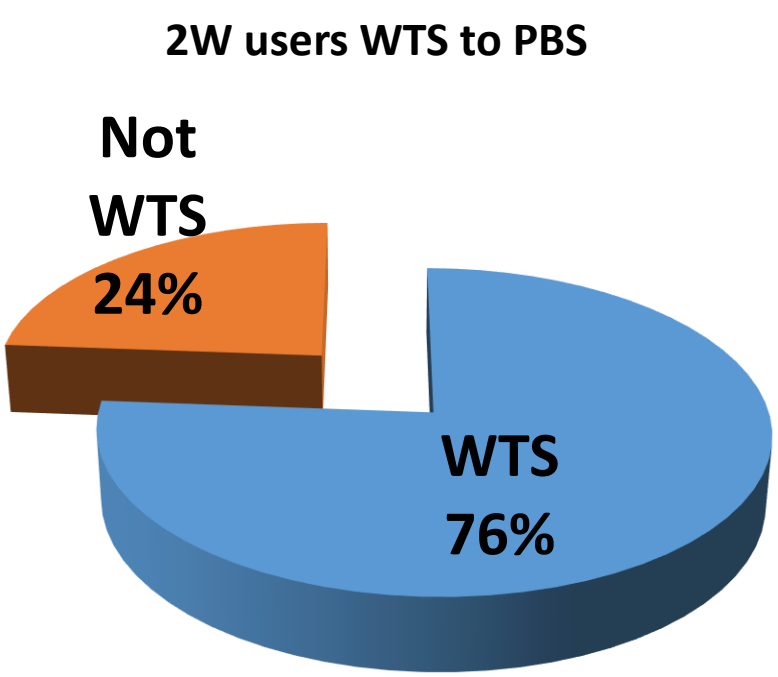
## Mode share of educational trip

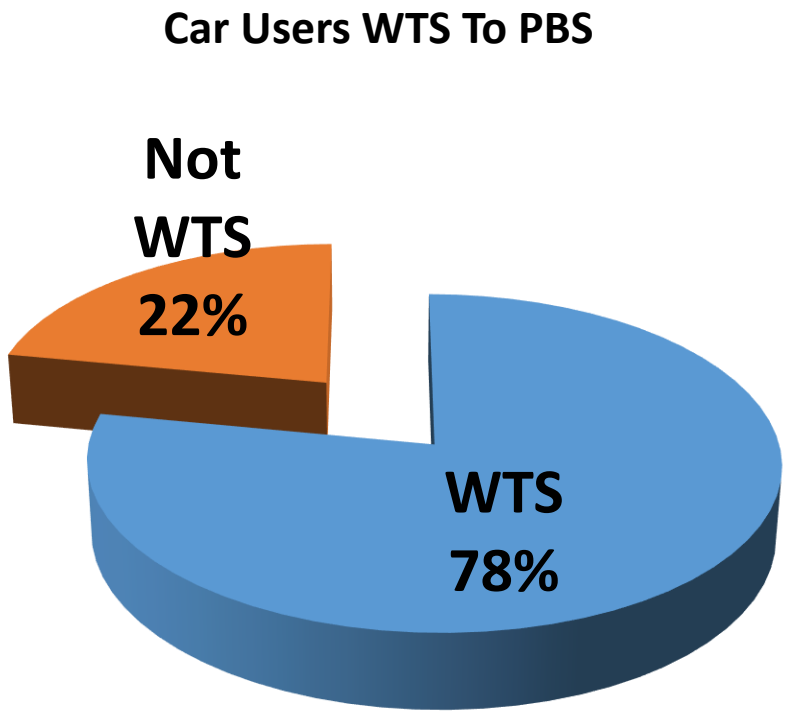



## Mode Share for Recreational Activity

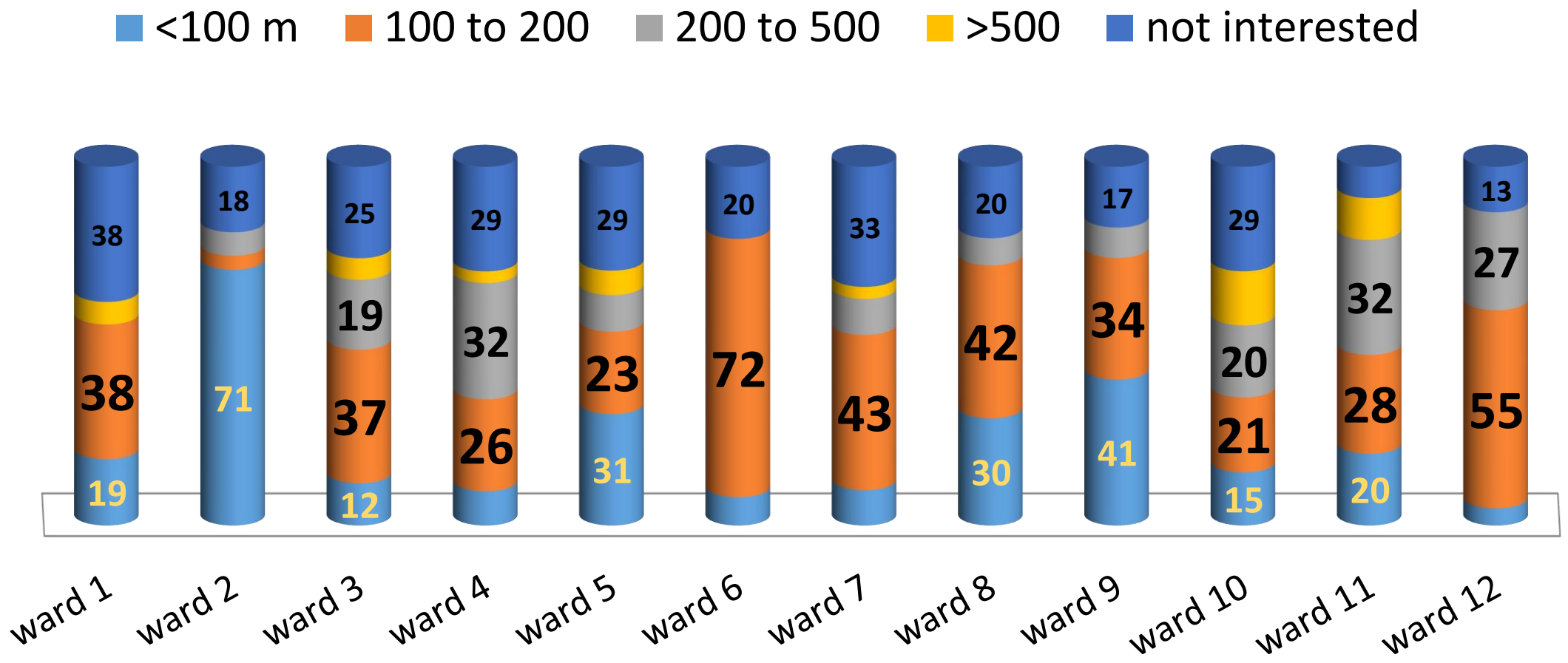


