Sustainable Urban Transport Project (India)

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MINISTRY OF URBAN DEVELOPMENT
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PBS Guidance Document

CONSULTANCY SERVICES FOR DEVELOPING GUIDANCE DOCUMENTS FOR TRANSIT ORIENTED DEVELOPMENT (TOD), NON-MOTORISED TRANSPORT (NMT) AND PUBLIC BICYCLE SHARING (PBS)

May, 2016

Public Bicycle Sharing
Guidance Document

Cover Page:

An illustration of proposed Public Bicycle Sharing Scheme in Dwarka, Delhi, India | Source: First Cycle Sharing Project in Dwarka (DDA) accessible at: http://uttipec.nic.in/writereaddata/mainlinkFile/File398.pdf

Prepared for Ministry of Urban Development, Government of India
By IBI Group

Foreword

Prior to the launch of the National Urban Renewal Mission (2005) and the National Urban Transport Policy (2006), investments in public transportation systems to meet the mobility needs of the current and future population were limited in Indian cities. Planning for essential city systems — environmental, land, mobility, economic and social — has largely been attempted in piecemeal. The need to induce a paradigm shift, putting people first in planning our regions, cities and neighbourhoods, implies providing for increased mobility choices from dependence on private vehicles to the availability of good public transportation and safe non-motorised transport.

Public Bicycle Sharing (PBS) is slowly emerging as one of the most sustainable, popular and attractive public transport modes throughout the world. This mode offers the conveniences of both public and personal modes. It enables public access to personal bicycles, offering maximum flexibility with minimum liability.

This PBS Guidance Document presents a compendium of strategies and recommendations for integrating bicycle sharing in transportation planning initiatives in India. It also identifies a five-step planning process for local authorities, central government agencies and development professionals to follow in implementing transit oriented development projects.

This Guidance Document brings out clarity in the acceptance of PBS schemes in Indian cities by analyzing challenges encountered in reviving the use of cycles as an alternative mobility choice. The purpose is first to document the state of the practice and finally to assemble the resources necessary to assist cities, transit agencies and professionals who wish to embrace PBS as a sustainable mobility concept.

It is of utmost importance that the knowledge contained in this document is transferred to on-the-ground practices to bring about sustainable transportation choices in India's cities.

Preface

The Guidance Documents for preparing Non-Motorised Transport (NMT) plans, Transit Oriented Development (TOD) plans and Public Bicycle Sharing schemes (PBS) have been undertaken by the Sustainable Urban Transport Project, Ministry of Urban Development (MoUD), Government of India (GOI) with support from Global Environment Facility (GEF), UNDP and World Bank. The primary objective of GEF-SUTP is to apply the National Urban Transport Policy principles to achieve a paradigm shift in India's urban transport system for more favourable sustained developments and alternatives.

Under the guidance of MoUD, these documents are envisioned to assist various government organizations, public authorities and development professionals in India, embarking on the process of integrating sustainable transport planning principles in diverse urban contexts. In addition, central government officials and representatives may refer to these documents when evaluating the implementation of the Smart City Mission in selected cities and future policy formulation initiatives by think tanks such as NITI Aayog.

A state of the art review was conducted as a first step to highlight successes and failures in application of NMT, TOD and PBS globally and in Indian cities. Building on the lessons learned from these experiences, the focus of the Guidance Documents was directed to establish a systematic process for plan preparation, serving more as an implementation manual with checklists of potential alternatives, rather than providing technical standards for development of detailed specifications. Based on local conditions, it is expected that state, city and special authorities will adapt the steps presented in the Guidance Documents to each city's own individual situations.

This Guidance Document on preparing PBS schemes goes beyond discussing the principles and includes a step-by-step planning process supported with tools for quick reference and application of standards in Indian cities. To test the practical value of the guidance document in Indian cities, PBS city specific plans were also prepared for Vadodara and Gurgaon. This document will serve as a handbook of ideas and strategies for promoting PBS as the foundation for creating sustainable transportation alternatives in India.

Acknowledgment

The PBS Guidance Document was prepared under the direction of Shri. Rajiv Gauba (Secretary, MoUD), Shri. Durga Shanker Mishra (Additional Secretary, UD), Shri. M.K.Sinha (OSD, UT), Shri. R.K.Singh (Director, UT-I), Shri. I. C. Sharma (National Project Manager, PMU, SUTP), Shri. Sudesh Kumar (Team Leader, Project Management Consultant, SUTP) and Ms. Nupur Gupta (Team Leader, World Bank).

The team would like to make special mention of Shri. Vikas Gupta (IAS, Commissioner, Municipal Corporation, Gurgaon) and Shri H.S. Patel (IAS, Municipal Commissioner, Vadodara Mahanagar Seva Sadan, Vadodara) for their valuable inputs during the PBS city specific workshops. We are also thankful to all stakeholders for participating in various workshops and sharing their feedback.

The consultant team for the preparation of the PBS Guidance Document included the following members from IBI Group:

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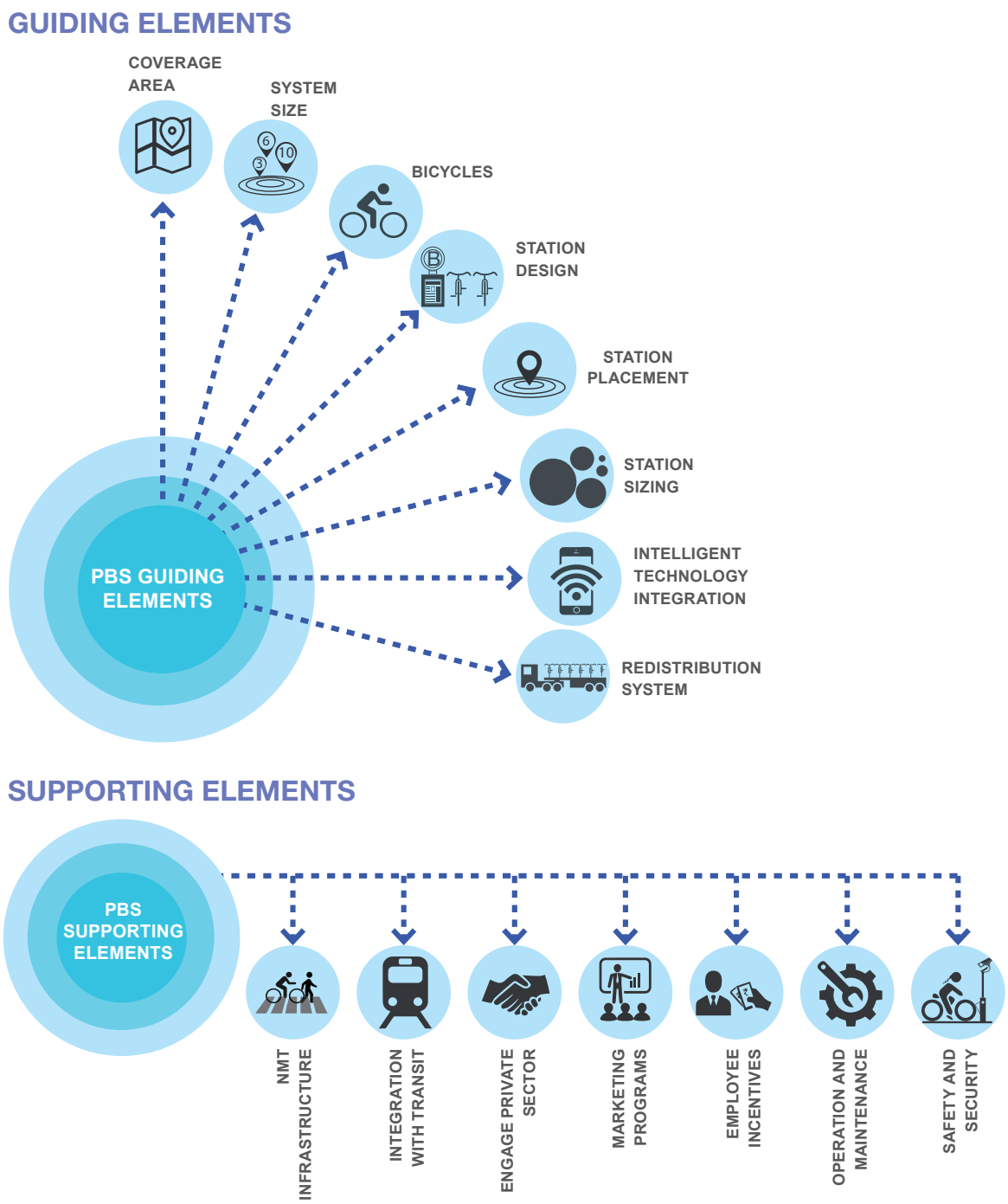
EXECUTIVE SUMMARY

DEFINING PUBLIC BICYCLE SHARING

Public Bicycle Sharing (PBS) is a **high quality bicycle based public transport system** in which bicycles, stored in a closely spaced network of stations, are made available for **short-term shared use**. Bicycle sharing programs involve **installing multiple bicycle stations** at several different key locations. A user **checks-out the bicycle from one location**, rides to his or her destination, and **drops off the bicycle to another location**. The operators coordinate the redistribution of bicycles and ensure availability of the vehicles at locations with the highest demand at any given time. PBS systems **eliminate the fears associated with owning a bicycle** such as theft or parking concerns, thereby encouraging people to use the bicycle for short and medium length trips.

Elements of a PBS System

PBS systems are defined by the following **key guiding and supporting elements to ensure successful implementation of PBS schemes:**



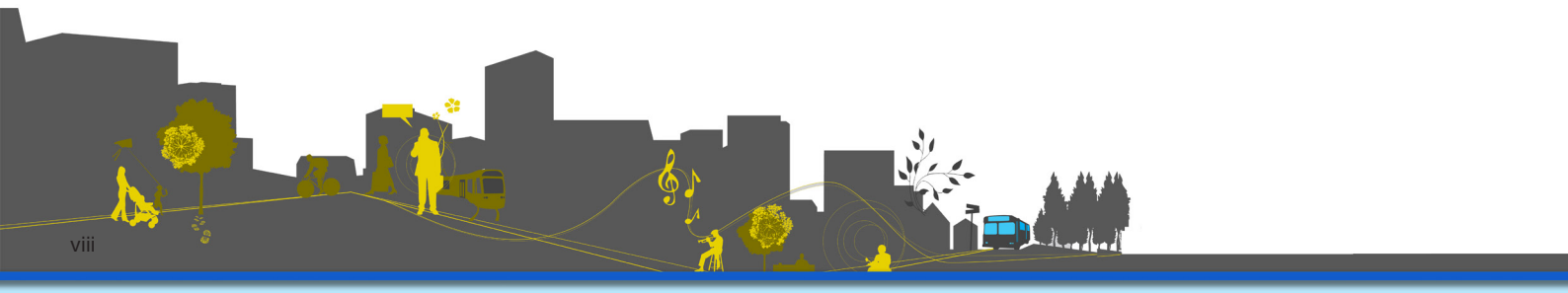
This document goes beyond discussing the theory of PBS especially as it relates to developing planning and design components. In order to capture the entire PBS planning from feasibility assessment to completion, the step-by-step guide is organized into “five key steps”. Each step is further guided by a series of task-based actions that will assist cities in making informed decisions related to adoption of PBS schemes.

STEP-1 ASSESS

1. Create a consolidated database of city characteristics
2. Conduct a review of current institutional support for bicycling
3. Develop an understanding of the city’s budgetary allocation for transportation
4. Formulate preliminary goals for the city’s PBS system
5. Identify stakeholders to create an effective communication strategy
6. Determine initial scale and scope of proposed coverage area
7. Prepare a preliminary feasibility study

STEP-2 ENABLE

1. Establish leadership support and project champions
2. Conduct capacity building workshops and awareness generation campaigns
3. Define PBS scheme delivery mechanism alternatives
4. Align PBS system with planned NMT and transit infrastructure improvement projects
5. Allocate funds to undertake detailed planning and implementation



STEP-3
PLAN+DESIGN

1. Conduct data inventory and demand analysis for initial PBS coverage area
2. Determine PBS system design including station density, location and sizing
3. Refine initial PBS coverage area and determine system phasing strategy
4. Conduct participatory planning workshops to finalize the PBS Network Plan
5. Prepare detailed technical specifications for system hardware and software design
6. Plan NMT infrastructure improvements to support PBS network
7. Create branding guidelines for the PBS system

STEP-4
INVEST

1. Identify detailed capital and operating costs
2. Determine revenue streams
3. Create operational business model

STEP-5
IMPLEMENT

1. Establish institutional framework including roles and responsibilities
2. Devise Operation & Maintenance protocol
3. Build awareness through communication and outreach strategy
4. Undertake operational training and capacity building
5. Develop monitoring system and improvement strategy
6. Expand System

FREQUENTLY ASKED QUESTIONS (FAQs)

1. What is PBS?

Public Bicycle Sharing (PBS) system, is a service in which bicycles are made available to multiple users (on a sharing basis) for short duration trips, offering an option of returning them at different destinations. Often, PBS systems are integrated with public transit stations to provide last mile connectivity or in mixed land use areas to facilitate short duration work and/ or personal trips.

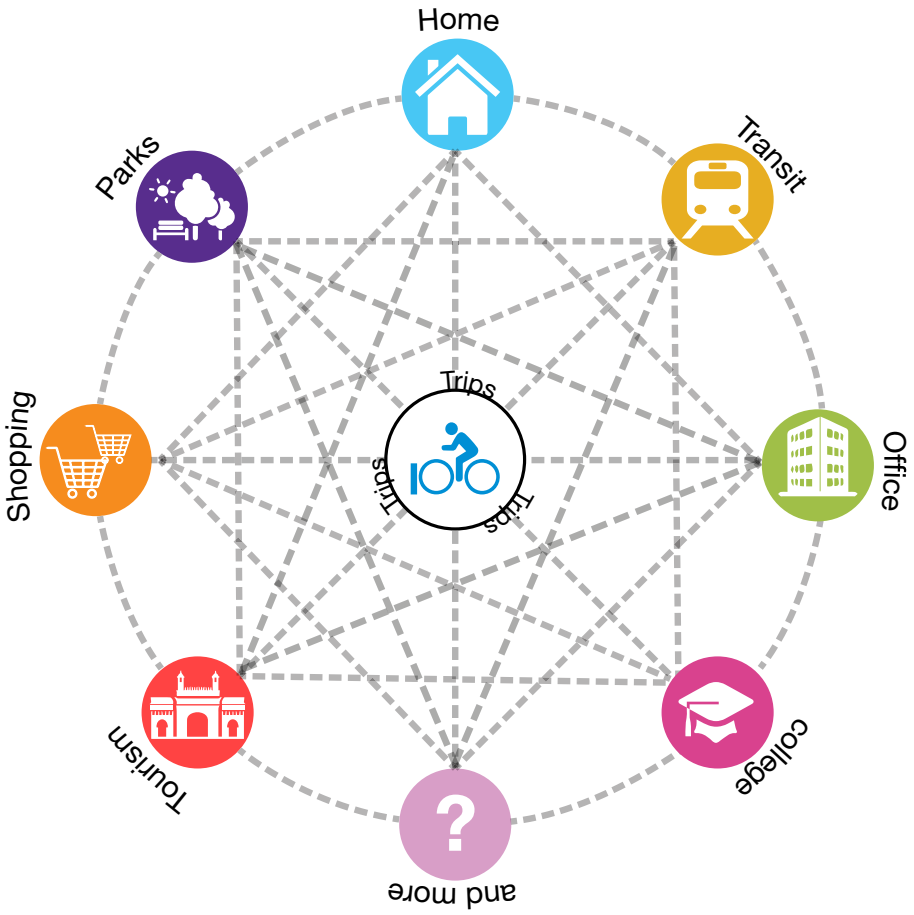
2. Who will use PBS?

PBS system is designed to be used by one and all, but it may be more frequently used by:

- Daily commuters for last-mile connectivity
- Residents and office employees to run general errands
- Time and budget sensitive tourists
- Students

3. What are the advantages of PBS over other IPT modes?

Using PBS is considerably cheaper than using Intermediate Public Transport (IPT) like cycle rickshaw, auto rickshaw or shared auto-rickshaw. Moreover, one has route flexibility using a PBS system compared to IPT modes like shared auto-rickshaw which run on specific routes and may not necessarily connect directly to one's destination. The density of stations in PBS system allows for convenient last mile connectivity in most cases.



Trips and destinations served by Bicycle Sharing | Source: IBI Group

4. I already own a bicycle, why will I use PBS?

Using PBS allows a user to secure the bicycle at designated parking stations, which are conveniently located at key destinations, thereby avoiding the hassle of finding a place to park and the fear of theft. One may even avoid parking charges and reduce the cost of ownership and maintenance by using PBS.

5. How is it different from bicycle renting?

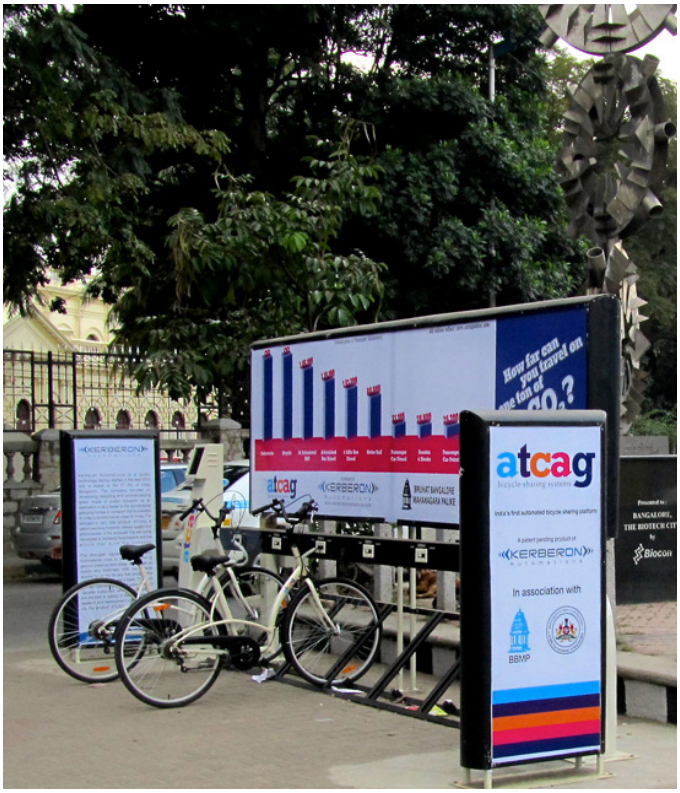
PBS and bicycle renting are two fundamentally different systems and cater to different types of users. PBS is essentially a flexible public transportation alternative focused on last mile connectivity/ short trips while bicycle renting focuses on long-term rentals for commuting, recreation and tourism. One key difference is that renting systems require the user to pick-up and return the bicycle to the same location; while PBS systems encourage redistribution of bicycles allowing each bicycle to serve several users per day.

6. Is bicycle sharing worth the investment?

A high quality bicycle sharing system with a large coverage area costs a fraction of any public transit system or infrastructure investment. As an alternate mobility option, PBS can potentially provide the following benefits:

- Reduce congestion and improve air quality
- Increase accessibility and reach of transit by providing last mile connectivity to the city's public transportation system
- Improve the image of bicycling
- Provide complimentary services to public transport
- Improve health of residents

Like most public transport services, PBS system might require government support for rolling out and to sustain itself, in the long run.



ATCAG, a fully automated bicycle sharing scheme initiated in Bengaluru
Source: Cycle Sharing India, ITDP

'Rent a Bicycle' initiative by Delhi Metro Rail Corporation
Source: IBI Group

7. Who finances PBS?

The capital costs of most successful and popular PBS systems across the world have been allocated from the city's budget. The ongoing operational costs are met from a combination of user charges, advertisement, government subsidy and grants.

Many private sector organizations come forward in support of environment-friendly PBS systems, in order to improve their image. As an example, London and Paris have partnered with private sector companies (Santander and JC Decaux respectively), which financially support the ongoing operations and maintenance costs of the PBS systems. In India, the private sector presents an enormous untapped potential that can very well benefit the city through PBS services.

8. Will it work in the extreme weather conditions?

PBS, like bicycling or any other public transport, can have leaner periods of use during extreme weather conditions and return to regular use in normal weather. As bicycling becomes more popular, city governments will find it lucrative to invest in better bicycling infrastructure such as shaded bicycle tracks and public conveniences to make bicycling more comfortable for the users.

9. How can theft and vandalism of bicycles be prevented?

A bicycle sharing system is safer than privatised bicycle as users doesn't have to worry about theft in this system. Registering the subscriber on the system with a check on valid identity documents is a pre-requisite to access the system. The PBS system identifies the user each time a bicycle is checked out, which helps in tracking and preventing thefts. The responsibility of the bicycle once checked out usually remains with the subscriber until the bicycle is returned at a station. In addition, with use of technology and surveillance at the stations, the security of the system can further improve in addressing the issues of theft.

Barclays Bank purchased the naming rights and branding privileges of the Bicycle Sharing Scheme which was named Barclays Bicycle Hire. | Source: Karl Fjellstrom, ITDP

10. Can the city start a PBS system without having the infrastructure for bicycling?

Having safe cycling facilities is desirable, but it is not critical to wait until the city is able to implement a complete street network with dedicated bicycle lanes to launch a PBS system. Initially, cycling in mixed traffic conditions supported by adequate traffic calming measures such as painted cycle lanes, intersection improvements, temporary barriers to designate cycle lanes and enforcement drives in place will help in influencing the riders' perception of safety. However, it is essential to simultaneously invest in creating NMT infrastructure throughout the city to ensure its long term success.

11. Can tourists and non-residents use PBS?

The bicycle share system can allow for short term subscriptions ranging from one day to a few weeks with similar user charges for both tourists and residents. The system blocks an amount on the credit card or takes cash deposit as security which is refunded as soon as the subscription term is over. Payment for subscriptions could be made available at the bicycle share station against a valid proof-of-identity, security deposit or credit card.

Paris first introduced the bicycle sharing scheme without bicycle tracks to encourage people towards a sustainable mode and later on planned bicycle network to further induce the shift. | Source: ITDP

TABLE OF CONTENTS

PBS FRAMEWORK

ACRONYMS

BOT	:	Build Operate Transfer
BRT	:	Bus Rapid Transit
BRTS	:	Bus Rapid Transit System
CAD	:	Computer Aided Design
CBD	:	Central Business District
CDP	:	City Development Plan
CMP	:	Comprehensive Mobility Plan
DDA	:	Delhi Development Authority
DMRC	:	Delhi Metro Rail Corporation
DP	:	Development Plan
DPR	:	Detail Project Report
ECS	:	Equivalent Car Space
GEF	:	Global Environment Facility
GHG	:	Green House Gas
GIS	:	Geographic Information System
GPS	:	Global Positioning System
IPT	:	Intermediate Public Transport
IRC	:	Indian Roads Congress
IT	:	Information Technology
ITDP	:	Institute for Transportation and Development Policy
ITS	:	Intelligent Transport System
LCMP	:	Low Carbon Mobility Plan
LRT	:	Light Rail Transit
MCD	:	Municipal Corporation of Delhi
MRT	:	Mass Rapid Transit
MRTS	:	Mass Rapid Transit System
MV	:	Motorized vehicle
NCT	:	National Capital Territory
NGO	:	Non-Governmental Organization
NMSH	:	National Mission on Sustainable Habitat
NMT	:	Non-Motorised Transport
NMV	:	Non-Motorised Vehicle
NUTP	:	National Urban Transport Policy
NYC	:	New York City
PBS	:	Public Bicycle Sharing

PIU	:	Project Implementation Unit
PPP	:	Public Private Partnership
RFID	:	Radio-Frequency Identification
RFP	:	Request for Proposal
SPV	:	Special Purpose Vehicle
SUTP	:	Sustainable Urban Transport Project
TOD	:	Transit Oriented Development
ULB	:	Urban Local Body
UMTA	:	Unified Metropolitan Transportation Authority
UNDP	:	United Nations Development Programme
URDPFI	:	Urban and Regional Development Plans Formulation and Implementation Guidelines
UTF	:	Urban Transport Fund

DOCUMENT ORGANIZATION

1 UNDERSTANDING PUBLIC BICYCLE SHARING

The Introduction chapter sets the stage for launching a PBS scheme through a general discussion of the concept's history, myths, and lessons learned from global practices and Indian experiences.

2 PBS GUIDANCE DOCUMENT

The need, objectives, target users and structure of the step-by-step process detailed in the PBS Guidance Document is explained in this chapter.

PBS FRAMEWORK

3 ASSESS

The Assess chapter presents an overview of the steps needed to examine a city's preparedness to adopt a public bicycle sharing system.

PBS FRAMEWORK

4 ENABLE

This chapter outlines the steps necessary to create an enabling environment for creating successful PBS prior to embarking on the PBS Plan preparation.

PBS FRAMEWORK

5 PLAN + DESIGN

The Plan + Design chapter contains a series of detailed PBS components to formulate a context specific PBS Plan that determines the PBS coverage area, fleet size, station locations, and type of PBS technology.

PBS FRAMEWORK

6 INVEST

Invest provides an overview of the financing tools, public funding sources, sponsors and other revenue sources that are essential for long term viability of the system.

PBS FRAMEWORK

7 IMPLEMENT

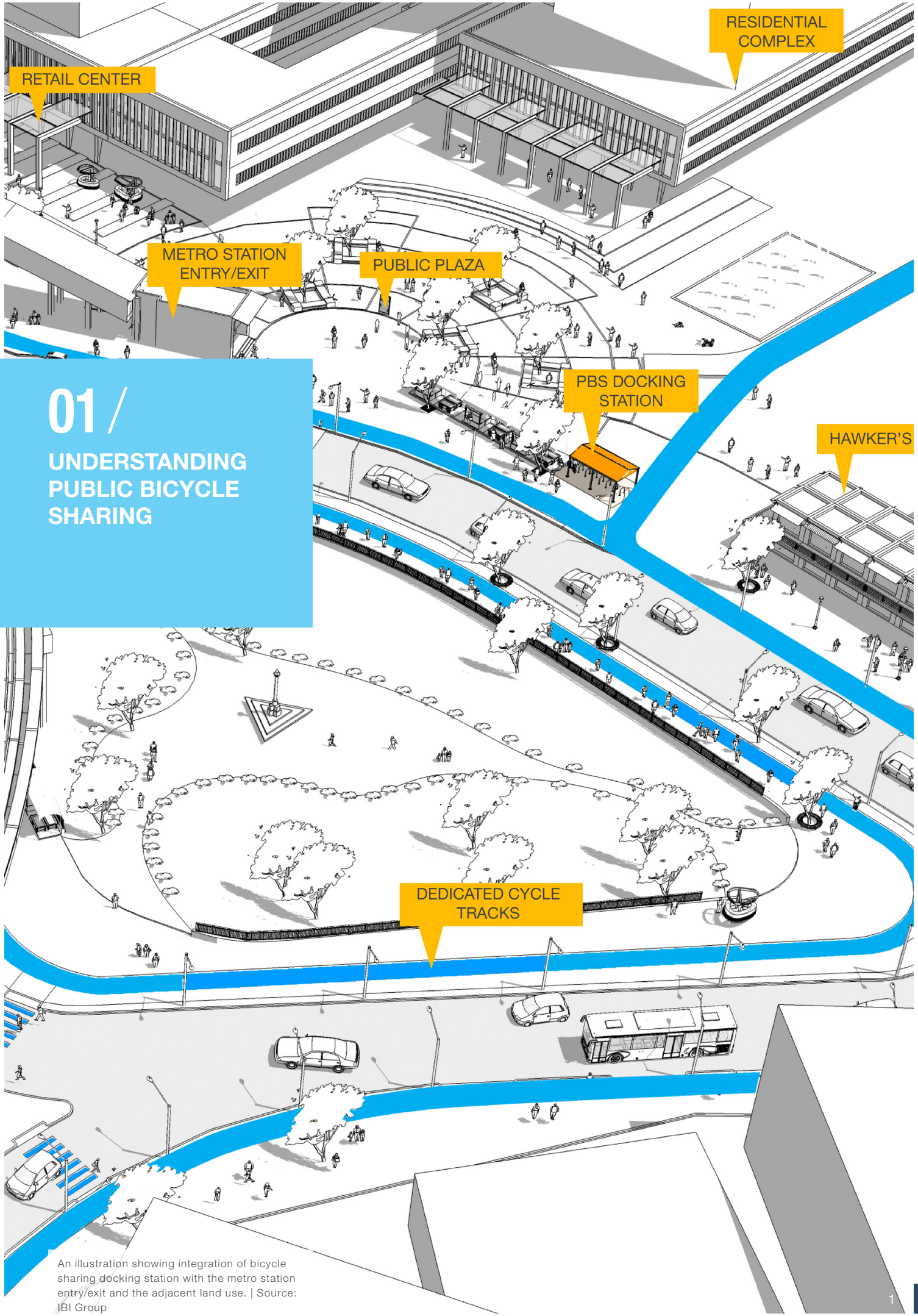
Implementation provides an overview of tasks and sub-tasks to implement PBS plans including institutional framework and supportive public policies.

The document concludes with a compendium of survey formats, glossary of terms, best practice case studies, and PBS specifications

LIST OF TOOLS

01 /

UNDERSTANDING PUBLIC BICYCLE SHARING



An illustration showing integration of bicycle sharing docking station with the metro station entry/exit and the adjacent land use. | Source: IBI Group

1.1 Background

As an emerging economy, India now faces urban challenges that are more complex than the western world, particularly due to the sheer size of the population and rapid pace of urbanization. Rising incomes have enabled the burgeoning middle class to aspire for larger homes and private automobile ownership; while the majority (over 70% according to some estimates) are still dependent on walking and cycling. Engineers and planners in Indian cities continue to design around the needs of the automobiles- width of roads, allocation of road space, high speed roadways, flyovers- in the process ignoring the needs of the urban poor and the environment.

The auto-centric street design environments are contributing to the common perception of cycling as an unsafe mode of travel and a 'poor man's vehicle'. The trend of cycling in the country continues to decrease rapidly in both urban and rural areas. For example, the National Urban Transport Policy 2006 observed that the share of bicyclists in Delhi has declined from 17% in 1981 to 7% in 1994. Despite negligible investments in cycling infrastructure facilities, bicycles have not disappeared from Indian streets. This indicates that current users are not users by choice but because they have no other option. Recent research in India's urban transportation sector provides enough evidence to prove that there is a strong correlation between cycling and income levels. As income levels increase, cycling ridership and ownership decreases in urban areas. With a diminishing market, India's cycling industry also continues to face challenges in sustaining a viable business model to stay competitive globally. As cities expand, increase in travel distances are also discouraging the use of non-motorised modes (NMT).

Given the growing concerns over climate change and global warming, including mitigation of the environmental impacts of polluting transportation, reviving cycling as a sustainable and inclusive mode of transport in the country is an inevitable step forward for all Indian cities. Policy measures, modifications to road design standards, institutional capacity building and other interventions will be needed to ensure that the share of cycling is maintained, if not increased.

Expansive roadways in Bhubaneswar designed only for automobiles to achieve much higher speeds causing safety threats for the NMT users | Source: IBI Group

THE MOVE TOWARDS SUSTAINABLE TRANSPORTATION IN INDIA

A new way of thinking is, however, emerging to reverse the planning processes so as to discourage driving and encourage walking and cycling. The objectives of mobility are no longer confined to improving speed of motorized modes. Instead, India's National Urban Transport Policy (NUTP), 2006 clearly states its objective is "**to ensure safe, affordable, quick, comfortable, reliable and sustainable access for the growing number of city residents to jobs, education, recreation and such other needs within our cities."**

The NUTP envisions a new planning paradigm that recognises "people occupying centre-stage in cities and all plans should be for their common benefit and well-being". Other key goals identified in support of NMT modes, include:

- Allocating travel space equitably among those with access to cars or public transport and those on foot, bicycle, or other NMVs.
- Encouraging a modal shift from private cars and motorcycles to the use of IPT and NMT modes such as walking and bicycling, thereby improving environmental quality and reducing dependence on oil.

