Research on…

# BIKE AND RIDE:
## *INTEGRATING BICYCLES AND PUBLIC TRANSPORT*

**Under Guidance of**
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**Presented by**
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***U**rban **T**ransport **P**lanning & **M**anagement*
*CEPT University*

# STRUCTURE OF PRESENTATION

- BACKGROUND
- INTRODUCTION TO “BIKE & RIDE” (B&R)
- IDENTIFY THE STUDY AREA
- ANALYSIS AND FINDINGS
- CONCLUSIONS AND RECOMMONDATIONS

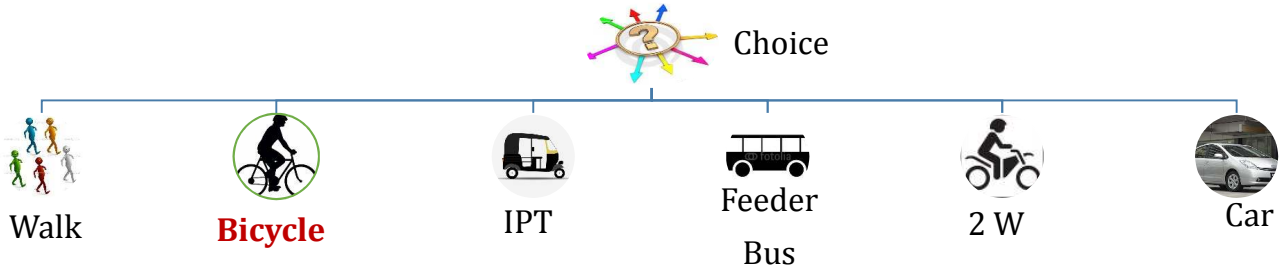
# NEED OF THE STUDY

In case of Ahmedabad,

- Share of **bicycle trips** out of total trips has **declined** from 19% in 2001 to 14% in 2011.
- Share of **public transport trips** has **declined** from 30% in 2001 to 22% in 2011
- Share of **private motorized trips** has **increasing** from 38% in 2001 to 42% in 2011
- NUTP emphasized on **priority to public transport and non-motorized transport (NMT)**

# RESEARCH PROBLEM

- Bus Rapid Transit System (BRTS) **serves the mobility needs** of the people. But, it is not designed to provide door-to-door connectivity. **Access and egress are weakest links** in public transport system.
- **Accessibility to public transport** is important to maximizing it attractiveness. As, it **recommended to have a feeder modes**.




**Hypothesis:**

- "Bike and Ride" can help to achieve shift of commuters from private vehicles to public transport.

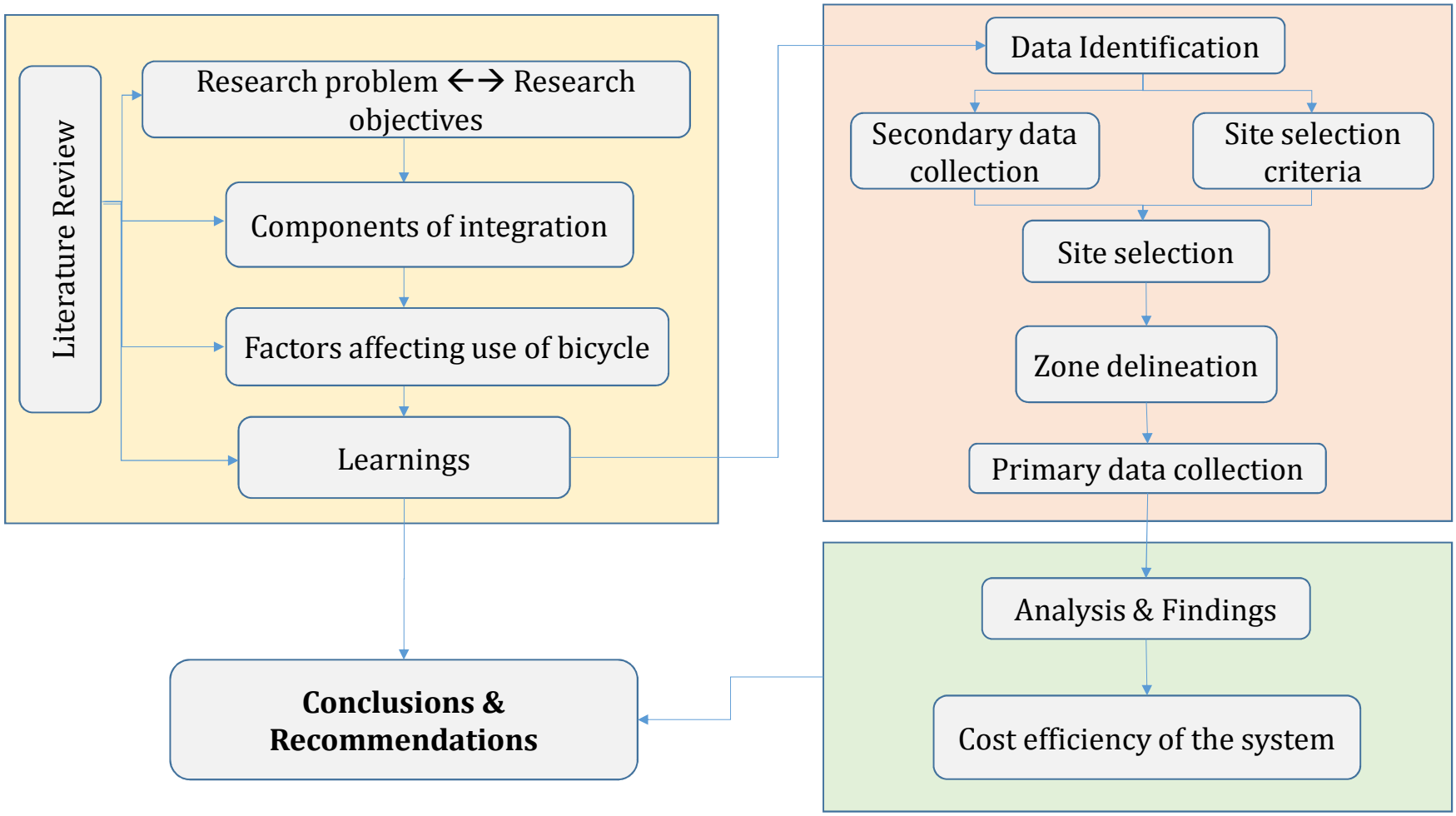
Source

MoUD. "Public Transport Accessibility Toolkit." Development of Toolkit under "Sustainable Urban Transport Project". MoUD, GoI, 2013.

# RESEARCH OBJECTIVES

- To review the various **components of integrating** bicycles and public transport.
- To identify the **factors affecting use of bicycle** as an access mode
- To identify the **potential demand for "Bike and Ride"** (B&R) services
- To estimate the **cost efficiency of the "B&R" system.**

# RESEARCH METHODOLOGY




Source

Analytical methodology is drawn from Shah, Jainal. PARK & RIDE: Integration of Private and Public mode of Transport. M. Plan Thesis. Ahmedabad: CEPT University, 2012. .pdf.

# LIMITATIONS OF RESEARCH

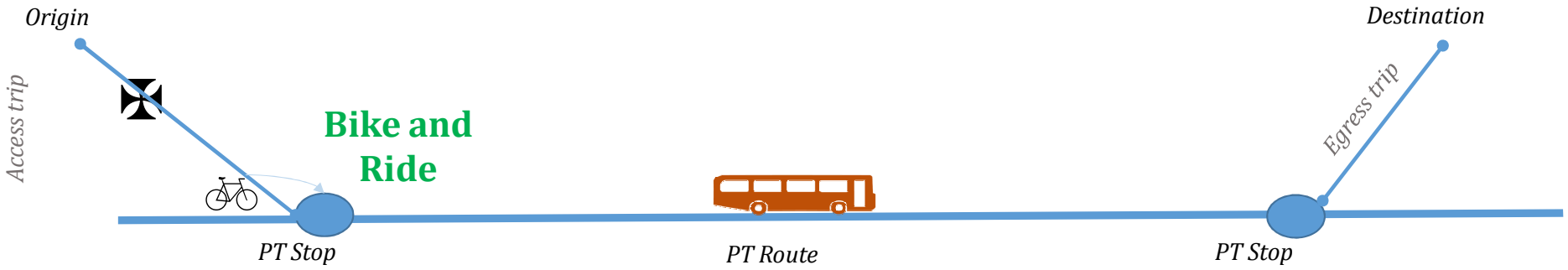
- Only **daily commuter trips** (workers and students) were captured during the survey.
- The **private mode users** (two wheelers and four wheelers) were the target group for the survey.
- **Intra city trips** were considered during the survey.
- Research findings are based on **bicycle owning households**. Public bicycles and cycle rentals were not considered.
- The travel cost is calculated based on the **fuel prices and BRT fare** during the time of research.