# Willingness To Shift (WTS) Analysis

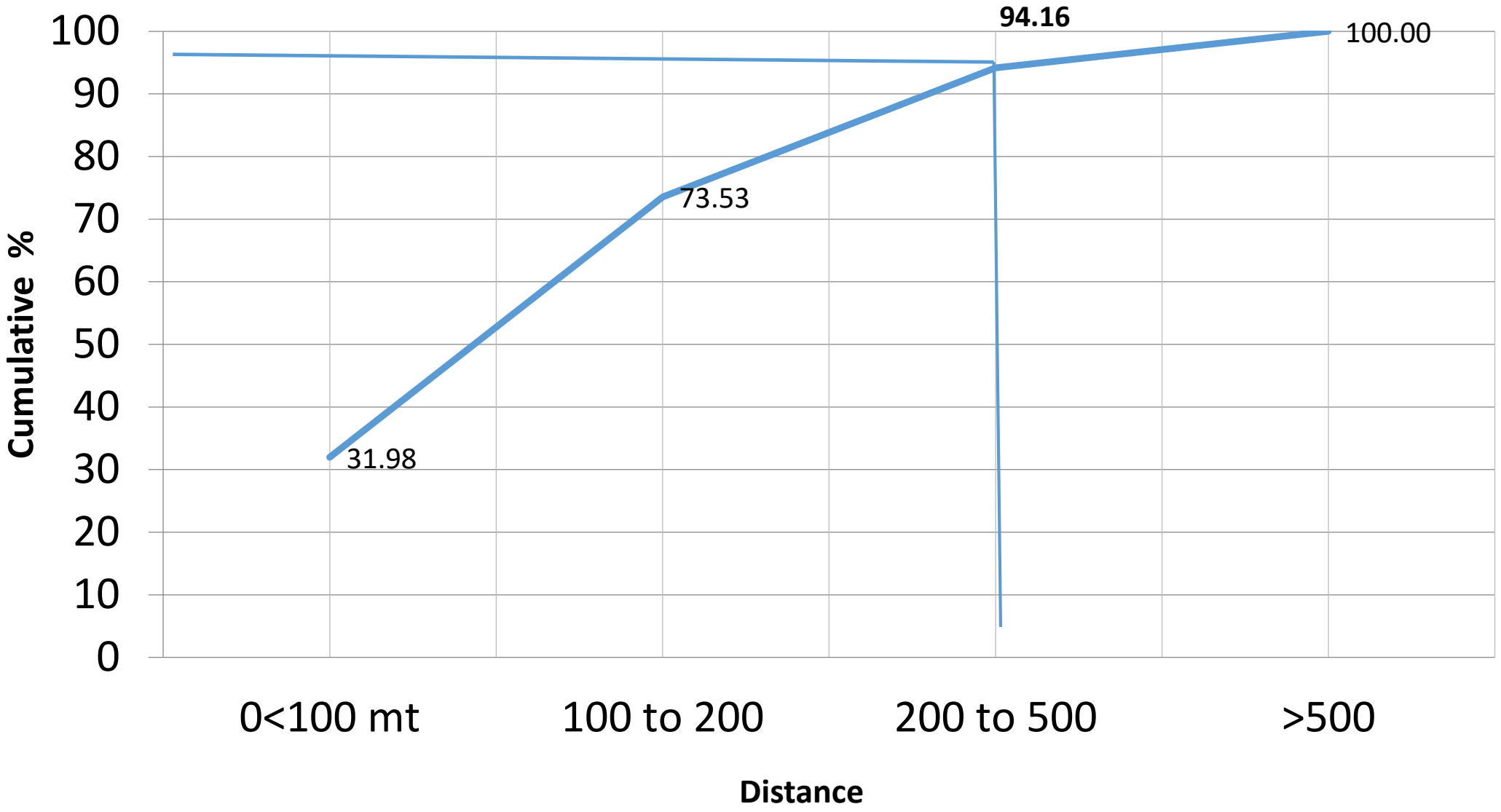


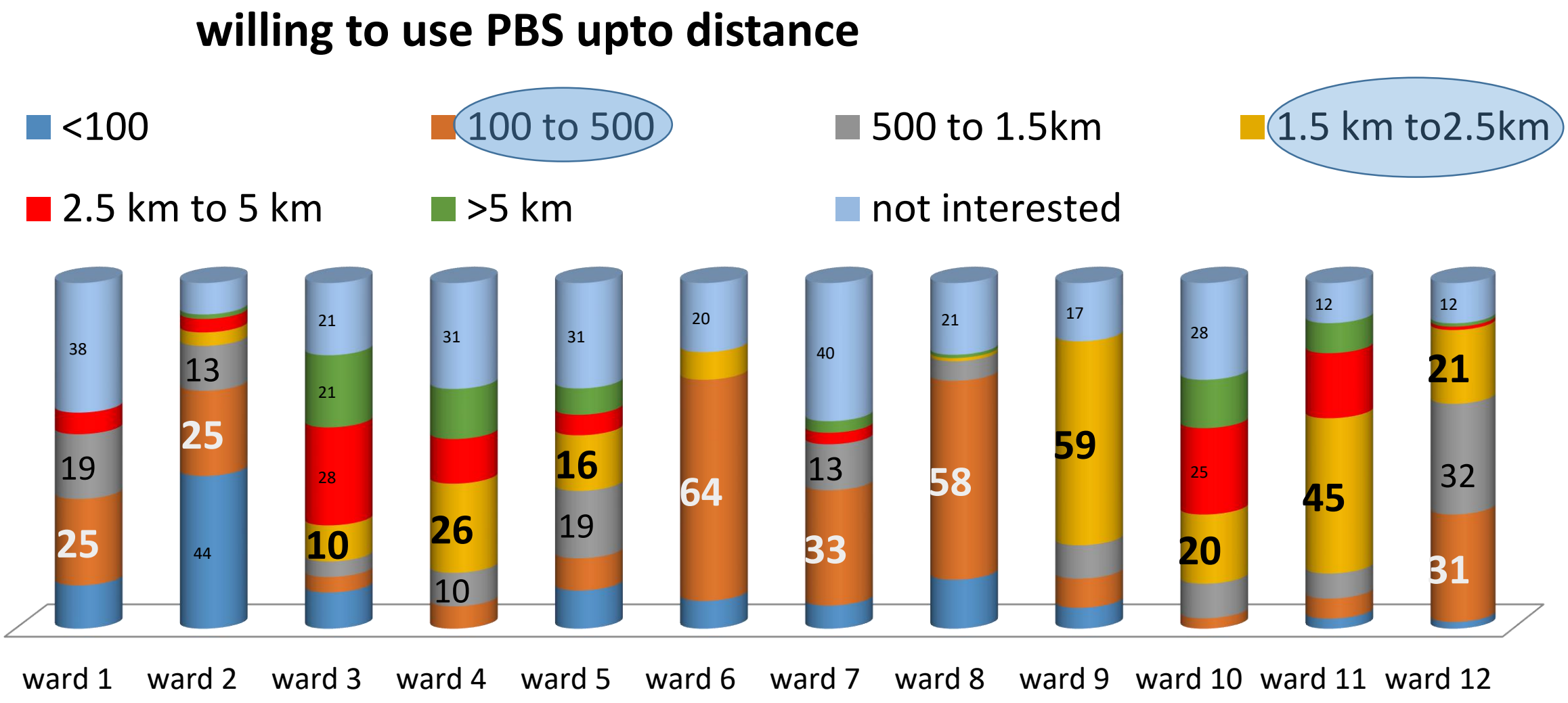
# Walking distance for cycle stand preferred by users