The National Mission on Sustainable Habitat (NMSH) 2009, one of the eight missions approved under the National Climate Change Action Plan, also supports non-motorised transport as an important strategy for reducing GHG emissions. The importance of NMT as an affordable and environmentally-friendly transport mode is increasingly being recognised as of prime importance to ensure a sustainable and inclusive future for Indian cities.

An illustration of a dedicated bicycle network proposed along the beachfront in Diu, India | Source: UT administration of Daman & Diu prepared by Center for Green Mobility

BICYCLING AS A SUSTAINABLE TRANSPORTATION MODE

In recent years cycling has seen a rebirth, triggered by the thrust towards greater environmental consciousness. The focus is on making cycling seem easier, healthier, convenient, and safer compared to driving, thus attracting more and more choice users. In cities where cycling shares are low, efforts are being made to promote cycling as a viable mode of transport. Besides improving infrastructure for bicycles and offering user incentives, encouraging recreational cycling through initiatives such as Raahgiri has also been effective in promoting cycling in urban areas as a social activity bringing different sections together to reclaim streets for public use.

FIRST AND LAST MILE CONNECTIVITY

First and last mile connectivity is a term used in transportation planning to describe the difficulty people face in reaching their origin and destination from transportation network stops and stations. In India, public transport users generally complete these trips by walking or on IPT modes such as cycle rickshaws, auto rickshaws, and shared auto rickshaws. While substantial efforts have been made to provide and improve sustainable mass transportation in India, the focus on first and last mile connectivity and linking IPT with mass transit into an integrated system to aid ease of access for users is lacking. The challenges to effective, reliable and affordable public transportation solutions to address this inadequacy include: poor customer service, fare uncertainty by the informal transport sector (rickshaws, auto rickshaws and private mini buses); lack of NMT infrastructure; and urban design issues related to disconnect between public and private development.

However, recently bicycling has gained prominence as a viable alternative to complete the first and last mile within their urban cores. Some Indian cities have borrowed from experiences of cities in Europe, North America and Asia to initiate similar Public Bicycle Sharing (PBS) schemes, as an integral part of their mobility solutions for the city.

An illustration highlighting the proposed network of sidewalk and cycle track along the metro to promote sustainable transportation in Dwarka, Delhi. | Source: First Cycle Sharing Project in Dwarka (DDA) accessible at: http://uttipec.nic.in/writereaddata/mainlinkFile/File398.pdf

1.2 Defining Public Bicycle Sharing

Public Bicycle Sharing (PBS) is a high quality bicycle based public transport system in which bicycles, stored in a closely spaced network of stations, are made available for short-term shared use. Bicycle sharing programs involve installing multiple bicycle stations at several different key locations. A user checks-out the bicycle from one location, rides to his or her 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.

The system reduces the fears associated with owning a personal bicycle such as theft or parking concerns, thereby encouraging people to use the bicycle for short and medium length trips. PBS is increasingly serving the role of a sustainable zero emission feeder alternative to access public transit networks.

Today, 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, in cities such as Hangzhou and Shanghai. In Paris, London, and Washington, D.C., highly successful systems have helped to promote bicycling as a viable and valued transport option. Each city has tailored its bicycle sharing system by adapting context sensitive design solutions catering to the city's unique demographic composition, urban form, topography, weather, infrastructure, and culture. Although other cities' examples can serve as useful case studies, there is no single model of bicycle-share that could be replicated from one city to the other.

Illustration on how to use a PBS system | Source: Center for Green Mobility

WHO USES PBS?

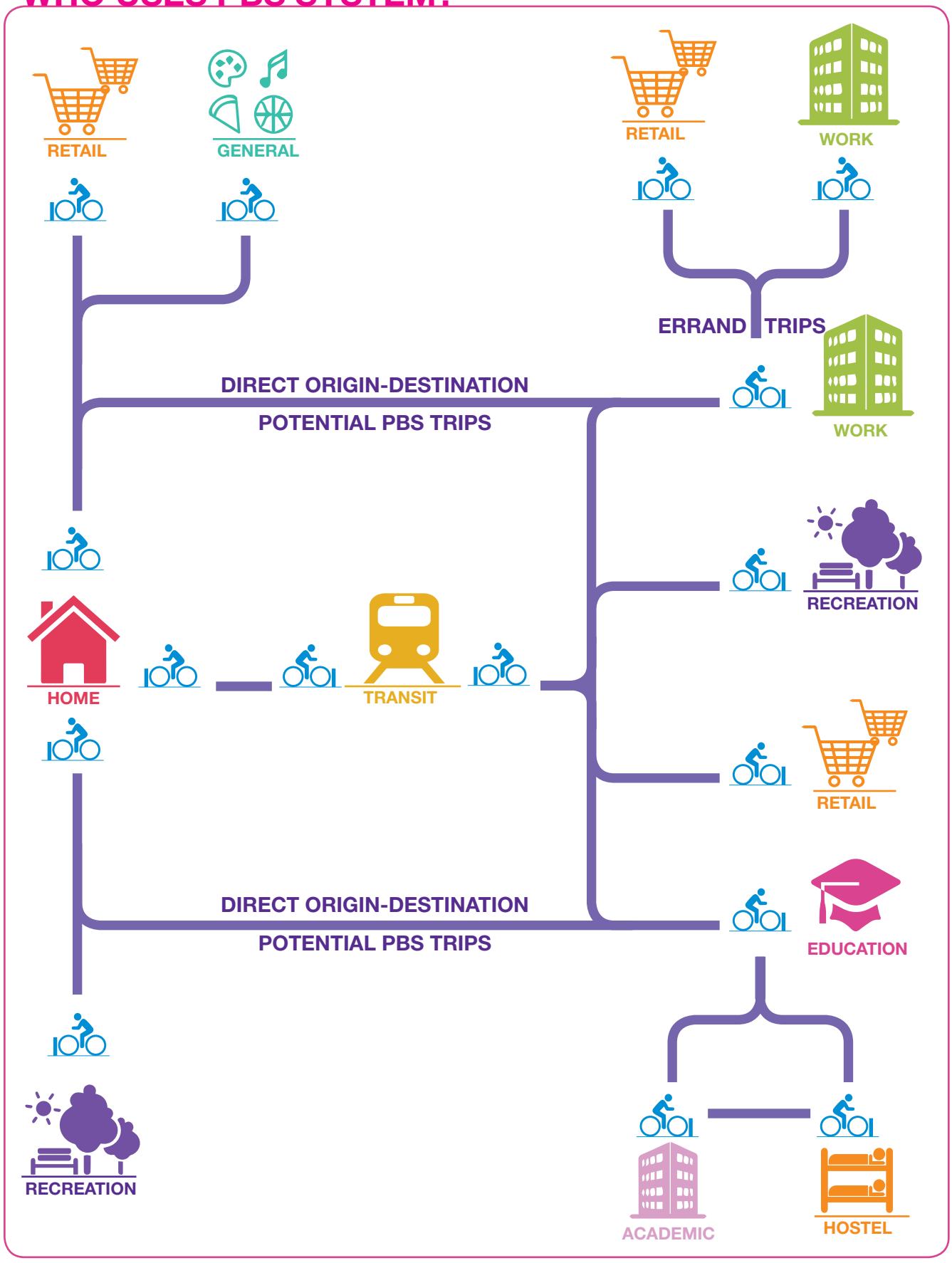
In Indian cities, commuting mode choices are a direct function of income levels. Consequently, the bicycling mode share in most Indian cities is dominated by captive cyclists, who have no choice other than to cycle. Such captive cyclists account for 13%-21% of the modal share in medium and small cities and 7-15% modal share in big cities (Tiwari.G and Jain.H, 2008). As bicycle owners, however, such captive cyclists cannot be considered as potential users of a PBS system. It is therefore important to understand who would be the potential users of a PBS system.

As a rule of thumb, people commuting for regular short trips (less than 5 kms), offer a huge potential to adopt PBS as an alternative mode of travel. It is estimated that about 35% of the vehicular trips in Indian cities are short trips (Tiwari.G and Jain.H, 2008). Apart from short trips, PBS could serve as an important sustainable mode of transportation for:

- Daily commuters using PBS as a feeder public transportation.
- Residents and office employees for short daily errands.
- Tourists who need flexibility and independent in experiencing the city at their own convenience.
- School and college going students on a budget. The potential of this user group is already prevalent in multiple educational campuses around the country.
- Women, especially those who are dependent on IPT modes for commuting short distances.

Depending on the target user group, the approach to plan and design the PBS system will change. Planners will have to be sensitive to the different needs of each user group to ensure the success of the PBS scheme in their respective cities. The following illustration maps the potential users and short trips in Indian cities that can be completed using a well-designed PBS system.

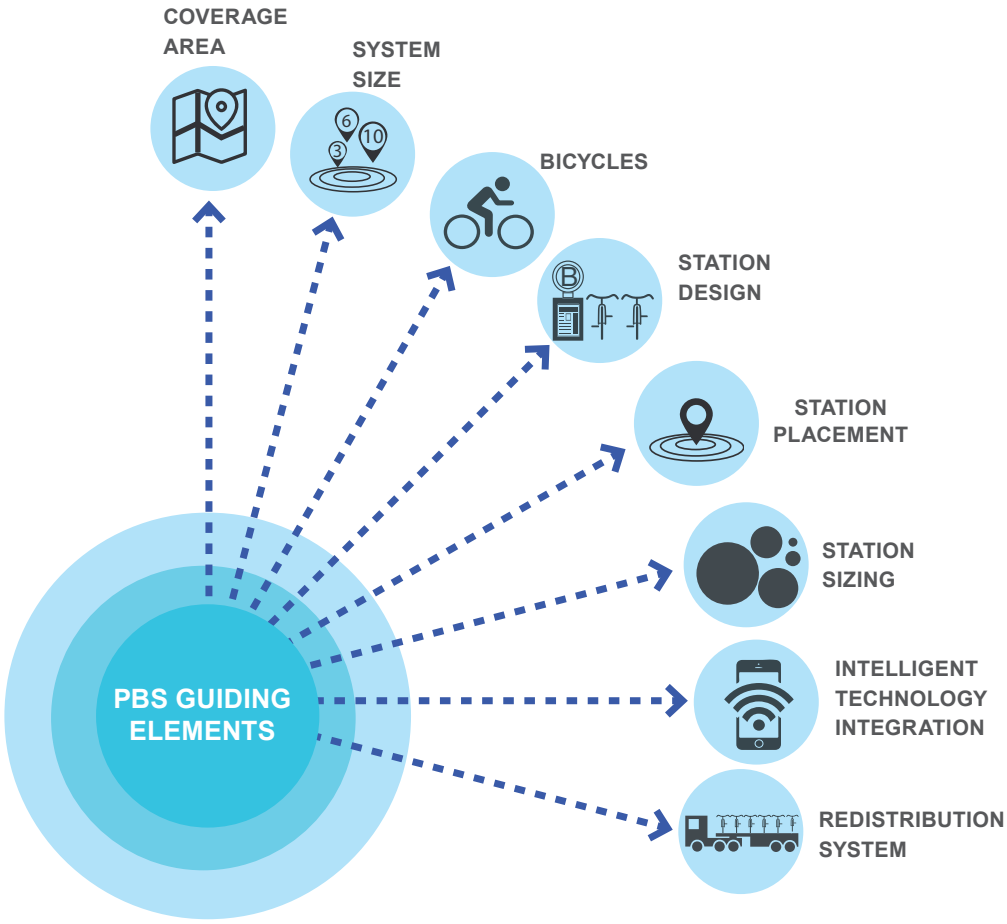
WHO USES PBS SYSTEM?



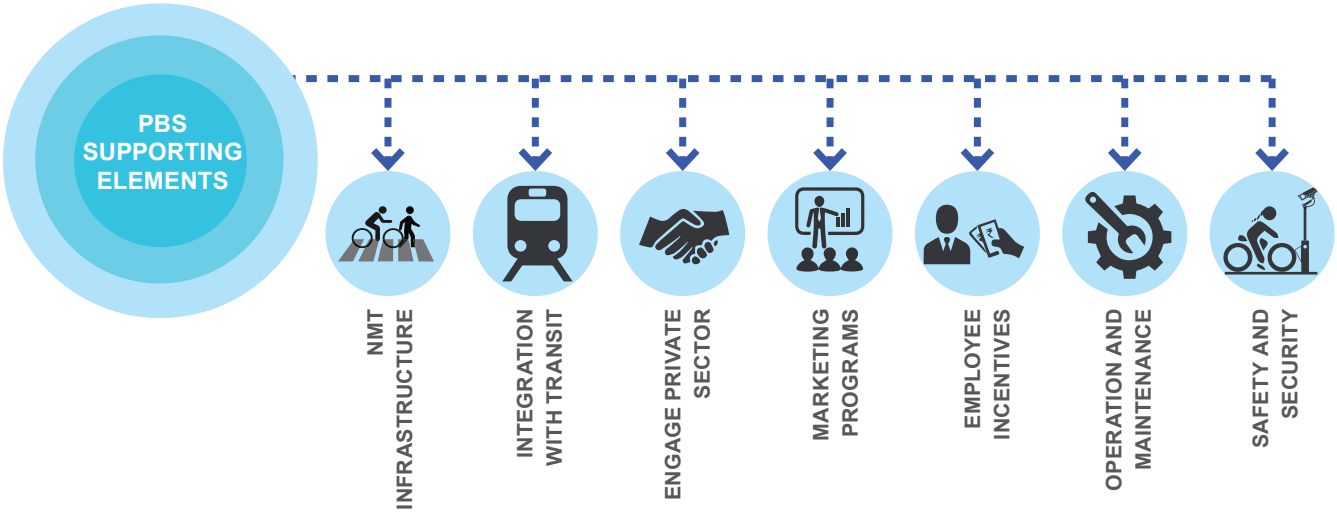
1.3 Elements of a PBS System

A PBS system is defined by a set of **key elements essential for planning, designing and operating PBS in a city.** Derived from a study of global best practices and lessons learned from PBS initiatives in India, the following section presents **8 guiding elements & 7 supporting elements** serving as the building blocks for launching PBS schemes. Each element is further elaborated in detail, complete with descriptive supporting strategies and relevant graphics in the following sections.

GUIDING ELEMENTS



SUPPORTING ELEMENTS



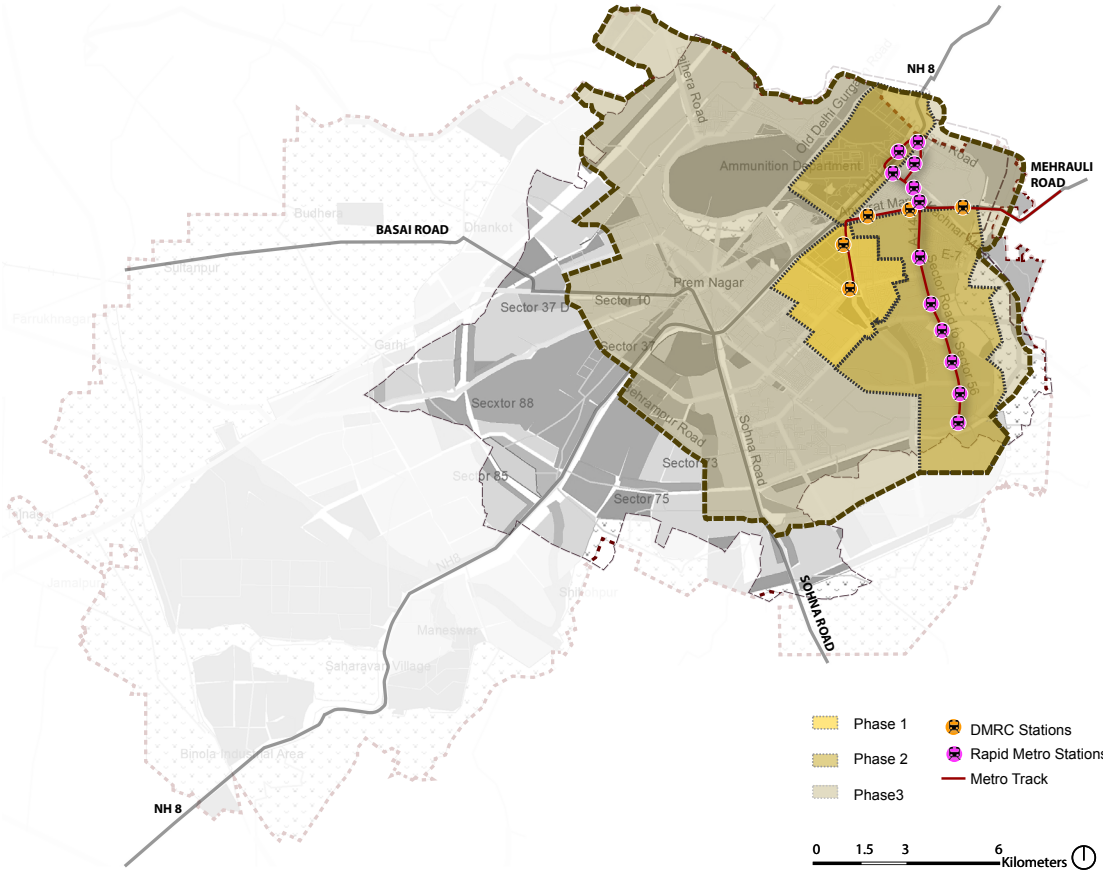
COVERAGE AREA

Description

Coverage area is the **geographic area where PBS system is available** for a user. The coverage area is identified with **maximum origins and destinations for creating a successful system with high ridership.**

The initial coverage area can be delineated based on:

- **Areas with high trip attractors and trip generators** such as high density residential area or major employment centres.
- **Catchment area (2km) of the transit corridor** for providing first and last mile connectivity.
- **Captive institutional areas and its neighbourhood** such as educational campus and their surrounding areas.
- Areas with **existing NMT network.**
- Areas with **relatively flat terrain.**



Proposed Coverage Area for Gurgaon | Source: IBI Group

References

- **Bicycle Share Planning Guide, ITDP: Minimum coverage area should be 10 km²**
- **Rajkot: Initial coverage area of 6 km²** *(Preliminary Phase 1 Proposal Public Bicycling Sharing System for Rajkot, ITDP)*
- **Dwarka: First phase coverage area 30km²** *(Delhi Development Authority with technical support from Centre for Green Mobility)*
- **Bhopal: Catchment area of BRT corridor** *(RFP for Installation and Operation of PBS, Bhopal Municipal Corporation)*
- **Mysuru: Key destinations of the city** *(Competitive bidding for implementation of Public Bicycle Sharing System, Mysore City Corporation)*

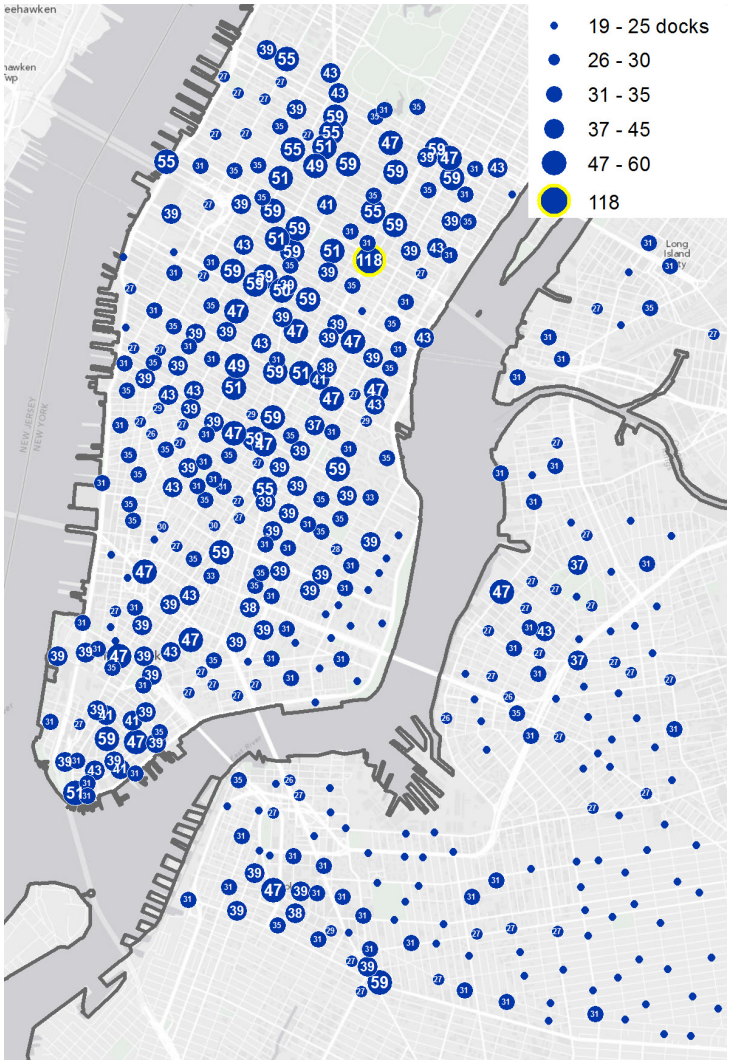
SYSTEM SIZE

Description

System size is defined by **the number of bicycles and number of stations** in a PBS system. The size of the system is generally a function of the coverage area and the desired spacing and density of stations.

Choosing an appropriate PBS system size is critical in determining its success. The following should be considered while planning the system:

- **Place stations within a 5-10min walk** so that it provides a nearby alternative to return a bicycle.
- **Provide more connections to origins and destinations** to generate demand for short trips.
- Plan a reasonable size **based on estimated ridership to justify the cost of system's operation.**
- **Place more stations near densely populated areas** while other areas may require less.



Different sizes of docking station in NYC based on destinations and user demand. | Source: NYC Interactive Map, accessible at https://cunycur.cartodb.com/tables/citibicyclenyc_kiosks/embed_map

References

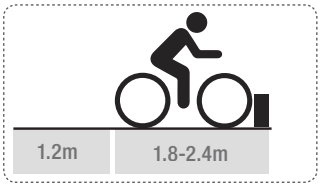
- **Bicycle Share Planning Guide, ITDP: Station Density: 10–16 stations per km²; Bicycles/ resident: 10–30 bicycles for every 1,000 residents (within coverage area); Docks per Bicycle Ratio: 2–2.5 docking spaces for every bicycle**
- **Rajkot: 64 Stations; 1160 bicycles** *(Preliminary Phase 1 Proposal Public Bicycling Sharing System for Rajkot, ITDP)*
- **Dwarka: Phase 1A: 100 stations, 1500 bicycles, Phase 1 B: 80 stations, 1000 bicycles** *(Delhi Development Authority with technical support from Centre for Green Mobility)*
- **Bhopal: 500 bicycles spread over minimum 50 stations** *(RFP for Installation and Operation of PBS, Bhopal Municipal Corporation)*
- **Mysuru: 550 bicycles spread over 52 stations** *(Competitive bidding for implementation of Public Bicycle Sharing System, Mysore City Corporation)*

BICYCLES

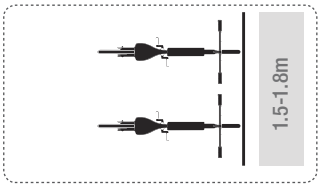
Description

The overall appearance of the bicycle is a key element in the overall **branding and should project a comfortable functional design**. The bicycle should be designed to:

- **Universal Design: Step-through Frame** (Unisex frame) accessible by **people of all age, gender and size** and therefore needs to be versatile.
- **Special Features:** Sturdy, light weight frame with adjustable seat, mudguard to protect clothes, storage space, gears and adjustable lights.
- **Identity: Customized bicycles** with unique features to stand out from regular bicycles.
- **Secure:** Provide **unique parts and tools**, so that it reduces the chance of theft.
- **Advertising Space:** To generate additional revenue.
- **Low Maintenance:** Designed with **robust materials** like alloy frame or aluminum to withstand changing weather conditions and time.



Dimensions of a bicycle in section: 1.8-2.4m wide with a clear space of 1.2m.
Source: Urban Road Code (Part I)



Clear space for parking two bicycles in plan: 1.5-1.8m.
Source: Urban Road Code (Part I)

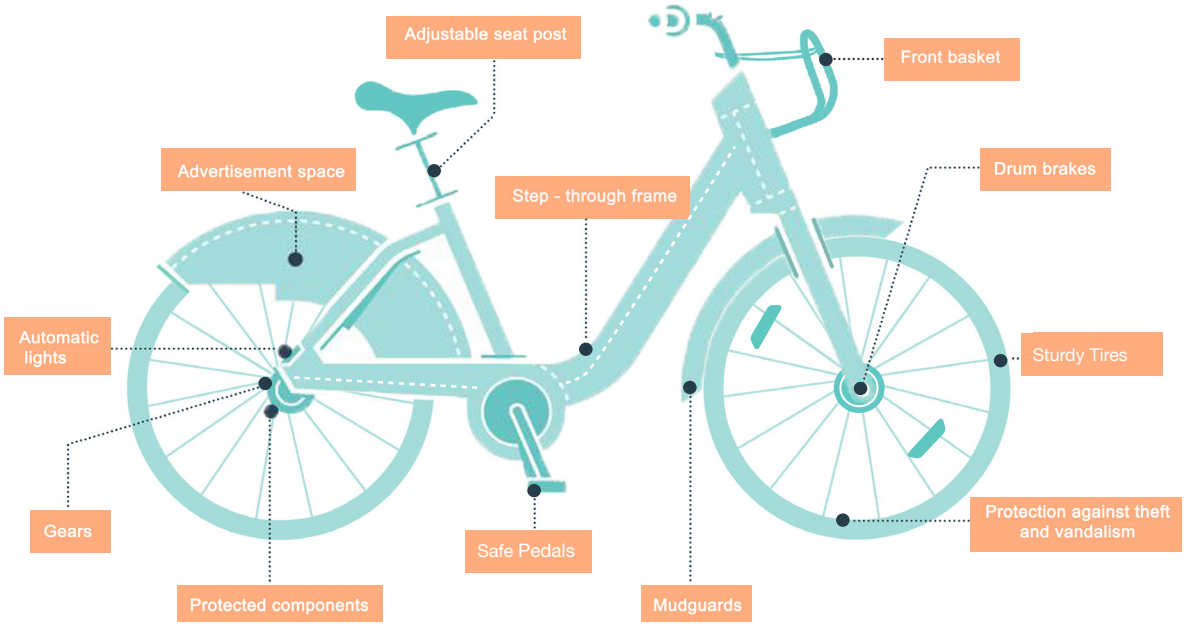
TYPE OF BICYCLES: GEARED AND NON GEARED

GEARED

- Easy to drive at slopes
- Less effort required with low frequency of pedaling
- Average Cost: INR 20,000- INR 30,000

NON-GEARED

- Single speed bicycles
- Simple design making it easier to maintain and repair
- Average Cost: INR 10,000- INR 15,000



Different elements for designing a bicycle for PBS | Source: Adapted from Toolkit for Public Cycle Sharing System, Ministry of Urban Development (MoUD)

References

- **Rajkot: Universal design; distinctive styling; front basket, reflectors, solid frame** *(Preliminary Phase 1 Proposal Public Bicycling Sharing System for Rajkot, ITDP)*
- **Dwarka: Unisex frame bicycle; GPS; RFID; one piece handlebar with grips; covered cables, derailleur and chain protector** *(Delhi Development Authority with technical support from Centre for Green Mobility)*
- **Bhopal: Step Through Frame; adjustable seat; Integrated lock; front basket; ad space; 3 speed gear** *(RFP for Installation and Operation of PBS, Bhopal Municipal Corporation)*
- **Mysuru: Universal design, unique parts; hidden wiring; gears; mudguard; tubeless wires; RFID tracking** *(Competitive bidding for implementation of Public Bicycle Sharing System, Mysore City Corporation)*

STATION DESIGN

Description

The locations at which a **user can pick up or return a bicycle** are known as “stations”. A station at minimum includes **bicycles, docks, terminal, advertisement space** and other structures such as shade protection. The following parameters should be considered while designing PBS stations:

1 DOCKING STYLE

Standalone Docking Space

Each bicycle has a separate dock to park. The size of the station is determined based on docking spaces required which is generally higher than the number of bicycles. Generally for a PBS system there are two different types of docks available:

London, UK | Source: Karl Fjelistrom, Itdp-China.org

Bollard style

- Space required per bicycle: 1.4 sq.m
- Circulation space required: 1.5 sq.m

(Source: Bicycle Sharing Policy for NCT of Delhi)

Barcelona, Spain | Source: Duan Xiaomei, Itdp-China.org

Beam style

- Space required per bicycle: 1 sq.m
- Circulation space required: 1.5 sq.m

(Source: Bicycle Sharing Policy for NCT of Delhi)

Parking Style Space

Parking style is generally preferred for stations where the demand for cycles is more, as it can hold more bicycles per square meter than docking spaces. Ideal for large stations which require more than 75 docks. Stations are secured by either fences or walls for storing bicycles which can be visually intrusive in public realm. At stations with parking style areas, bicycles are checked in and out through a turnstile or manually.


Guangzhou, China | Source: Karl Fjelistrom, Itdp-China.org


Hangzhou, China | Source: Li Shanshan, Itdp-China.org

STATION DESIGN

2 SPACE FLEXIBILITY

Montreal, Canada | Source: IBI Group

Modular station

The stations allow flexibility for relocation and expansion. Docks are separate modules supported with solar power and wireless communications for more flexibility.

New York, US | Source: Karl Fjelistrom, Itdp-China.org

Fixed station

Permanently fixed stations with proper excavation or hardwiring to support the docks.

Gurgaon, India | Source: IBI Group

Caged fixed station

Caged fixed station are closed stations to secure bicycles

3 LEVEL OF AUTOMATION

Bangalore, India | Source: http://www.nammacycle.in/

Manual station

A person manually records the user's information and helps with check-in or check-out the bicycle, including payment.

Beijing, Source: Karl Fjelistrom, Itdp-China.org

Semi-automated station

The system offers a combination of automation and human intervention

Paris, France | Source: Karl Fjelistrom, Itdp-China.org

Fully automated station

A user check-in or check-out the bicycle and makes payments electronically at the terminal.

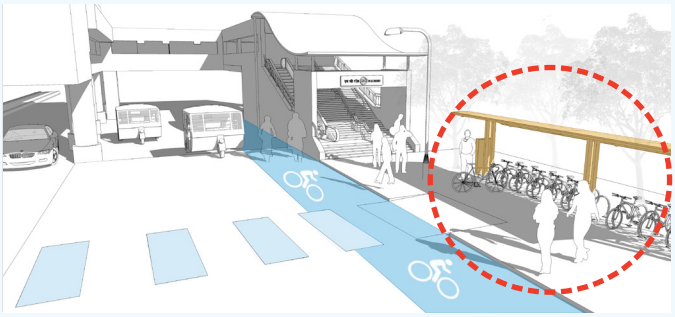
References

- **Rajkot: Automated fixed stations** *(Preliminary Phase 1 Proposal Public Bicycling Sharing System for Rajkot, ITDP)*
- **Dwarka: Automated; modular and stand-alone stations** *(Delhi Development Authority with technical support from Centre for Green Mobility)*
- **Bhopal: Semi-automated stations** *(RFP for Installation and Operation of PBS, Bhopal Municipal Corporation)*
- **Mysuru: Automated fixed stations** *(Competitive bidding for implementation of Public Bicycle Sharing System, Mysore City Corporation)*

STATION PLACEMENT

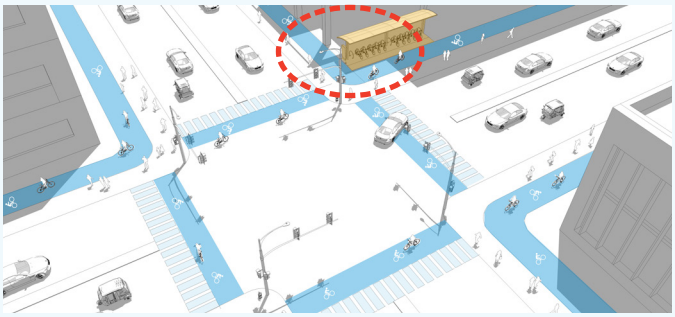
Description

PBS stations should be placed such that they are **safe, convenient, accessible and highly visible.** Alternative locations for station placement may include:



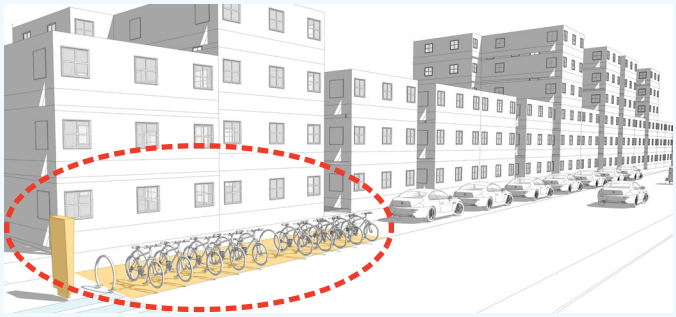
1 Entrance/Exit of Metro/Commuter Rail/BRT stations

- Identify within 50m of major entrances / exits of station on either side of the road.
- Clearly visible from the station entry/exit.