# INTRODUCTION TO "BIKE AND RIDE" (B&R) SERVICES

- DEFINING "BIKE AND RIDE" (B&R)
- COMPONENTS OF INTEGRATION
- APPLICABILITY OF B&R SERVICES
- FACTORS AFFECTING USE OF BICYCLE MODE

# DEFINING "BIKE AND RIDE" (B&R)

- "Bike and Ride" allows you to park your bicycle in a bicycle parking facility during the day and transfer to a bus for the rest of your trip. You pay a normal bus fare, with no additional charge to park your bicycle at a parking facility.




**Benefits of B&R:**

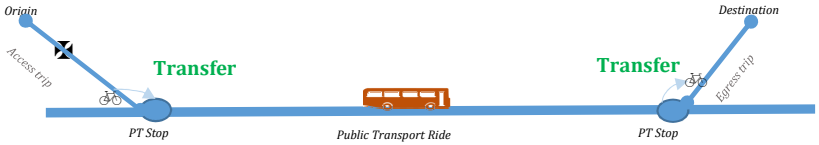
- Reduce vehicle kilometers travelled
- Reduce congestion
- Reduce energy consumption
- Reduce fatalities and injuries
- Improve air quality
- Co-benefits: health effects, more livable communities, etc.

Source

http://www.transport.act.gov.au/cycle_or_walk/bike_and_ride; WHO
http://www.unece.org/fileadmin/DAM/thepep/en/workplan/urban/documents/Batumi/presentations/christian.schweizer.pdf)

# COMPONENTS OF INTEGRATION

- Integrating bicycles and public transport consists of many links.




*Origin*

**Access**

**Transfer**

**Public transport ride**

**Transfer**

**Egress**

*Destination*

Access trip

*(The principles of bicycle routes are Consistency, Directness, Attractiveness, Road safety and Convenience)*

Transfers bicycle to public transport

*(The principles of good bicycle parking facilities are Time, Cost, Service, Safety and Comfort)*

Public transport ride

*(High quality public transport in terms of frequency, time, cost and also allowing bicycles on public transport during the trip)*

Transfer public transport to bicycle

*(The facilities at destination transit stop would be Purchase & store second bicycle (regular commuters), Bicycle rental services and Public bicycle services)*

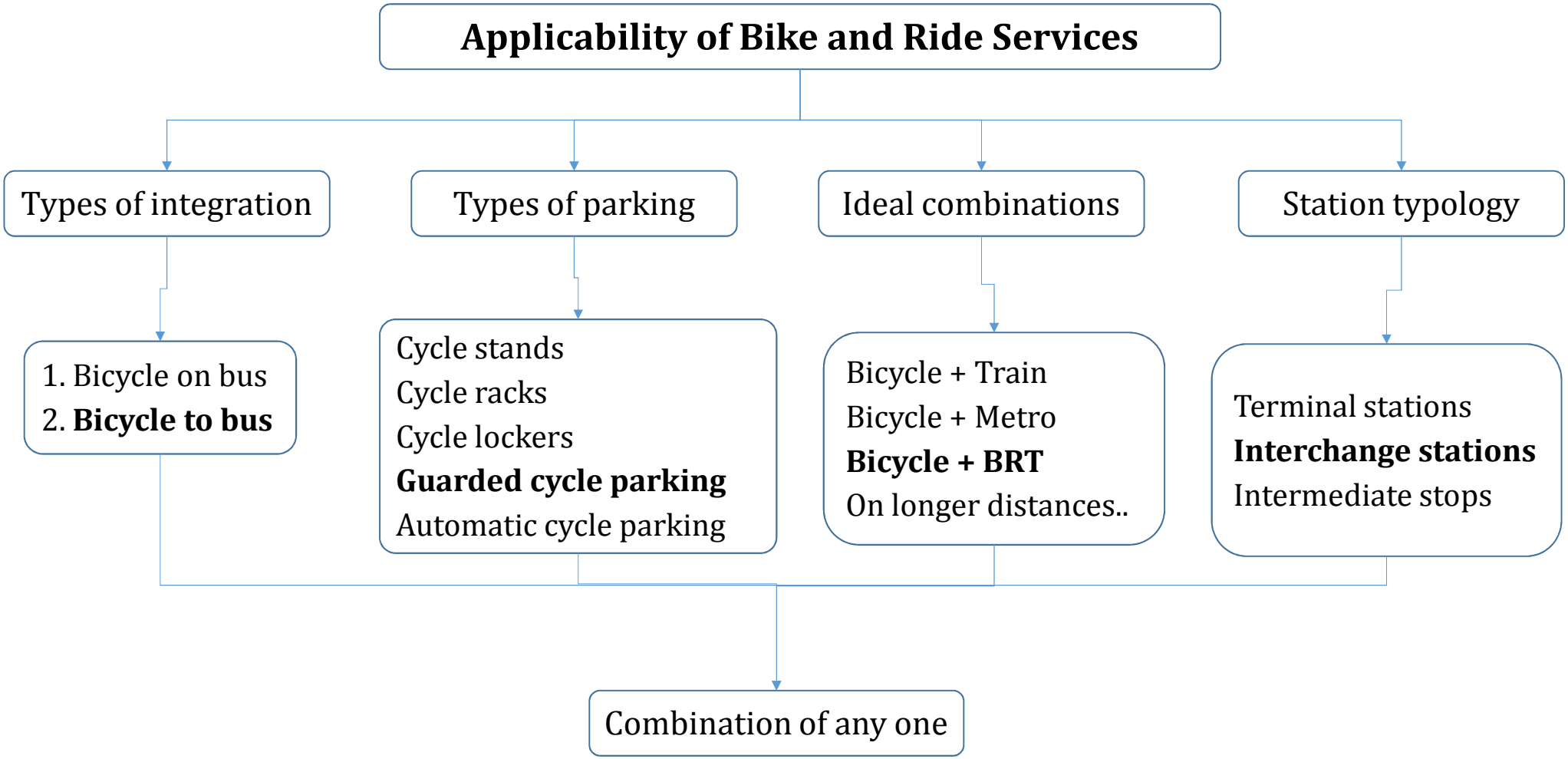
Egress trip

*(The safe and fast passages and routes to important destinations as like access trip)*

Source

GTZ. Cycling-Inclusive Policy Development: A Handbook;
http://www.cleanairinstitute.org/cops/bd/file/tnm/22_Integrating_NMT_to_PT_Oct09_DRAFT.pdf