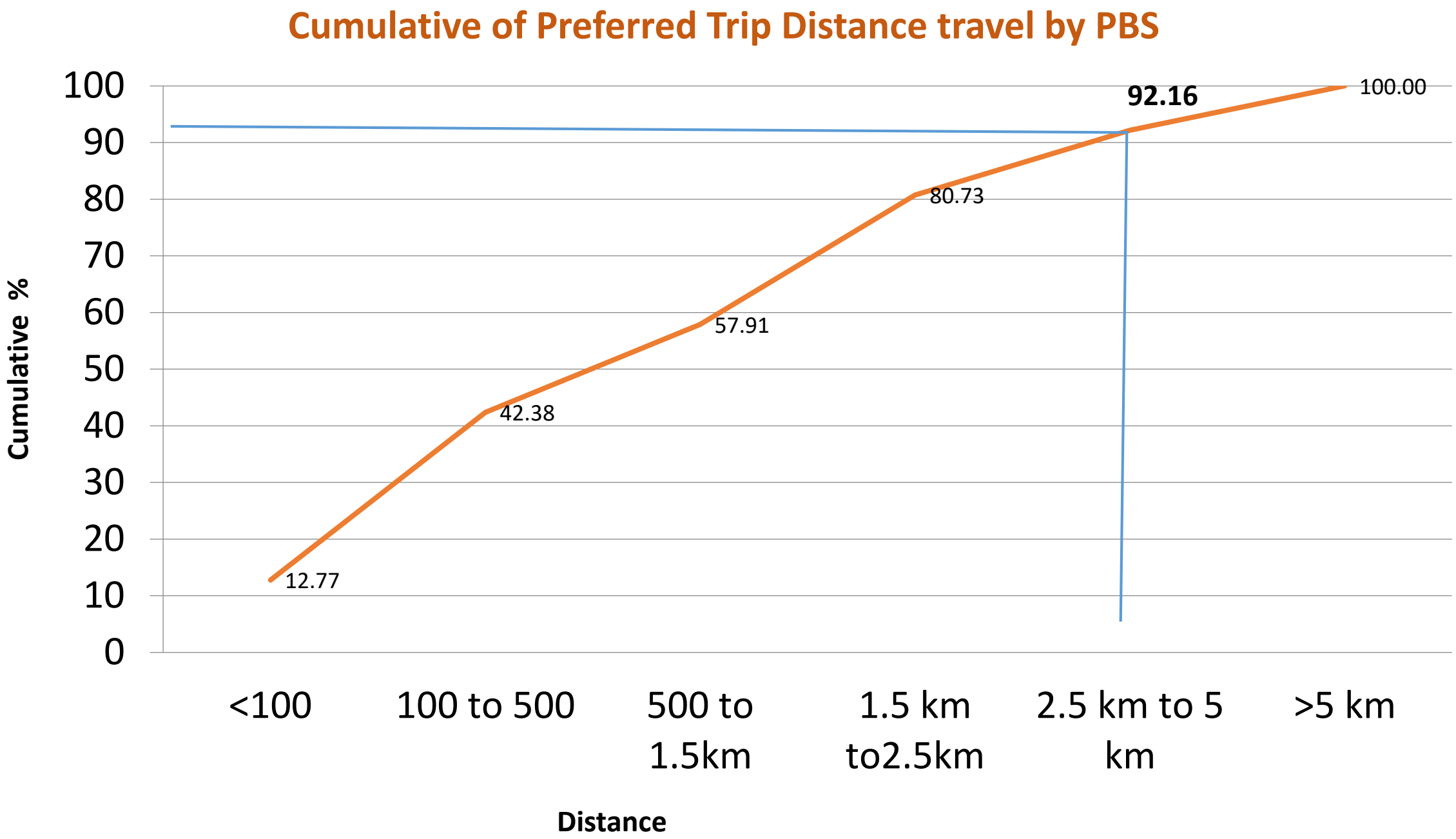


# Cumulative of Acceptable walking distance for Cycle stand

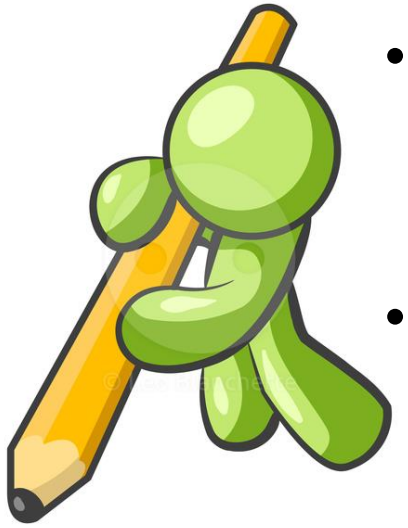


# Travel Distance Preferred For Cycling




Cumulative of Preferred Trip Distance travel by PBS
Cumulative %
100
90
80
70
60
50
40
30
20
10
0
12.77
42.38
57.91
80.73
92.16
100.00
<100
100 to 500
500 to 1.5km
1.5 km to2.5km
2.5 km to 5 km
>5 km
Distance

# System Design Phasing For CBD



- **Overall delineation** of study area divided into various phases for PBS implementation due to technical or financial reasons.

- Phasing was derived from the analysis of density of activity nodes. Surat's proposed PBS system is divided into three phases.

**Phase I** is the Core inner city region, which has highest number of activity areas and population density.

**Phase II** includes areas with high potential for growth, mainly the core residential areas in the city

**Phase III** includes the rest of study area to ensure denser PBS network coverage.

**PHASE I : Has potential to create maximum PBS trips**

**Areas: Ring Road, Raj Marg, Nanpura, Railway station Lal Darwaja,Gopi Talav**

| | |
|---|---|
| **POPULATION DENSITY** | **Very High population density**. Largely covering areas with more than and equal to 600ppha |
| **LAND USE** | Includes **residential population, major administrative offices** like- SMC building, Main office , post office, **commercial areas, market places, recreational places, educational institutes** |
| **ROAD NETWORK** | Includes the **Ring Road, Raj Marg**, Kotsafil Road and **other arterial roads** along railway and bus station and within the old city. |
| **TRAFFIC GENERATING ACTIVITY** | **Dense** number of **PT and IPT** stops. **Existing railway station, bus station** **High density** of commercial, recreational, public, religious places and schools colleges & other institutions Includes Chauta pull, Gopi talav, Chowk, Bhagal, Mahidhar Pura etc. |
| **PT & IPT** | Existing PT and IPT service available<br>**High demand of ridership** |
| **Availability of Open Land for Docking Stations** | Readily available Open Space, Land Under control of SMC. Multilevel Parking, below flyover. |

## PHASE II : Include areas with high growth potential
## Areas: Begaumpura, Slabatpura, Mahidharpura, Nanavat

| | |
|---|---|
| **POPULATION DENSITY** | **High population density**. Largely covering areas with more than or equal to 500-600ppha |
| **LAND USE** | Includes largely **residential areas** and **some industrial areas**. Residential growth is observed along the major roads of Mahidharpura, |
| **ROAD NETWORK** | The **major arterials** like Navsari bazaar, and road towrdes **city centre**. |
| **TRAFFIC GENERATING ACTIVITY** | **Moderate number of PT and IPT stops** **Moderate density** of commercial, recreational, public, religious places and schools colleges & other institutions. |
| **PT & IPT** | Existing PT and IPT service available **Moderate demand of ridership** |
| **Availability of Open Land for Docking Stations** | Ward offices, Govt Building Schools , Urban Health Centres |

| **PHASE III : Geographical limit, Include areas with growth potential near core residential areas of city**<br>**Areas: Rampura, Sagrampura, Timaliyawad,** | |
|---|---|
| **POPULATION DENSITY** | **Moderate population density.** Largely covering areas with less than 500ppha. |
| **LAND USE** | Includes **mostly core residential areas** and the areas not on the major arterial and sub arterial roads. |
| **ROAD NETWORK** | **Other arterial roads and collector roads .** |
| **TRAFFIC GENERATING ACTIVITY** | **Sparse number of PT and IPT stops Low density** of commercial, religious places and moderate schools colleges & other institutions . |
| **PT & IPT** | Existing PT and IPT service available **Low demand of ridership** |
| **Availability of Open Land for Docking Stations** | Land Under control of SMC but under encroachment, privet land which need to be acquired . |

# The criteria followed in locating stations are as follows

1. ensure mostly dense and uniform coverage in high demand area Station distance between 200- 400m
2. coverage includes 10 PBS stations per sq km.
3. Stations location will be near mass transit stations or transit stops
4. Preferable Location of station should near or on SMC/ Government property, Multi Level Parking, Below Flyover, On major arterials like Ring Road , Rajamrg, and kotsafil Road and places along the street that are safe to access by bicyclists.
5. Stations should be located inside residential cores and near important public institutions or places like, school, colleges, parks, markets, commercial areas and other activity nodes.