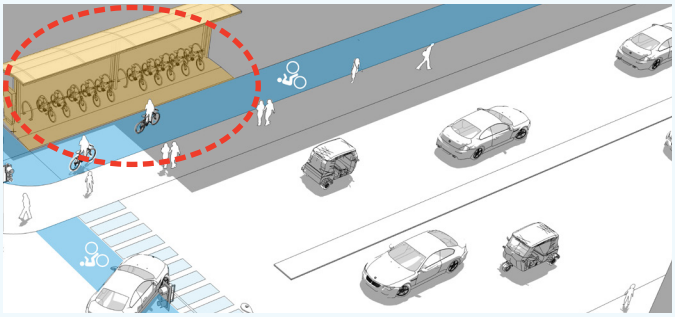
4 Sidewalks near intersections

- Provide near intersections corners (access from multiple directions).
- Place station after maintaining a minimum sidewalk width requirement (1.8m).



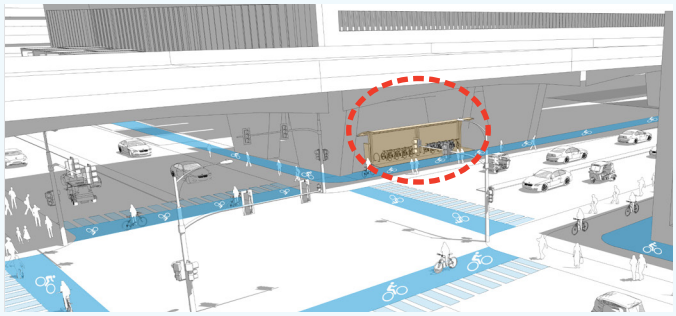
2 On-street parking spaces

- Located on streets with lower traffic volumes and controlled speeds for pedestrian safety.



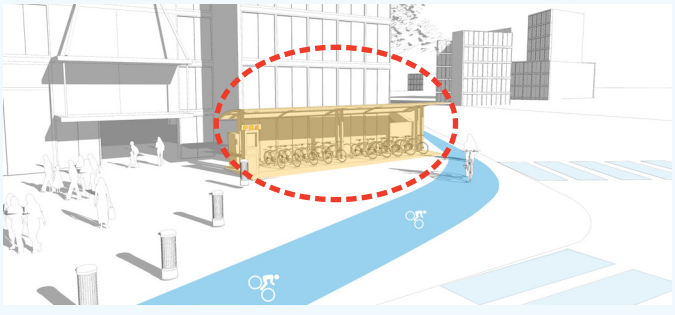
5 Adjacent to NMT infrastructure

- Place stations along existing bicycle lanes.
- Station should not impede pedestrian or vehicular traffic.



3 Transportation Infrastructure (Under Flyovers / Footbridges)

- The underutilized spaces near flyover can be used for placing stations, however, should be located near the crossings for safe movement.



6 Private Developments

- Integrate with commercial places/offices/apartments.
- Maintain circulation clearances and access to public utilities.

STATION SIZING

Description

The size of a PBS station, measured by the **number of parking docks, is dependent upon the demand in the vicinity.**

The demand for the location should be assessed by:

- Undertake an origin destination survey to identify travel patterns.
- Review existing mode splits and conduct survey to assess willingness of people to shift to the PBS facility.
- Map origin and destination points that may create a higher demand.

SMALL SIZE STATION

Land Requirement: Dock, bicycles and terminal
Technology used: Automated/ Manual/ Semi-automated

Small size station in Bangkok, Thailand with the docking space for less than 10 bicycles | Source: Karl Fjelistrom, Itdp-China.org

MEDIUM SIZE STATION

Land Requirement: Dock, bicycles and may be more than one terminal required to avoid delay in check-in and check-out
Technology used: Automated/ Manual/ Semi-automated

Medium size station in London, UK with the docking space for more than 20 bicycles | Source: Karl Fjelistrom, Itdp-China.org

LARGE SIZE STATION

Land Requirement: Bicycle parking style is preferred as they can hold more bicycles with card reading units at entrance and exit.
Technology used: Semi-automated

Large size station in shanghai, China with the docking space for more than 50 bicycles | Source: Karl Fjelistrom, Itdp-China.org

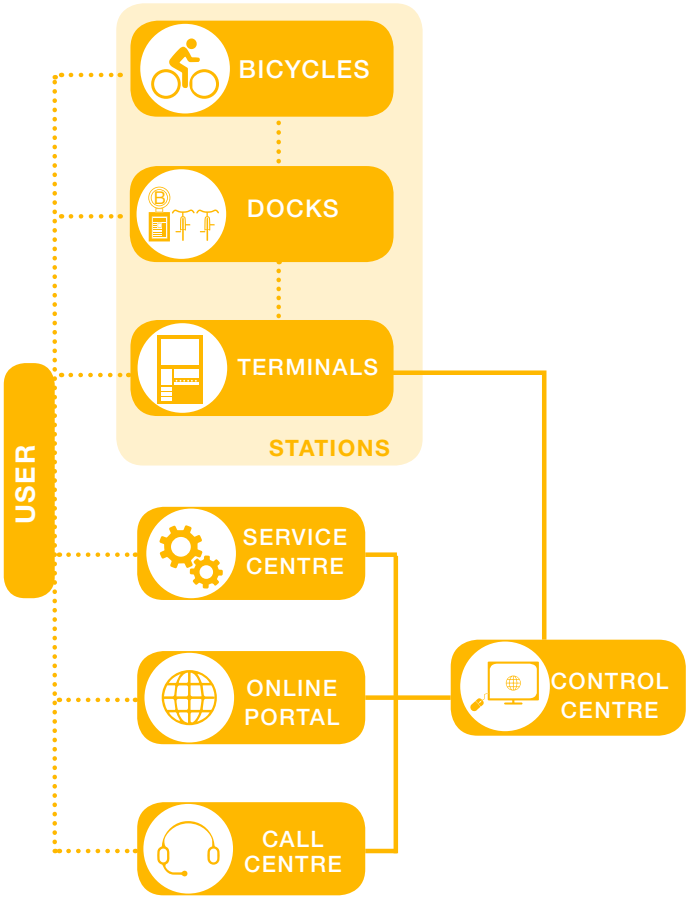
References

- **Bicycle Share Planning Guide, ITDP: Depend on docking-spaces-per-bicycle ratio; the station size will then be the number of bicycles per station multiplied by the docking-space-per-bicycle ratio to determine the number of docking spaces at each station**
- **Rajkot: Small- 14 docks; Medium- 28 docks ; Large- 56 docks** *(Preliminary Phase 1 Proposal Public Bicycling Sharing System for Rajkot, ITDP)*
- **Bhopal: Number of Docks should be 1.5 times the authorized fleet** *(RFP for Installation and Operation of PBS, Bhopal Municipal Corporation)*
- **Mysuru: Modular docking station in two sizes- 12 bicycles for a docking station of size 50'X6' (15mx1.8m) and 16 bicycles for a docking station of size 35'X6' (10m x1.8m)** *(Competitive bidding for implementation of Public Bicycle Sharing System, Mysore City Corporation)*

INTELLIGENT TECHNOLOGY INTEGRATION

Description

Intelligent Technology System (ITS) facilitates integration of users, stations and terminals using technology applications. ITS allows for: real-time data sharing; user registration; automatic check in and out from stations; and access to information.



Communications Systems and User-Interface Schematic | Adapted from Bicycle Sharing Planning Guide, ITDP

The main elements that enable IT integration include:

Smart Cards or key to check bicycles in or out. The smart cards can be special PBS access cards or be integrated with credit/debit card through collaboration with banks.

Radio Frequency Identification Device (RFID) on the user's smart card/key and on the bicycle allows real-time tracking of bicycles and users

Terminal allows a user interface for making payments, check in and out of bicycles and to display basic system information such as PBS station map, user charges or advertisements.

Card Reader at bicycle dock allows users with smart cards/ key to directly check-in / check-out the bicycles.

GPS device in bicycles allows real-time monitoring of bicycles and minimize theft.

Control Center is the central management unit to manage the operations of the PBS system. It manages the redistribution operations, call center, information management, and inventory of the system like bicycles and station related information.

Mobile App / website portals allows the user to view information related to the PBS system, renew memberships, find information regarding number of bicycles available (in real-time) at any station.

References

- **Dwarka: Smart card, RFID, card reader, GPS, Control Room, mobile app** *(Delhi development Authority with technical support from Centre for Green Mobility)*
- **Bhopal: Smart cards, device for Check in and check out; Central Control System ; Smart Phone App** *(RFP for Installation and Operation of PBS, Bhopal Municipal Corporation)*
- **Mysuru: Smart card, RFID, control centre; website and phone apps** *(Competitive bidding for implementation of Public Bicycle Sharing System, Mysore City Corporation)*

REDISTRIBUTION SYSTEM

Description

Redistribution in PBS systems is the process of transferring bicycles from one station to another to meet the demand and supply at different locations. It could be either manual or through redistribution vehicles.

REDISTRIBUTION PROCESS

Bicycle redistribution is essential to ensure regular availability of bicycles at docking stations, especially during peak hours. Bicycle redistribution vehicles carry multiple bicycles to empty docking stations to meet the peak demand. With integration of IT systems, operators of bicycle systems are able to redistribute the bicycles between the stations by knowing the capacities at different PBS stations.

TYPES OF REDISTRIBUTION VEHICLES

Bicycle powered trailer for bicycle redistribution in San Antonio. | Source: https://sanantonio.bcycle.com/

Nantes uses a trailer with no rails for easier loading and unloading bicycle. | Source: Karl Fjelistrom, Itdp-China. org

A simple redistribution truck in Shenzen, China. | Source: Karl Fjelistrom, Itdp-China. org

References

- **Mysuru: 6 Shifting vehicle (one per 10 docking station) should have a capacity to carry at least 10 bicycles at a time for redistribution purpose** *(Competitive bidding for implementation of Public Bicycle Sharing System, Mysore City Corporation)*

SUPPORTING ELEMENTS

NMT INFRASTRUCTURE

PBS can be implemented without an extensive NMT network in place. However, pairing the construction of new NMT infrastructure with the launch of a PBS system will add to public acceptance and help improve the safety for users of the new system.

INTEGRATION WITH TRANSIT

Promoting PBS with transit stops will help expand the transit catchment area. PBS can be integrated with transit through:

- A single integrated payment system that allow for the use of both transit and the bicycle sharing system.
- Real time information available for multiple public modes at both transit stations and PBS stations.

ENGAGE PRIVATE SECTOR

Fostering private sector participation during the PBS implementation phase could create entrepreneurship, employment opportunities, and infrastructure funding through sponsorships and advertising.

MARKETING PROGRAMS

Early promotion helps to capitalize on the initial "buzz" about the program and to build interest and excitement for continued success of the system (Raahgiri Day and Cycle-to-work day)

EMPLOYER INCENTIVES

Another way of bolstering subscriptions is through collaboration with various local institutions and businesses to incentivize employees. Incentives may include:

- *Employer-based health and wellness programs:* Subsidizing / purchase annual memberships for employees.
- *Subscriber benefits program:* Restaurants and other small businesses within PBS service area can be marked on the official service map in exchange for providing customers with discounts on their purchases.

OPERATIONS AND MAINTENANCE

Efficient operations, maintenance and monitoring are critical to the reliability and image of a PBS system.

SAFETY AND SECURITY

Social safety and physical security are prime determinants for making PBS conducive and safer for people.

- Plan the PBS station locations to incorporate design principles that optimize natural surveillance with strategies such as adequate street lighting, street vendors, and active frontages to provide a secure environment for vulnerable pedestrians and cyclists, particularly women and children.
- Enhance safety by creating safe refuge points for women and persons with disabilities by introducing 24X7 CCTV surveillance and panic button.

1.4 Bicycle Sharing vs. Bicycle Renting

Bicycle sharing is designed to cater to daily short commuting trips in a relatively dense urban environment. These trips could be the connecting trips to public transport, replacing intermediate public transit (IPT) trips or independent trips made for other purposes. Bicycle renting, on the other hand, allows a longer duration of hire with a typical pre-condition that bicycle is returned to the base station from where they were hired. Longer durations may vary from half a day to full day or even till the subscription period which can be week, month or even a year.

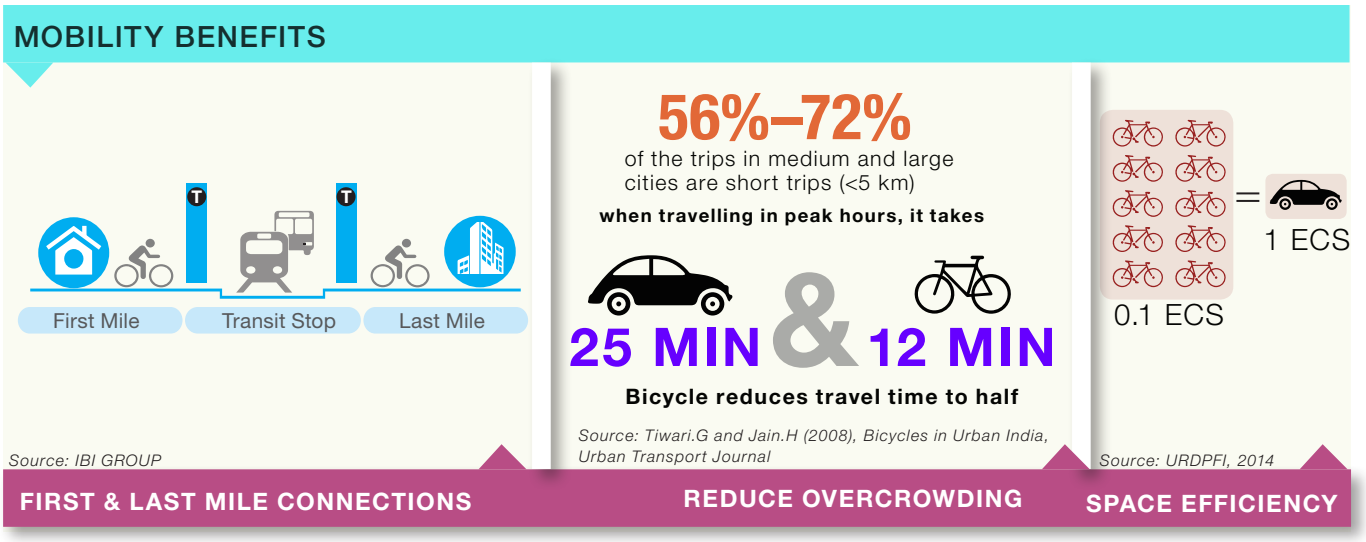
However, these two are fundamentally different systems and cater to different types of users. Bicycle sharing is essentially a public transportation system focused on first and last mile connectivity or short trips while bicycle renting focuses on longer-term rentals for commuting, recreation and tourism. Other key differences of the two systems are highlighted below:

ATTRIBUTES	BICYCLE SHARING	BICYCLE RENTING
Ownership model	Public transportation service	Privately owned bicycle rental company
Duration	Short trips	Longer trips / usage
Purpose	Errands / last-mile connectivity	Daily commuting, recreation and tourism
Stop locations	Origin / destination based; User can return it at any of the cycle location in the network	Pick-up and return are at the same location
Accessibility	24 hours a day (can vary between systems)	Normal working hours
Fare structure	Subscription fee+ usage charge (telescopic pricing): Encourages short trips	Subscription fee only: encourages long term rentals
Revenue	Advertising, Sponsorships, User Fee, Registration charges, Cross or direct subsidies	Subscription Fee, User Fee
Automation	Fully/ semi automated/	Manual

1.5 Benefits

PBS offers both tangible and intangible benefits at both individual and societal levels. In general, a high quality affordable bicycle share system combined with supportive NMT infrastructure, can ensure access to sustainable travel options for all segments of the society.

In most cities around the world, PBS implementation has been preceded by the implementation of other measures to improve the bicycling environment as part of a citywide strategy for sustainable mobility. As a result, the increased cycling mode share contributes to enhance the overall quality of life in a city. The potential outcomes are illustrated below under the categories of mobility, environmental, social and financial benefits.



Improve first & last mile connectivity and extend the reach of the city's transportation system

PBS fills that critical gap between the transit station or stop and the origin or destination. Since bicycling is more efficient than walking, PBS enhances mobility and is a less expensive investment for the city compared to extending public transport service or providing feeder services.

Reduce overcrowding on public transportation

PBS offers an alternative for short trips that people would have otherwise made by transit. This is especially beneficial during rush hours when transit is at capacity and often provides a poor experience for a patron due to congestion, delays and overcrowding.

Promote space efficiency

In comparison, bicycles are small and compact and take up less than 1/10th the space occupied by a single car, thus resolving parking woes faced in cities. Moreover the compact size and less space required for the supported infrastructure reduces the impact on scarce land.

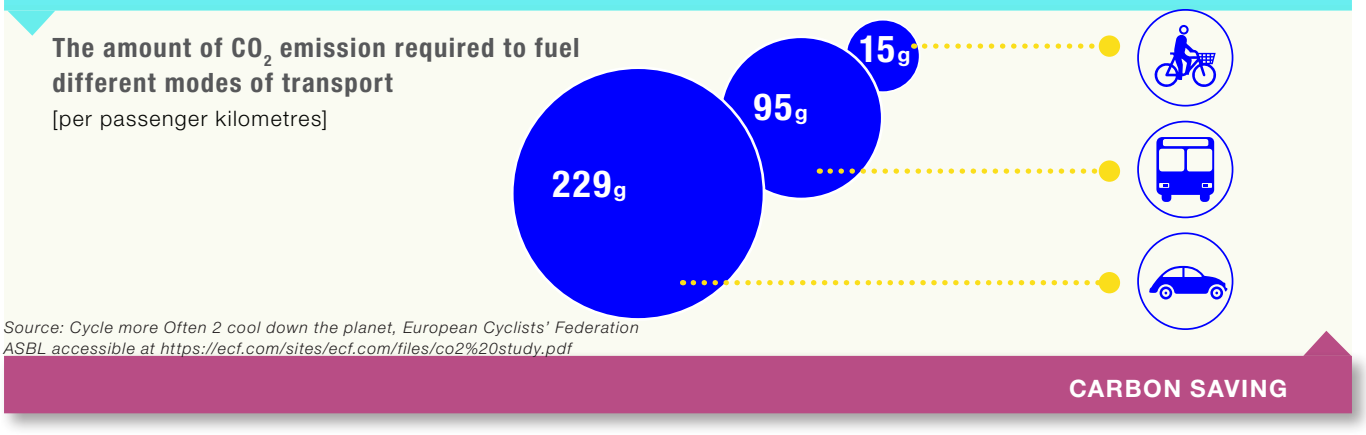
Improve mode-share of bicycling

PBS offers an easy transition into bicycling for people who do not wish to invest in owning a bicycle due to safety issues such as theft, vandalism and lack of bicycle parking facilities. This will significantly improve mode share targets set in the city's overall mobility plans.

Change the nature of travel for short trips, by substituting motorised transport with NMT alternatives, including PBS

PBS offers an alternative for short trips that people would have otherwise made by private automobiles.

ENVIRONMENTAL BENEFITS



Source: Cycle more Often 2 cool down the planet, European Cyclists' Federation ASBL accessible at https://ecf.com/sites/ecf.com/files/co2%20study.pdf

CARBON SAVING

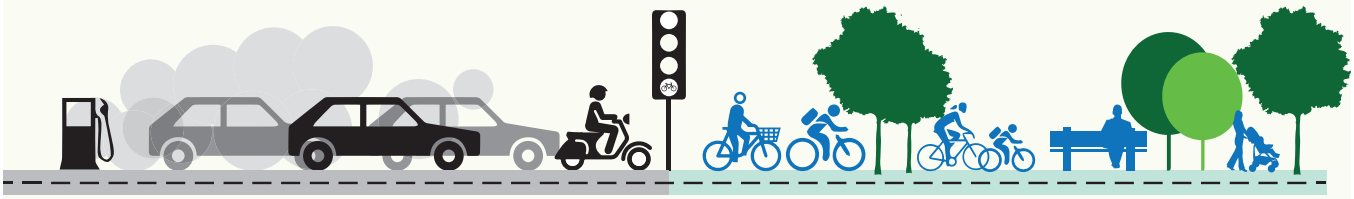
Improved urban environment

Bicycles are among the few modes of transport that are non-polluting, energy efficient and non-fuel consuming. Bicycle sharing creates new options for an alternative mode of transportation for shorter trips. Idling cars in traffic, millions of two-stroke motor powered vehicles, vehicles with low fuel economy standards, diesel buses, etc. are all contributing, not just to personal health risks, but to global climate change and a decrease in air quality.

Reduce congestion and improve air quality

By reducing the number of trips made on automobiles, PBS schemes alleviate traffic congestion which in turn improves air quality of the city. By far the greatest environmental benefit of bicycling is that it enables public to bypass fossil fuels and the associated pollution. Today, India spends approximately $80 billion every year as pollution and environmental degradation cost, which is nearly 6% of its GDP (World Bank, 2013). Introducing an environment friendly mode like cycling, through PBS systems, shall not only ensure less damage to air quality and environment at large, but also prevent such intensive expenditures.

SOCIAL BENEFITS



Source: IBI GROUP

IMPROVED NEIGHBOURHOOD

Improve the quality of public spaces

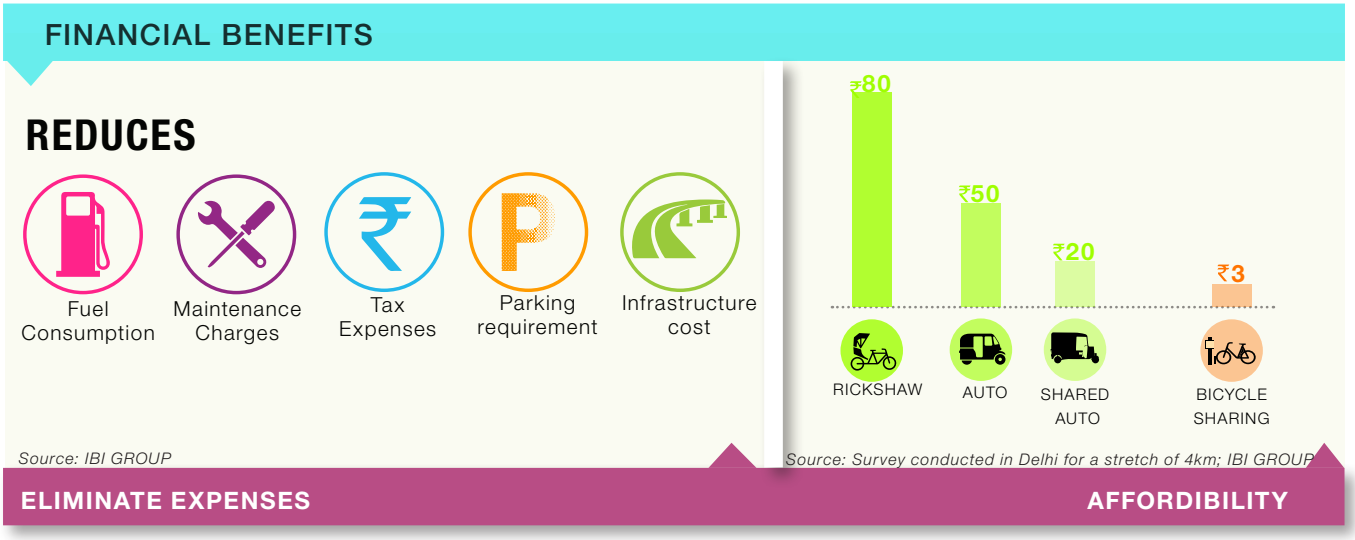
Taking away the space allotted to motorized personal vehicles and replacing them with bicycles will allow for creation of more spaces for parks and thus enabling people to interact socially and also enhances sense of community.

Improve the health of people

In addition to alleviating pollution, bicycle sharing also contributes to health benefits such as longevity, reducing obesity and heart diseases and overall physical fitness.

Change the common perception of bicycling as a low income mobility choice

PBS systems can help transform the bicycling culture in a city by appropriate branding and awareness campaigns.



Eliminate expenses

Bicycle sharing offers a cost effective mobility alternative for consumers by decreasing a family's transportation costs by reducing investment on fuel consumption, maintenance charges, parking taxes and license registration charges. Further, providing an access to PBS system reduces the need for large infrastructure investments like flyover/highways or road widening dedicated primarily to accommodating vehicles.

Affordability

PBS offers an independent travel option at more economic rates in comparison to any other personalized vehicle. Depending on the terms of the bicycle share system, a user generally pays an upfront membership fee and then receives free access to a bicycle for a short-trip spanning 30 minutes.

Job Creation

Bicycle sharing programs assist in creating full-time jobs locally as these programs require staff to maintain the bicycles, redistribute them and administer and oversee the system's central computer network.

1.6 Lessons Learned from Global Practices

Bicycle sharing has a long history. In its infancy, as a free community service, Amsterdam (Netherlands) introduced white painted bicycles at its city centre meant for a user to pick-up and drop-off at the same location. Unfortunately, in most cases, the bicycles were either stolen or vandalized within days; however, the attempt received recognition. Many of these first generation free share systems were implemented on small scales such as commercial districts or university campuses.

The idea grew, as did technology, and a second generation bicycle share system was experimented with. This method involved locked bicycles that would release with a coin deposit. The deposit was then refunded upon the return of the bicycle. A shortcoming of these systems was the coin deposit required that was only a tiny fraction of the bicycle cost, so there was little incentive to return the bicycles.

Technological advancements have enabled more sophisticated systems that are safer and smarter in their operational systems. Currently, there are bicycle sharing systems in over 200 cities globally and more systems are being implemented every year. The following illustration presents a brief overview of the evolution of the PBS concept to the present day model that allows for better management and enhanced user friendliness.

FIRST GENERATION

COMPONENTS	CHARACTERISTICS
• Bicycles • Parked in open space	• White painted distinct bicycles • Free of charge • Same location for pick-up and drop-off • Unlocked bicycles incited theft

SECOND GENERATION

COMPONENTS	CHARACTERISTICS
• Bicycles • Parking racks	• Custom-built, heavy-duty bicycles with distinct designs • Bicycles with coin-operated locks • Vulnerable as users were not registered

THIRD GENERATION

COMPONENTS	CHARACTERISTICS
• Bicycles • Docking stations • Kiosks - user interface technology	• Distinct bicycle design with advertisement space • Locked bicycles available at different docking stations • Smart technology for check-in/check-out • Theft deterrents through user registration (Program membership/ credit card)

FOURTH GENERATION

COMPONENTS	CHARACTERISTICS
• Bicycles • Docking stations • Kiosks – user interface • Bicycle redistribution system	• Distinct bicycle design • May include electric bicycles, improved docking station (mobile, solar powered) • Linked to public transit smart card

Bicycle Sharing Generations | Source: Adapted from Shaheen, Susan, Guzman, Stacey, Zhang, Hua, Bicycle Sharing in Europe, the Americas, and Asia: Past, Present, and Future, 2010

While each city and PBS project is unique, global best practices demonstrate some key lessons that are integral to successful PBS implementation and their applicability in Indian conditions. These include:

Political Support

Ensuring that a strong enabling environment is in place prior to embarking on actual projects is a critical component of successful PBS schemes around the world. Some of the largest cycle sharing systems in the world - such as those in Paris and London - are the result of active championing by city mayors. London's Barclays Cycle Hire scheme is nicknamed "Boris' Bicycles" after Mayor Boris Johnson. Mayor's Boris Johnson's support of the Cycle Hire system went a long way in creating a positive impression of it.

Integrated NMT and PBS Infrastructure

London's Barclays Cycle Hire demonstrates a model case study at implementing a PBS system as part of a cohesive strategy to make London more bicycle-friendly. The sponsorship deal with Barclays, national bank, also includes a sponsorship for a superhighway, known as the Barclays Superhighway. This shows that an integrated approach in building cycling infrastructure along with implementing the PBS system can help create far more interest among potential users and sponsors.

Marketing and Outreach Programme

Efforts need to be made to create a local brand identity before the system launch to generate awareness of the wider system benefits. For example in Montreal, before the launch of the BIXI bicycle share system, rigorous efforts were made to spread awareness of the system in different directions. An online contest was started to derive a suitable name for the bicycle share system, which ensured local ownership and identity in the people for the Bixi PBS system. Pre-launch outreach packages are advisable as a means to dispelling such myths and emphasizing cost savings for users through PBS.

London's Barclays Bicycle Hire planned docking stations at the on-street parking locations to discourage use of private vehicles | Source: Karl Fjellstrom, ITDP

System Design

The detailed planning and design of determining coverage areas and station locations should be studied carefully. Identifying the appropriate scales of PBS network is crucial for achieving system efficiencies. Stations should be visible to pedestrians, while at the same time, make use of underutilized and vacant spaces to minimize interference with other activities and the overall urban landscape. For example, Barclays Cycle Hire System in London designed different docking stations based on the site context to maintain the aesthetic character of London's streetscapes as well as to incorporate parking signage and pedestrian way-finding signage into the bicycle dock design.

Integration with Public Transport Service

Consolidated transportation authorities that have complete responsibility and powers for integrating all city modes of transport are critical to ensure PBS longevity and success. For example, Transport for London (TfL) has a dedicated team taking care of cycling, walking and accessibility in the city. The PBS service is owned by TfL and hence considered a public transport service, making it eligible for transport subsidies, as required. The Municipal Corporation of Delhi (MCD) established a bicycle cell in 2004. However, due to an unclear mandate and ambiguous role in the city's larger transportation network, the bicycle cell was unsuccessful in getting funds allocated that would help achieve its goals (Tiwari.G and Jain.H, 2008). Authorities need to recognize and promote PBS as a sustainable mode of travel, and shift focus from cost intensive projects towards more clean and low cost solutions.

Mexico introduced a fleet of unisex bright red bicycles that stood out in mixed traffic adding to the cyclist | Source: Denis Bocquet via Flickr Creative Commons

1.7 Lessons Learned from PBS initiatives in India

While it is acknowledged that Public Bicycle Sharing systems are not an end by itself, its role in increasing investment in NMT infrastructure to address first and last mile connectivity issues to public transit and changing the nature of how shorter trips are completed in urbanized areas cannot be underestimated. Initiatives implemented or under planning stages currently in India draw attention to the fact that there are several interrelated physical, social, economic and cultural factors that need to be taken into consideration before rolling out plans for instituting PBS schemes in any city.

Key lessons learned from the study of Indian initiatives to-date include:

1. System Design Considerations

Most of the Indian case studies analyzed indicate deficiencies in creating an effective system-wide network of bicycle sharing origin and destination points. For example, Delhi Metro Rail Corporation's initiative was unable to create a network of PBS stations at destinations near its transit stations. In the end, there were PBS stations only at transit stations and users had to return the cycles at the same location, rendering the initiative to a bicycle-rental system instead of a sharing model. Similar experiences were observed in the case of Bangalore's ATCAG model, where the system's service area is not large enough to address the first and last mile connectivity issues. Other issues such as requirement of pre-registration and limited operation timings have also contributed in the failure of PBS schemes such as the Green Bicycle and DMRC feeder system in Delhi. The key takeaway is to ensure that a balance between the service area and station density is given high priority during the project design stage. This can be achieved through identification of appropriate origin and destination points, preferably with a well-designed NMT infrastructure network.