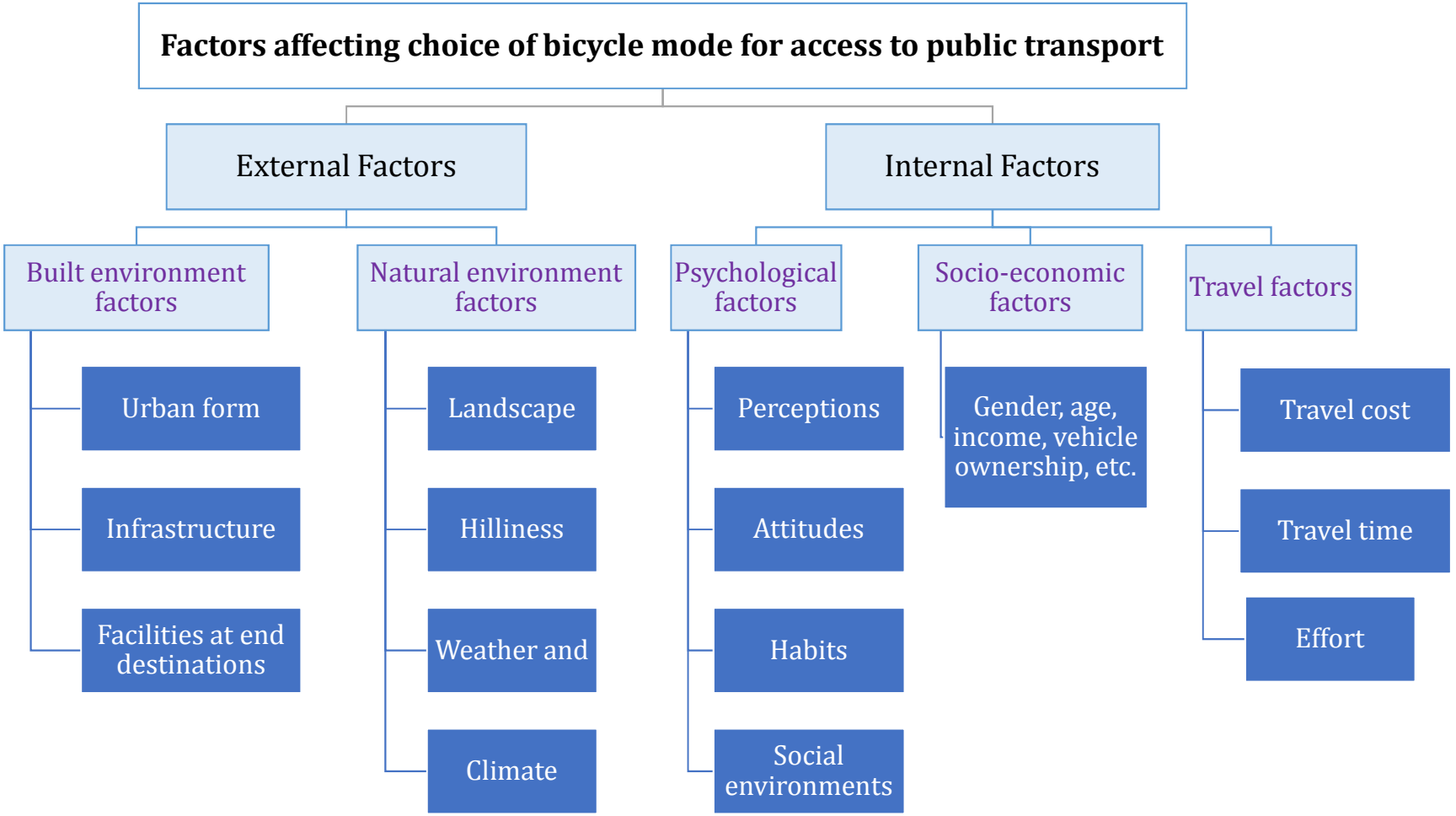
# APPLICABILITY OF "B&R" SERVICES




Source

ADJEI, Eric. Multi-modal Urban Transport: Integrating Non-Motorized and Bus Transport. Masters of Science. Netherlands: ITC, 2010. .pdf.; GTZ. Cycling-Inclusive Policy Development: A Handbook. Utrecht: Rajiv Beri for Macmillan , 2009. Book; TCRP Report 153. Guidelines for providing access to public transportation stations.

# FACTORS AFFECTING USE OF BICYCLE MODE




Source

Eva Heinen, Bert van Wee & Kees Maat. "Commuting by Bicycle: An Overview of the Literature." A Transnational Transdisciplinary Journal (2010). Pdf;
Willis, D., Manaugh, K., & El-Geneidy, A. "Cycling Under Influence: Summarizing the influence of attitudes, habits, social environments and perceptions on cycling for Transportation." International Journal of Sustainable Transportation (2013). Pdf.

# Site Selection Criteria And Data Collection

**Site selection criteria**

- Availability of public transit
- Station typology
- Residential land use
- Appropriate population density
- Appropriate worker & Student Population
- Appropriate income group people

**Secondary data collection***

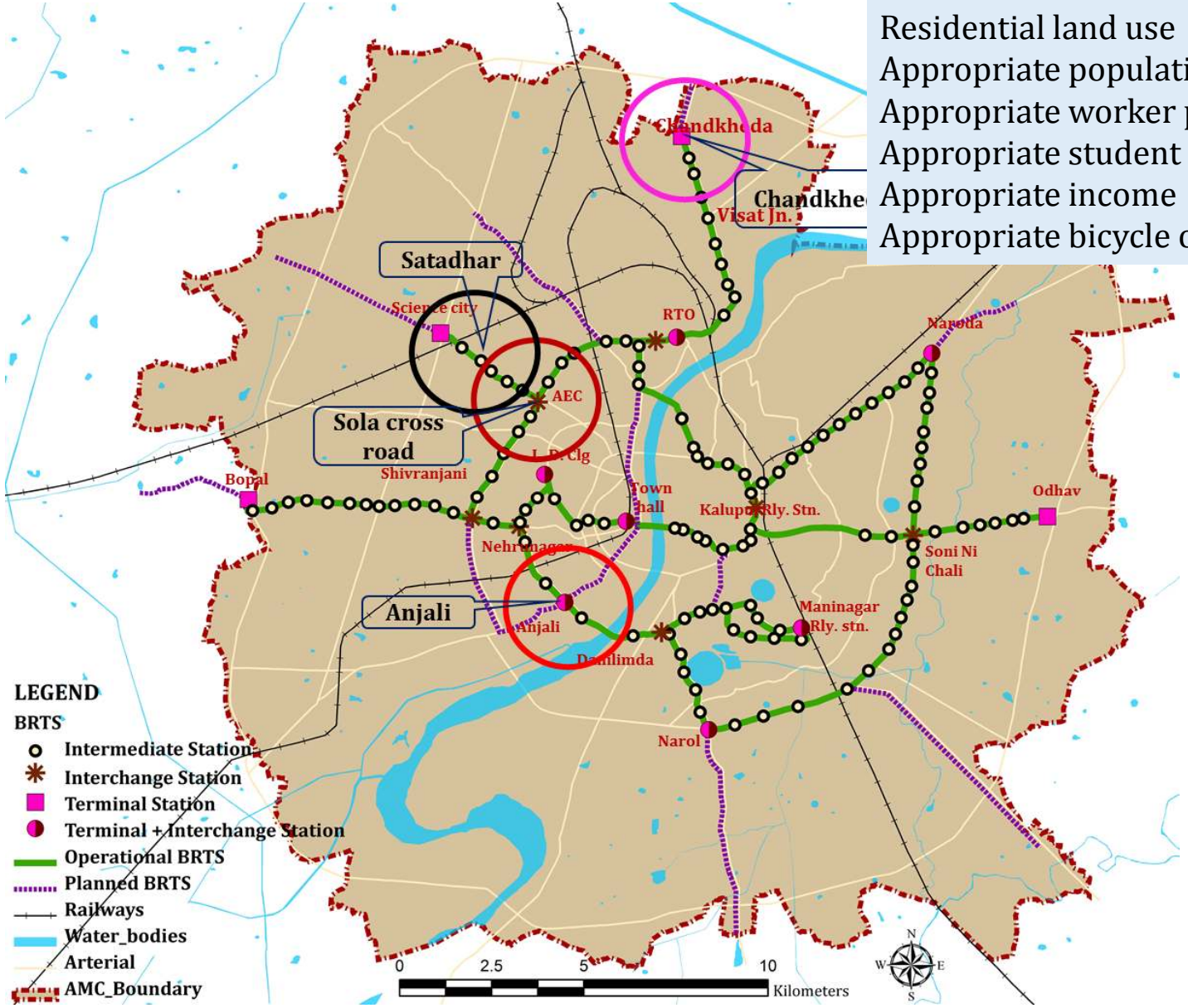
- Public transit system characteristics
- Land use
- Demography characteristics
- Socio-economic characteristics
- Bicycle ownership

Source

* Center of Excellence in Urban Transport, CEPT University; and Janmarg

# STUDY AREA DEFINITION

# Site Selection




Residential land use
Appropriate population density
Appropriate worker population density
Appropriate student population density
Appropriate income
Appropriate bicycle owning households

Source

Centre of Excellence in Urban Transport, CEPT University.