# PBS system coverage of all the phases

| Sr. No | Phase | Coverage Area (Sq.km) | % Area Covered | No of Stations |
|---|---|---|---|---|
| **1** | **1** | **4.0** | **49%** | **40** |
| **2** | 2 | 3.0 | 36% | 11 |
| **3** | 3 | 1.18 | 15% | 30 |
| | **Total** | **8.18** | 100% | **81** |

## PBS guidelines as per guidance document

| Sr. No | Guidelines as per PBS Guidance Document (GD) | |
|---|---|---|
| 1 | 10 to 15 stations per square km of PBS influence area | |
| 2 | Number of bicycles in **Small Stations** | **15** |
| 3 | Number of bicycles in **Medium Stations** | **20** |
| 4 | Number of bicycles in **Large Stations** | **40** |

## PBS system size estimation

| Sr.No | Phase | Coverage Area (Sq.km) | No of Stations | No of Bicycles |
|---|---|---|---|---|
| **1** | **1** | **4.0** | **40** | **1160** |
| **2** | 2 | 1.18 | 11 | 210 |
| **3** | 3 | 3.0 | 30 | 550 |
| **Total** | | **8.18** | **81** | **1920** |


# Station Location

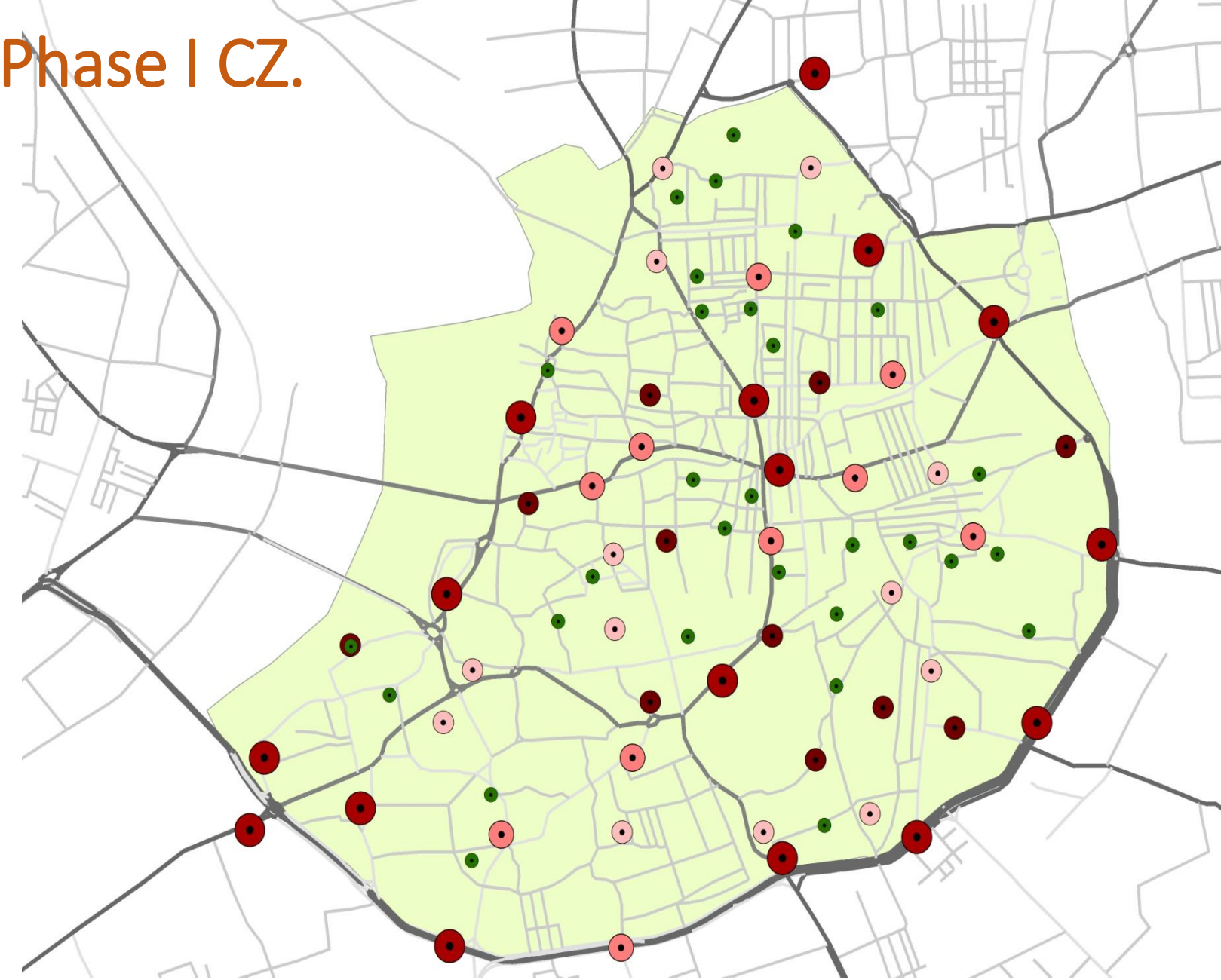
# Station Location for PBS Phase I CZ.

| | |
|---|---|
| **Total No. of Stations** | **40** |
| Large stations | 16 |
| Medium stations | 11 |
| Small stations | 13 |
| **No. of Bicycles** based on station sizing | **1055** |
| Spares (10%) | 105 |
| **Total No. of Bicycles to be deployed** | **1160** |