Typical station design in Bengaluru developed by Kerberon Automations | Source: Facebook page of Kerberon Automations (https://www.facebook.com/kerberonautomations)

2. Station and Bicycle Design

One of the other challenges that is currently impeding acceptance of existing PBS models in India is the design of docking stations in terms of accessibility, design of bicycles, available advertisement space, and technology integration. In Delhi, while the location of docking stations in terms of visibility is ideal, accessing the bicycles is an issue due to a lack of adequate pedestrian infrastructure. Additionally, in Delhi's case manned PBS stations as opposed to ITS based systems adopted in Bangalore by Kerberon systems has had a considerable impact in attracting members/ users to the scheme. Furthermore, providing RFID tags and advertising panels on the fleet of bicycles continues to pose issues for ensuring financial viability in terms of revenue generation for the private investors.

3. Institutional Support

Mumbai's Bicycle Chalao system brought forward the importance of government investment in developing a viable financial system especially during the early stages of the scheme's launch. From giving tax incentives to bicycle manufacturers to integration with transit station designs, the government needs to provide ample opportunities for the private sector to earn revenues to ensure long term viability of PBS schemes. For example, regulations related to rationalization of advertising spaces throughout the city will be needed to ensure that revenues from advertisements are indeed a viable source of income for private operators and not just a theoretical concept.

Cycle Chalao, a bicycle share program that piloted in Mumbai in 2010, renting out bicycles at a busy corridor in Mumbai to provide last mile connectivity | Source: http://www.sparktherise.com/projectdetails.php?pId=3936

4. Socio-cultural Issues

Similar to public transportation, bicycles are viewed as the "poor man's vehicle" and changing this perception will be crucial in success of any PBS scheme. Majority of the PBS efforts in Indian did not undertake a parallel branding, marketing and communication strategy to educate the people about benefits of cycling while launching the system. In addition, addressing gender biases during design stages in most cases is typically ignored. For example, none of the PBS experiments in the country have given importance to increased safety and security at stations for women and ensuring bicycles designs cater to the needs of women cyclists as well. Changing perceptions through focused initiatives that overcome gender, income and age barriers could help enormously in attracting a larger user base for the PBS systems.

5. Financial Viability

Each component of any PBS system from the network design and station location to revenue generation and operations needs to be financially viable. In all cities that are currently implementing or planning PBS schemes, the financial aspects are the weakest link. Limited government intervention and handing over complete control to private investors has not been a successful model in most Indian cities. Capital investments from local, state or central governments, user subsidies, and incentives for revenue generation are crucial in implementing successful ventures. Increased investments in implementation of pilot projects, in collaboration with private investors, are needed to determine the ideal financial model for building, operating and maintaining PBS systems in the Indian context.

Mysore has started the Mycycle initiative that provides short guided bicycle tours for visitors | Source: http://meandmycycle.com/2014/03/

02 /

PBS GUIDANCE DOCUMENT

Proposed NMT infrastructure in Dwarka to support Public Bicycle Sharing Scheme | Source: First Cycle Sharing Project in Dwarka (DDA) accessible at: http://uttipec.nic.in/writereaddata/mainlinkFile/File398.pdf

2.1 Need for PBS Guidance Document

With increased investments in promoting sustainable transportation modes in India, there is a need to provide assistance to urban local bodies and development professionals in promoting a shift to non-motorized transportation. This shift in Indian cities continues to be a challenge as most of the statutory acts, regulations and design standards are based on automobile-oriented planning principles. Acknowledging the need to bridge this policy gap including implementation of the National Urban Transport Policy, the Ministry of Urban Development, has initiated the Sustainable Urban Transportation Project (SUTP), with assistance from the Global Environment Facility (GEF).

With a goal to improve national, state, and local capacities to implement the National Urban Transport Policy, SUTP conceived this project to develop a suite of guidance documents for preparing plans to promote three emerging sustainable transport concepts in Indian cities - Transit Oriented Development (TOD), Non-motorized Transport (NMT) and Public Bicycle Sharing (PBS).

This document, the PBS Guidance Document, is intended to introduce bicycle sharing and its applicability in the Indian context. The document intentionally goes beyond discussing the theory of PBS and includes a detailed planning process, tools for implementation, references for relevant standards, case studies and templates for initiating PBS system plans in cities. It identifies strategies to address barriers in implementing PBS systems, create NMT plans to support the bicycle sharing system, and develop alternative financing mechanisms to ensure long term viability.

PBS as a planning concept is hinged upon the principle of developing context sensitive solutions to local issues. It is with this purpose in mind that the guidelines, norms and sample references presented is designed to be applicable at varying contexts in India's diverse urban environments. It is important not to perceive the Guidance Document as a 'manual of standards' for creating successful PBS systems. Based on local conditions, it is expected that state, city and special authorities will adapt the steps presented to their own individual situations to develop solutions and approached beyond these contained in this document.

2.2 Objectives

The PBS Guidance Document intends to provide a step-by-step approach in planning and implementing PBS systems in cities that are interested in adopting bicycle sharing as an integral component of their mobility plans. The broad objectives of this document include:

	**A. Awareness Generation**	Clearly communicate need for PBS to all stakeholders as a cleaner, healthier and low-cost travel alternative, particularly for shorter journeys.
	**B. "How-to" Manual**	Provide a "how-to" manual to development professionals for implementing high quality affordable bicycle share systems that are financially viable and inclusive, benefiting all segments of the society.
	**C. One-stop Resource**	Serve not only as a technical reference guide on implementing PBS, but also as a compendium of resources and case studies that can be used throughout the system design process.
	**D. Capacity Building**	Assist agencies and development professionals in identifying their technical, human resources, and financial capacity building needs in delivering successful PBS projects.

2.3 Target Users

This guidance document provides detailed information on planning and implementing PBS systems in Indian cities. The document will be beneficial for local governments, urban planners, transport planners, engineers, and community leaders, advocates and others involved in the development and design of transport infrastructure and sustainable development. The concept of bicycle sharing is not a new one, but has not yet been fully accepted as a sustainable transport alternative. Currently, cities are facing several questions and resistance from various groups to implement such systems.

USING THE PBS GUIDANCE DOCUMENT

PLANNING AUTHORITY

If you are a:

City Development Authority

Municipal Corporations/ Urban Local Body

Special Planning Authority

Public Works Department

And if you want to:

ASSESS your city's readiness for implementing PBS system.

ENABLE political and citizen support for investment in implementing PBS system.

PLAN + DESIGN a balanced transportation strategy for your city that encourages a shift to NMT modes.

INVEST in a low-cost public transport system with diverse private financing options.

IMPLEMENT quick-win projects in your city that have long-term social, environmental and economic benefits.

TRANSIT AGENCY

If you are a:

Transit Agency or Special Purpose Vehicle (SPV) for BRTS/ Metro Rail

Bus Transport Department

Other Transportation Agency

And if you want to:

ASSESS opportunities to improve first and last mile connections for transit riders to bus stops and rail stations.

ENABLE multimodal integration at transit facilities.

PLAN + DESIGN PBS system components as part of the transit facilities.

INVEST in financing PBS systems to increase transit ridership.

IMPLEMENT PBS system projects in collaboration with city agencies and private sector.

PRIVATE STAKEHOLDERS / PROFESSIONALS

If you want to:

Improve your neighbourhood's NMT infrastructure and facilities

Promote cycling as a sustainable mode of travel

Become a vendor for operating PBS systems

Invest in the sustainable transportation industry

Use PBS for marketing and branding

2.4 Step-by-Step approach to PBS

This document goes beyond discussing the theory of PBS as a concept. It concentrates on providing decision makers with the tools necessary to make informed decisions for developing a realistic and implementable PBS system plan. The entire PBS planning process from feasibility assessment to completion, is presented through the following five key steps:

PBS FRAMEWORK

1 ASSESS

ASSESS: Prior to developing a road map for interventions needed to construct a PBS system, gaining an in-depth understanding of the city's readiness to invest in PBS is essential. The '**Assess' section establishes a set of 'tasks' and 'sub-tasks' to identify the baseline conditions pertinent to success of bicycle sharing programmes.** In this step, a tool to **determine the appropriate scale and scope** for preparation of a realistic PBS Plan is also presented.

PBS FRAMEWORK

2 ENABLE

ENABLE: One of the challenges in implementing a PBS system is improving the 'acceptance' of bicycle as public transport alternative within the city. **The 'Enable' step outlines tasks that may be undertaken to build commitment and support from city leaders to bring a change in common perceptions of cycling.** It also includes a discussion on integrating NMT and PBS principles with other urban planning initiatives, transportation investments and city budgets to enable effective implementation.

PBS FRAMEWORK

3 PLAN + DESIGN

PLAN + DESIGN: The 'Plan + Design' step outlines the application of 'Guiding Elements' of PBS systems to prepare a detailed PBS Plan. This includes a definition of the area to be covered by the initial system, the recommended size of the stations, proposed station locations and considerations for future expansion of the program. This chapter will also help translate the findings of the Assess and Enable steps into physical infrastructure requirements for the city's PBS system.

PBS FRAMEWORK

4 INVEST

INVEST: The 'Invest' section outlines the tasks **involved in developing a financial model for sustaining the PBS system.** It also explores potential financing strategies along with business models that need to be evaluated to determine the investment and economic viability of the proposed PBS system.

PBS FRAMEWORK

5 IMPLEMENT

IMPLEMENT: The 'Implement' section presents the various steps involved in actual implementation of the PBS system**, including determining institutional roles and responsibilities, creating a marketing strategy to attract new users, and monitoring of the system's performance prior to expanding the system to other parts of the city.**

2.4.1. Typical PBS Timeline

ASSESS

- Create a consolidated database of city characteristics
- Conduct a review of current institutional support for PBS
- Develop an understanding of the city's budgetary allocation for transportation
- Formulate preliminary goals for the city's PBS system
- Identify stakeholders to create an effective communications strategy
- Determine initial scale and scope of proposed coverage area
- Prepare a Preliminary Feasibility Study

3 MONTHS

ENABLE

- Establish Leadership Support and Project Champions
- Conduct a series of workshops to determine the city's interest and level of support
- Define PBS scheme delivery mechanism alternatives
- Align PBS with planned NMT and transit infrastructure improvement projects
- Allocate funds to undertake detailed planning and implementation

1 MONTH

PLAN + DESIGN

- Prepare detailed data inventory and demand analysis for initial PBS coverage area
- Determine PBS system design including density, location and sizing
- Refine PBS coverage area and develop phasing strategy
- Conduct participatory planning workshops to finalize the PBS Network Plan
- Prepare detailed technical specifications for system hardware and software design
- Identify NMT infrastructure improvements to support PBS network plan
- Create branding guidelines for the PBS system

8 MONTHS

INVEST

- Identify detailed Capital and Operating Costs
- Determine Revenue Streams including Pricing Structure
- Create Operational Business Model

1 MONTH

IMPLEMENT

- Establish institutional framework including roles and responsibilities
- Devise Maintenance and Repair protocol
- Build awareness through communication and outreach strategy
- Undertake operational training and Capacity Building
- Develop Monitoring System and Improvement Strategy
- Expand System

3 MONTHS

16 MONTHS

Throughout the document, each step has been provided a separate layout.

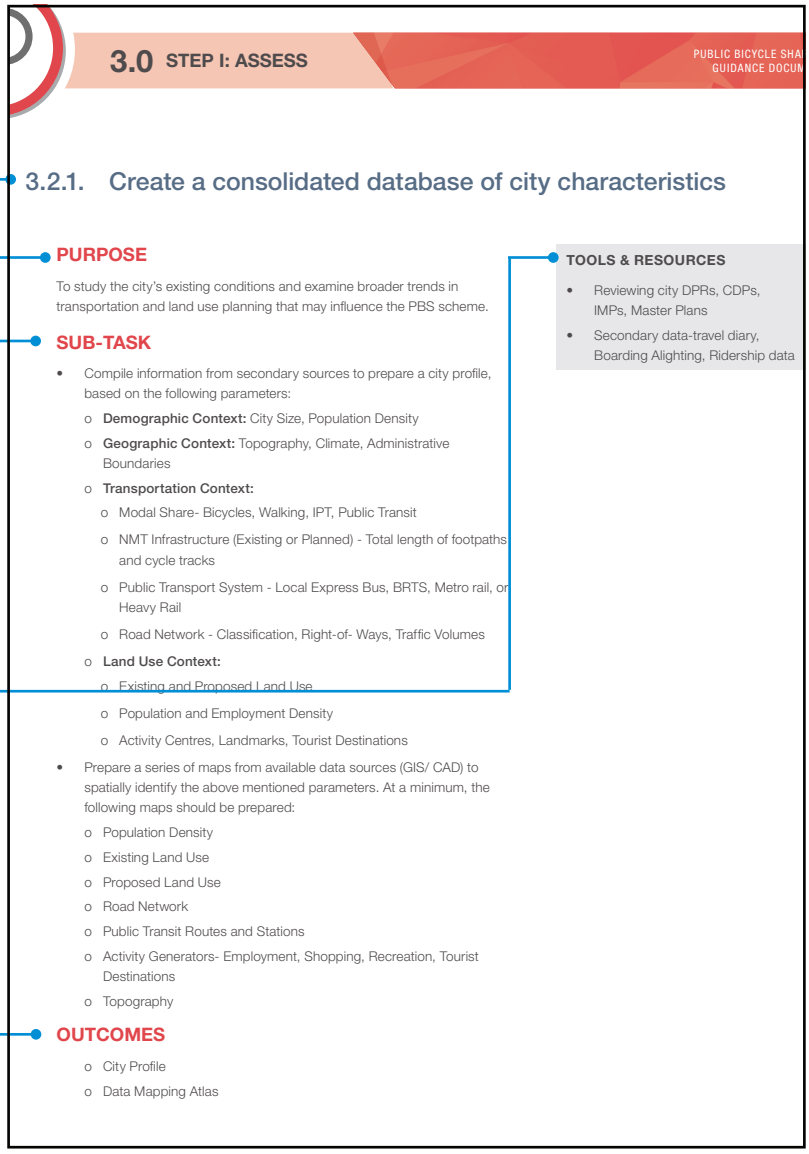
The guidelines are organized into a series of tasks and sub-tasks, each of which has been consistently structured as per the illustration shown below.

Tasks: Actions to be taken to complete step
Purpose: Describes the purpose of the task

Sub- tasks: Activities to be undertaken that will aid in completing the identified task

Tools & Resources: References that provide additional information for completing the identified task.

Outcomes: Result expected following completion of the identified task.



A series of Tools are provided to support the key tasks identified in the step-by-step process. The tools are intended to provide additional detail on following a logical sequence of activities in accomplishing tasks in varying conditions.

03 /
ASSESS

Easy access to Bixi cycle stands, adjacent to the dedicated cycle track at Montreal, Quebec, Canada. | Source: IBI Group

3.1 Understanding the potential for PBS in a city

This section provides a step-by-step process to ascertain whether or not there is a latent demand and the physical environment for implementing a PBS system in cities. Starting with documenting the general considerations related to understanding the existing bicycling culture in a city to mapping activity generators in a city, the data compiled through this step is critical in determining the extent of the initial service area and the target user base for the bicycle sharing system.

Since PBS schemes are often directly related to city's intent to promote sustainable transportation modes, aligning with citywide mobility and transportation projects from the inception of the project can help in gaining support from local stakeholders not familiar with the concept of PBS.

Due to the relative newness of PBS systems in India and a lack of successful examples in India, stakeholders may be skeptical about supporting the concept. In such a scenario, building confidence through a well structured communication strategy will be of prime importance to garner the required support.

In developing PBS feasibility plans, issues related to organizational structure, funding, system profitability, equity and institutional support need to be considered early-on in the process. A thorough assessment of the baseline conditions as the first step will help agency staff, private operators and city leadership develop a realistic PBS system plan that is tailored to the local context.

3.2 Assess Tasks, Key Outcomes & Tools

The "Assess" step is designed to assist in determining the city's level of readiness for planning a PBS system or a pre-feasibility study for preparing a PBS strategic plan.

	Tasks	Outcomes	Tools
1	**Create a consolidated database of city characteristics**	City profile; GIS database; Mapping atlas	
2	**Conduct a review of current institutional support for PBS**	List of NMT supportive policies and projects; Institutional capacity analysis	
3	**Develop an understanding of the city's budgetary allocation for transportation**	Existing NMT budget allocation	
4	**Formulate preliminary goals for the city's PBS system**	PBS Goals	
5	**Identify stakeholders to create an effective communications strategy**	List of stakeholders	
6	**Determine initial scale and scope of proposed coverage area**	Initial PBS coverage area	Tool 1 - "How to" identify initial PBS coverage area
7	**Prepare a preliminary feasibility study**	Preliminary feasibility study report	

3.2.1. Create a consolidated database of city characteristics

PURPOSE

To study the city's existing demographic composition and examine broader trends in transportation and land use planning that may influence the PBS scheme.

SUB-TASK

- Compile information from secondary sources to prepare a city profile at ward level or based on traffic analysis zones addressing following parameters:
  - **Demographic Context:** City size, population density
  - **Geographic Context:** Topography, climate, administrative boundaries
  - **Transportation Context:**
    - Modal Share- Cycling, walking, IPT, public transit, personal vehicles
    - NMT Infrastructure (existing and planned) - Total length of footpaths and cycle tracks
    - Public Transport System - Route analysis for local bus, BRTS, Metro rail, or heavy rail
    - Road Network - Classification, right-of-ways, traffic volumes
  - **Land Use Context:**
    - Existing and proposed land uses
    - Population and employment density
    - Activity centres, landmarks, tourist destinations
- Prepare a series of maps from available data sources (GIS/ CAD) to spatially identify the above mentioned parameters. At a minimum, the following maps should be prepared:
  - Population density
  - Existing land use
  - Proposed land use
  - Road network
  - Public transit routes and stations
  - Activity Generators- employment, shopping, recreation, tourist destinations
  - Topography

OUTCOMES

- City profile
- GIS database
- Mapping atlas

TOOLS AND RESOURCES

- Comprehensive Transport Study / Comprehensive Mobility Plan
- City Master Plan/ Development Plan
- Accident Data (Traffic Police Records)

3.2.2. Conduct a review of current institutional support for bicycling

PURPOSE

To understand the level of institutional and regulatory support locally for investing in public bicycle sharing and NMT infrastructure.

SUB-TASK

- Identify governmental agencies involved in transportation related policies and projects, with special emphasis on NMT, at both state and city levels. The following agencies are generally associated with transportation planning in Indian cities:
  - State Departments: Urban Development/ Transportation/ Roadways/ State Transport Undertakings
  - Urban Local Bodies: Development Authorities/ Municipal Corporations/ Traffic Police/ City bus undertaking
  - Special Purpose Vehicles for transit systems
- Identify gaps and consistencies in policies related to promotion of NMT infrastructure including planning, implementation, and enforcement. At a minimum, the following documents should be reviewed, if available:
  - State Transport Policy
  - Development Plan/ Master Plan
  - Development Control Regulations/ Building Bye-Laws
  - Street Design Guidelines
  - MV Act/rules including provisions applicable to NMT such as safety requirements, right of passage etc.
  - Dynamic and static traffic regulations like one way, speed limits, NMT prohibition
  - Licensing, taxation, incentives and regulations applicable to bicycles NMV manufacturers/sellers vis-a-vis those applicable to car
- Create a list of key NMT infrastructure improvements under construction, planned or proposed at the city level. Some of the plans and policies to be reviewed include:
  - Comprehensive Mobility Plan/ Low Carbon Mobility Plan
  - Comprehensive Transportation and Traffic Plan
  - Transit System Detailed Project Reports
  - Smart City Proposal(s)

OUTCOMES

- NMT and PBS Policy Analysis Memorandum
  - Existing institutional framework
  - NMT (Bicycling) gaps and consistencies analysis (Statutory Documents)
  - List of key NMT (emphasis on bicycling) infrastructure projects

TOOLS & RESOURCES

- Relevant Notified State and Municipal Acts
- Smart City Proposal(s)

REFERENCES

- UMTA Guidance Document prepared by SUTP, MoUD
- Ecomobility Readiness assessment - ICLEI South Asia

3.2.3. Develop an understanding of the city's budgetary allocation for transportation

PURPOSE

To identify the city's level of financial commitment in addressing mobility needs, specifically in bicycling infrastructure.

SUB-TASK

- Conduct a trend analysis of the municipal budget for the last three years and the estimated budget for next financial year with a special emphasis on budget allocated for transportation infrastructure. The following aspects of the budget should be examined at a minimum:
  - Percentage share of funds allocated to transport projects from the city's total budget
  - Details related to Capital costs, O&M expenses specifically for public transport, NMT, and roadways
- Examine city's revenue sources dedicated to funding sustainable transportation projects. These sources may include:
  - Property taxation
  - Taxation on private vehicles and public transport vehicles
  - Parking revenues
  - Advertisement charges
- Document additional fiscal measures adopted to achieve a balanced modal split in the city. Some of these measures may include:
  - Fare policy for public transportation, IPT and parking
  - Subsidy policy for public transport operators and intermediate transport operators;
  - Taxation on private vehicles and public transport vehicles;
  - Permits and regularisation of intermediate public transport
  - Grants and soft loans tapped into from international development agencies

OUTCOMES

- List of existing financing alternatives for transportation investments
- Potential funding sources currently untapped for implementing PBS schemes

TOOLS & RESOURCES

- Centrally and State Sponsored Schemes
- Municipal Budget
- Non-Governmental Funding Sources

REFERENCES

- National Institute of Public Finance and Policy
- Planning, Connecting and Financing Cities Now. World Bank (2013), http://siteresources.worldbank.org/EXTSDNET/Resources/Urbanization-Planning-Connecting- Financing-2013.pdf

3.2.4. Formulate preliminary goals for the city's PBS system

PURPOSE

To ensure that stakeholders are aware of the benefits in order to set realistic targets to be measured post-implementation of PBS system.

SUB-TASK

- Assess current goals of the state/ city/ neighbourhood and identify their transport related objectives.
- Integrate preliminary PBS goals with development and transport goals of transportation plans. Examples of PBS goals may include:
  - Increase bicycling modal share
  - Reduce carbon emissions
  - Ensure first and last mile connectivity to transit through PBS schemes as the highest priority
  - Achieve economic self-sufficiency for PBS schemes
- Develop time-bound targets to be achieved through NMT interventions These targets may include:
  - Increase in bicycling and transit mode share
  - Reduction in pedestrian and cyclist accident rates
  - Improved performance of local bicycle industry
- Engage political leaders, policy makers and decision-makers, in goal setting and vision building for establishing commitment to NMT. Engagement techniques may include:
  - Visioning workshops in collaboration with central government agencies, state agencies, and NGOs/ advocacy groups.
  - Integrating cycling and walking as the backbone of all city-level policy discussions across agencies related to transportation, land use and economic development.

OUTCOMES

- PBS Goals and Targets

TOOLS & RESOURCES

- Development Plans/ Master Plans/ Sustainable Mobility Studies

  To prepare consolidated goals or vision for the City's growth for a horizon year.
- Consultation with the city officials
- Meetings and documentation of information gathered based on parameters mentioned.

REFERENCES

- MoUD Public Bike Sharing Toolkit, http://www.cyclesharing.in/toolkit/

3.2.5. Identify stakeholders to create an effective communication strategy

PURPOSE

To establish an inclusive participatory planning process to generate awareness of the PBS concept, build consensus, and ownership to increase the chances of project acceptance, implementation and sustained growth.

SUB-TASK

- Identify multiple stakeholders with different objectives to help build consensus for the project and progress with smooth implementation. Key stakeholders may include:

Government sector

- Political leadership and local elected representatives
- Transit agencies
- State and Municipal Public Transport departments
- Local urban development and public work departments
- Traffic police

Non-Government Sector

- Existing transport operators and drivers associations (formal and informal)
- Experts and professionals in the field of urban development and transport
- Schools, colleges and other academic institutions
- Citizens and Resident Welfare Associations
- Business associations
- Local NGOs or Civil Society Organizations
- Relevant national agencies
- Public transport experts and consultants
- Media
- Private sector such as property managers, bicycle manufacturers, PBS related vendors
- Potential corporate sponsors

OUTCOMES

- List of stakeholders
- Individual interviews and focus group meetings

TOOLS & RESOURCES

- Consultations with Local Agencies
- Consultations with NGOs working on urban development issues

REFERENCES

- Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets- IFC
- Good Practice Guide to Public Engagement in Development Schemes - RTPI UK

3.2.6. Determine initial scale and scope of proposed coverage area

PURPOSE

To determine the pilot area for creating a network of stations based on the findings of the tasks related to city characteristics, institutional support, financial priorities and stakeholder engagement.

SUB-TASK

- Conduct an overlay analysis of the various parameters listed in Task 3.2.1 to define the initial service area alternatives for the system. The following are typical parameters used to determine a phased approach for PBS implementation:
  - Areas with higher population and employment densities
  - Concentration of educational institutions
  - Areas with existing NMT infrastructure
  - Available public transit systems and facilities
  - Proximity to tourist destinations and recreation areas
  - Areas with slopes at a grade less than 4%
- Engage stakeholders to finalize initial PBS coverage area taking into consideration the following additional factors:
  - Political support and preference for PBS investment
  - Potential for alignment with existing projects such as transit station upgrade or roadway upgrades
  - Stakeholder input through planning workshops
  - Implementation potential in terms of timing and available financial sources
  - Potential for expansion in subsequent phases

OUTCOMES

- PBS Initial Service Area based on applicable parameters and stakeholder input

TOOLS & RESOURCES

- Tool 1: “How –To” Determine Initial PBS Coverage Area

3.2.7. Prepare a preliminary feasibility study

PURPOSE

To establish critical physical, financial and operational factors that will help determine whether the PBS scheme will be feasible and identify alternative solutions to address barriers for successful implementation. The preliminary feasibility study is intended to assist cities set realistic service level targets before committing to implementation.

This task is an iterative process as political decisions and integration with proposed projects may warrant modifications to project details. The preliminary PBS feasibility study should include the following activities:

- Finalizing the proposed initial PBS coverage area identified (Task 3.2.6) taking into consideration the following factors:
  - Local government priorities including funding availability
  - Opportunities to integrate with other transportation projects planned including transit facility improvements
  - Institutional capacity of the lead agency
  - Regulatory framework
- Including demand profile based on initial PBS coverage area proposed
  - Existing population densities
  - Current modal split including transit commuters
  - Potential PBS user base
- Proposing system sizing alternatives based on demand profile and coverage area.
- Preparing a preliminary estimate to explore alternative business models for stakeholders to consider. At this stage, a detailed budget is not required.
- Proposing an interim structure that may get dissolved or merged into the formal structure when it gets formed.
- Developing financing options including revenue generation alternatives to align with city priorities and regulatory environment.
- Identifying barriers to implementation and propose recommendations to eliminate obstacles that may hinder implementation.

OUTCOMES

- Preliminary Feasibility Study including the following components:
  - Proposed initial coverage area
  - User demand profile
  - PBS system sizing alternatives
  - Preliminary cost estimates
  - Interim operational structure
  - Revenue generation alternatives
  - Barriers, risks and mitigation strategies

TOOLS & RESOURCES

- Comparison of preliminary costs for PBS systems

REFERENCES

- Bike Share Planning guide- ITDP, https://www.itdp.org/wp-content/uploads/2014/07/ITDP_Bike_Share_Planning_Guide.pdf
- MoUD Public Bike Sharing Toolkit, http://www.cyclesharing.in/toolkit/

COMPARISON OF PRELIMINARY COSTS FOR PBS SYSTEMS

There are three primary costs associated with the PBS system - captial, operating and maintenance. The illustration below summarizes cost estimates of each of the key components for manual, semi-automated and automated configurations for a system. The estimates are based on market research conducted through interviews with local and international PBS system vendors and analysis of existing bicycle sharing systems in India.

Capital costs are those required to install and launch each phase of the system and include equipment purchase, bicyle and station assembly, station installation, software development, control centre set-up, and purchasing redistribution vehicles.

Operating costs are the cost to operate and maintain the system. These include hiring employees for operational tasks such as maintaining the stations, bikes, and other infrastructure, rebalancing the system, providing customer service, etc.

Maintenance costs include operations facility, purchasing tools and spare parts, upkeep of software, communications, and IT, and general administrative costs such as insurance.

CAPITAL COST (UNIT RATES IN INR)

Component	Automatic	Semi-Automatic	Manual
Bicycle	15,000		
Dock (Electronic)	70,000	-	-
Terminal at PBS Station	2,20,000	1,00,000	10,000
PBS Station - Small	1,00,000	5,00,000	5,00,000
PBS Station - Medium	2,00,000	8,00,000	8,00,000
PBS Station - Large	3,00,000	12,00,000	12,00,000
Redistribution Vehicles	8,00,000		
Control Centre	2,00,00,000	20,00,000	-
Maintenance Garage Setup	8,00,000		
Installation + Management Cost	25% of total		
For Bicycle with GPS	2,000	-	-

** The Terminal at PBS Station for a Semi- Automatic System would work along with a computer/ tablet enabled with a smart card reader. For a manual system only paper tracking is considered.*

OPERATIONAL COST (% OF CAPITAL COST PER ANNUM)

Component	Automatic	Semi-Automatic	Manual
Manpower	8%	15%	14%
Maintenance Cost (Including administration, maintenance, insurance and spare parts)	12%	9%	8%

ADDITIONAL COSTS

Apart from the PBS capital and operational costs, additional infrastructure costs should be considered for supporting PBS system, including, but not limited to:

- Land acquisition costs for locating PBS stations, garage or control centre
- Civil construction costs for fixing PBS stations
- NMT infrastructure costs- intersections improvements, cycle lanes (dedicated, lane demarcation or temporary barricading)
- Marketing and Branding costs

TOOL 1: "HOW –TO" DETERMINE INITIAL PBS COVERAGE AREA

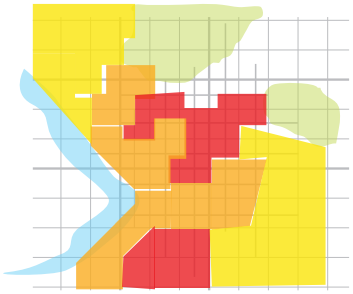
1

Map existing / proposed population densities

Higher population densities tend to support higher PBS demand

DATA SOURCES:

- GIS Data
- Existing / Approved Master Plan
- Existing / Approved Comprehensive Mobility Plan



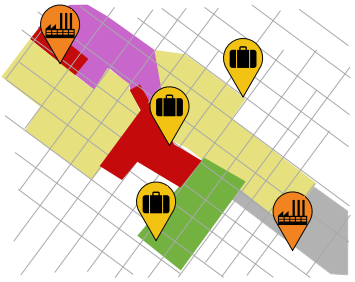
2

Map existing / proposed employment centers

Concentration of employment centres tend to support first and last mile trips to transit and short trip lengths

DATA SOURCES:

- As per approved Master Plan/ Development Plan (DP)
- Satellite Image/ Remote Sensing/ GIS Data
- List of Approved Developments
- Field Surveys
- Online Research



3

Map major educational institutions

- Schools
- Colleges / Universities
- Training Institutes
- Educational Campuses

DATA SOURCES:

- As per approved Master Plan/ Development Plan (DP)
- Satellite Image/ Remote Sensing/ GIS Data
- List of Approved Developments
- Field Surveys
- Online Research

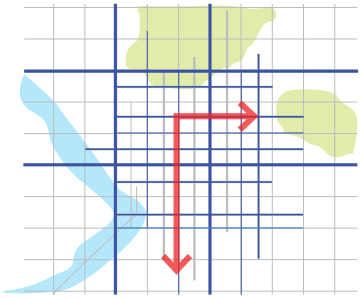
4

Map existing & proposed NMT infrastructure

- Existing bicycle tracks and footpaths
- Existing PBS stations
- High-quality streetscape
- Pedestrian-only streets/ markets

DATA SOURCE:

- Satellite Image/ Remote Sensing/ GIS Data
- NMT Master Plan
- Comprehensive Mobility Plan (CMP)
- Right-of-way widths: Google earth/ satellite images/ surveys



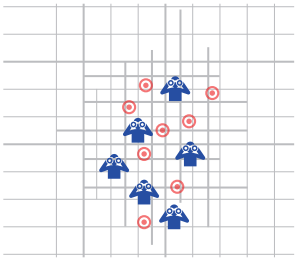
5

Identify major activity nodes & tourist attractions

- Commercial nodes
- Informal Markets
- Recreational Areas
- Religious / Tourism Destinations

DATA SOURCE:

- As per approved Master Plan/ Development Plan (DP)
- Satellite Image/ Remote Sensing/ GIS Data
- List of Approved Developments
- Visual Surveys
- Online Research



6

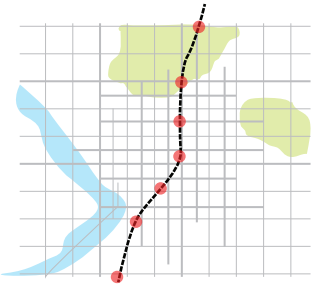
Identify transit priority nodes

Map existing

- Metro / BRT / LRT / Bus route alignment
- Major transit nodes
- Closely spaced transit stations

DATA SOURCES:

- Transit System DPR
- Comprehensive Mobility Plan
- Comprehensive Development Plan/ Master Plan
- Traffic Impact Studies



7

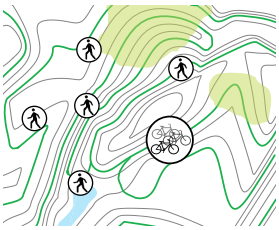
Topography analysis

Steep inclines can be a deterrent to PBS. Slopes at a grade of 4% or higher are considered a major barrier for bicyclists.