# PRIORITIZING STATIONS

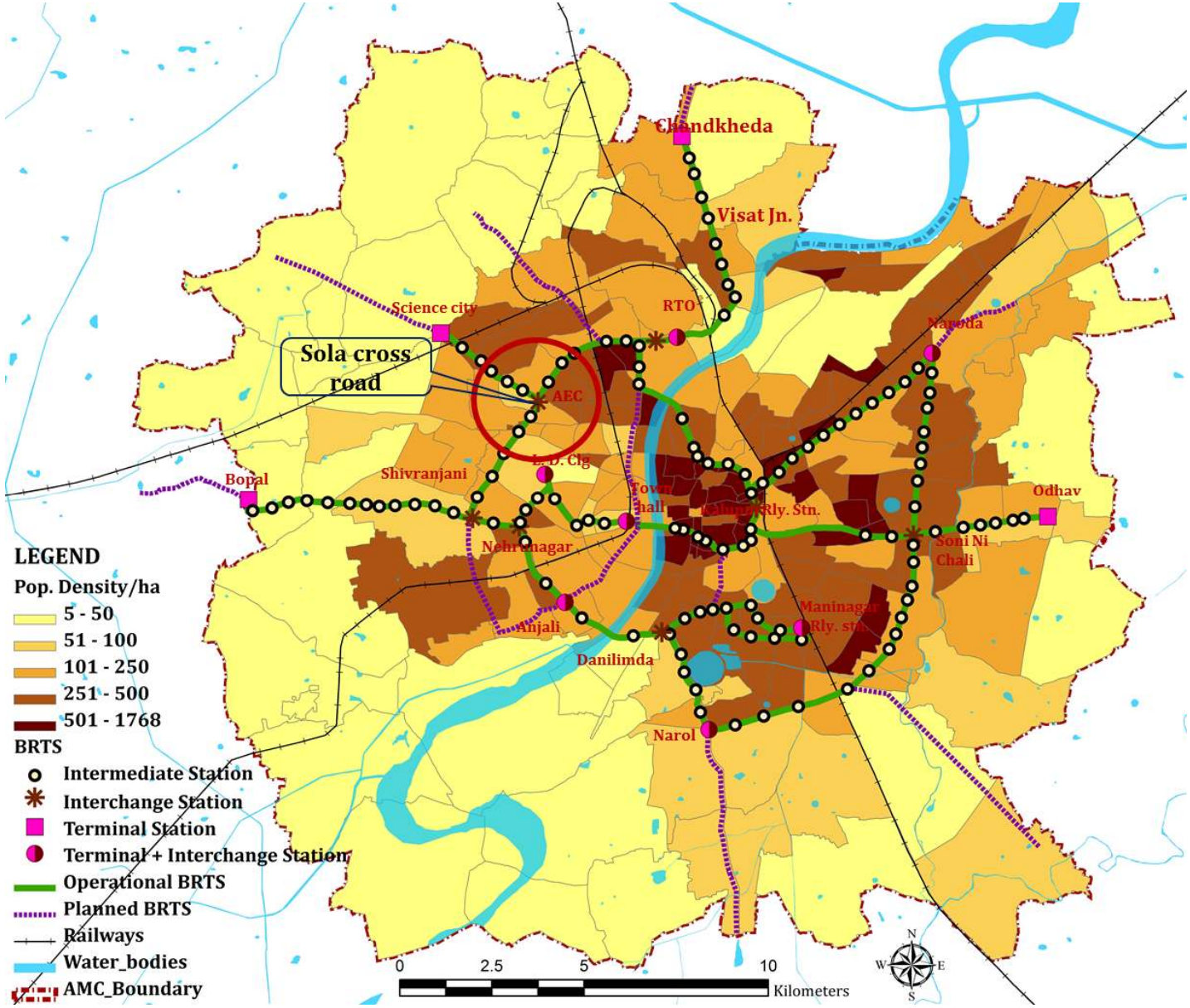
| Station Typology | Terminal Station | Interchange Station | Terminal cum interchange Station | Intermediate Station |
|---|---|---|---|---|
| Station Name | Chandkheda | Sola cross road | Anjali | Satadhar cross road |
| No. of samples | 43 | 42 | 41 | 32 |
| Willingness | 13 | 14 | 11 | 6 |
| Bicycle ownership wise willingness | 11 | 8 | 9 | 4 |
| Private vehicle users willingness | 4 | 6 | 5 | 1 |
| % of willingness | 9% | **14%** | 12% | 3% |

- The acceptance of B&R is **high at the interchange station** followed by interchange cum terminal, terminal and intermediate stations.

Source

Household survey (2014)

# STATION LOCATION




Source

Centre of Excellence in Urban Transport, CEPT University (2006).

# ZONE DELINATION




- Study Area: **2.04 sq. kms** and Estimated Population: **56, 790** (2006)
- **Major road network** leading towards selected station.
- Total four BRT routes are meeting at this station which is **well connected to all major employment and education destinations** like Narol, Naroda, Kalupur, L. D. College, etc.
- **0.5 km** distance is considered as walkable.
- Interval of 0.5 km upto 1.5 km has been taken for conducting household survey.
- In each zone **2% HH** were taken for collecting primary data

Source

Centre of Excellence in Urban Transport, CEPT University (2006).

# Household Survey Details

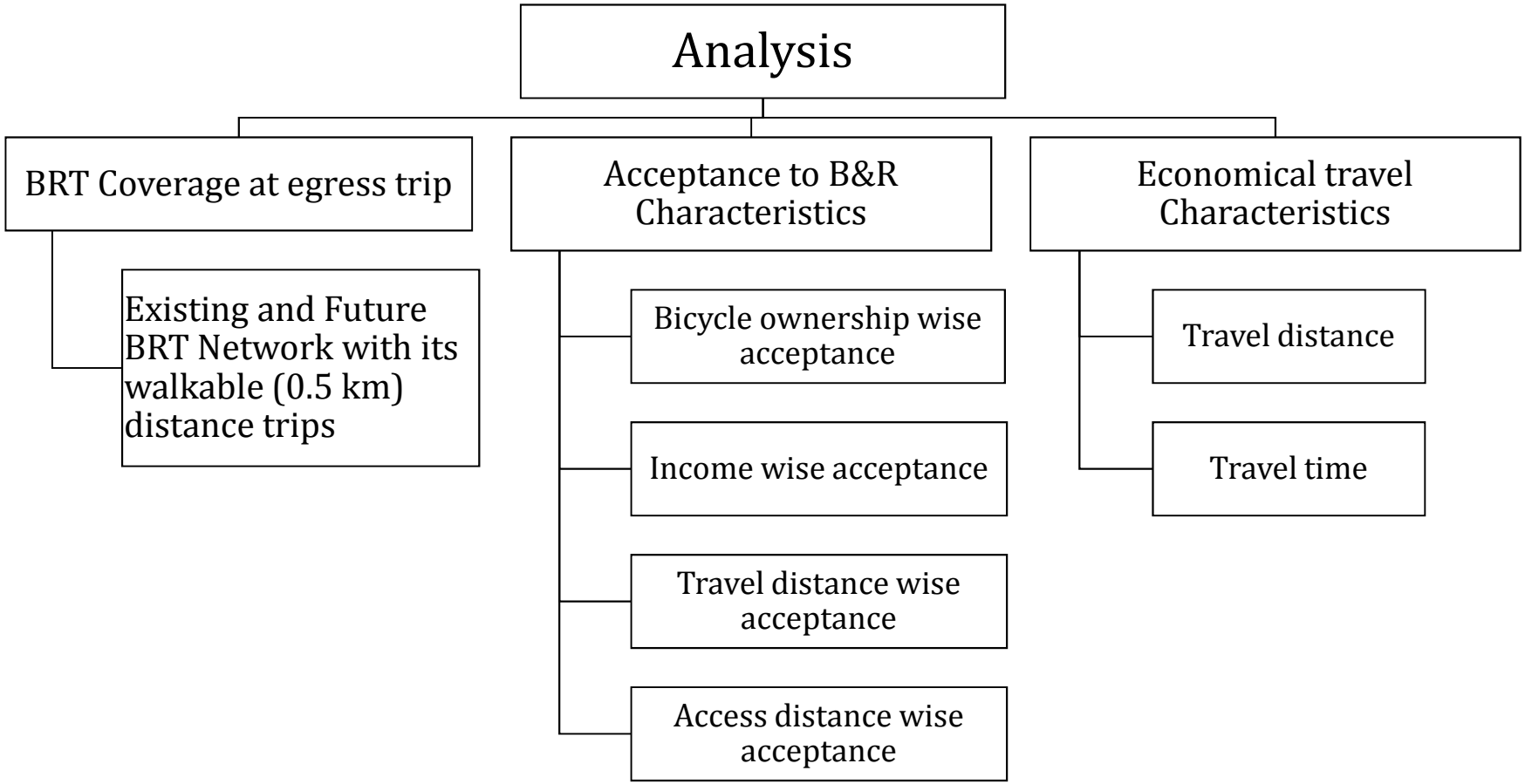
| Particular | Value |
|---|---|
| No. of HH's Surveyed | 188 |
| No. of Samples | 309 |