Large stations

Medium stations

Small stations



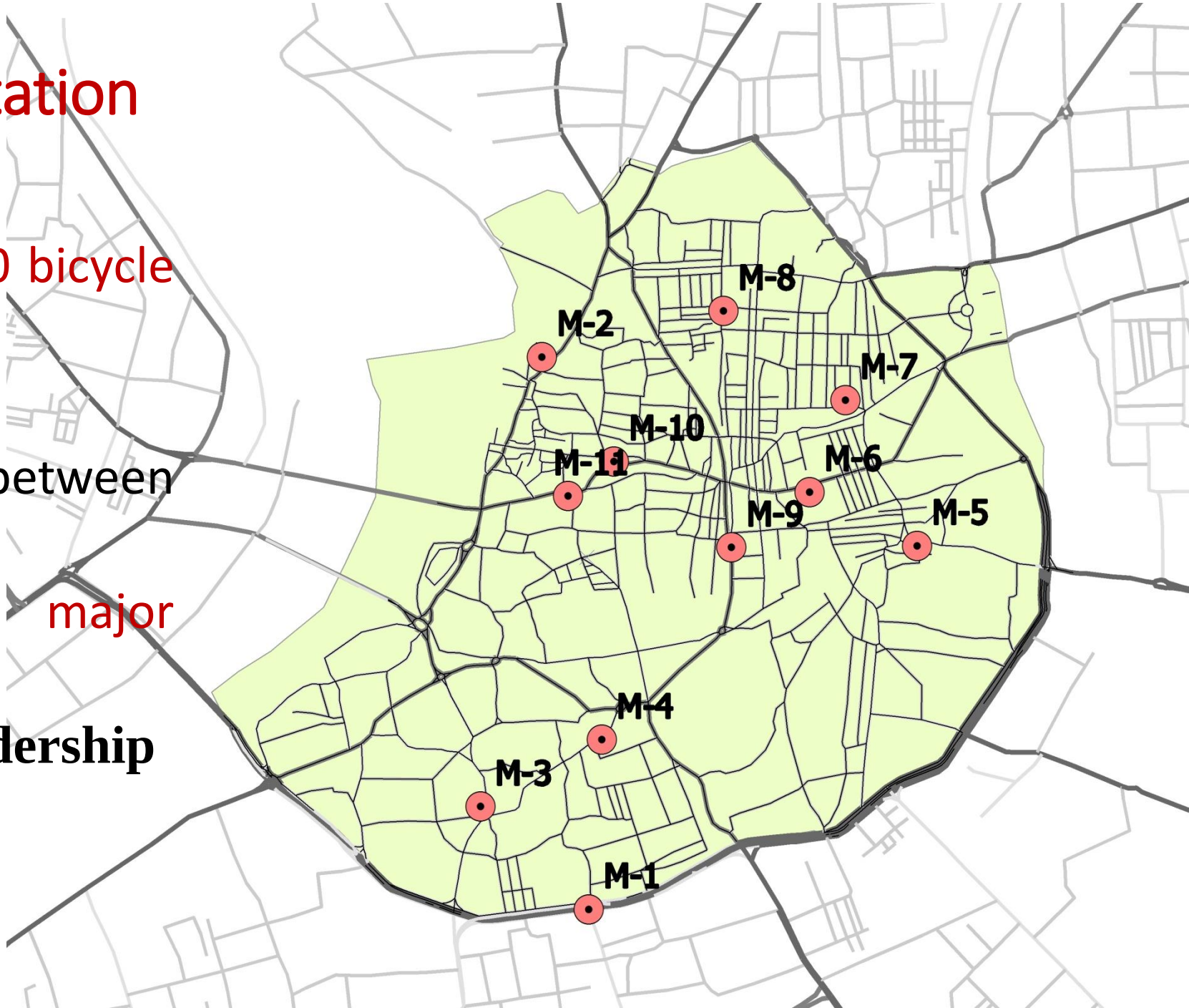
# Phase I Large Station

- Total : 16 Station with 40 bicycle capacity
- Very High population density 600pphaResidential Population
- major administrative offices
- High demand of ridership

# Phase I Medium Station

- Total : 11 Station with 20 bicycle capacity

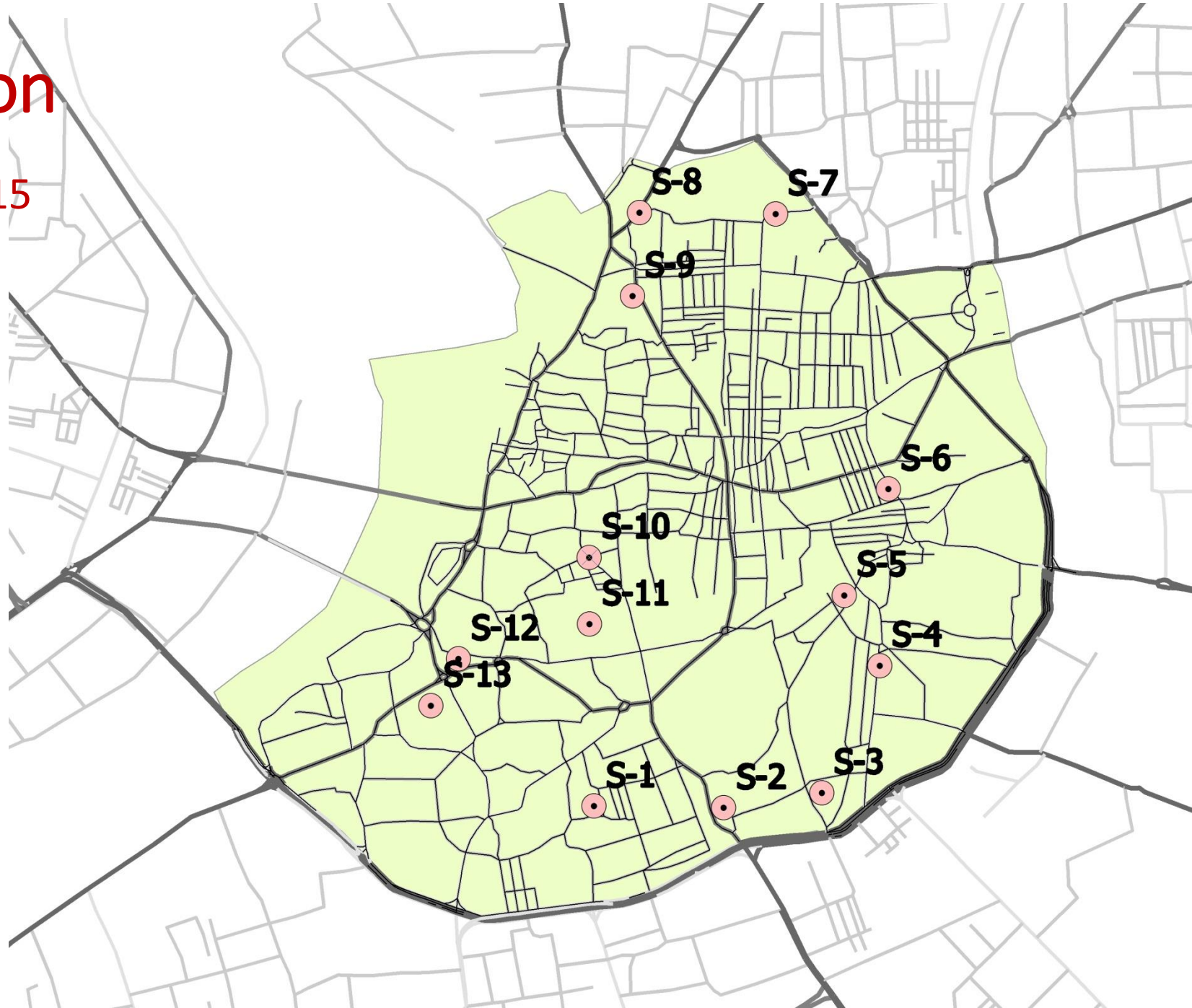
- Population Density in between 500-600ppha
- Residential population, major administrative offices
- **Moderate demand of ridership**