DATA SOURCES:

Undertake Slope analysis using:

- GIS data
- Contour Maps (Google Earth Pro)
- Topographical Maps (Survey of India)

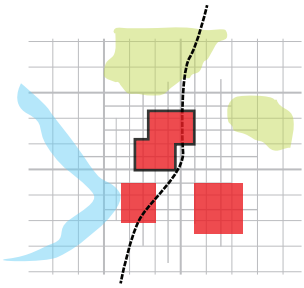


8

Selection of initial Coverage Area

DATA SOURCES:

- Overlay Analysis (step 1 -7)
- Technical & political Review
- Stakeholder input
- Implementation potential
- Potential for phasing / scaling



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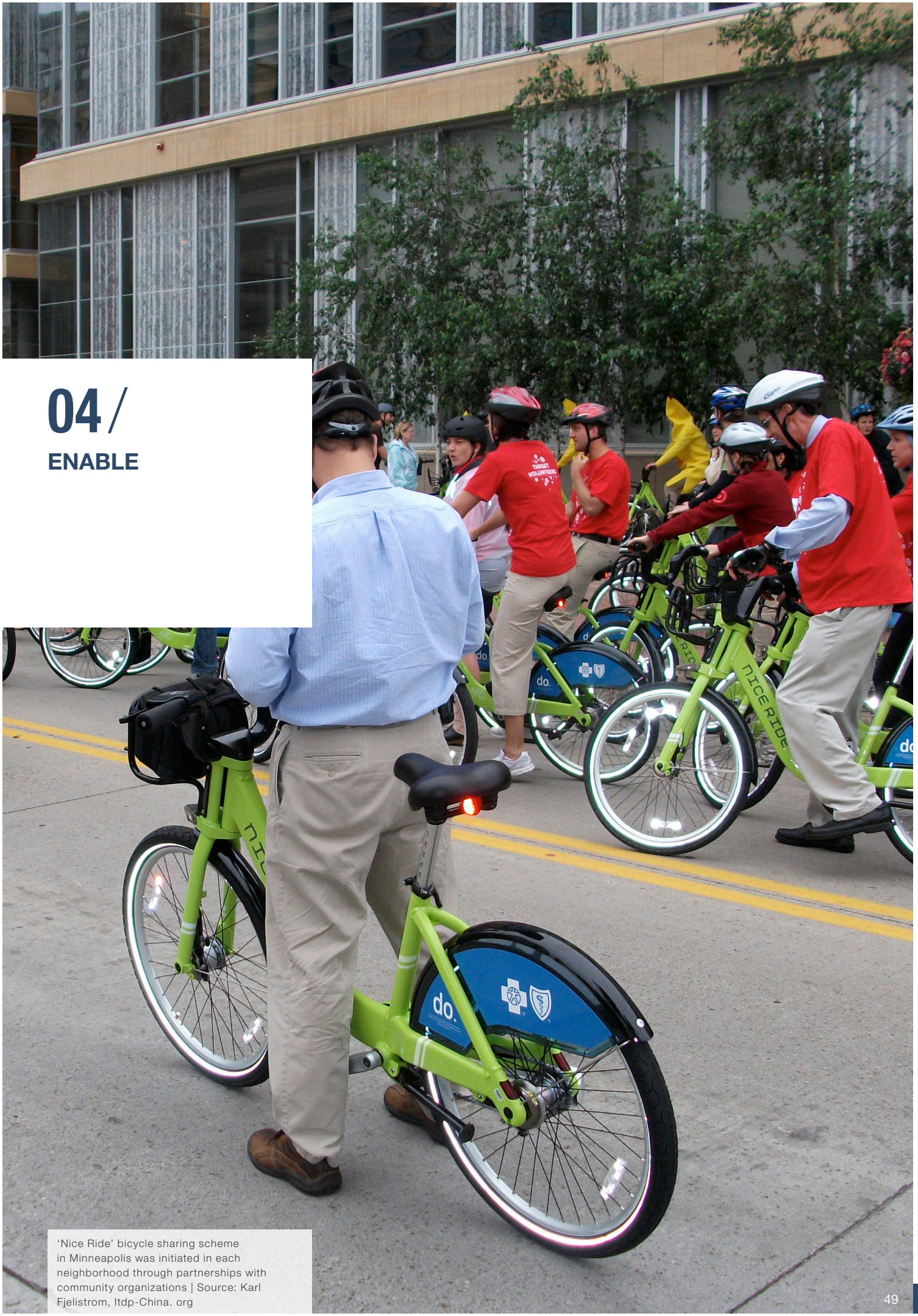


'Nice Ride' bicycle sharing scheme in Minneapolis was initiated in each neighborhood through partnerships with community organizations | Source: Karl Fjelistrom, Itdp-China. org

4.1 Setting the stage for PBS

Gaining political support is vital to successful implementation of a PBS system. Active participation from city leaders is important in promoting increased use of bicycles along with facilitating coordination between governmental agencies, prioritizing funds from local budgets for NMT and PBS infrastructure improvements, and pursuing policy modifications to address regulatory barriers including enforcement and fare policies.

Enabling PBS also entails eliminating roadblocks ranging from larger social issues such as ensuring equity and accessibility to the system, to details including degree of control and oversight of the system. Experience from other successful systems around the world has demonstrated that identifying project champions, local ambassadors, supportive media coverage and regular awareness campaigns within the local community is crucial in attracting users. Policy barriers, such as inter-agency agreements, need to be identified and addressed in this step so that PBS projects can be rolled out with minimal legal and regulatory hurdles.

From the outset, cities should be provided with alternatives to select a business model that aligns with local political, financial and institutional capacity of the lead agency. It is important to prepare a preliminary feasibility study that takes an unbiased approach and takes into consideration creating an incremental approach to rolling out a complete PBS network. Taking a proactive approach towards setting up enabling institutions, such as creating a PBS Advisory Group, is therefore critical to the ultimate success of PBS. To effectively build a case for introducing PBS systems in a city, the “Enable” step recommends cities should employ the tasks, detailed in the following section, throughout the planning process.

4.2 Enable Tasks, Key Outcomes & Tools

The “Enable” step focuses on proactive tasks that cities will need to take towards implementing PBS schemes. These tasks are initiated early-on in the process and must continue throughout the course of the project.

	Tasks	Outcomes	Tools
1	**Establish leadership support and project champions**	PBS Advisory Group	
2	**Conduct capacity building workshops and awareness generation campaigns**	Augmentation of technical skills	
3	**Define PBS scheme delivery mechanism alternatives**	Terms of Reference Management structure	
4	**Align PBS scheme with planned NMT and transit infrastructure improvement projects**	List of opportunities to integrate PBS with NMT and transit improvement projects	
5	**Allocate funds to undertake detailed planning and implementation**	Funding strategy	

4.2.1. Establish leadership support and project champions

PURPOSE

To build political support for investments in PBS systems, as well as ensuring continuity in sustaining the system beyond the term of elected officials.

TOOLS & RESOURCES

- Advisory Group/ Steering Committee Meetings

SUB-TASK

- Engage political leaders, policy makers and decision-makers, in goal setting and vision building for establishing commitment to cycling and PBS in the city. Engagement techniques may include:
  - Visioning workshops in collaboration with central government agencies, state agencies, and NGOs/ advocacy groups
  - Integrating NMT principles as the backbone of all city-level policy discussions across agencies related to transportation, land use and economic development
  - Public outreach processes as part of master planning activities.
- Establish a PBS Advisory Group with representatives from city agencies, transit authorities, and local NGOs to maintain continuity throughout the planning and implementation process.
- Identify project champions among executive or elected leadership to ensure a sustained environment conducive to cycling within the relevant city departments.
- Identify technical leadership preferably from city staff, representatives from NGOs or local advocacy groups that will remain committed to the PBS planning and implementation process.
- Identify brand ambassadors who can help create a positive image of cycling.

OUTCOMES

- **Formation of PBS Advisory Group**

4.2.2. Conduct capacity building workshops and awareness generation campaigns

PURPOSE

To increase awareness levels and capacities of government officials and stakeholders in supporting and implementing PBS projects.

SUB-TASK

- Collaborate with local cycling clubs, corporate sponsors and bicycle vendors to conduct cycling and bicycle sharing promotion workshops and awareness generation campaigns.
- Organize PBS training workshops for both administrative and elected officials. Training modules may include:
  - Safe bicycling practices
  - Integrating PBS with other transportation modes
  - PBS system planning, design and implementation
  - Branding and marketing bicycle sharing
  - Operation and maintenance workshops
  - Contract management
- Undertake study tours with assistance from central and state governments both nationally and globally for experiential training.

OUTCOMES

- **Augmentation of technical skills related to project management and implementation**
- **Increased attendance in PBS workshops from diverse stakeholders**
- **Study tours with experiences applied locally**

TOOLS & RESOURCES

- Capacity building / Training workshops
- Study tours

REFERENCES

- JnNURM Toolkit for Comprehensive Capacity Building Programme http://urban.bih.nic.in/Docs/Capacity-Building-Guidelines.pdf
- Institute of Urban Transport (India) Capacity Building Toolkits (http://www.iutindia.org/apacityBuilding/Toolkits.aspx)
- Urban Capacity Building Programme, Janagraha Urban Space Foundation (http://www.janaagraha.org/content/program/urban-capacity-building)

4.2.3. Define PBS scheme delivery mechanism alternatives

PURPOSE

To determine appropriate implementation activities including governance structure and partnership alternatives with private sector.

SUB-TASK

- Convene PBS Advisory meetings to determine the approach for embarking on preparing a PBS Detailed Project Report. Some approaches include:
  - In-house plan preparation by available resource capacities at the city staff level.
  - Retain an external consultant through a competitive and transparent bidding process
- Prepare for a bid management process if an external consultant is to be retained, including:
  - Assigning Project Manager to monitor the RFP selection process and actual preparation of PBS plans based on the Guidelines presented in this document.
  - Preparing a Terms of Reference (ToR) with timelines and deliverables anticipated based on the scale and scope analysis conducted.
  - Identify a Quality and Cost-Based Selection (QCBS) process with technical and financial weightage determined based on the scope of planning study.
  - Refer the list of PBS empanelment consultants shortlisted by the Ministry of Urban Development.
- Evaluate governance structure alternatives for managing the PBS project cycle. Alternatives include:
  - City ownership, management and operation may include formation of a Special Purpose Vehicle (SPV) or as part of existing SPV such as the Smart City SPV or Transit SPV
  - City owned and managed, operated by private sector
  - Privately owned, operated and managed
  - Transit agency owned and operated

OUTCOMES

- **Terms of Reference for implementation of Public Bicycle Sharing system**
- **PBS system management structure**

4.2.4. Align PBS system with planned NMT and transit infrastructure improvement projects

PURPOSE

To improve safety and convenience for all cyclists, including users of the bicycle sharing system; and enable financial assistance as part of the city's overall mobility plan.

SUB-TASK

- Identify planned and proposed NMT developments underway in the study area, including:
  - Construction of separate/ dedicated cycle tracks
  - Traffic improvements such as traffic calming measures
  - Accessibility improvements along transit stations
- Work with relevant government agencies to prioritize implementation of NMT projects proposed in the study area. Priority areas can include:
  - Streets with high-speed traffic
  - Streets with large cycle volumes or streets near destinations that generate cycle traffic demand, such as schools, mixed uses and institutional spaces
  - Street management strategy to ensure that existing cycle tracks remain free of encroachments
  - Accessibility improvements to transit stops
- Collaborate with transit agency to designate space near station entrances for bicycle docking station.

OUTCOMES

- **List of potential opportunities to integrate PBS with NMT and transit improvement projects**

TOOLS & RESOURCES

- Development Plans/ Master Plans/ Sustainable Mobility Studies
- Transit DPR

4.2.5. Allocate funds to undertake detailed planning and implementation

PURPOSE

To identify multiple funding sources to obtain direct financial assistance for PBS planning and implementation.

SUB-TASK

- Connect PBS project with NMT grants available from central, state, local government agencies and other sources. Some available options include:
  - Municipal budgets available for transport infrastructure
  - Urban Transport Fund (if established)
  - Tourism departments can dedicate funds for NMT planning if the scheme is planned to target tourists.
  - Historic preservation institutions such as Archaeological Society of India (ASI) and Indian National Trust for Art and Cultural Heritage (INTACH) can dedicate funds for historic areas.
  - International development agencies, NGOs and academic institutions to provide technical assistance in undertaking NMT studies.
- Coordinate with the governmental agencies to bundle PBS cost with NMT infrastructure and transit projects that have large funds available. Some available options include:
  - Integrate cycle tracks and PBS stations installation as part of NMT projects.
  - Align PBS with station accessibility improvements funds.
- Independent and private entities may be encouraged to undertake PBS planning at small or big scales in exchange for incentives such as naming rights or advertisement space.

OUTCOMES

- **Systematic funding strategy including list of funding sources available for PBS planning studies.**

TOOLS & RESOURCES

- Centrally and State Sponsored Schemes
- Local Planning Budgets
- Non-Governmental Funding Sources
- Advisory- Inclusion of feeder buses, public bike sharing, and pedestrianization in the influence zone of MRTS projects August 30, 2013 [No.K-14011/1/2007-UT-IV]

REFERENCES

- National Institute of Public Finance and Policy
- Planning, Connecting and Financing Cities Now. World Bank (2013) http://siteresources.worldbank. org/EXTSDNET/Resources/ Urbanization-Planning-Connecting-Financing-2013.pdf

05 /

PLAN + DESIGN

Citi Bike, a bike sharing scheme in New York has a touchscreen kiosk, a map of the service area and surrounding neighborhood, and a docking system at each station. Source: (Digiday, 2013)

5.1 Programming the PBS system components

Once the feasibility study is approved by the city's administration, the detailed system planning and programming of the PBS system compoents should be initiated. This step is guided by the application of PBS components categorized into two main categories: Guiding Elements and Supporting Elements. In this step, initial PBS coverage area is detailed with station densities, on-ground station locations, station sizing at the system level. In support of the system requirements, hardware components such as bicycle design, docks, and terminals are detailed with specifications. In parallel, conceptual design of the ITS architecture is carried out, including: technology interventions, integration with other public transportation modes and designing of radio frequency identification tags (RFID). Finally, branding, operations and maintenance tasks are initiatie, including: bicycle redistribution, detailed financial analysis and pricing structure are proposed.

5.2 Plan + Design Tasks, Key Outcomes & Tools

Plan + Design section provides a step-by-step process to undertake detailed planning of a PBS system. This step builds upon the findings of the feasibility study, and provides the details related to the possible locations of stations, type of hardware and software components, operations plan, and branding guidelines.

	Tasks	Outcomes	Tools
1	Conduct data inventory and demand analysis for initial PBS coverage area	Primary Surveys Demand Assessment	Tool 2: "How –To" undertake Demand Analysis?
2	Determine PBS system design including station density, location and sizing	PBS Network Plan	Tool 3: "How –To" Develop PBS System Design Components?
3	Refine coverage area and develop phasing strategy	Finalized PBS Coverage Area Phasing Strategy	
4	Conduct participatory planning workshops to finalize the PBS Network Plan	Key Findings & Comments on PBS Network Plan	
5	Prepare detailed technical specifications for system hardware and software design	Detailed Project Report	Tool 4: "How-to" Determine Level of Automation?
6	Plan NMT infrastructure improvements to support PBS network	NMT Network Plan and Phasing Plan	
7	Create branding guidelines for the PBS system	Branding and Marketing Guidelines	

5.2.1. Conduct data inventory and demand analysis for initial PBS coverage area

PURPOSE

To provide detailed data that will assist in finalizing the boundary of the PBS coverage area by ensuring that the system is both large and dense enough to encourage high ridership.

SUB-TASK

- Initiate existing conditions inventory through primary surveys to determine the appropriate system network by engaging a professional survey agency. At a minimum, the following primary surveys should be undertaken:
  - Perception and Willingness to Shift (to PBS)
  - Transit boarding-alighting data for commuters
  - Land Use and building uses
  - Street Audit to document existing NMT infrastructure
  - Origin-destination surveys
  - Parking surveys
- Analyze data collected through primary surveys to establish planning parameters for detailed PBS system design, including:
  - Demand assessment (including PBS user profiles)
  - PBS coverage area delineation
  - System sizing
  - Activity mapping including potential station locations
- Estimate demand assessment for PBS users to identify the potential number of system users. The implementing agency may select one of the following estimation methods to estimate demand, based on time and budgetary constraints:
  - Rapid demand assessment based on scenario analysis, expressed as aggressive, conservative or very conservative. The scenarios may be calculated based on the following assumptions:
    - Percentage of the residential population in the initial coverage area; or
    - Percentage of transit users that are more likely to use IPT or NMT modes for short trips; or
    - Percentage of tourist demand estimates in a city.
  - Detailed travel demand modeling using most recent CMP data available or as a stand-alone modeling study for PBS.
  - Analysis based on variables that influence bike sharing demands such as age, number of jobs, type of transit stops, number of IPT users and other similar variables.

OUTCOMES

- Checklist of existing data sources, and identification of gaps in data
- User surveys
- PBS demand estimation models

TOOLS & RESOURCES

- Tool 2: “How-To” Undertake Demand Analysis?
- Primary Surveys (see Appendix A)
- Focus Group Meetings and Interviews

REFERENCES

- Multimodal Level of Service Analysis for Urban Streets: User Guide (http:// onlinepubs.trb.org/ onlinepubs/ nchrp/nchrp_w128. pdf)
- Guidebook on Volume Data Collection (http://onlinepubs.trb. org/ onlinepubs/nchrp/nchrp_ rpt_797. pdf)

5.2.2. Determine PBS system design including station density, location and sizing

PURPOSE

To create a network of stations that ensure reliability, convenience and effective redistribution of bicycles for PBS users.

TOOLS & RESOURCES

- Tool 3: "How –To" Develop PBS System Design Components?

SUB-TASK

- Determine appropriate **station density** in the coverage area by mapping approximate station locations followed by field verification, based on the following parameters:
  - Stations placed at a distance of 250m-400m from each other in high demand areas or 400m-600m in low demand areas
  - Average of 10 to 30 bikes per 1,000 residents
  - 10-15 stations per square km
- Create a list of potential **station locations** and prepare a map using GIS or Google Maps based on the following parameters:
  - Proximity to residential and commercial activity nodes
  - At mass transit stations and high capacity bus stops
  - Near tourist destinations, educational institutions, and recreational facilities
  - Proximity to existing NMT infrastructure
  - Near existing IPT stands
- Conduct field visits (or use total station survey data, if feasible) to verify the exact location of proposed stations.
- Organize stakeholder workshops and utilize crowdsourcing online methods to validate station locations and assess demand at identified stations.
- Identify **station size** based on estimated demand of the coverage area and/or space availability determined during identification of station locations:
  - Spatial planning tools such as PBS demand heat mapping/ overlay mapping to identify concentrations of PBS supportive activity areas.
  - Availability of vacant/underutilized public owned lands near activity areas such as surface parking facilities, on-street parking or multimodal terminals.
  - Stations can be categorized into small (10 bicycles), medium (20 bicycles) and large stations (50 bicycles).

OUTCOMES

- Fleet estimation for PBS system

5.2.3. Refine initial PBS coverage area and determine system phasing strategy

PURPOSE

To finalize the PBS network plan including the system coverage area, system design components and phasing strategy for rolling out the proposed network.

SUB-TASK

- Detail initial PBS coverage area with proposed station densities, station locations and station sizing to develop a PBS network plan. This network plan should be vetted by local authorities and key stakeholders prior to finalization. The PBS system network plan should include the following at a minimum:
  - PBS coverage area
  - Proposed station density and sizing
  - List of station locations
- Develop a system phasing strategy based on proposed network plan, broad financial implications calculated in the feasibility study, and political support for the system. Phasing priorities may be determined based on the following considerations:
  - Phase 1 should ideally be larger than the scale of typical pilot projects along corridors and cover an entire network. This phase should ideally be started in areas with:
    - High concentration of residential, office and transit users
    - Transit stations with high ridership estimates
    - Implemented in conjunction with transit systems
    - Tourist destinations located in a dense setting
    - Areas with strong bicycling and pedestrian infrastructure
    - Partnership potential with transit agencies or private sector entities
    - Areas with high NMT usage for shorter trips
  - Subsequent phases should focus on area expansion to the overall network plan building upon the learnings of the existing phase. Future phases may be dependent on:
    - Success of Phase 1
    - Increased financial commitment
    - Expansion into dense areas surrounding the first phase area

OUTCOMES

- System phasing strategy

5.2.4. Conduct participatory planning workshops to finalize the PBS Network Plan

PURPOSE

To maintain a feedback loop with stakeholders and citizens as well as obtain validation of the final proposal

SUB-TASK

- Hold citizen and stakeholder meetings to solicit feedback on the proposed PBS system network plan. Key stakeholders may include:
  - Citizens, area employers, property managers, business owners, and other civic society representatives.
  - Elected officials and bureaucrats to gain political support.
  - Subject experts—who will present innovations; introduce planning subjects, techniques, solutions and lessons learned from different cities and projects.
- Document and share feedback obtained from workshop participants with local government and implementing agency.
- Update and finalize PBS network plan incorporating relevant comments shared during the workshop.

OUTCOMES

- Identification of issues and opportunities
- Master list of preferences and ideas
- Discussion and approval on key decisions

TOOLS & RESOURCES

- Online Community Engagement Applications
- Design Charrettes
- Visual Preference Surveys/ Computer-generated Simulations

REFERENCES

- Stakeholder Engagement: A Good Practice Handbook for companies doing Business in Emerging Markets- IFC
- Good Practice Guide to Public engagement in development schemes - RTPI UK

5.2.5. Prepare detailed technical specifications for system hardware and software design

PURPOSE

To tailor the PBS system that meets the financial commitment of the city.

SUB-TASK

- Determine specifications for the following PBS **hardware components** as per international standards (see Section 1.3 and Appendix C), but adapted to local Indian conditions:
  - **Station Design:** The key decisions related to station design focus on selecting appropriate systems- manual, automated or semi-automated- and modular versus permanent stations. (Refer Tool 4)
  - **Bicycles:** In addition to the typical features related to comfort, safety, utility and low-maintenance, bicycles need to incorporate features to suit the Indian customer including “women specific designs” for bicycles.
  - **Docks:** These are structural units for parking bicycles and are usually the most expensive component of the PBS system. Alternatives include **bollard style docks and beam style docks.**
  - **Terminals:** Serve as the interface between the user, docking station, and control center.
  - **Control Centre:** The operational centre serves as the processing unit for the operations of the PBS system. Functions of the control centre include managing the redistribution operations, mobile applications, call centre for customer service.
- Evaluate application of **information technology applications** (see Section 1.3 and Appendix C) based on system and station design decisions. PBS-related IT integration components include:
  - **Station Capacity and Bicycle Availability (Redistribution)**
  - **User Registration and Accounting (Smart Cards)**
  - **Data Tracking and Dissemination**
  - **Integration with other public transport and public service systems**
  - **Real-time tracking of bicycles and users**
  - **GPS enabled bicycles**
  - **Cycle sharing websites and mobile applications**

OUTCOMES

- Specifications Report for:
  - Station placement and layout
  - Control Center
  - ITS components

TOOLS & RESOURCES

- Tool 4: How-to Determine Level of Automation
- Appendix C “PBS Specifications”

5.2.6. Plan NMT infrastructure improvements to support PBS network

PURPOSE

To create a safe, direct, attractive, and comfortable cycling environment connecting PBS system stations.

SUB-TASK

- **Prepare a base map** of the current road network delineating the availability and condition of NMT facilities within the PBS coverage area.
- Prepare an **overlay of the desired NMT network** emphasizing the principles of continuity and interconnectivity. At a minimum, the proposed NMT network should incorporate the following:
  - o Cycle track of minimum width of 2 m for one-way movement and 3 m for two-way movement
  - o Buffer of 0.5 m between the cycle track and parking areas or the carriageway
  - o Continuous cycle tracks with appropriate ramps outside cycle tracks for vehicles to access private property.
  - o Smooth surface for traveling with infrastructure utilities in place
- **Identify priority corridors**, specifying where segregated cycle tracks and pedestrian footpaths are needed as well as the links for which traffic calming is needed.
- **Suggest typical designs** that may be used for different types of streets, intersections and areas.
- **Prepare a compendium of NMT proposals** which includes preliminary recommendations with relevant priorities to enable the planning agency to systematically implement the recommendations.

OUTCOMES

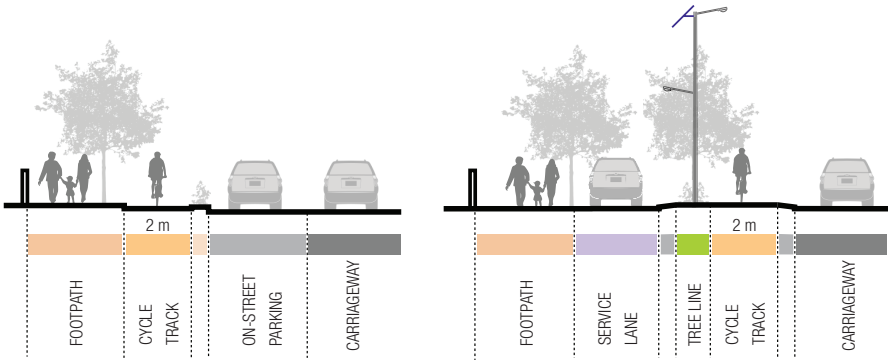
- List of priority NMT improvements needed to connect PBS coverage area

TOOLS & RESOURCES

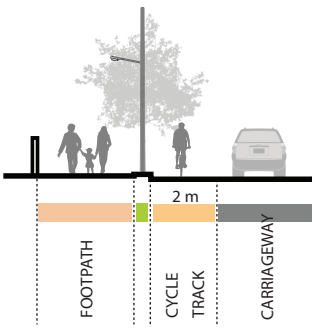
- Secondary Data Sources including GIS or AutoCAD data files

REFERENCES

- Urban Road Code (http://www.iutindia.org/downloads/Documents.aspx)
- IRC code 103, 2012 Guidelines for Pedestrian Facilities
- IRC Code 011,1962 Recommended Practice for the Design and Layout of Cycle Tracks
- Better Streets, Better Cities: A guide to street design in Urban India (ITDP) (http://itdp.in/wp-content/ uploads/2014/04/07.-Better-Streets- Better-Cities-EN.pdf)



Cycle Tracks are the most preferred means of achieving a safe, comfortable and efficient network. Recommended on wide streets with higher vehicular speeds to protect the safety of bicyclists. Left: Placed adjacent to parking lane; Right: Placed along a service lane | Source: IBI Group



On streets with limited RoW, **cycle lanes** are an alternative to cycle tracks. Needs stringent enforcement support to avoid encroachment of vehicles on the cycle lanes | Source: IBI Group

5.2.7. Create branding guidelines for the PBS system

PURPOSE

To establish a unique identity for the PBS system and ensure consistent application in all design elements.

SUB-TASK

- Design a distinctive and adaptable concept for the various PBS system components. Branding elements should include:
  - System name which is catchy and reflects the aspirations of the community
  - Logo and slogan that is easily identifiable and readable at various scales
  - System map design at terminals
  - Colour palette for docking stations, bicycles, terminals, and redistribution vehicles
  - Promotional material such as brochures, maps, brochures, t-shirts, hats, bags or other collateral for the pre-launch marketing effort
  - Website and mobile app design
- Propose guidelines for standards related to advertising regulations to maintain consistency across all system elements including advertising on bicycles, terminals, docking stations, hoardings and supporting public transportation modes (buses, trains and redistribution vehicles).
- Retain a branding and communication consultant to ensure that the branding process is inclusive and stakeholder driven. Strategies to ensure a participatory approach may include:
  - Open competition for citizens to create a system name, logo and slogan or tag line
  - Online voting to select proposed branding
  - Mobile kiosks at key destinations such as transit stations, tourist areas, and other activity centres to solicit input

OUTCOMES

- System Name, Logo, Map, Promotional Material
- Branding and Marketing Guidelines
- Website and mobile app design
- Advertisement Guidelines

REFERENCES

atcag™ bicycle sharing systems — **Bangalore**

Cycle Chalao! — **Mumbai**

namma — **Bangalore**

Planet Green Bike — **Delhi**

FreMo FREEDOM TO MOVE — **Mumbai**

TOOL 2: "HOW-TO" UNDERTAKE DEMAND ANALYSIS

1 DATA COLLECTION

User Perception Survey

Conduct user perception survey to determine the willingness to use the proposed PBS scheme with following details:

- **User profile** such as age group, gender, vehicle ownership, etc.
- **Trip information** such as trip purpose, travel time, travel distance, travel cost, etc.
- **Willingness** of the same users to shift

Household Travel Survey

Preferably to determine **travel** and **socio-economic characteristics** of the people of the study area

Secondary Data

Total population of the area

2 ESTIMATING TRIPS BASED ON DIFFERENT CATEGORIZES

Categorize the trips

Trip Length	Trip Purpose	Age Group	Mode of Travel

Total Trips =

Average Trip Rate* **x** Population

Trips of Particular Category =

Total Trips **x** % of trips of that category

** Average trip rate and above category split of trips should be determined possibly from house hold surveys or can be taken from recent transportation study.*

3 DETERMINE MODAL SHIFT

Analysis should be conducted from the collected user perception survey to determine **% of users willing to shift** under each category of trip length, trip purpose and mode, etc.

4 DETERMINE PBS DEMAND

Based on the estimated percentage of modal shift, the PBS trips should be determined for each category of trips.

Total PBS demand = [Total trips in each category] x [% of Modal Shift]

TOOL 3: "HOW –TO" DEVELOP PBS SYSTEM DESIGN COMPONENTS?