| Item | Absolute value | Relative value |
|---|---|---|
| **Mode share** | | |
| **Two wheelers** | 263 | 85% |
| **Cars** | 46 | 15% |
| **Average trip length** | | |
| **Two wheelers** | 5.7 kms | |
| **Cars** | 4.5 kms | |
| **Average journey speed** | | |
| **Two wheelers** | 23 km/hr | |
| **Cars** | 23 km/hr | |

| Item | Absolute value | Relative value |
|---|---|---|
| **Willingness** | | |
| Two wheeler | 36 | 12% |
| Car | 0 | 0% |

# ANALYSIS AND RESULTS

# APPROACH



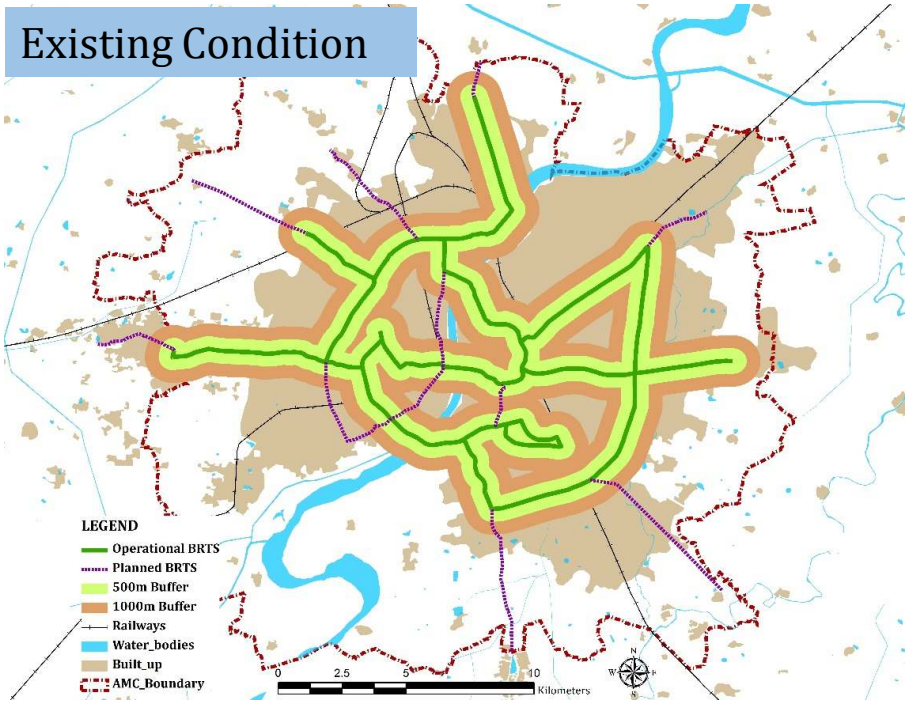

Source

Analytical framework is drawn with the reference of Shah, Jainal. PARK & RIDE: Integration of Private and Public mode of Transport. M. Plan Thesis. Ahmedabad: CEPT University, 2012. .pdf.