# Phase I Small Station

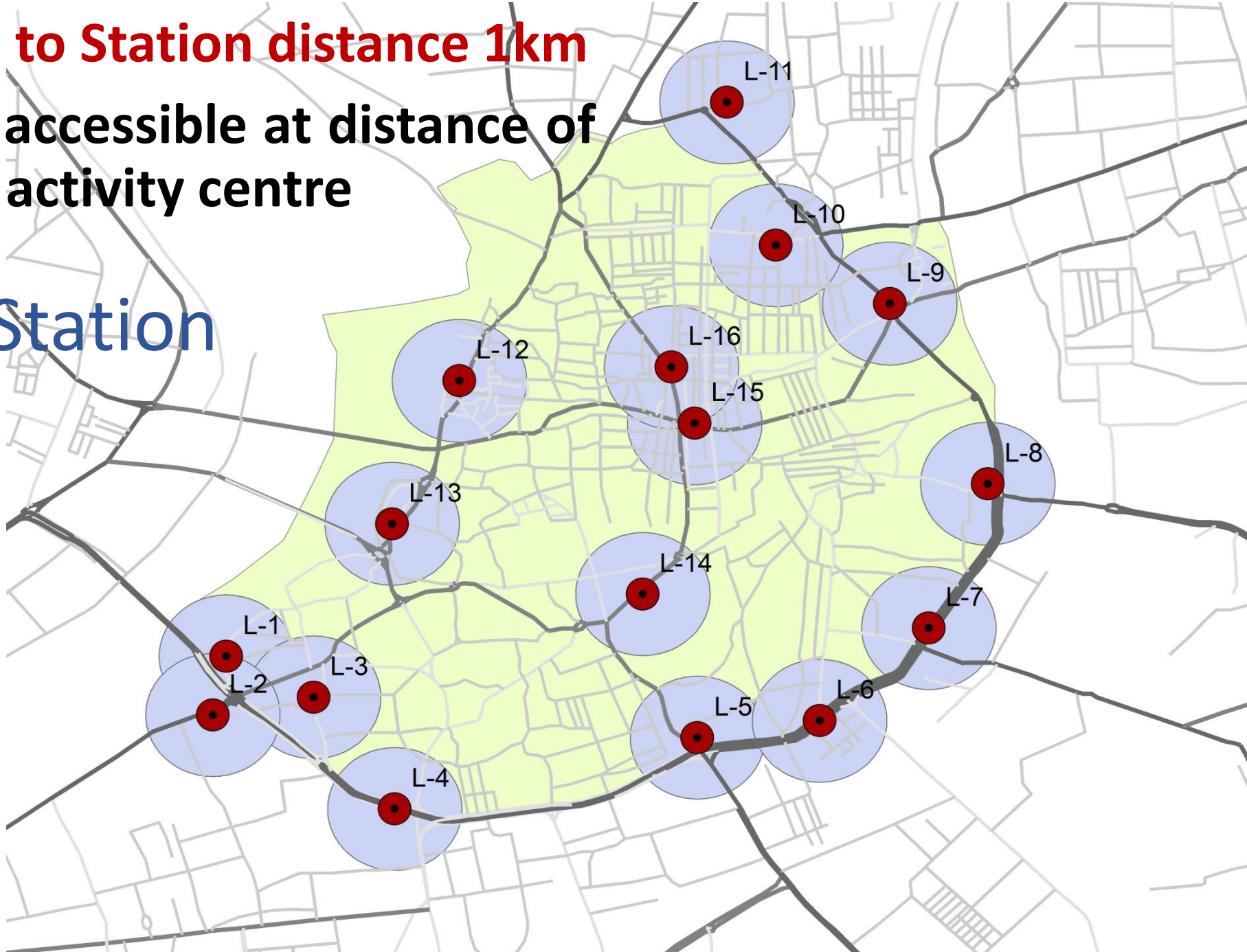
- Total :13 Station with 15 bicycle capacity

- less than 500ppha
- Mostly Core Residential areas
- Low demand of ridership



- **Maximum Station to Station distance 1km**
- **Station are easily accessible at distance of 300m from major activity centre**