I. SYSTEM SIZE

1 ESTIMATE NUMBER OF PBS STATIONS AS PER INTERNATIONAL STANDARDS

10 PBS Stations per sq. km.

** Source: Bicycle Share Planning Guide, ITDP*

2 ESTIMATE NUMBER OF BICYCLES AS PER STANDARD OR ASSESSED DEMAND, WHICHEVER IS HIGHER

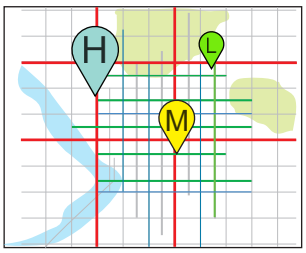
10-30 bicycles for every 1,000 residents

** Source: Bicycle Share Planning Guide, ITDP*

II. STATION LOCATION

1 IDENTIFY KEY ACTIVITY GENERATORS

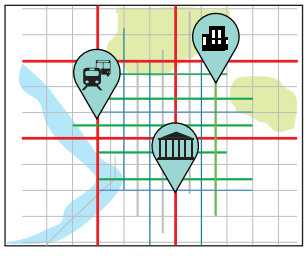
- Transit Hubs
- Offices
- Institutions
- Recreational Centres
- Residential Complexes



2 CLASSIFY ACTIVITIES INTO HIGH, MEDIUM, AND LOW TRAFFIC GENERATORS

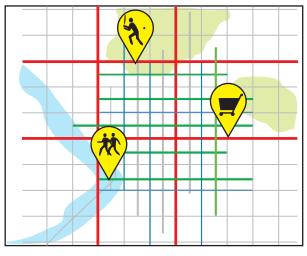
High Traffic Generators

Mass Transit Station, High rise office complex, Major Institutions.



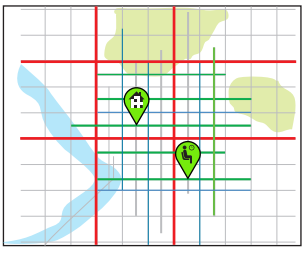
Medium Traffic Generators

Offices & shops, small institutions, Recreational centres, High rise residences

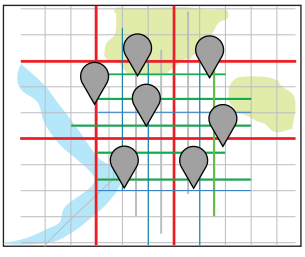


Low Traffic Generators

Residential Areas & small offices

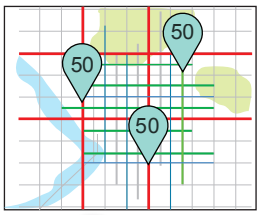


3 LOCATE A PBS STATION NEAR EACH GENERATOR OR GROUP OF GENERATORS

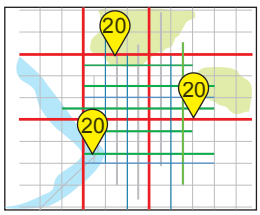


4 DETERMINE PBS STATION SIZE OR TYPE

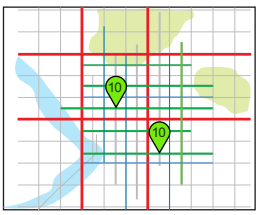
Large station (50 bicycles)
for high traffic generator or group of medium traffic generators



Medium station (20 bicycles)
for medium generator or group of low traffic generators

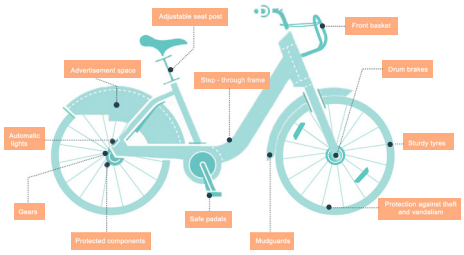


Small station (10 bicycles)
for low traffic generators



5 DETERMINE BICYCLE DESIGN

Customize universal design as needed



Determine incremental components

1. Speed Gears
☐ YES
☐ NO

2. RFID
☐ YES
☐ NO

3. GPS
☐ YES
☐ NO

6 DETERMINE STATION DESIGN BASED ON LEVEL OF AUTOMATION

Fully Automated
- beam (space contraints) or bollard
- fixed or modular

Semi-automated
- station kiosk with cycle racks or caged
- fixed or modular

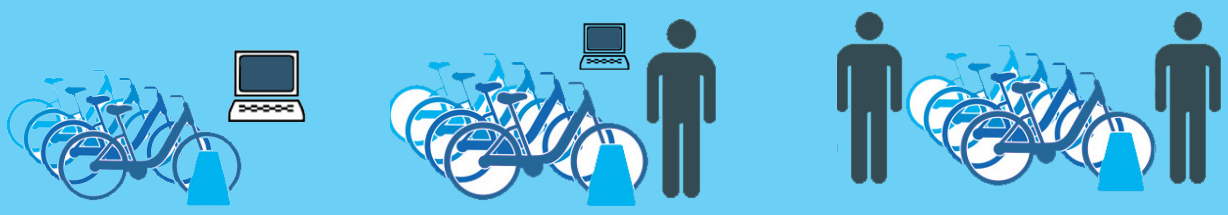
Manual
- station kiosk with cycle racks or caged
- fixed or modular

7 SELECT INTELLIGENT TRANSPORTATION SYSTEM COMPONENTS

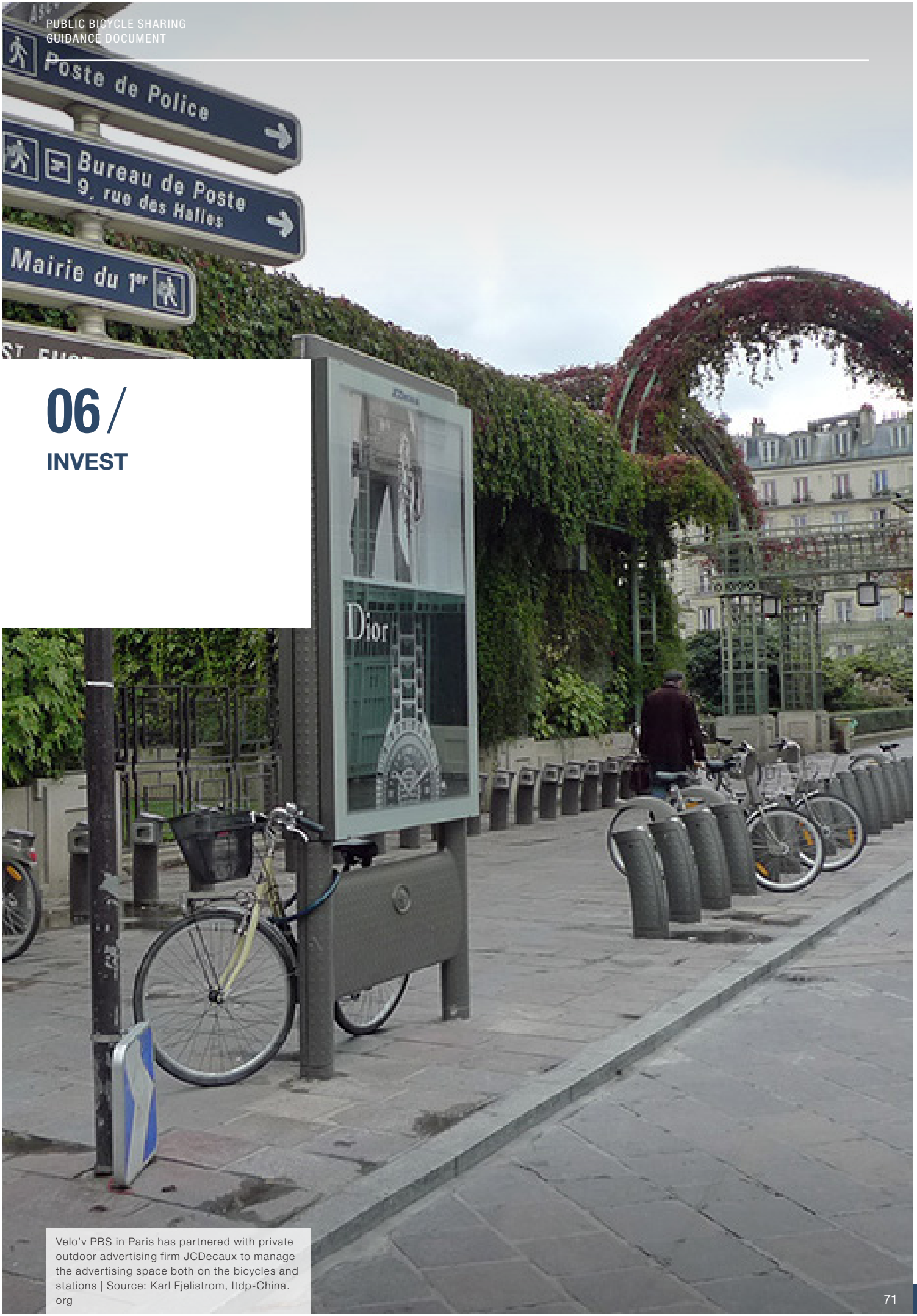
	FULLY AUTOMATIC	SEMI-AUTOMATIC	MANUAL
1. Smart cards or keys	✓	✓	
2. Mobile applications	✓	✓	
3. Real-time bicycle location monitoring	✓		
4. User - operated terminals / kiosk	✓		
5. Central control centre	✓	✓	
6. Fleet management system	✓	✓	

TOOL 4: "HOW-TO" DETERMINE LEVEL OF AUTOMATION

	Automatic	Semi-Automatic	Manual
Digital connectivity reach and existing IT applications access	High	Moderate	Low
Vendor readiness to support automation	High	High-Moderate	Low
Funding availability for capital expenditure	High	Moderate	Low
Funding availability for operating expenditure	High	Moderate	Low



06 /
INVEST



Velo'v PBS in Paris has partnered with private outdoor advertising firm JCDecaux to manage the advertising space both on the bicycles and stations | Source: Karl Fjelistrom, Itdp-China.org

6.1 Fundamentals of PBS financing

Financial analysis is a critical step in assessing the scale, operations and project life-cycle cost of the system. It is crucial to develop a business model that takes into consideration the possible funding sources and revenue streams for meeting the capital investments as well as the ongoing operational expenses over the life cycle of the PBS project. The capital and operating costs can be determined based on the fixed cost of the assets, however the revenue for the system is difficult to be assessed as it is dependent on usage, marketing, political support as well as funding availability. The system requires active and ongoing support from the municipal and state governments, as well as support from private sector to sustain the system.

Based on a detailed review of the selection of financial models by cities across the world, the following priorities were typically considered in making decisions related to the adopted financial and business models:

Flexible funding – Explore access to tapping into diverse funding options including grants, loans and sponsorship for determining viability.

Low financial risk – Mitigating the financial risks by partnering with a third party- private sector or non-profit.

Profitability – By hiring a for profit private company the focus is most likely to be on maximizing the profitable stations which may be at the expense of geographical coverage.

Geographical coverage – If geographical coverage is a significant priority using a government agency in a city owned program was selected as that would result in the highest operational control.

User Affordability – If user affordability is a significant priority using a government agency in a publically owned program should be selected to maximize the operational control.

The Invest chapter provides a step by step guidance in identifying the potential sources for capital and operating funds followed by a discussion on the various possible business models to meet the financial needs of the PBS system.

6.2 Invest Tasks, Key Outcomes & Tools

The Invest section elaborates on the potential costs and revenue streams that ultimately will help determine the PBS system business model. This includes identifying a combination of public funding sources, sponsors and other revenue sources to cover capital, operational and maintenance costs.

	Tasks	Outcomes	Tools
1	**Identify detailed capital and operating Costs**	Pricing Strategy Revenue Streams	
2	**Determine revenue streams**	Capital & Operating Cost Analysis	
3	**Explore diverse operational business models**	Operational & Business Strategy	

6.2.1. Identify detailed capital and operating costs

PURPOSE

To understand the initial investment required for planning, procurement of equipment, and operating the system over the life cycle of the PBS project.

SUB-TASK

- Estimate the **capital cost**- initial investment cost for procuring the hardware components of the system. The key components of the investment typically include:
  - Purchase of bicycles, docks, terminals, and any other station facility like shading elements
  - Membership cards or/and tokens
  - Land acquisition costs
  - Installing and trenching cost of bicycle station
  - Planning, construction and infrastructure cost for bicycle depot, workshop, and central control center
  - System technology for communications and data tracking
  - Pre-launch marketing cost
- Prepare an estimated **operating cost** for operating and maintaining the system. This includes:
  - Staff and equipment for maintenance related cleaning and clearing the station, regular inspection and servicing of bikes as well as maintaining equipment inventory
  - Re-distributions costs- staff time, equipment and fuel charges associated with moving bikes to empty station
  - Manpower cost for operating systems- administration, management, and customer service
  - Power supply and other infrastructure requirements such as internet connectivity to operate the stations
  - Marketing and Customer Information- promotional material and activities associated with running the system
  - Bank loans and financing cost
- Consider adding **contingency cost** in a cost estimate that may effect the operating cost of the bicycle sharing system. These costs can be in the form of:
  - Inflation in manpower cost
  - Depreciation cost of the hardware components used in the system
  - Potential risk of theft and vandalism

OUTCOMES

- Cost Analysis

6.2.2. Determine revenue streams

PURPOSE

To tie the entire capital and operating cost of the PBS system with flexible and diverse revenue sources to ensure the sustainability of the PBS system.

SUB-TASK

- Evaluate alternative mechanisms to raise funds from different sources including:
- **User fees**

  For most of the systems, typically the initial 30 and 60 minutes are free, where the user pays no additional costs if the bike is returned within that time period. After that, fees are charged exponentially as a way to encourage shorter trips. Normally, these fees are collected in two forms- **subscription charges** and **usage fees**.

  - **Subscription Charges** requires the customer to register and pay in advance to avail the unlimited access for a certain time period—a day, week, month, or year.
  - **Usage fees** to the user are charged through on-arrival payments based on the time the bicycle is in use.
- **Government funds**

  Financing PBS capital costs through direct government funds is one of the most popular mechanisms used worldwide. The sources of government funding may include:

  - **Direct Funding**
    - State and municipal budgets available for transport infrastructure could be dedicated for implementing PBS projects.
    - Special funds such as Urban Transport Funds, if avaialble, can be used to implement PBS projects.
    - Appropriation of government owned lands or right of ways for deployment of the system.
  - **Transit Funding:** PBS systems. when designed to serve as extension of the public transport system, can provide access to transit funding available.
  - **Grants & Loans**
    - Grant sovereign loans for financing urban infrastructure projects from bank or other lending institutions.
    - Grants and soft loans from international development agencies and foundations focussed on addressing mobility issues.
  - **Cross Funding-** Consider creating green financing options in the city by taxing use of private vehicles. These can be in the form of:
    - Reallocation of state transport duties revenue from imposing various transport duties like MV licencing, octroi etc.
    - Dedication of parking revenues to fund PBS systems.

- **Private Investment**

  Private sector investments are commonly used by cities to finance the costs of a PBS system, especially operations and maintenance. Advertising and sponsorship are common means of supplementing revenue for bike sharing systems.

  - **Advertisement rights:** Advertising includes a contract with a company to provide a regularly changing graphic and message, typically on the following locations:
    - At information panels located on stations kiosks throughout the service area
    - On bicycles near step through frame, basket, and panel covering the tyres.
  - **Sponsorship** is different from advertising in that it typically involves a long-term relationship between the sponsor and the vendor, where stickers are put on the infrastructure (bikes, stations, and/or website) with a logo and support tagline. Different types of sponsorship include:
    - **Title sponsorship:** where a company pays for full and exclusive sponsorship rights to the system and its components, i.e. stations, bikes, etc. Sponsor's name is included in referring to the system, e.g., London Barclay's Cycle Hire.
    - **Naming and Branding rights** for individual stations in name of private agency.
  - **Corporate Social Responsibility funds**: Private sector employers or developers may be willing to contribute to the capital cost or provide land near their premises for installing bike station. This could be used as means to augment the revenue base.
  - **Carbon off-setting:** Funds collected from carbon off-setting programs being directed towards transportation projects are increasingly being tapped in cities around the world, e.g. TransMilenio bus transit system in Bogota, Columbia.

OUTCOMES

- List of potential revenue streams

6.2.3. Create operational business model

PURPOSE

To determine the preferred organizational model and funding strategy to launch bicycle sharing in cities.

SUB-TASK

- Identify the nature of city's financial commitment to launching PBS.
- Undertake a review of existing technical and professional staff available to manage, implement and monitor PBS projects.
- Map the external funding sources such as independent and private entities that may be potential partners to undertake PBS planning at varying scales.
- Conduct a gap analysis between resources available and PBS activities to determine the need for adopting an appropriate business model from the following alternatives:

Business Model	Agencies Role	Advantages	Disadvantages
City ownership, management and operation	**Implementing Agency and Operating Agency: Government** o Capital investment o Owns the infrastructure and equipment o Operates the system o Makes decisions and drives direction of the program.	o Design related changes can be initiated at any stage of implementation o Government sets the parameters and operates the system. o Fee structure can be controlled. o Social equity is consistent with agency goals and responsibilities	o Agency lacks start-up and operating expertise, which can affect level of service o Risk and ongoing financial responsibility are taken on by the City
City owned and managed, operated by private sector	**Implementing Agency: Government** o Capital investment o Owns the infrastructure and equipment o Administers contract with private operator; and o Makes decisions and drives direction of the program o Operating Agency: Private	o Maximizes transparency of financing and decision making by involving opertaing agency through competitive bidding. o Provides access to additional funding mechanisms o Established skills and experience for operating the system	o Risk and ongoing financial responsibility are taken on by the City o Requires more time for contract negotiation.
Owned, operated and managed by private sector	**Implementing Agency and Operating Agency: Private** o Capital investment o Owns the infrastructure and equipment o Operates the system o Makes decisions and drives direction of the program.	o Expansion likely to be demand driven o Established skills and experience. o Removes risk and financial responsibility from the City	o Price structure may need to reflect financial performance. o Minimal government control and less transparency than other models o Limited ability to push for policy and planning changes in government
Government Agencies include: Local Government, Transit Agency, and Special SPVs			

07 /
IMPLEMENT

A Public Bicycle Docking Station integrated with the housing complex in Dwarka (Delhi), to serve for last mile connections. | Source: First Cycle Sharing Project in Dwarka (DDA) accessible at: http://uttipec.nic.in/writereaddata/mainlinkFile/File398.pdf

7.1 Making it Happen

Cycle sharing is akin to a public transport system and requires a similar institutional structure. Its operational approach needs to focus on excellence in customer service while the implementing arm needs to be adept with new technologies and economic modelling. A successful PBS system is able to create a positive user experience and in turn build long-term customer loyalty to maximize the value of the city's investment in the system. The 'Implement' chapter provides a step-by-step approach to ensure that PBS systems serve its larger purpose of improving the quality of life in a city and are accessible to all sections of the society.

Maintenance and logistics are large operational issues. Therefore, service centres/repair shops and mobile units are critical to the system sustenance such that it is effectively deployed at the stations.

Marketing and outreach program on creating awareness about PBS programs could change the common perception of cycling as a "poor person's vehicle". Local advocacy groups and political leaders could be involved to support the campaign to catch the attention of wider masses.

Constant upgradation to meet usage demand and user satisfaction: It is imperative to upgrade the system to fix gaps in service delivery based upon the findings of **constant monitoring against the service level benchmarks established for the system.**

Undertake capacity building by educating the people and the staff on the functioning of the system, through demonstrations, positive media coverage and training workshops.

7.2 Implement Tasks, Key Outcomes & Tools

Implementation of the PBS system requires mobilizing a multitude of resources, partnerships and innovative implementation mechanisms. The section identifies the roles and responsibilities of potential stakeholders, community engagement and outreach activities, project management task, and monitoring and evaluation to gauge success.

	Tasks	Outcomes
1	Establish institutional framework including roles and responsibilities	Implementation manual detailing roles and responsibilities
2	Devise operation & maintenance protocol	Service level assessment for Operation and Maintenance
3	Build awareness through communication and outreach strategy	Ongoing system branding
4	Undertake operational training and capacity building	Augmentation of managerial and technical skills
5	Develop monitoring system and improvement strategy	Monitoring and Evaluation Framework
6	Expand System	Upgradation and Expansion Plan

7.2.1. Establish institutional framework including roles and responsibilities

PURPOSE

To facilitate partnerships and delineate responsibilities for effective implementation.

SUB-TASK

Based on the appropriate business model selected, responsibilities for various stakeholders in a coordinated PBS implementation programme can be delineated according to the following phases:

- **Implementation Phase:**
  - Arranging finances for the system based on the estimated capital cost.
  - Acquiring clearance and approval from all the required authorities for installation of the system, including land rights.
  - Procuring hardware: cycles + stations (terminals + docks/ locking posts + device for card verification).
  - Procurement vehicles for daily redistribution of cycles.
  - Supervision of installation of stations as per the detailed specifications.
  - Establishment of central control system: appropriation of land, software and equipment to manage & monitor the system operations.
  - Establishing and operating depots & workshop for repair of cycles and other system parts and storage of spare parts and back up cycles.
  - Approving system branding and naming/ advertisements on the system.
  - Establishing benchmarks for assessing the operations and maintenance.
- **Operational Phase**
  - Arranging finances for the system based on the estimated operational and maintenance costs.
  - Planning and hiring adequate staff with the appropriate technical capabilities.
  - Preparing a plan for regular maintenance of stations and cycles.
  - Providing ongoing equipment inspection, maintenance and cleaning including annual overhaul of all equipment
  - Managing and coordinating the advertisement space on the system/ sponsorship rights to the system.
  - Collecting fare box revenue.
  - Managing the registration of users at notified registration centres.
  - Maintain website and smart phone app for the system
  - Maintaining data reporting- real time transfer of data and monthly reports based on performance Indicators
  - Reviewing quarterly operations report and fare box revenue.
  - Organizing public events for continuous branding of the system.

OUTCOMES

- **Implementation manual detailing roles and responsibilities**

7.2.2. Devise Operation & Maintenance protocol

PURPOSE

To ensure that the projects are implemented as per plan and successes, failures and benefits are monitored and evaluated.

SUB-TASK

Based on the established benchmarks for assessing the operations and maintenance, the following activities need to be monitored post-implementation:

- **Redistribution**
  - Percent of the time that high-priority stations are empty during peak hours
  - Percentage of the time that high priority stations are empty during off-peak hours
  - Percent of the time that low-priority stations are empty during peak hours
  - Percent of the time that low-priority stations are empty during off-peak hours
- **Customer Service Indicators**
  - Number of hours when the system is operational
  - % of valid applications and registrations that are processed and membership issued within a day
  - % of valid applications for non-members, renewals and top of smart cards within half an hour
  - % of total time in a month when website and smart phone app is not available
  - Average ridership of the system per cycle/ day
- **IT System Indicators**
  - Smart card performance at the dock
  - Payment processing (for recharge when debit/ credit card is used)
  - Transaction failure at Kiosks
- **Maintenance Indicator**
  - Percentage of cycle repaired within 4 hours of being flagged for repair by a customer
  - Average cycle fleet available per day
  - Bicycle station is cleaned once
- Incentivize and reward the operator for excellent performance based on performance management system.
- Conduct quarterly audits to monitor that the project is beneficial in the short and long terms and for the targeted beneficiaries.

OUTCOMES

- **Service Level Assessment for operation and maintenance**

7.2.3. Build awareness through communication and outreach strategy

PURPOSE

To disseminate benefits and create awareness for increased PBS system ridership.

SUB-TASK

- Prepare an Outreach and Communications Plan to publicize benefits of PBS as a sustainable transportation mode:
  - Develop a media strategy- newspapers, magazines, community flyers, radio and television- to tie the benefits and key components of PBS with improved quality of life.
  - Capitalize on social media outlets such as Facebook, Twitter and blog posts to promote the program.
  - Involve key political and administrative figures to adopt PBS and create a positive image for cycling.
  - Organize public events, promotional campaigns, and workshops to reach out to the community.
  - Create a unified theme for branding cycles, station facilities and advertisement spaces.
  - Create a website and publish photos and promotional activities to generate project interest and solicit feedback.
- Ensure effective public engagement and consultation process through the implementation of the project.
- Collaborate with private companies, institutions or organizations, such as universities, hospitals or IT hubs to promote PBS among its employees.
- Align PBS branding and marketing efforts with existing public transport service to portray the image of a sustainable city to a broader audience.

OUTCOMES

- **Ongoing system branding and support from citizens and stakeholders**

REFERENCES

- Naming and Branding for Chicago Bike Sharing, https://www.behance.net/gallery/21107895/Divvy-Chicagos-Bikeshare
- Raahgiriday initiative in Gurgaon, http://raahgiriday.com/

7.2.4. Undertake operational training and capacity building

PURPOSE

Advocating about PBS operations among municipal and operators for successful implementation.

SUB-TASK

- Prepare a phased staffing plan to recruit skilled professionals covering key areas of PBS- system operations, customer service, maintenance, marketing, and planning NMT infrastructure.
- Collaborate with central government agencies under MoUD to design and implement training programmes for augmenting existing capacities for planning and implementing PBS plans and projects.
- Contact local and international NGOs and academic experience with experience in PBS to hand-hold municipal staff to oversee material procurement and installation of the program.
- Outsource capacity building and technical assistance activities to qualified consultants through a competitive bidding process.

OUTCOMES

- **Augmentation of managerial and technical skills related to managing the project and its implementation.**

REFERENCES

- JnNURM Toolkit for Comprehensive Capacity Building Programme http://urban.bih.nic.in/Docs/ Capacity-Building-Guidelines.pdf
- Institute of Urban Transport (India) Capacity Building Toolkits (http:// www.iutindia.org/ CapacityBuilding/ Toolkits.aspx)
- Urban Capacity Building Programme, Janagraha Urban Space Foundation (http://www.janaagraha.org/content/program/urban-capacity-building)

7.2.5. Develop monitoring system and improvement strategy

PURPOSE

To ensure accountability of PBS vendors in timely completion and high quality service delivery, monitored through qualitative and quantitative performance measures.

SUB-TASK

- Develop quantitative indicators for system goals as established in section 3.2.4 that can be used to monitor the success of the project.
- Create service level benchmarks as a tool for monitoring system's operations- hardware and software, customer service, maintenance, redistribution, marketing, and reporting.
- Ensure conformance of the system's benchmarks with the city's sustainable mobility goals- increased mobility; reduced traffic congestion on roads and reduced fuel use- through performance measures connected to phasing strategy.
- Develop a post -project audit format to monitor that the project is beneficial in the short and long terms for the targeted beneficiaries.
- Develop a monthly report on the performance of the system with respect to the selected indicators.

OUTCOMES

- **Monitoring and Evaluation Framework and Progress Reports**

7.2.6. Expand System

PURPOSE

To preempt and plan for expansion and upgradation of PBS system

SUB-TASK

- Plan expansion to the overall network building upon the success and learnings of the existing phase. The expansion may include:
  - Upgradation of the existing level of technology in the system.
  - Enlarge existing station capacity by introducing more bikes and docking stations at the high demand areas.
  - Provide higher availability and reliability by extending the number of hours of operation for the system
  - Expand coverage area into dense areas surrounding the first phase area.
- Develop desired NMT network, emphasizing the principles of continuity, interconnectivity, walkability, and universal accessibility.
- Allocate additional financial commitment for funding PBS from NMT funds or transportation funds to promote the expansion of the system

OUTCOMES

- **Upgradation and expansion plan**

APPENDIX A:

SURVEY FORMATS

B. Survey Formats

Household Survey

Socio-econiomic information

Travel Diary

Person No.	Trip No.	Trip Origin	Trip Destination	Start Time (hh:mm)	Trip Purpose	Travel time to destination	Distance Travelled	mode	cost	access/egress/main trip	Frequency of trip	Parking fare
					(6)	(mins)	(Km)				(5)	
1												
2												
3												
4												
5												
6												

Source: Adapted from Toolkits for Urban Transport Development, Comprehensive Mobility Plans, MoUD

Accessibility to important location		
	Distance (km)	**Walking minutes**
Grocery Shop		
Recreation		
Doctor		
Dhobi		
Religious		
Garden		

For NON PUBLIC TRANSPORT USERS Why are you not using public transport? Please tell your perception about following parameters:							
1	**About Network**	a) Not connected to my destination		b) Not available next to my house		c) Need to transfer	
2	**Comfort**	a) Seat availability issue		b) over crowded bus		c) Hot inside the bus	
3	**Service**	a) Unreliable service		b) Longer Travel time		c) Less frequency	
		d) Dirty buses and stops		e) Lack of information		f) bad behavior of bus operators	
4	**Inconvinience**	a) Cant carry luggage		b) Not childern friendly		c) Difficult boarding and alighting	
5	**Safety and security**	a) Not safe to walk to bus stop		b) Not safe to be on bus		c) Not safe on bus stops	
6	**Bicycle**	a) Not healthy to cycle		b) Bicycle do not suit me(social status)		c) being a girl, can't ride bicycle	
		d) No shade		e) Bad weather		f) safety	
		No cycle tracks		No shade			

Source: Adapted from Toolkits for Urban Transport Development, Comprehensive Mobility Plans, MoUD

User Perception Survey

For …… by……

Survey Location:_____ Name of the Surveyor:_____

Name of the Respondent:_____ Date:_____

Gender / Age:_____/_____ Time:_____

Occupation:_____ Contact Number:_____

1. OD Detail:

Trip No.	Trip Origin	Trip Destination	Start Time (hh:mm)	Trip Purpose	Travel distance	Travel Time	Mode	Cost	Frequency of trip	Parking fare
1 (access)										
2 (main trip)										
3 (egress)										

2. Have u heard about Public bicycle sharing? Yes No
3. If you have Public bicycle available for commuting from home to metro station & from destination metro station to workplace/destination place- will you avail the system? [Tick the appropriate]

If Yes, why	If No, why
To save money (parking fare, fuel saving, IPT fare)	No shaded Streets
To save environment	No safety on Streets
Because I'm health conscious	Looks Bad
To commute faster and escape traffic jam/ IPT queuing	Its slow Moving
Others (mention)	Others (mention)

4. How much distance/time would you walk to reach the nearest cycle share system?

   _____[example: 5 min, 10 min or 300m, 500 m or so on]

5. How many days will you use public bicycle in a month?

   Occasionally weekly 5 days a week everyday

6. How much in a month would you pay for a daily hour usage of bicycle?_____
7. Preferred mode of payment

   Cash Card (Credit/ Debit card)

8. Preferred subscription

   Daily Weekly Monthly Yearly

Source: Adapted from Toolkits for Urban Transport Development, Comprehensive Mobility Plans, MoUD

APPENDIX B:

CASE STUDIES

London, UK – Barclays Cycle Hire

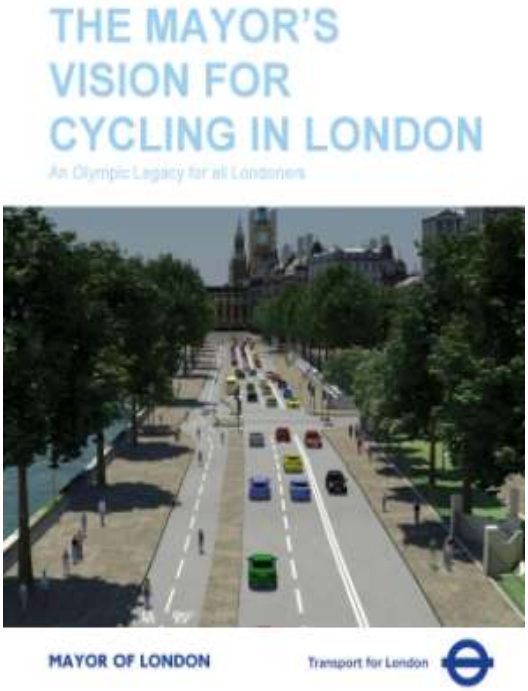
Name of City	London, UK
Population	[City] 8.38 million (2012)
Urban area	1,572 sq. Km
Weather Extremes	Average high: 23.2˚C – Average low: 2.4˚C
Topography	
Cycling Mode Share (Work trips)	1.6% (2010)
Bike share System Name	Barclays Cycle Hire
Operator	Serco Group
System Type	Automated with Fixed Stations
Business Model	TfL owned scheme, sponsored by Barclays
Start date	July 2010
Number of Bicycles	8300
Number of Stations	561
Coverage Area	65 sq. Km
Trips per Cycle per Day	4.2
Docking points per Bicycle	1.7
Free period	30 minutes + grace period for docking

Background

London, the capital city of England and the United Kingdom, is the largest city in the European Union. It is served by a dense network of public transportation lines, including the underground metro with 270 stations, the over ground rail, and more than 700 bus routes. In the last decade, cycling has experienced rapid growth in London, with the number of cyclists on city streets almost doubling. The Mayor of London has set an ambitious target to increase the number of cycling trips within London by 400 percent by 2026. A number of initiatives are being planned to improve cycling conditions, including building bicycle paths and superhighways, and even a “Tube” network for the bicycle.