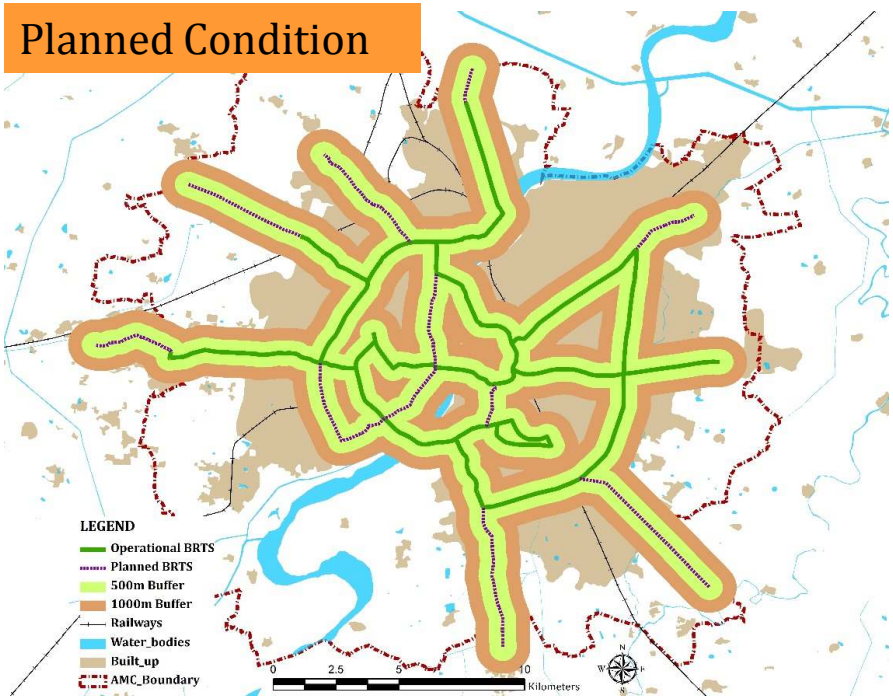
NK1

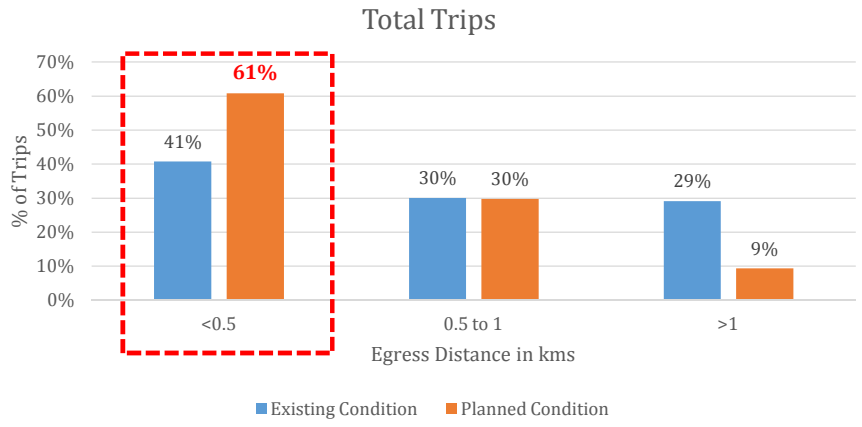
# BRT COVERAGE AT EGRESS TRIP

## Existing Condition




## Planned Condition







**61%** of trips out of total trips are within **walkable egress distance**

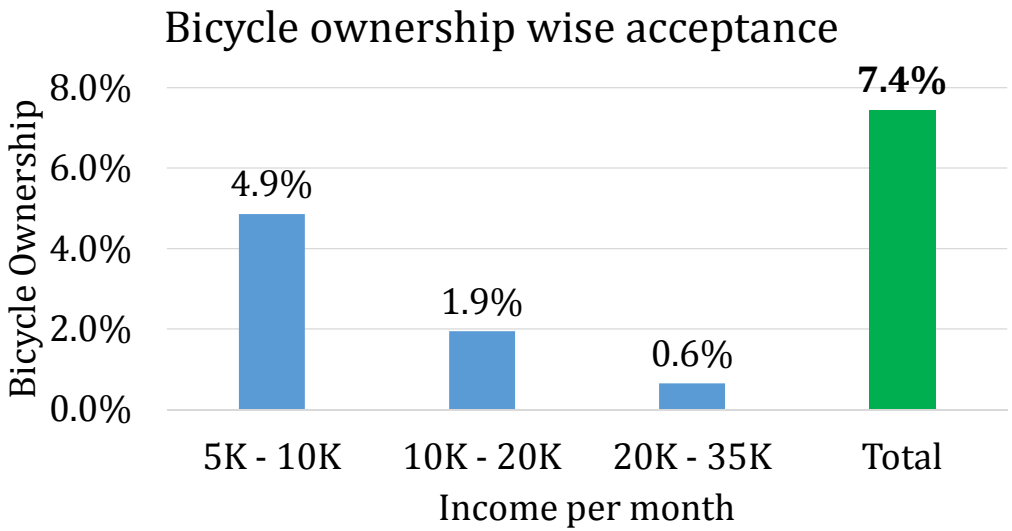
**9%** of willingness trips out of total trips are within **walkable egress distance**

## Slide 22

**NK1** This is a measure of the coverage of a bus route network. In an urban area, a walk of 500 meters or less to or from the nearest bus stop is normally regarded as desirable: a distance greater than this is regarded as inconvenient

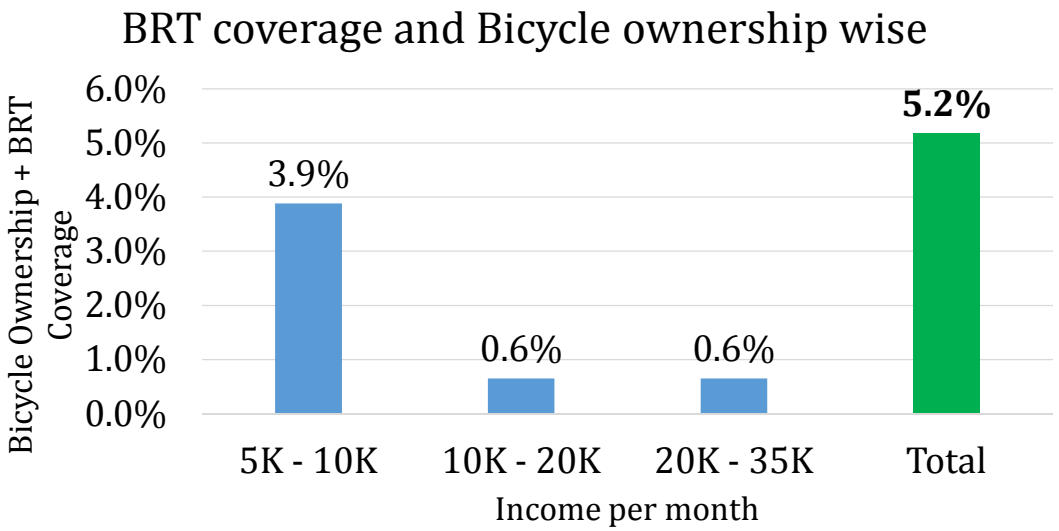
Naresh Kuruba, 4/23/2014

# Bicycle ownership and Income wise acceptance




- **7.4 %** of the people are accepted for B&R services.

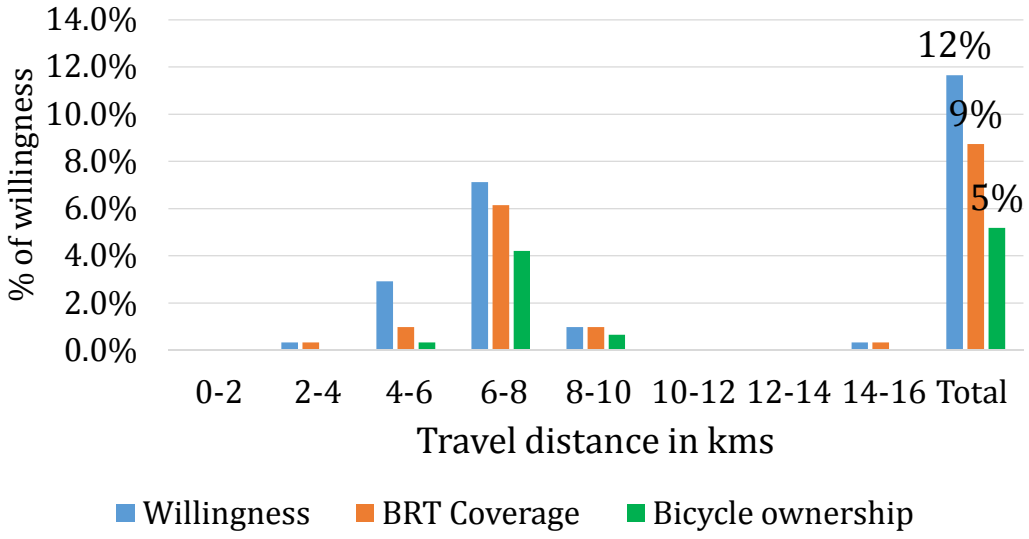
- **5.2 %** of the people are accepted for B&R services.
- Average income of acceptance is **10,937** per month.
- Average value of time of acceptance is Rs. **54.68 /hr.**




Source

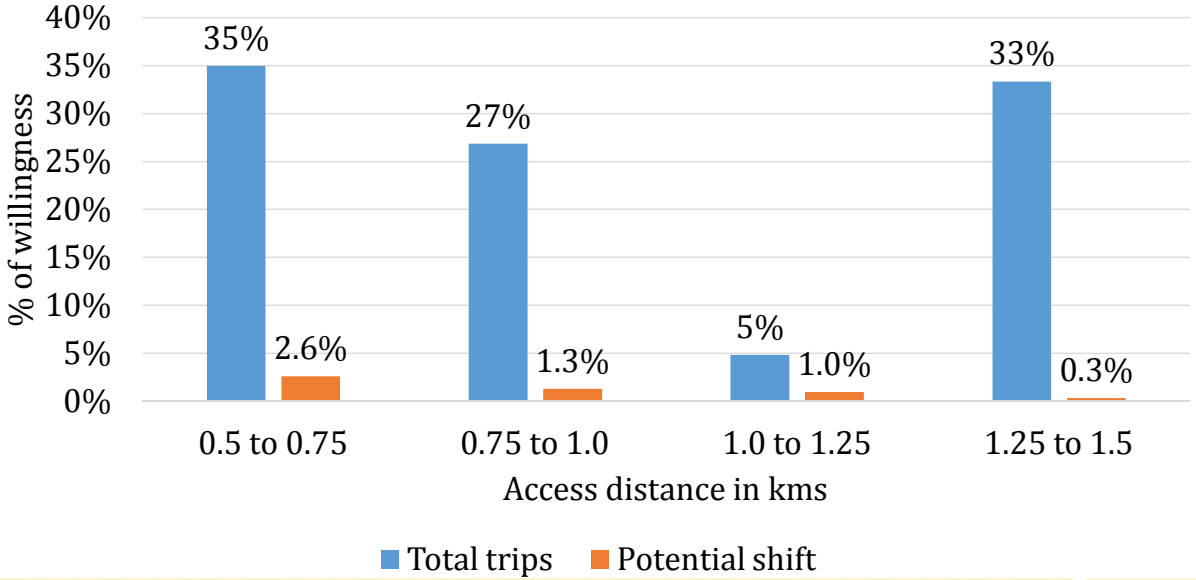
Household survey

# Travel and Access distance wise acceptance




- **>4 km travel distance** travelers are accepted for B&R services.
- The average travel distance of acceptance is **7.5 kms**