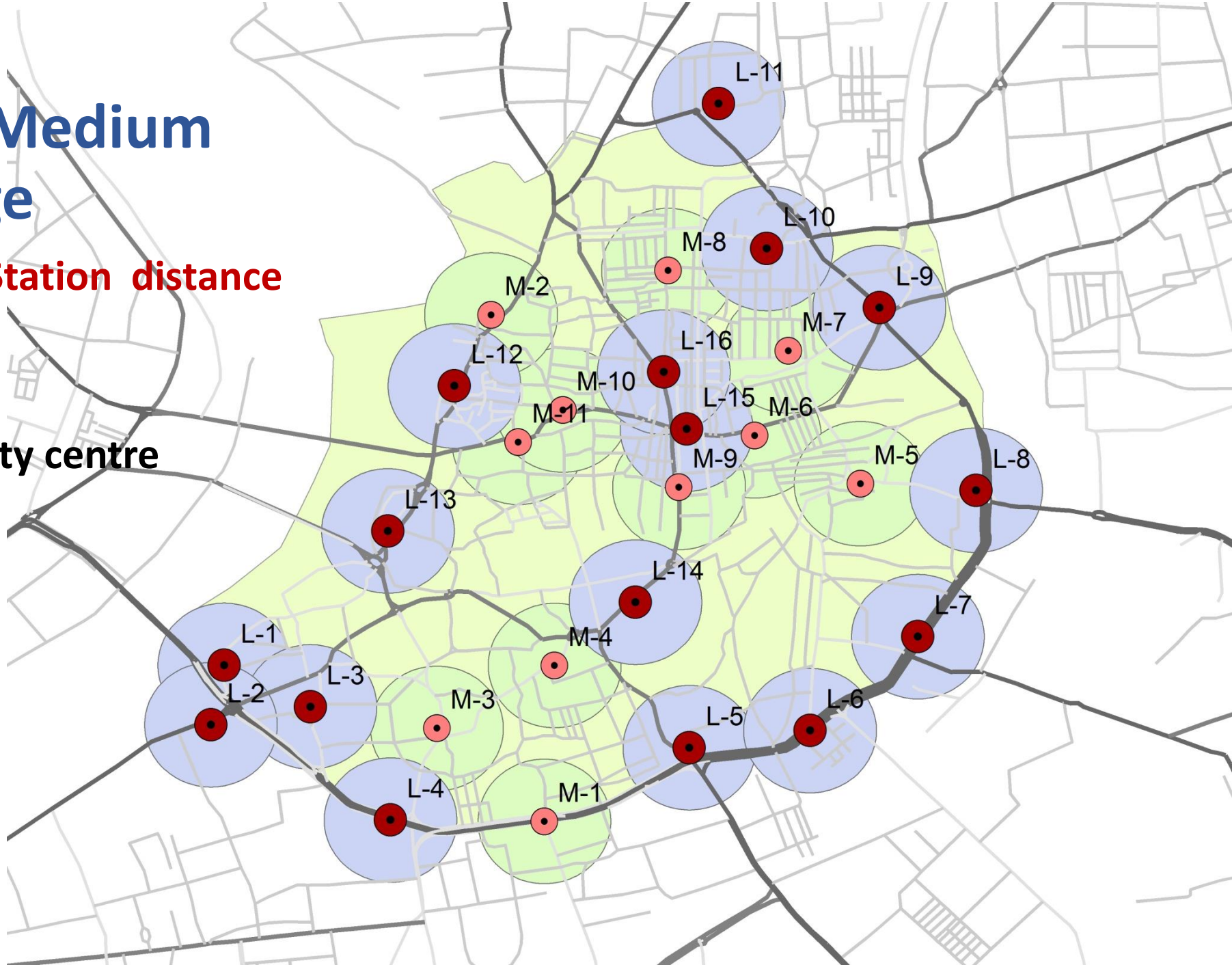
# Phase I Large Station Coverage



# Phase I Large+Medium Station Coverage

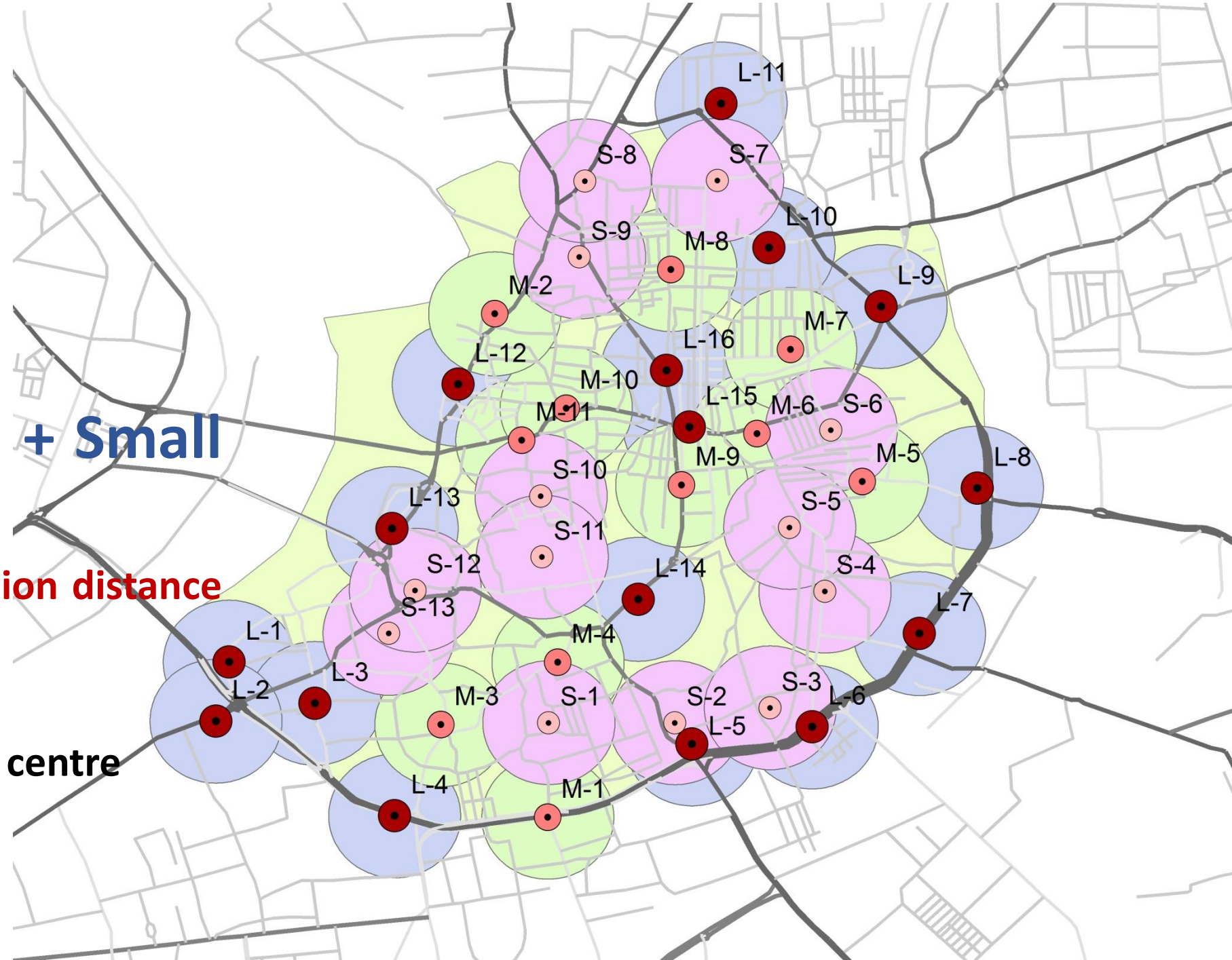
- **Maximum Station to Station distance 700 m**