Enable

In 2010, branded as the Year of Cycling, three major programmes were launched. One of these programmes, planned to help increase cycling



The Mayor's Vision for Cycling in London | Source: Official TfL website

numbers, is the Barclays Cycle Hire, locally known as “Boris Bikes” after Boris Johnson -- who was the Mayor of London when the system commenced on July 30th, 2010. The system was first envisioned by the Mayor of London, Ken Livingstone in 2007, to be along the lines of Paris’ Velib system. Official plans were released in 2008. The objectives of the PBS system were to make cycling attractive by reducing the following barriers to cycling:[16]

- Access to a bicycle;
- Storage space;
- Theft;
- Maintenance;
- Cycling ‘image’; and
- Commitment.

The Barclays Cycle Hire system was launched by the Transport for London (TfL) with 6000 bikes and 400 stations distributed across a 45 sq. km area of central London.[17] The system opened to casual users on December 3rd, 2010.[18]

The system allows people to hire the Barclays cycle from a docking station, use it as desired, and return it to either the same or any other docking station. The scheme was developed in collaboration with the Royal Parks and the 9 London Boroughs. It is contracted to and operated by Serco Group. The system has been immensely popular since its initiation, so much so that when the system was made open to the public in December, 2010, a part of the system crashed due to high demand.[19] Over 2 million trips were made on Barclays Cycle Hire in the first six months of operation. At present, the system includes about 9,200 cycles and 687 stations in the scheme.[20]

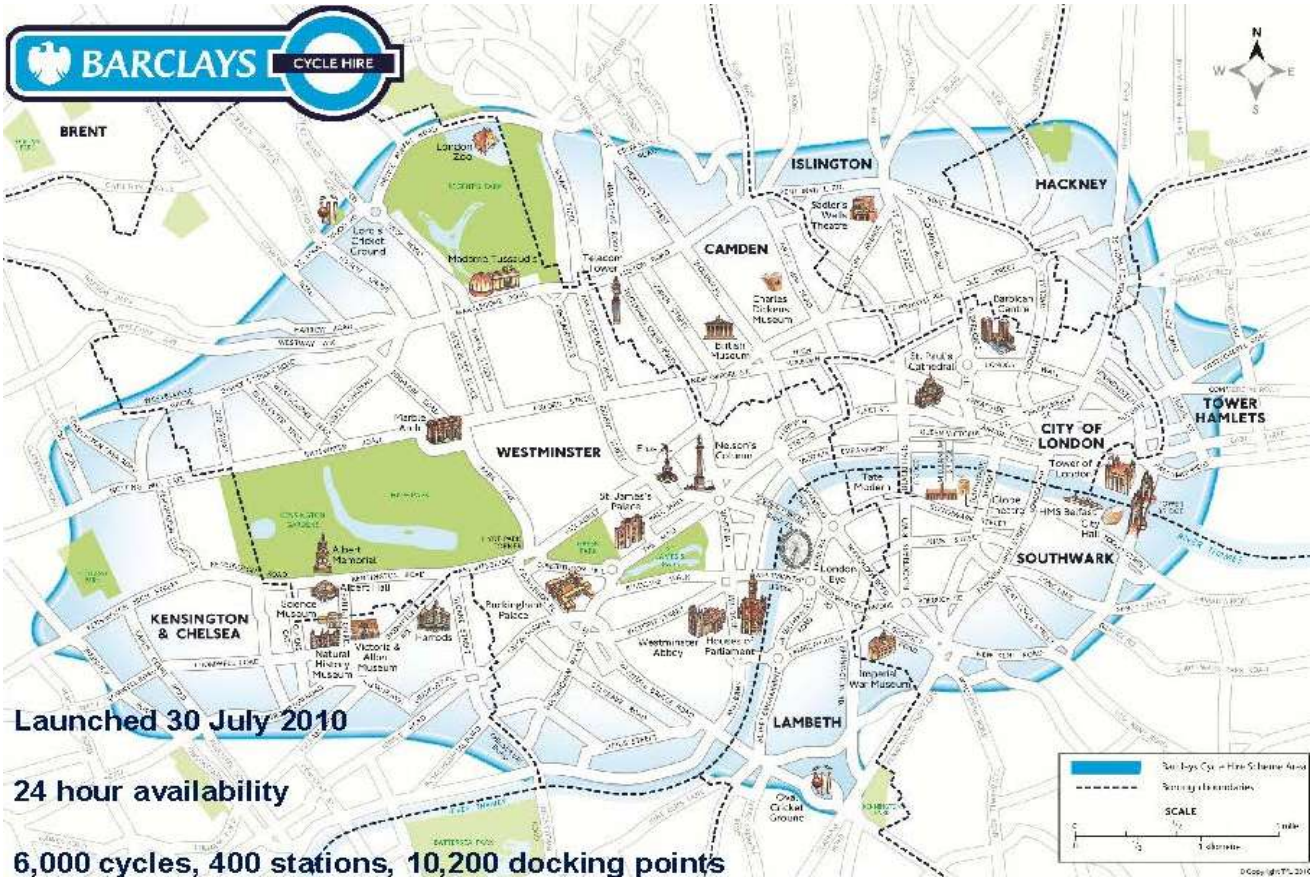
System Planning

The system was planned with the following overarching principles:[21]

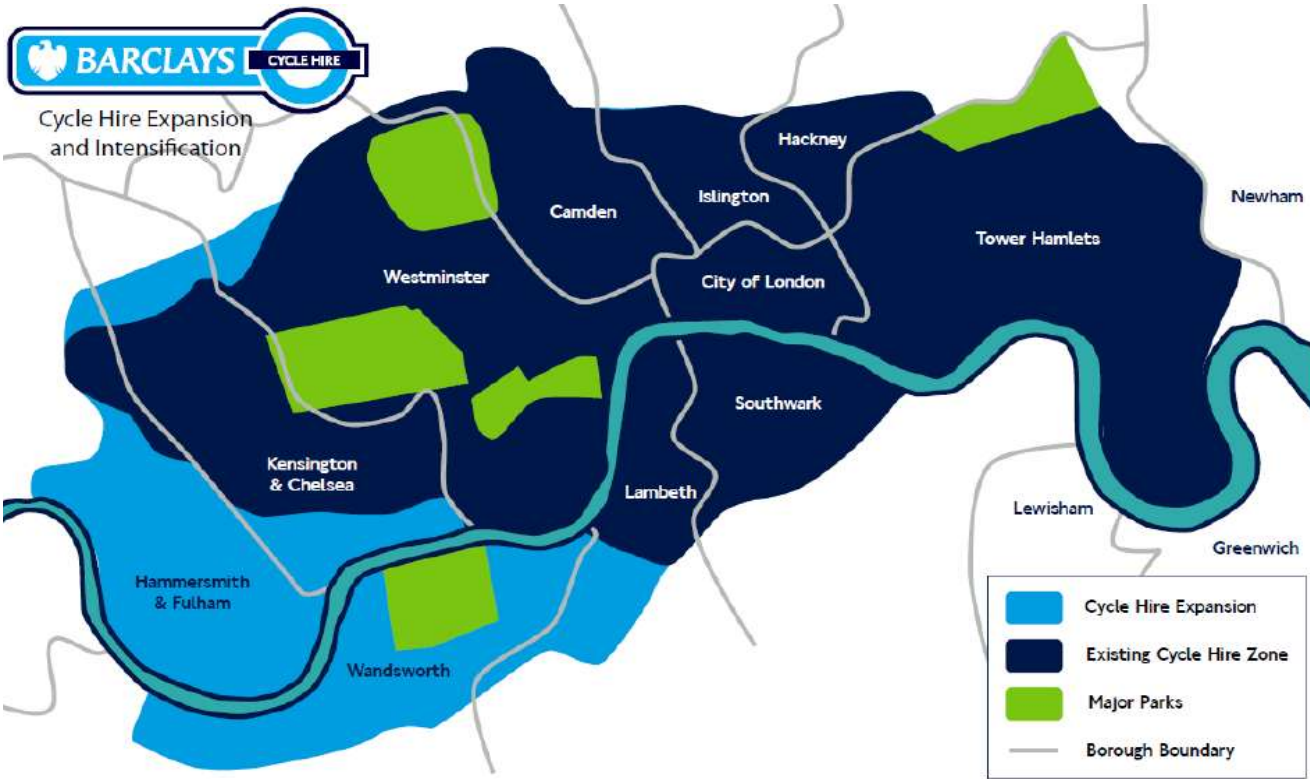
1. Ratio of docking points to bicycles to be higher, so that the chances of finding docking points were high;
2. High density of docking stations (one station every 300m) for user convenience;
3. Fixed docking stations to improve predictability and reliability;
4. The coverage area to encompass Fare Zone 1, which was considered the optimum size for the scheme to function as a network as well as be small enough for quick implementation;
5. Last mile connections at the end of rail corridors would not be covered by the system;
6. Redistribution services would be limited to maintaining cycle availability only; and
7. Sponsorship to supplement funding needs.

Coverage Area

In Phase 1, the Barclays Cycle Hire was planned to serve an area of approximately 45 sq km, which corresponded to Fare Zone 1 in the public transport system. This was considered a good size for implementation. Zone 1 also encompasses the employment and activity hub of London. The density and mix of land uses in Central London ensures multiple short trips. The Barclays cycles would therefore be directly useful to complete last mile trips to the work place and short intra-zonal trips. The plan was to install 10,200 docking points distributed among 400 cycle stations across the service area, at a density of one station every 300 m. In keeping with their original system planning principle, more docks than bicycles were provided to assure riders of the availability of empty docks at any location. This in turn would ensure that users do not unnecessarily have to ride around looking for an available dock.



Barclays Phase I Scheme Area | Source: Barclays Cycle hire, Sadler, Knight 2012, http://www.cyclecities.eu/data-en/file/Cycle%20Hire%20BCH%20-%20TfL(1).pdf



Barclays Phase 3 planned expansion in light blue |Source: Barclays Cycle hire, Sadler, Knight 2012 - http://www.cyclecities.eu/data-en/file/Cycle%20Hire%20BCH%20-%20TfL(1).pdf

In Phase 2, launched on March 8th, 2012, the service area was expanded to 65 sq km, incorporating the rest of Tower Hamlets borough. At present, the Barclays system includes a fleet of 8,300 bicycles available at 561 stations with over 14,000 docking points. The density of bicycle stations within its service area is very high, about one station every 300 m. The number of bicycle docks per station is also high compared to the example of Montreal and dependent upon the use at that particular station. Waterloo Station which sees the highest number of cycles hired from the location has about 126 docks.

Phase 3, which is expected to launch in spring, 2014, will include introduction of 2,400 additional bicycles and 170 to 190 new docking stations (). After this phase of expansion, the Barclays Cycle Hire system will cover all of the City of London and the surrounding 9 boroughs.[22]

Locations for bicycle docking stations were identified based on the following criteria:[23]

- Location accessibility;
- Minimum loss to green space;
- Safety and security;
- No hindrance to vehicle/pedestrian paths;
- Road safety;
- Build-ability, in terms of space availability and surrounding infrastructure; and
- Potential for installing maximum docking points.

Additional contextual considerations were also made for site specific conditions, namely presence of heritage assets.

Bikes at Docking Station | Source: https://web.barclayscyclehire.tfl.gov.uk/

Plan + Design

Barclays' uses the PSBC BIXI Bicycle system, with the following adaptations:

- No modular station platforms - The Transport for London required the docks to be permanently installed. The modular technical platforms were modified as individual docking units hardwired to the corresponding service terminal;
- No solar panels - The Transport for London required the stations to draw electricity from the underground electricity grid. The docks and stations terminal are connected by hardwiring to city's electric grid for its power requirements;
- Addition of advertising and branding panels – These were added as per Transport for London's branding and advertising strategy; and
- The cycles are similar to the BIXI in design, except the brakes go with the London side of the road, exposed cables and mechanisms were covered, lights were modified to stay on longer, a rear reflector was added, and a "Barclays' logo is provided over the enhanced splash guard.

The Barclays cycle | Source: Report by Transport for London

The permanently installed docking stations are designed to unique conditions of each site. For a historic city like London, this has helped in maintaining the required aesthetic character of London's streetscapes, without increasing unnecessary clutter. Terminal designs incorporate parking signage as well as pedestrian way finding signage, where applicable.

User Conditions and Fees

There are two types of users: members and casual users. Both have to pay an access fee and separate charges to use the system. Members have to be registered and purchase an annual membership online or through a contact centre. A casual user can purchase short term access cards at the local service terminal or through the Barclays website. Payments can be made only using credit and debit cards. The access charges are as follows:

Period of Access	Annual	7 days	24 hours
Rates	$129	$14.5	$ 3

Like most other PBS systems, the first 30 minutes of use is free. Users also get a 15 min grace period if docking points are not available. Beyond 30 mins, use charges are as follows:

	Up to (hours)						
Duration	1	1.5	2	2.5	3	6	24 (max)
Rates	$1.5	$ 5.7	$8.5	$14.5	$ 21.5	$50.5	$72

Bicycles are the responsibility of the user once removed from a docking station and extra charges are applicable in case of damage or late return. JCDecaux charges $216 to the credit or debit card used to pay the access fee if bicycles are returned after 24 hours and $432 if the bicycle is damaged or not returned.

Finance

The Barclays Cycle Hire programme is owned by the Transport for London (TfL), and is mainly financed through user-generated revenues. Additional funding has been arranged through a substantial sponsorship deal with Barclays Bank, a premier London-based bank. Barclays Bank purchased the naming rights and branding privileges of the system for a 5-year period at a price of $36 million. The sponsorship deal was later extended by 3 years for an additional of $36 million. The additional funding through the sponsorship deal has helped TfL ensure that the PBS system's expansion plans remain on track. The table below shows the information related to the Revenue Model for Barclays Cycle Hire programme.

Summary table for Revenue System

Component	London ,UK -Barclays Cycle Hire	
	Applicability	**Present Status**
User Fee	● (Y)	User fee is the main source of revenue.
Membership fee	●	Daily $29, Weekly $14.5, Annual $86.5;
Advertisement fee	⊙ (N)	
Sponsorship	●	Barclays Bank; Barclays Bank purchased the naming rights and branding privileges of the system for a 5-year period at a price of £25 million (18% of total). The sponsorship deal was later extended by 3 years for an additional of £25 million.
Retail revenue	⊙	No Retail Revenue
Subsidy from Government	●	NI
Parking Revenue	⊙	No Parking revenue
Operator & Ownership	Transport for London-TfL (City's transportation agency) is the owner. SERCO is the design-build-operate contractor. Transport for London all the revenue and pays the operator.	
● **(Yes)** ⊙ **(No)**		

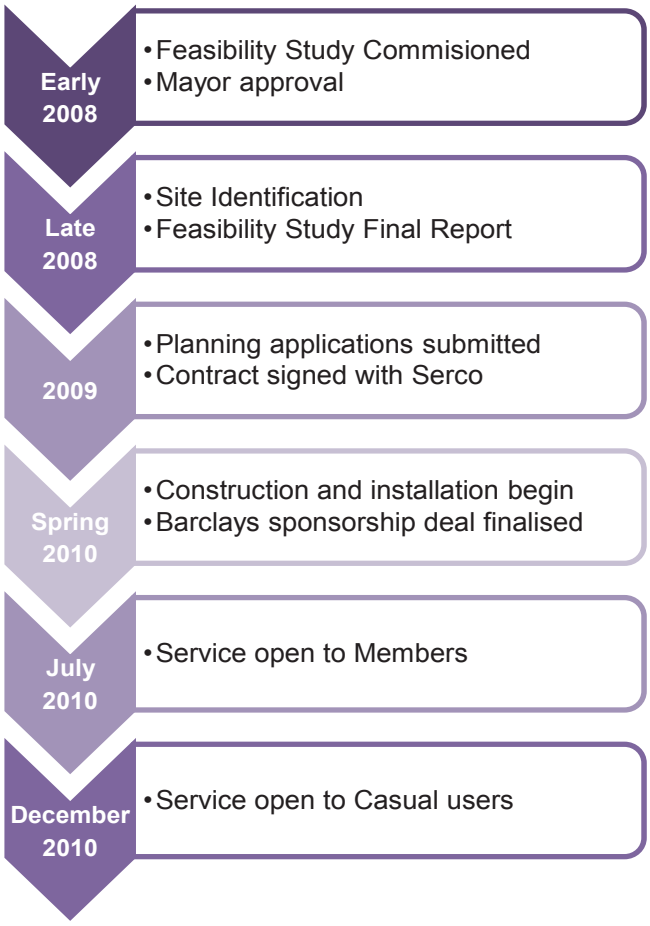
Costs

Initial implementation costs of the Barclays Cycle Hire system amounted to £80 million. This amount included costs of pre-implementation studies, construction costs, system procurements costs and marketing and communication.

A $200 million design-build-operate contract for a period of 6 years was awarded to Serco Group in 2009. In early 2011, the contract was expanded to incorporate the geographical expansion of the system for a cost of $72 million.

Implement

The Barclays Cycle Hire was conceptualized in early 2008, and service opened in 2010. The speed of implementation, as seen in the chart below[24], was primarily due to the momentum provided by the preparations for the London Olympics 2012. The provision of the system was also supplemented by measures to improve safety and comfort for cyclists in the city.



Operations and Management

The Barclays Cycle Hire system is open to the public for 24 hours, all through the year.

Responsibility for on-street operations, infrastructure maintenance and contact centre has been contracted out to Serco Group, who is also responsible for procurement and construction. The contract is managed by TfL. Service Level Agreements ensure minimum service quality is maintained. Serco Group is liable to pay penalties if minimum service targets are not met. For example, if too many docks are empty at some stations while some stations have no docks available.

Routine maintenance is performed by mechanics either on-site or at a depot. Reactive maintenance teams are available in response to alerts received from users who press the red “fault” button on the relevant dock.

Redistribution System

Bicycle redistribution is carried out using special vans, as shown below.

Redistribution vans for Barclays Cycle Hire | Source: Report by Transport for London, https://web.barclayscyclehire.tfl.gov.uk/

Personnel driving the redistribution vans are equipped with Personal Digital Assistant (PDA) devices which help them follow real-time instructions from the control centre on where to pick up bicycles from and where to drop them off.

Marketing and Promotion

One of the biggest promoters of the Barclays Cycle Hire theme has been the Mayor of London, Boris Johnson, after which the cycle hire system is colloquially named ("Boris Bikes"). The promotion of cycling investments had reached a peak before and during the Olympics. The images below illustrate how the Mayor of London was used to demonstrate the political commitment of the administration in delivering cycling infrastructure to the city of London.

Example of Promotional material to raise awareness about Barclays | Source: White, Hannah and Dye, Morgan, Raising the profile of cycling: The London Experience 2012, http://www.cyclecities.eu/data-en/file/The%20London%20Experience.pdf

Benefits and Challenges

Introducing a new unknown system of Barclay cycle hire system in London had its own benefits but still had to face certain challenges in implementing it. The following section gives an overview of it.

Benefits

Almost 2/3rd of Barclays Cycle Hire users were new cyclists, suggesting a modal shift from other modes to cycling. Almost 95% of the users interviewed and presented by TfL in the Rob Sadler and Daniel Knight authored Barclays Cycle Hire believed that the system contributed positively to London's quality of life. 82% also agreed that the PBS system gave them confidence to cycle more in the future.

Challenges

The following challenges were identified by the TfL in implementing the PBS:[25]

- Introducing a new unknown system ran the risk of people being weary of trying it out;
- Designing and implementing a uniform scheme across nine local authorities and the Royal Parks was a large target to achieve;
- The dense London streetscape meant that identifying station locations was a particular challenge;
- Obtaining planning permissions from various authorities, including heritage commissions and tree authorities was a cumbersome task and added to the challenge of building stations;
- There was cynicism in the attitude of the media, particularly responding to sponsorship deal with Barclays. However, the sponsorship deal has played a big part in keeping the expansion plans on track;
- Incorporating the right level of technology was a challenge, such that it would make the system more user friendly without seeming too complicated to the technologically-challenged; and

- A number of operational assumptions were made while modelling potential usage of the system. A few wrong assumptions could have posed a risk to the success of the system as a whole.

Lessons Learned for Indian Context

Following are important lessons learned from the Barclays scheme:

- **Integrated approach in creating cycling infrastructure and PBS**: The Barclays Cycle Hire has demonstrated an excellent effort at implementing a PBS system as part of a cohesive strategy to make London more bicycle-friendly. The sponsorship deal with Barclays also includes a sponsorship for a superhighway, known as the Barclays superhighway. This shows that an integrated approach in building cycling infrastructure along with implementing the PBS system can help create far more interest among potential users and sponsors;
- **Sponsorship**: By offering Barclays, a London-based bank the naming and branding rights, the PBS system was able to maintain the flavour of being “local” while also receiving large amounts of funds through direct sponsorship;
- **Public Transport Service**: The service is owned by the TfL and is hence considered a public transport service, making it eligible for transport subsidies as required;
- **Using a Tried and Tested Model**: Unlike the Montreal case, the Barclays system used a tried and tested bicycle system – the BIXI, thus saving time and costs on hardware development and testing;
- **Combining Marketing Efforts**: The Barclays Cycle Hire marketing efforts were combined with overall urban improvements being made for the 2012 London Olympics. This helped spread awareness about the initiative much faster; and
- **Political Support**: Mayor’s Boris Johnson’s support and espousal of the Cycle Hire system went a long way in creating a positive impression of it.

Lyon, France – *VELO'V*

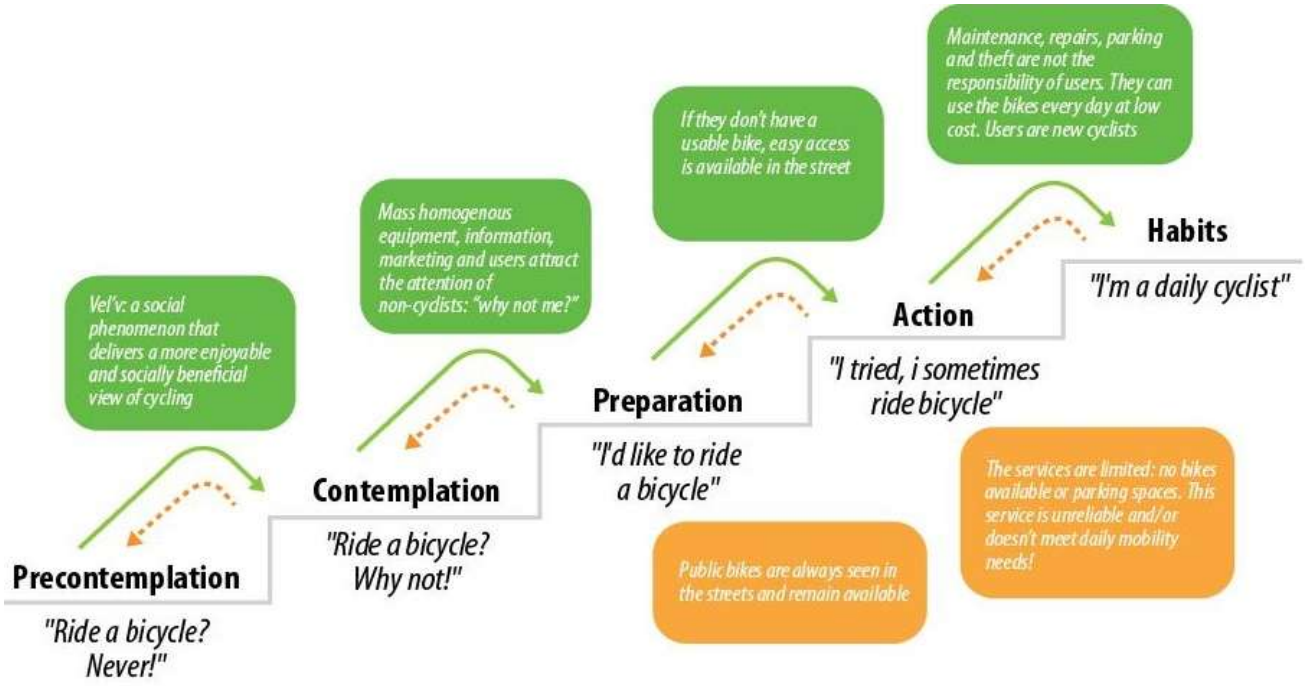
Name of City	Lyon, France
Population	[Metro] 1.551 million (2010)
Urban area	954.19 sq km
Weather Extremes	Average high: 27.7˚C – Average low: 0.3˚C
Topography	Mainly flat with a couple of hills in the outskirts
Cycling Mode Share	2%
Bike share System Name	Velo'v
Operator	J C Decaux
System Type	Automated with Fixed Stations
Business Model	Public private partnership between city and JCDecaux
Start date	19 May, 2005
Number of Bicycles	4000
Number of Stations	347
Coverage Area	63 sq km
Trips per Cycle per Day	5.4
Docking points per Bicycle	1.6
Free period	30 – 60 minutes + grace period for docking

Background

Lyon, France's third largest city is a centre of education with a diversified economy including banking and chemical, pharmaceutical and biotech industries. The city is a UNESCO World Heritage Site, and an important centre for tourism.

Geographically, Lyon is located at the confluence of Saone and Rhone rivers. The City of Lyon comprises 9 municipal arrondissements with a total population of just over 484,344 (2010). Greater Lyon, consisting of the city of Lyon and surrounding suburbs, comprises the urban core of metropolitan Lyon.

Lyon has a well-developed public transport network comprised of four modes – metro system with 4 lines, served by 42 stations; tram network with 5 tram lines; bus network serves areas outside the city centre; and two funicular lines. All of these are run by a single operator, Transports en Commun Lyonnais (TCL). Originally very unfriendly to cyclists, the city had a watershed moment in 2005 when the public transportation services were strengthened with the launch of 2000 bicycles of the new Velo'v public bicycle sharing system. Simultaneously, a number of traffic control measures were put into place to manage and reduce entry of cars into the city centre.



Change in cycling behaviour in the case of Lyon - From the Mobility - European Public Transport Magazine | Source: http://www.mobiped.com/wa_files/Mobiped-4_years_down_the_path-what_is_the_mobility_impact_of_Velo_v.pdf

Enable

Velo'v was the first large scale third-generation PBS program to be implemented in the world. Encountering tremendous success, it has become a trend setter in demonstrating how a well implemented system can mutually benefit the private operator, the public agency and, most importantly, the citizens. Velo'v has provided residents and tourists in Lyon with an attractive and affordable alternative mode of transport. According to a 2007 study, Velo'v has enabled a substantial modal shift, replacing over 150,000 motor vehicle trips.[26] The benefits of Velo'v are not only mobility related but also have to do with quality of life, as well as many environmental and public health goals. Velo'v has contributed to alleviating the car induced gridlock that had afflicted Lyon's historic downtown area. It has also been effective at encouraging an overall improvement in cycling behaviour by introducing new cyclists on city streets. Between 2005 and 2009, bicycle use increased by 80%. In 2009 it was reported that Velo'v accounted for 31% of all bicycles used.[27]

NMT Improvements

The launch of Velo'v also triggered public support for non-motorised transportation in general. Acceptance of the bicycle as an attractive way of travel paved the way for some crucial NMT investments that promised to make the city safer and more attractive for cyclists. In 2007, driven by public support, the banks of the river Rhone were completely closed to traffic and redeveloped into an NMT-only promenade. The redevelopment provided opportunity to upgrade the ecology of the area, while also creating a public open space.[28]

At present, the city of Lyon has 400 km of cycle paths, 90 km of which have been built in the last three years. Public pressure also enabled Greater

Velo'v bicycle system | Source: Jean Bono via Creative Commons

Lyon to launch a five year cycling master plan in 2009 worth €90 million. The plan includes development of an expansive cycling network and a potential long-term cycle sharing service.[29]

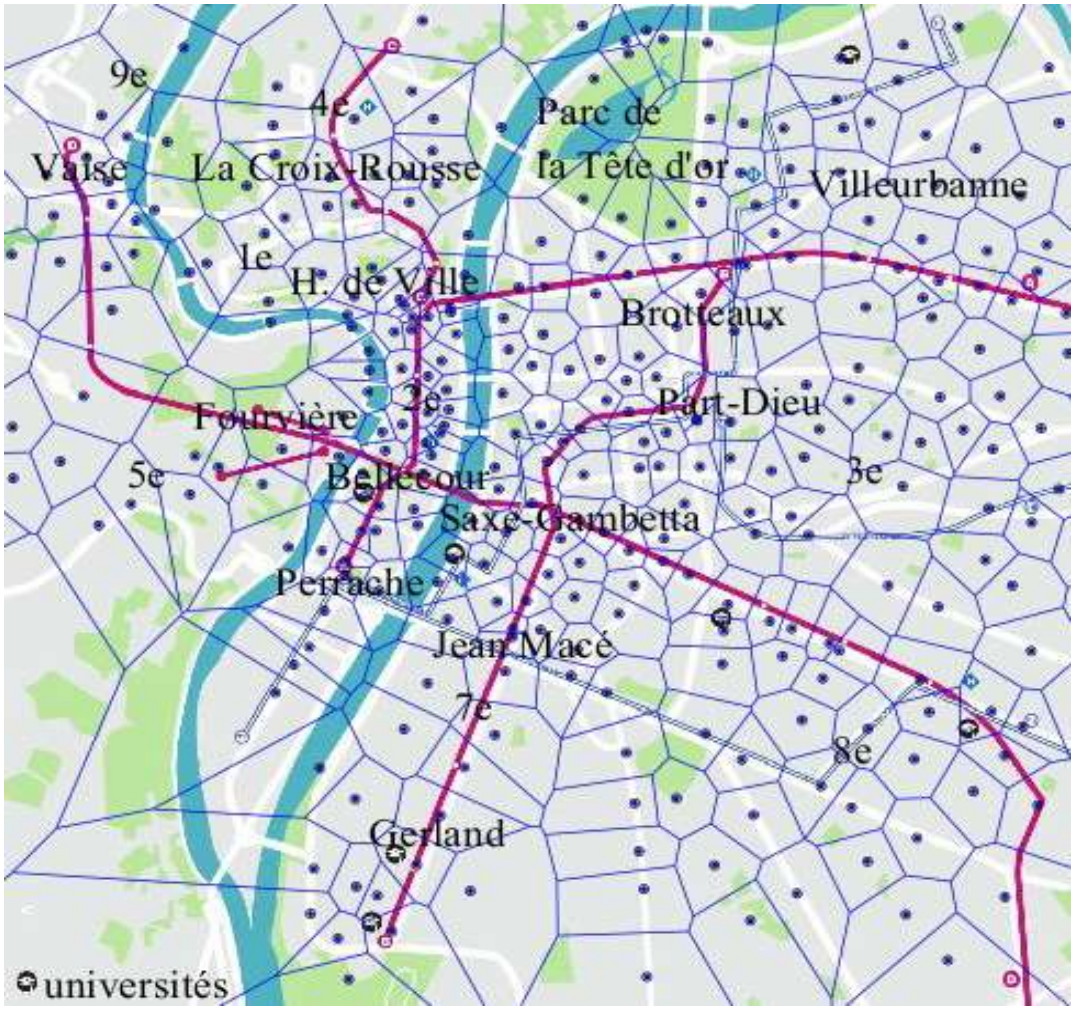
Plan + Design

The Velo'v was planned as a third generation bicycle sharing system, inspired by the system oriented design of the Velo à la Carte, a much smaller scale system implemented in Rennes, France. Following are main system planning goals:[30]

- Create a more sustainable transportation system;
- Provide a new mobility option for short trips;
- Enable pollution emission reductions and reduced traffic congestion;
- Enable road and parking cost savings, consumer cost savings and energy conservation; and
- Reduce accident risks, improve public health and support smart growth land use development.