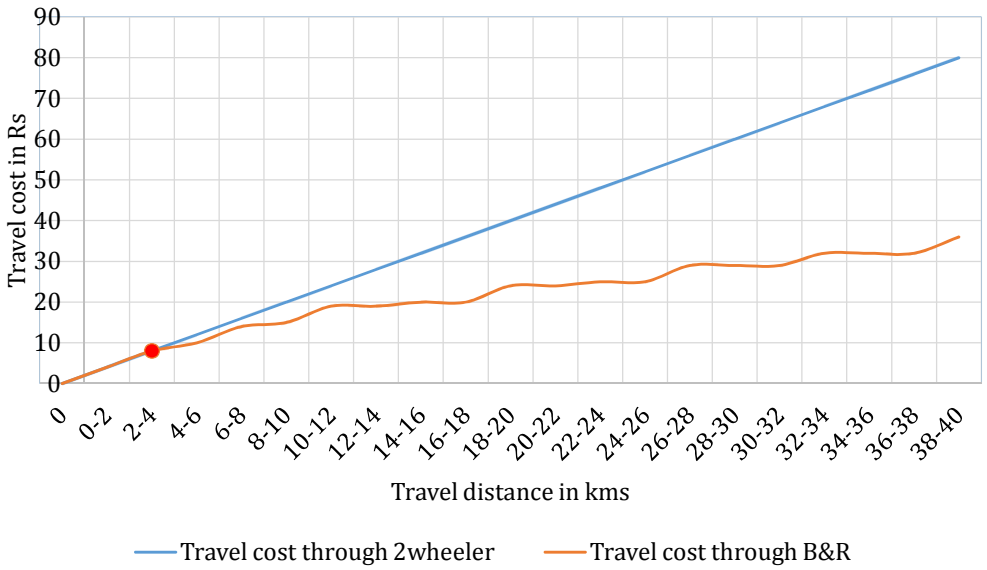
- **Upto 1.25 km** from the stations people are more willing to use B&R services.




Source

Household survey

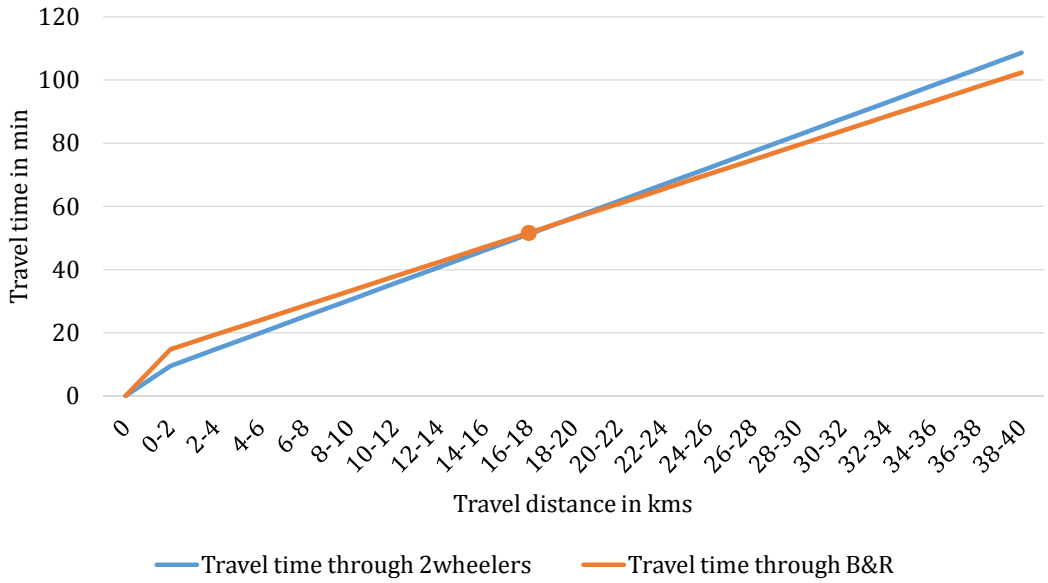
# Economical travel distance and time




- The travel distance **more than 4 km** is economical to shift for B&R services.
- It is calculated based on **fuel price and BRT fare.**

- The travel distance more than 4 kms will **loss <4 min**.
- It is calculated based on **average speeds** of different modes.

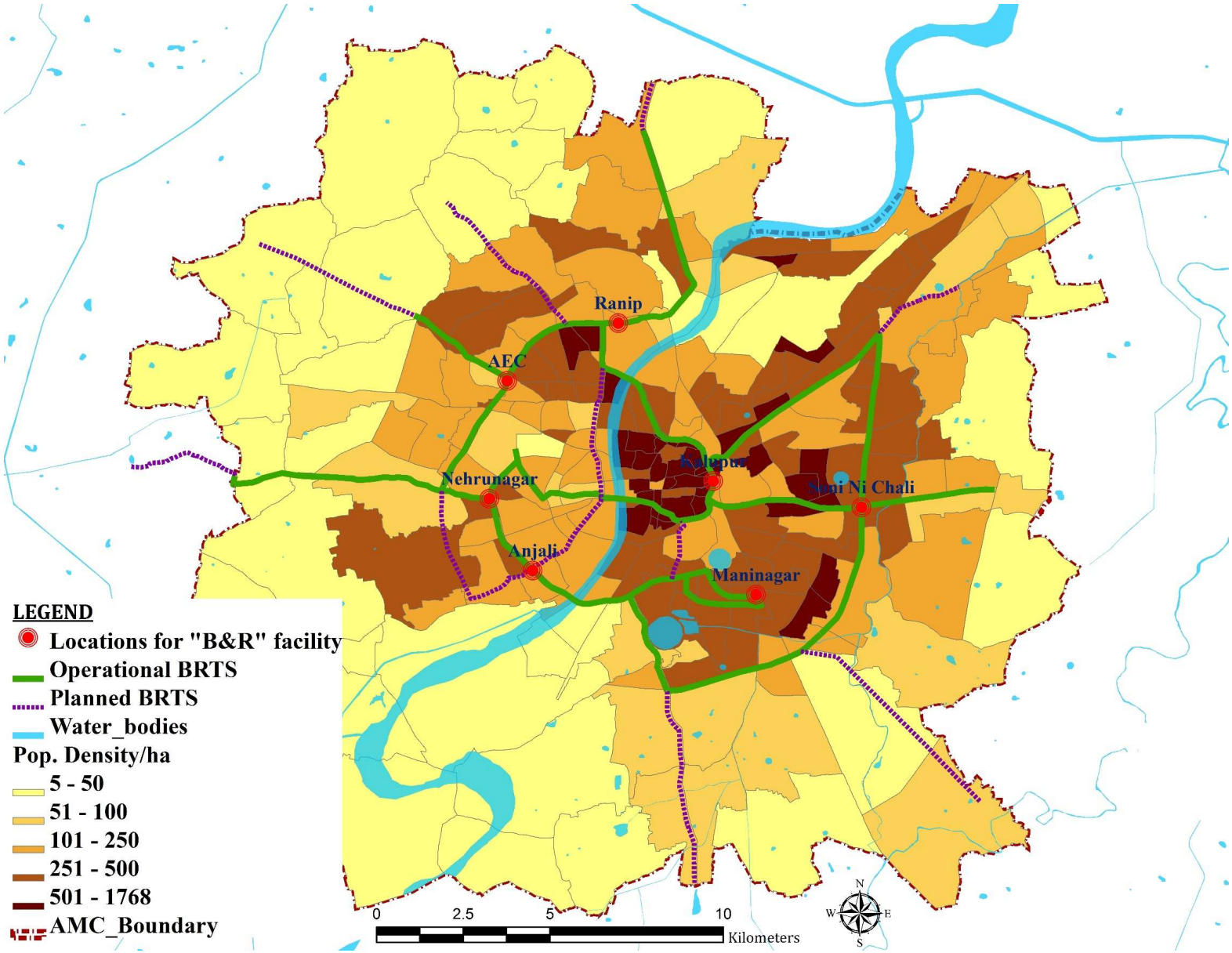
| Mode | Average speed |
|---|---|
| Two wheeler | 23 kmph |
| BRTS | 26* kmph |
| Bicycle | 12** kmph |
| Walk | 3.5** kmph |