- **300m from major activity centre**

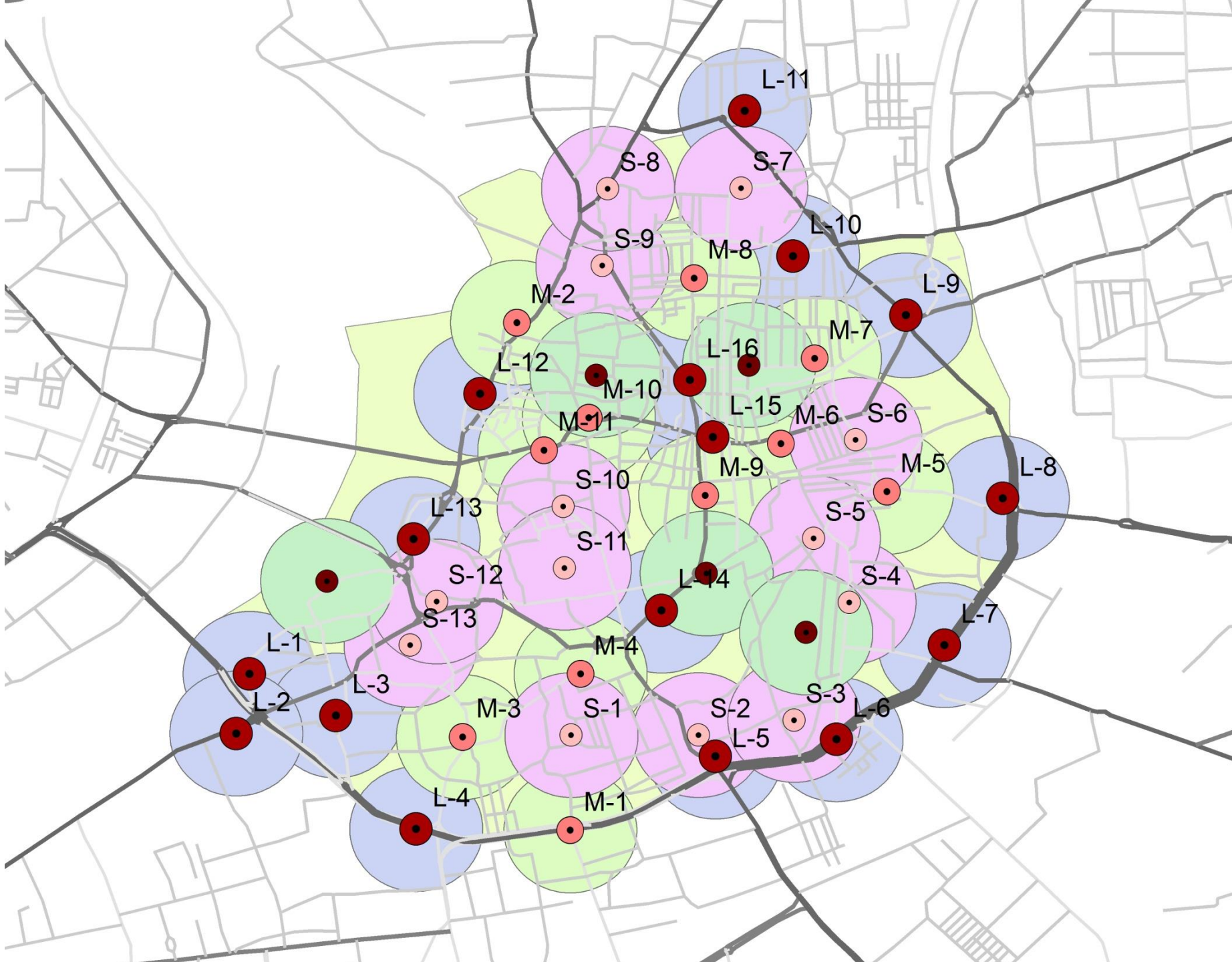


# Phase I

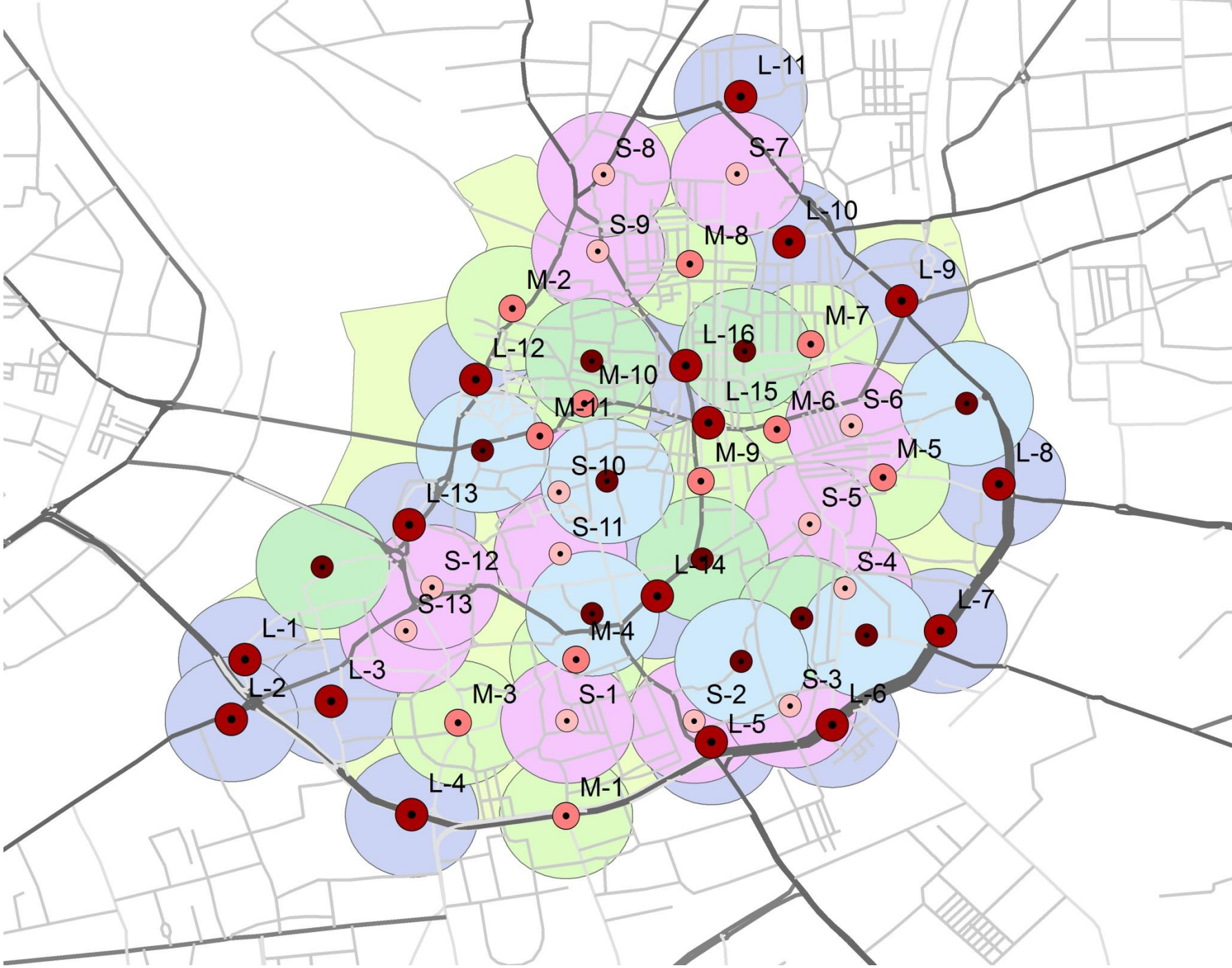
- **Large + Medium + Small Station Coverage**
- **Maximum Station to Station distance 700m**
- **300m from major activity centre**



# Phase I
# +
# Phase II



# Phase I
# +
# Phase II
# +
# **Phase III**



# Summary

•Present study demonstrates a methodology for identifying docking station location for PBS System using maximum coverage method in **ArcGIS platform**

• Preliminary identification has resulted in **81 stations** out of which 40 stations are proposed for Phase I, 11 stations are proposed for Phase II, and to make denser network 30 stations can be provided in Phase III.

•Proportion of large, medium, and small stations is fixed to accommodate the required fleet size of 1920 bicycles.

•In this study, it is observed that 72% 2W & 76% Car users are willing to shift from their private mode to PBS if implemented.

User

Home/PT

Destination Direction

Ride

Ride

Mobile Application

Check In with valid ID

Check out at PBS station

RETURN

TO ANY STATION

Nearer PBS station

Mode to reach PBS station

Walk to the Destination & Return

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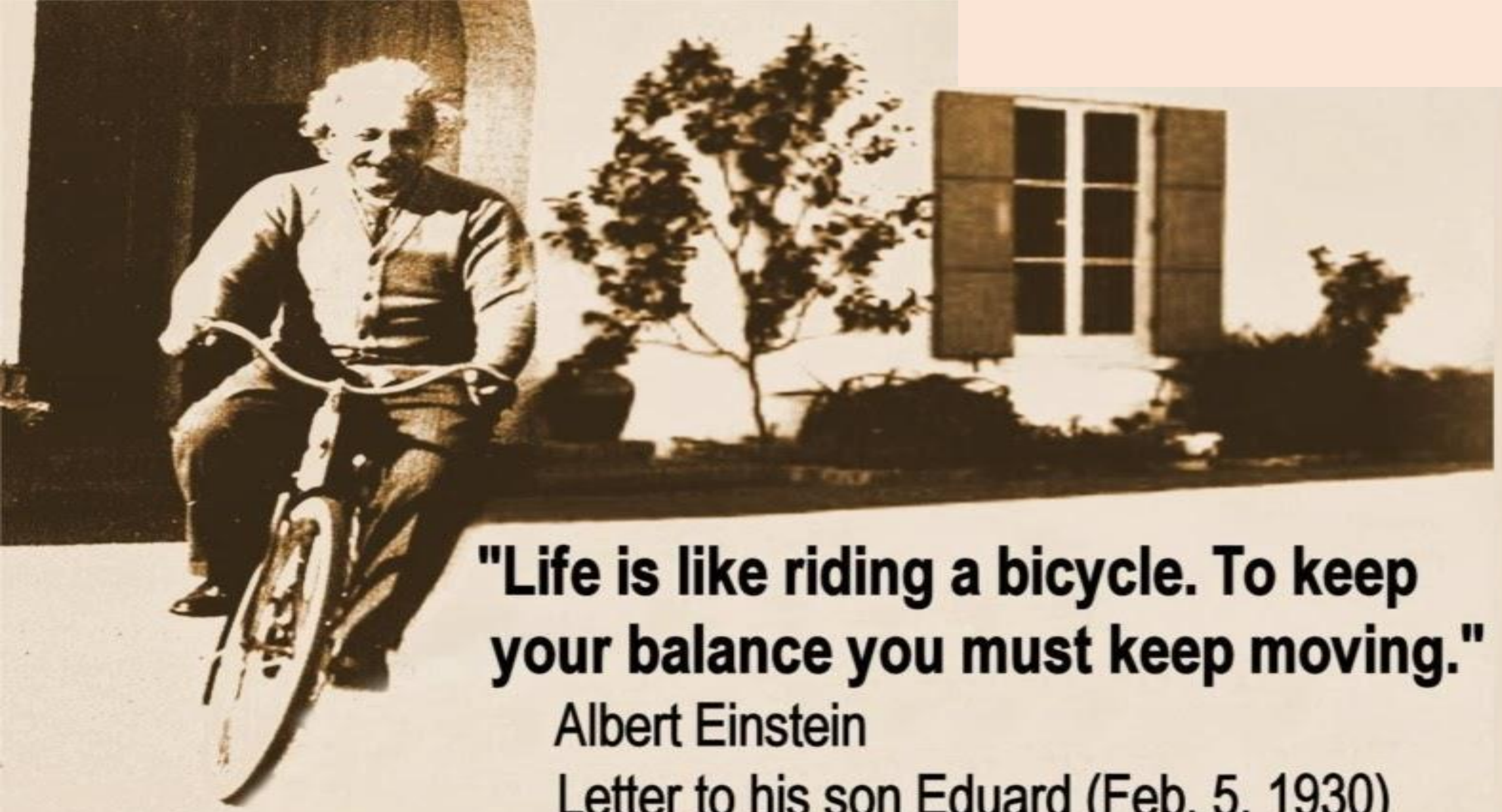
# Questions & Suggestions


INSTITUTE OF URBAN TRANSPORT (INDIA)

https://bikeshare.files.wordpress.com/2013/07/nyc-bike-share.jpg?w=593



**"Life is like riding a bicycle. To keep your balance you must keep moving."**

Albert Einstein

Letter to his son Eduard (Feb. 5, 1930)