Source

*Centre of Excellence in Urban Transport, CEPT University. Bus Rapid Transit System, Ahmedabad. BRTS Phase-III Draft Report. Ahmedabad: AMC & GoG, 2013. Document.; **Mark Brussel, ITC, PGM Department. "The Integration of Cycling and Public Transport." Workshop Session Urban Cycling: The Integration of Cycling and Public Transport. University of Twente, 13 12 2013. .pdf; AJL and Market survey

# POTENTIAL LOCATIONS FOR "B&R" SYSTEM

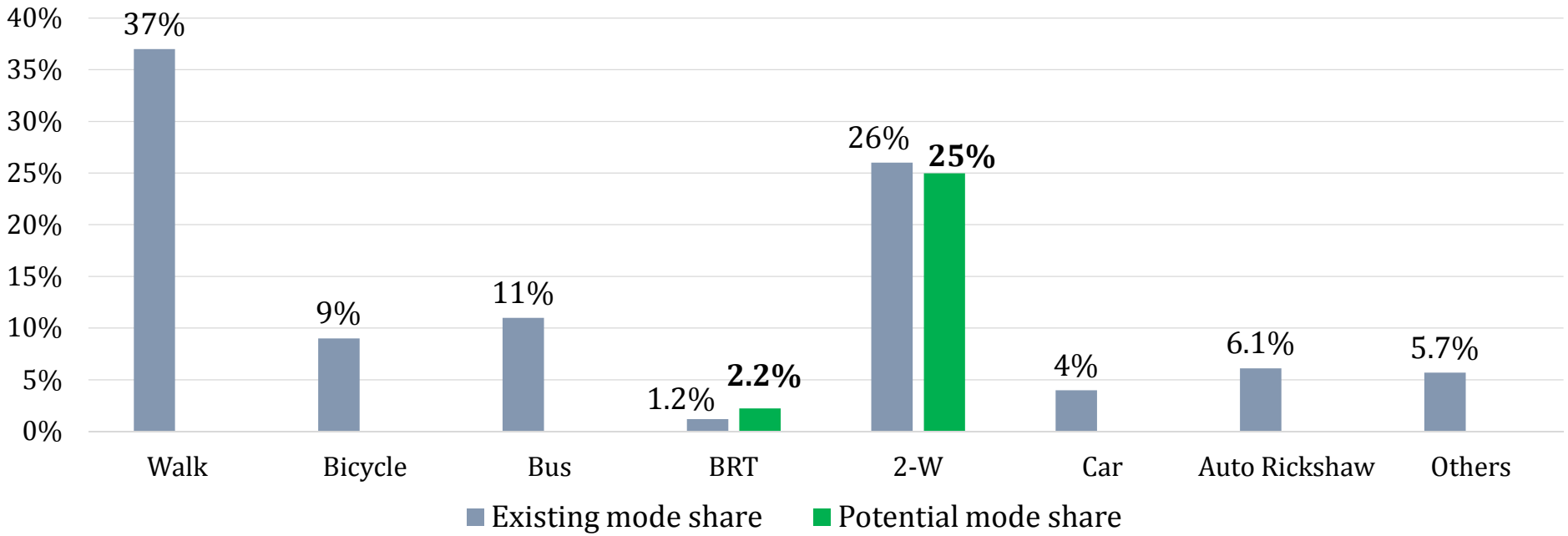



Source

Centre of Excellence in Urban Transport, CEPT University.

# POTENTIAL MODE SHARE

| | |
|---|---|
| No. of commuters shift observed at Interchange station | 791 (expanded) |
| Total no. of stations identified for "B&R" facility | 7 |
| Total commuters shift to "B&R" facilities | 5537 |
| Trips made by commuters per day | 11074 |
| Total Trips made by two wheelers per day | 10, 71,417 (26%) |
| % of shift from two wheelers to PT | 1.03% |




Source

Centre of Excellence in Urban Transport, CEPT University. *Bus Rapid Transit System, Ahmedabad*. BRTS Phase-III Draft Report. Ahmedabad: AMC & GoG, 2013. Document.

# COST-BENEFIT ANALYSIS

# COST ESTIMATES

## CAPITAL COST

| No | Item | Total cost |
|---|---|---|
| 1 | Land cost (in lakhs) | 379.6 |
| 2 | Total construction cost (in lakhs) | 421.9 |
| 3 | Total equipment's cost (in lakhs) | 10 |
| 4 | Junction improvements (in lakhs) | 7.5 |
| 5 | Other costs (in lakhs) | 31.6 |
| **Total capital cost in lakhs** | | **850.8** |

## OPERATION COST

- The operation costs includes, security staff requirements, administration requirements and other operations. The total cost requirements for **base year operations is 27.8 lakhs**. The **inflation (Wholesale price index) 6.5%** is applied every annum for the **period of 20 years**.

## MAINTANANCE COST

- Maintenance cost is basically considered as two types. 1. Annual maintenance and, 2. Regular maintenance. **Annual maintenance is assumed as 2% percentage of construction cost** per annum for the project and **periodic maintenance is assumed as 5% of construction** cost per every five years for the period of 20 years.

# BENEFITS ESTIMATES

| Item | Unit | Savings in base year |
|---|---|---|
| **Vehicle Kilometers Travelled** | **kms** | **3241688** |
| Travel cost savings | Rs. | 2106038 |
| Revenue generated through BRT Fare | Rs. | 4746000 |
| Revenue from Advertisement | Rs. | 240000 |
| Parking cost savings | Rs. | 5932500 |
| Travel time savings | Rs. | -1792174 |
| Accident cost savings | Rs. | 629478* |
| Pollution savings | Rs. | 880 |
| **Total Benefits in lakhs** | | **119** |

- The economic analysis is carried out for the **period of 20 years** for development of the "B&R" system on the Sola Crossroad BRT station of Ahmedabad city. It is estimated that the **Economical Internal Rate of Return (EIRR) of the project is 20.1%.** It is clear that the project is **economically feasible with minimum EIRR %,** i.e., the minimum requirement of EIRR is 20%. Hence it is recommended for implementation from the perspective of economic consideration.

Source

*http://tripp.iitd.ernet.in/publications/paper/safety/dnmrk01.PDF; Centre of Excellence in Urban Transport, CEPT University.

# CONCLUSION

- Priority of BRT stations
  - **Interchanges**
  - Terminals
  - Intermediate stations
- Total potential shift of commuters from two wheeler to B&R services is **1.03%**
- Economical travel distance is **>4 kms**
- Effective catchment area is upto **1.25 kms**
- Cost efficiency (EIRR) of the system within period of 20 years is **20.1%**

# RECOMMENDATIONS

- It is recommended to provide **public bicycles and/or rental bicycle** possibly to increase the potential demand for B&R facilities.
- Make sure the **availability of bicycles**, whose point of **destination is too far** from the station.
- Private vehicles are relatively costly to own but relatively cheap to use. So, it is recommended to have a policy to provide **incentives to the private vehicle users** to encourage the use of B&R services.
- It is recommended to **identify the funding sources** for capital investment on bicycle infrastructure.
- However, there is **no significant change in private mode share** due to implementation of B&R facilities other alternative modes should be explored.

***Thank you…***