Coverage Area

The Vélo'v system covers an area of 62.96 sq km within the cities of Lyon of Villeurbanne. It is currently equipped with a fleet of 4000 cycles distributed through 6,600 docking points at about 347 docking stations. Docking stations are located at distances such that they are no more than 300 m apart in the inner city, and between 300 to 400 m towards the periphery (see). Providing higher density of stations within the core city where a larger number of origins and destinations exist ensured maximum bicycle availability at all times, minimising the need for redistribution. This also reduced the potential burden from any one station becoming the most heavily used.



Velo'v station locations marked with a dot within Voronoi cells. Each voronoi cell represents the immediate cycle-able area surrounding using bicycles from that station | Source: Borgnat, et al, A Dynamical Network View of Lyon's Velo'v Shared Bicycle System

Bicycle System

The Velo'v is an automated GPS-enabled system of bicycles and docking points. Velo'v bicycles are designed to be ergonomic, robust, and simple to use for people with all body types. Following are some of its special features:[31]

- 3-speed gear system;
- Sturdy handle bar with attached front light and basket;
- Adjustable seat and saddle;
- Rear lights for additional security;
- Disk brakes;
- Cables hidden inside the frame;
- Dynamo integrated into the hub to power lights; and
- Electronic cards (CPU) that contain unique ID information and engage with the docks when 'locked'.

Bicycle dock | Source: Jean Bono via Creative Commons

- Station terminals and bicycle docks are also designed to be ergonomic, simple and strong.
- Station terminals offer a user-friendly interface allowing electronic payment as well as cash services.

ITS Integration

When it was launched, Velo'v stood out from its precedents due to its next generation innovative technology, such as electronic locks, onboard computers and access via smart cards.

Due to the GPS tracking enabled cycles, a database is recorded with the date and time of the start and end of the trip and the IDs of the departure and arrival stations (their geographical location being known). Since its introduction, with the help of this tracking mechanism, the system has kept track of the start and finishing location plus travel distance and travel time of every journey.

Station Terminal | Source: Jean Bono via Creative Commons

Conditions for Use and Fees

Access is via a subscription system in which a card is purchased online or at a station giving the user an account and a PIN with which they access bicycles through a terminal situated at the bicycle stations. It does not take more than 2 minutes to draw a cycle out of the docking station.

To make the system friendly even for tourists all Vélo'v stations accept international bank cards. This allows tourists to subscribe to the system before arrival, minimizing registration hassles.

Six types of subscriptions are offered. Annual renewable subscriptions are offered for three types of users: classic users, 14 – 25 year olds and users with RSA certificates. For tourists and other short term users special tickets are available for 1-day and 7-days. The Lyon City card is also valid for Velo'v and can be used as a 3-day ticket. Subscription charges are as follows:

Period of Subscription	Annual	1-day ticket	3-day ticket	7-day ticket
Classic	$ 28	$ 1.7		$ 5.64
Special offers	$ 17		$ 3.38	

Rentals can last from less than 30 minutes up to 24 hours and are available to anyone above 14 years of age. After this period, users must pay extra when they want to use the bicycles. It allows free use for a reasonable period of 30 minutes to 1 hour (with a Velo'v partner card). Allowing variety to usage patterns, users have two card choices, either for long duration (1 year) or short duration (7 days or 1 day subscription). Users need to pay a refundable deposit costing $168 for the long duration card. As per rules the PBS operator will not refund the deposit amount if the bicycle is damaged by the user. For the short duration card, people must pay by bank card in order that the Vélo'v team can identify the people who don't bring back or break bicycles.

The usage fee structure is as follows:

	Card cost	30 min	90 min	+ 60 min
Long duration	$ 5.64	$ 0	$ 0.85	$ 1.69
Short duration	$ 1.13	$ 0	$ 1.13	$ 2.26

Finance

The Velo'v PBS system functions as a public-private partnership. The Lyon city council, who initiated the project, signed a contract with a private outdoor advertising firm JCDecaux, which functions as the promoter as well as the operator of the program. JCDecaux is responsible for procuring the cycles, building stations and operating the system on a day-to day basis. In return, JCDecaux earns revenue from subscription charges, as well as owns the rights to sell advertising space both on the bicycles and stations themselves and in other selected locations in the city. The city earns revenues from rental charges and usage fees. In Lyon, almost 96% of the trips happen free of charge, limiting potential revenues for the city.

Summary table for Revenue System

Component	Lyon, France – VELO'V	
	Applicability	**Present Status**
User Fee	●	The first half hour- free; first additional half hour - € 0.75; the next half hour - an additional $1.7;
Membership fee	●	Daily $1.7, Weekly $5.6, Annual $28;
Advertisement fee	●	NI
Sponsorship	●	JCDecaux procures bicycles, builds stations and operates the system under PPP.
Retail revenue	⊙	No Retail Revenue
Subsidy from Government	⊙	No
Parking Revenue	⊙	No
Operator & Ownership	Runs on PPP model. JCDecaux (Private Sector agency) is the operator cum promoting agency. It procures bicycles, builds stations and operates the system. It collects the revenue and shares a % with Lyon City.	
● **(Yes)** ⊙ **(No)**		

Implement

The Vélo'v system deliver service for 24 hours, rendering it as a transitional medium for the user to choose public transport systems at odd hours as well.

Response time for maintenance is quick by way of mobile vans and the incident is reported by passing the smart card in front of the optical reader at a station.

As was seen in the case of Montreal, during certain peak times in the day, docking stations at many locations are either completely full of parked cycles or completely empty of it, making the return or rental impossible. An obvious issue like this can de-motivate users from further using the system, since looking for another dock wastes time and money. To address this issue, Vélo'v has devised a system whereby users can deal with such situations by inserting their cards in the card reader machine of the busy station and being granted another 15 minutes to find another rack.

Promotion and Customer Information

Customer information for choosing public transportation has been stepped up by various mediums to provide real time and travel plans, including 500 visual terminals and broadcasting information. The city has a wide range of still open projects and investments to make in this direction. The current investment costs for public transport amount to $783 per person.

A user benefits from discounted rates on producing bus, train or other public transport cards, another mile in encouraging one to pick a cycle from the Velo'v bicycle share system. This partnership serves as a catalyst in increasing the residents to frequently use the well-connected network of public transportation with its efficient last mile connectivity, consequently reducing the use of private vehicles.

Benefits and Challenges

The system has been successful and has increased its ridership over the years but few challenges Velo'v faced were diversity in age of the users and inter modal connectivity. The section below emphasizes on the benefits and challenges faced by the Velo'v system.

Benefits

- The Velo'v was declared a resounding success within a few months of its implementation. System use has increased every year, with the number of cyclists on city roads increasing by as far as 500% since 2005, and a quarter of these new cyclists are due to Vélo'v. 2011 also saw a 15% decrease in traffic, marking a significant achievement that has been attributed to the success of Velo'v.
- Research has found that, before joining, 96% of Vélo'v members had never ridden a bicycle in the city before. Velo'v tends to retain a good amount of members with an improving infrastructure and high-quality customer service policy.
- In 2010, bicycles accounted for about 2.5% of the modal share from 2% in 2006. The Velo'v system accounted for about 25% of the total bicycles on the street, the remaining 75% having been encouraged to use their own bicycles by the bicycle share system. Since the system has achieved a critical mass of cyclists on regular routes, a new relationship has been established between other modes of mobility; consequently making it more conducive and safer for people to get on the streets with their own cycle.
- As of 2013, there are 60,000+ members subscribed to the PBS System.
- According to a 2010 study that appeared in the journal Transportation Research, an experiment was conducted in which scholars put GPS chips in Lyon's public bicycles and examined how they were used. They found that rental bicycles actually go faster than cars in rush hour traffic. Thus, one bicycle could take 10-15 rides a day with different users and can be ridden up to 10,000 km (6000 miles) annually.[32]
- In Lyon, a bicycle journey is increasingly preferred to one in a car, due mainly to traffic calming measures , poor availability of personal motorized vehicle parking -- and abundantly available docking stations.
- Pablo Jensen at the École Normale Supérieure de Lyon looked at 11.6 million bicycle trips in Lyon between May 2005 and December 2007 to extract some urban cyclist's behaviour. The study found that, on an average trip, bicyclists travel 2.49 km in 14.7 minutes, making their average speed about 10 km/h. That compares well with the average car speed in inner cities across Europe.
- During rush hour, however, the average speed rises to almost 15 km/h, a speed which outstrips the average car speed. And that's not including the time it takes to find a place to park which is much easier for a Vélo'v cycle than a car.

Challenges

- A few challenges that the system has not been able to address is the stunted use by some demographic groups. For example 60% of the Velov's users are men. 75% of the users are between 17 and 35 years of age. Continued innovation is required to cater to the needs of other demographic groups as well.
- Another challenge is effective inter modality. At present, Velo'v does not serve feeder routes at important transit stations outside the central city area. By using Velo'v to serve feeder routes, the potential of the service can increase further.

Lessons Learned for Indian Context

Following are some important lessons learned from the Velo'v project:

- **Simultaneous Traffic Management Measures**: Velo'v was introduced in a city that was known to be unfriendly to cyclists. However, with increasing traffic congestion in the city core, the city envisioned creating two parallel movements: one was restricting car movement within city limits, and the second was providing affordable transport alternatives for short term use within the city limits. Together the two measures turned out to be game changers for Lyon, moving the city away from all the ill-effects of motorisation and slowly paving the way for continued investment in non-motorised transportation.
- **Use of Bicycle Design and Technology to enhance image-ability**: Velo'v's unique third generation design directly undercut the previous impression of a cycle as a poor man's vehicle, and made it chic and cool. This enhanced its acceptability among all user classes.

Mexico City – *ECOBICI*

Name of City	Mexico City, Mexico
Population	[Metro] 8.851 million (2010)
Urban area	1,485 sq km
Weather Extremes	Average high: 26.6˚C – Average low: 5.9˚C
Topography	Flat centre, hilly periphery
Cycling Mode Share	2-3%
Bike share System Name	Ecobici
Operator	Clear Channel
System Type	
Business Model	Public private partnership
Start date	2010
Number of Bicycles	4000
Number of Stations	276
Coverage Area	
Trips per Cycle per Day	6.25
Free period	45 minutes

Background

Mexico City is the political, cultural and economic hub of Mexico. This mega-city is a sprawling home to 21 million people and is North America's largest metropolis. Mexico City is plagued with very high pollution levels that pose serious health risks to its inhabitants. Part of the issue is the high altitude and physicality of the city, along with a large dependence on car culture creating horrible traffic congestion. Millions of residents are forced to commute for an average of 2.5 hours a day to get to work. Most trips are no further than 7 km, or a 30 minute bicycle ride, and largely concentrated in the city centre, where the land is flat, and public bicycles are available.

Enable

The Environment Secretariat has been actively pursuing a modern bicycle mobility strategy for Mexico City since 2007. The city is now setting an example as it works towards a Green Plan, adopted by the city government in 2008. A priority component of the Green Plan is the promotion of sustainable movement, including the bicycle share program Ecobici and the infrastructure needed to support it.

System Planning

PBS program launched in March 2010 in Mexico City was part of the city Mayor's goal to increase the number of bicycle trips made in Mexico City from 1.2–5.0 % by the end of his term in 2012. Since this target was established beforehand, the city authority together with technical experts and an operating advertising company was determined to meet this target and worked actively towards it

Coverage Area

The government issued volume count studies to be completed with demographic information on riders to analyze and project how to best plan for a bicycle share system. The planning itself was completed by the Ecobici's parent company, Clear Channel.

Ecobici, Docking Station | Source: Denis Bocquet via Flickr Creative Commons

Ecobici started phase 1 in 2010 with 70 stations and over a thousand bicycles. The system had a maximum of 30,000 allowable subscribers. In 2011 there was a small expansion of 15 stations. Implementation of Phase 2 included 78 new stations and 1,180 new bicycles that stretch over four districts in two municipalities. Currently, in the implementation of phase 3, there are 271 stations and 73,000 members. The completion of phase 3 will have 4,000 bicycles, 275 stations and an annual allowance of 100,000 subscribers. Phase 3 also includes a plan to bring free public bicycles for use at the iconic Reforma Avenue and surrounding area.

Plan + Design

Ecobici uses a fleet of unisex bicycles that are bright red, which is said to increase visibility for added safety in mixed traffic. They have adjustable seats, automatic lights that use a dynamo generator powered by pedalling, a basket, bell, three speeds, chain cover and fenders. The frames are built from a steel and aluminium alloy that gives a lighter overall weight than many comparable bicycles. The weight coupled with the three speed drive train and a smaller front wheel allow for an agile and comfortable ride.

The station design itself resembles a long bicycle rack connected to a tall computerized access terminal cylinder. If the destination station is full, the access terminal will reveal the closest empty cycle station. The system also gives an additional 10 minutes to reach the new station. Ecobici stations are located around 300 meters from one another at vantage points allowing for quick and comfortable short journeys within the hours of 6:00 to 00:30.

ITS Elements

Ecobici is a third generation system which includes many technological user advantages that were not possible in early systems. For example, Ecobici has a Smart phone application that allows users to check in real time the closest station and the number of available bicycles at each station. The app can also show popular attractions and important municipal destinations near the stations.

Conditions for Use and Fees

Unlike other PBS systems, Ecobici does not encourage short term rentals by dis-incentivising longer use; it makes it mandatory for users to return cycles within 2 hours.

Users must confirm the following information before using the system:

- Age Confirmation as Adult (over 16 years old);
- Know the traffic regulations and driving and be trained in motorcycle riding;
- Know the functioning of the system, rates and processes;
- Make use of the service and bicycle with utmost diligence;
- Use urban bicycle exclusively for personal transportation purposes;
- Report promptly to the Customer Service Centre any fault or any accident noting the location and condition. If for reasons of not fault the bicycle placed in a station, you assume the custody of the bicycle within two hours after the malfunction report Care Centre Customers;
- Assume full custody of the bicycle from the moment it is removed from the Station until the time of depositing the bicycle at a station, responding personally to their health and their restitution after the period of Thirty (30) minutes;
- Check the braking system, check the attachment of the removable elements the bicycle, adjust the seat height and generally verify the correct use of the bicycle;
- Place the bicycle in designated stations at the end of the period of use; and
- Maintain updated personal and payment information either by the internet or by going to the Customer Service Centre.

Membership is limited to annual subscribers, so tourists cannot use the Ecobici system. In addition, the system has a member limit, which until now was 30,000 (and sold out). The new member limit will be 73,000, eventually increasing to 100,000. The fee structure is as follows:

Fee Type	Annual Subscription	0 – 45 min	45 – 60 min	61+ every 60 min
Rates	$400	$0	$10	$35.00

The charge for providing a replacement Ecobici card is $50, and the penalty for not returning a bicycle in 24 hours is $5,000.

Using an Ecobici bicycle for longer than two hours also generates a penalty in the system, and once 3 penalties have been generated for a user, s/he is unregistered from the service.

Finance

Ecobici runs on a public-private partnership model. The cost of launching the Ecobici in 2010 was roughly US$ 6.25 million. It receives a government subsidy of around 7 million dollars, which has allowed the system to grow. The private partner -- a subsidiary of the U.S. Company Clear Channel Outdoor -- is the world's largest outdoor advertising company. The company earns its revenues by selling advertising rights in and around the bicycle stations areas. The table below shows the information related to the Revenue Model for Ecobici.

Summary table for Revenue System

Component	Mexico City – ECOBICI	
	Applicability	**Present Status**
User Fee	●	The first 45 min- free; first 15 min - $10; the next hour - an additional $35;
Membership fee	●	Annual $400;
Advertisement fee	●	NI
Sponsorship	●	Clear Channel (an advertisement firm) Runs the system on PPP model.
Retail revenue	⊙	No Retail Revenue
Subsidy from Government	●	Government has give subsidy of $7 million.
Parking Revenue	⊙	No
Operator & Ownership	Clear Channel Runs on PPP model and gets the revenue from advertisement rights.	

● **(Yes)** ⊙ **(No)**

Implement

Ecobici is operated through its concessionaire, Channel Outdoor. Bicycle share program operated by Clear Channel is called SmartBike. There are currently 14 SmartBike systems around the world with 17.8 million bike trips that represents more than 55 million kilometres travelled on bikes.Clear Channel integrates the management, supply and maintenance of the Ecobici system. It also monitors teams that circulate the service area and move bicycles from stations where there is an excess to undersupplied stations.

Marketing and Branding

The bicycles have a style and components that make them unique and unmistakable. Their bright red paint creates a stylized presence on the urban city streets.

Lessons Learned for Indian Context

- The benefits for Mexico City from Ecobici are limited to areas where other cycling improvements have also taken place. This reinforces the importance of implementing NMT improvements in tandem with PBS implementation.
- Currently, Ecobici is only accessible to yearly subscribers that limit its usage and do not facilitate tourists and short term users to access the system and explore Mexico City by bicycle.

Montreal, Canada – *BIXI*

Name of City	Montreal, Canada
Population	[City] 1.65 million; [CMA] 3.82 million (2011)
Median Age	38.6 years
Urban area	[City] 365.13 sq km; [CMA] 4258.97 sq km
Weather Extremes	Average high: 26.6˚C – Average low: -12.4˚C
Topography	Irregular sloped with a few hill peaks
Cycling Mode Share (Work trips)	2.2% (2010)
Bike share System Name	*BIXI*
Operator	Public Bike Systems Company
System Type	Automated with Portable Fixed Station
Business Model	Publicly funded scheme with financial support from city and sponsors
Start date	12 May 2009
Number of Bicycles	5120
Number of Stations	411
Coverage Area	82 sq. km.
Trips per Cycle per Day	3.8
Free period	45 minutes

Background

Montreal, Canada's second largest city, is located in the French-speaking province of Quebec, and is an important centre of commerce, finance, technology, design, culture, tourism, cinema and world affairs. The city's population and its surrounding suburbs reached a million in the 1930s, post the World War I influx of migrant population. The size and population of the metropolitan region has been growing consistently since then. At present, the population of metropolitan Montreal is over 3.8 million people at a density of 898 people per sq. km. The urban density in the main city area is over 4,517 people per sq. Km. In the last decade, the city has seen a population growth rate of 2.3%. The median age is about 38.6 years.

Montreal has a well-developed public transport system, including an underground Metro network comprising four lines, 69.2 km in length, with 68 stations, and a dense network of bus routes. The city also boasts an expansive network of bicycle ways, including 650 km of bicycle lanes and paths. Montreal's public bike sharing system, known as BIXI, was in some ways imagined as a tool to increase the utilization of the existing bicycle network. This suggests that pre-existing cycling infrastructure played an important role in its success.

Enable

The first time a PBS system was referred to in Montreal's transportation history was in the 'Reinvent Montreal' Transportation Plan, adopted by the city in 2008. The purpose of the plan was to create a framework for sustainable growth in the transport sector that could meet the needs of all Montreal residents, while also providing for a better quality of life and reducing the negative impacts on the

environment. A “self-service bicycle system” was identified as a key action item for improving the cycling environment in Montreal.

Work on the PBS system had begun even before the Reinvent Montreal Plan was formally adopted. The *Société en commandite Stationnement de Montreal*, a private enterprise regulating parking operations in Montreal, was created to execute this project in collaboration with *Regroupement des Corporations de développement économique et communautaire* [Community economic development corporation] (CDEC).

In May 2009, the Stationnement de Montreal launched BIXI – North America’s first PBS program with a fleet of 3000 bicycles supported by 300 stations. By 2013, the bicycle fleet has increased to about 5120 bicycles with 411 docking stations. The success and popularity of the BIXI can be measured by the fact that between its launch in 2009 and the date of this review in 2014, almost 30 new PBS systems have emerged all over North America. Almost 10 of these systems, as well as the Barclays Cycle Hire in London and another in Melbourne, use the BIXI bicycle system for their respective PBS systems.

A demonstration bike station installed in New York City before the launch of Citibike, showing the BIXI bikes being run by different PBS systems | Source: NYTimes http://www.nytimes.com/2011/09/15/nyregion/new-york-picks-alta-to-run-PBS-program.html?_r=0#

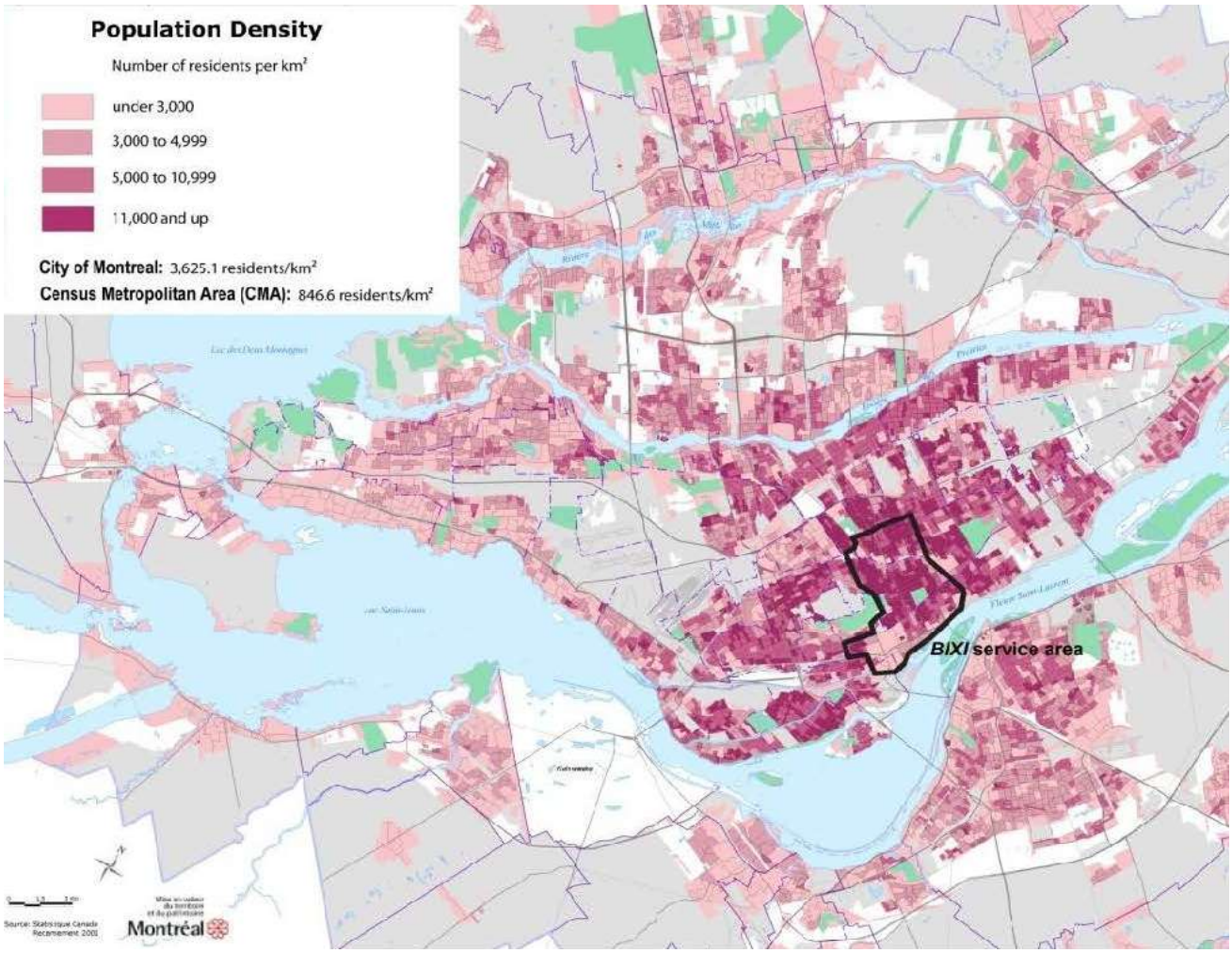
System Planning

Planning the Montreal PBS System included two steps. First, identifying the coverage area or service area; and second, designing the bicycle system including the bicycle, bicycle docks and pay stations.

Coverage Area

The Montreal BIXI has one the densest system coverage in North America. As per an official document released by PBSC, the system, comprising 411 stations covers an area of 82 sq km with an average distance of 300 m between stations.[33] Almost 19,643 trips are taken daily on the BIXI and the average trip distance is 1.9 m. Half of all daily trips are generated by 25% of the stations within the service area.[34]

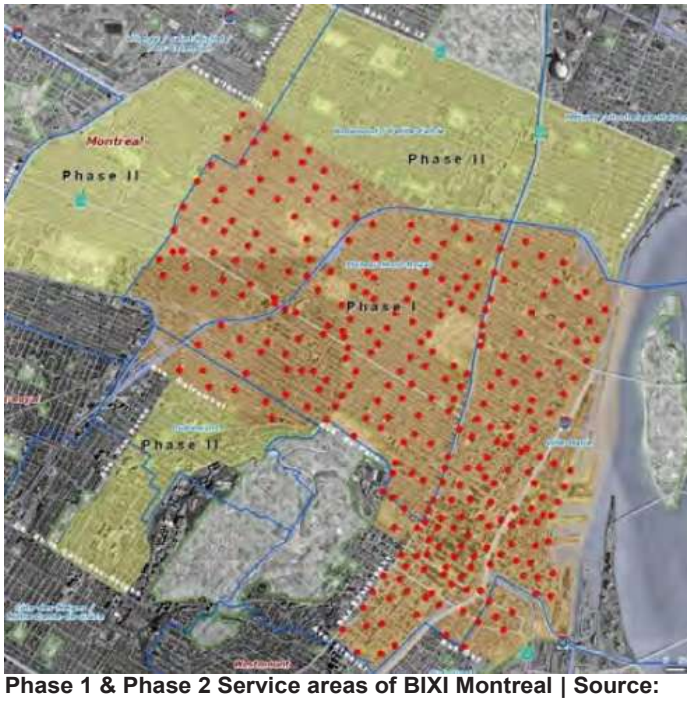
The parameters used for selecting the BIXI service area in Montreal primarily included population density, prevalence of good bicycle facilities, potential for transit inter modality and existing levels of bicycle use. BIXI’s coverage area overlaid on a distribution of population densities in the metropolitan area.



BIXI's service area and distribution of population densities in the Montreal Metropolitan Area | Source: Canada Bike sharing Guide, Transport Canada 2009

The initial (Phase I) service area for Montreal's BIXI included some of the city's densest boroughs, namely Plateau–Mont-Royal with over 13,000 inhabitants/sq km and Rosemont–Petite-Patrie with over 9,000 inhabitants/sq km. These areas also had the highest bicycle use. In Plateau-Mont-Royal, for example, 7% of all trips were on bicycle, and the bicycle mode share went up to 12% in the summers.[35]

In Phase II, which was introduced in April 2010, BIXI stations were provided in the central Ville-Marie which contains the metropolitan CBD. The central Ville-Marie has a population density much lower than the city's average population density. However, being an employment centre, it has a high density of workplaces with over 22,400 jobs per sq km. The BIXI, in this district, serves a crucial function of providing first/last mile connectivity to the work place.



Phase 1 & Phase 2 Service areas of BIXI Montreal | Source: Canada Bike sharing Guide, Transport Canada 2009

Identifying station locations in the coverage area was done after extensive research, pilots and mobility studies. The considerations used for selecting station locations included points of interest or activities such as universities and tourist destinations, presence of other transit stations, presence of good quality cycling infrastructure and existing travel patterns derived from mobility studies. shows the current distribution of station locations in Montreal.

Plan + Design

The Montreal BIXI's bicycle system was designed to be an automated modular system, and comprised of uniquely designed bicycles and portable modular bicycle stations. The main module of the bicycle station incorporated multiple bicycle docks and a pay station powered by solar panels. The modular bicycle station modules can be installed, expanded, configured and dismantled in less than 30 minutes, under the monitoring of a real-time management system. The installation requires minimal site preparation, keeping marginal expenditures very low. Having developed their own design for the bicycle system, the Montreal BIXI held patents for the following:

- Bicycle design;
- Modular technical platforms; and
- Solar powered operating system.
- Anti-theft locking mechanisms.

A BIXI Bicycle locked into a bicycle dock | Source: press release on official website of BIXI https://bixi.com/about-bixi/news/2011/Avril/de-bonnes-nouvelles-et-plusieurs-nouveaut%C3%A9s-pour-la-saison

The Cycle

Stationnement De Montreal worked in collaboration with renowned industrial designer, Michel Dallaire, to create a unique cycle design. Their production was outsourced to Cycle de Vinci, which sourced its raw materials from three different suppliers.

Bicycles are designed to appear unisex and to drive and serve as utility bicycles with rack and basket. The cycle also incorporates internal hub gears. For user comfort, features like seat adjustability and a lower

centre of gravity (for greater stability) have been incorporated. The unique bicycle design makes it easily identifiable and difficult to disassemble, thus discouraging thefts.

***Durability*:** The light, strong and durable aluminium frame and the one-piece handle bar cover and protect the concealed cables from vandalism and unsuited weather conditions. The cycle weighs about 18 kgs

Tyres are designed to be puncture resistant, filled with nitrogen to maintain adequate pressure for relatively longer periods. The bicycle is fit with an active front and back LED lighting feature that is perpetually on when the cycle is in use

Safety features: A chain protector is integrated into the design of the cycles, which not only protects the chain itself, but also protects the user's clothes from getting caught in the chain, protects riders from dirt grease and debris associated with the chain and strengthens the structural framework.

The cycle also includes front and rear internal brakes to prevent skidding.

The BIXI bicycle system | Source: {{own}} |Date=2010-04-28 |Author= Yanik Crépeau |Permission= |other_versions= }} Category:Bixi (Montreal)

Stations

The portable modular station was innovated by the BIXI. Station modules are rectangular platforms with bicycle stands and locking stations mounted on top. There exist two types of station modules. The main module includes a service terminal, or pay station, in addition to three bicycle docks. Secondary modules substitute the service terminal with an additional bicycle dock. Thus the size of each modular rectangular platform remains the same. A station location requires having at least one main module installed with any

BIXI Service Terminal | Source: http://www.ycif.org/upload/docs/events/PUBLIC_BIKE_SYSTEM_COMPANY__-_V2.pdf

ITS Integration

The integrated software for the system was designed by 8D Technology based on the design of the existing Pay and Go parking system in Montreal.

The system uses wireless Radio Frequency Identification (RFID) for wireless real-time connection payment. The RFID communication network also enables obtaining real-time information on the following:[37]

- The number of empty docks and bicycles at a given station. This information, when disseminated to users through applications like Spotcycle, helps locate the best station locations to drop off or pick up cycles;
- The status of all bicycle system components, including the cycles, docks, solar panels and other electronic components;
- Usage patterns of bicycles and bicycle stations. It allows system managers to pre-schedule bicycle redistribution; and
- Information about undocked bicycles, including the bicycle IDs, location of undocking, and information on the user who undocked the bicycle. This feature enables the system to track down the user in case of theft or misplaced cycles.

User Conditions and Fees

Two kinds of user conditions are available with the BIXI system. A user can either be a member, having purchased a short or long term subscription; or a casual user, having paid a security deposit for short term system use. Members can obtain subscriptions online, after which they are provided with a BIXI key allowing hassle-free unlocking directly at the bicycle docks. Three types of memberships are available, with the following membership fees (2013 rates):

number of secondary modules. Two solar panels are attached to the service terminal, and all the docks incorporate wireless communication infrastructure. As such, these self-powered station modules require no wiring or site preparation. They can be simply placed at the identified locations (see).

Following is a list of the advantages of the portable modular system, particularly in the context of Montreal:[36]

- Easy installation and removal saves time and labour, making it cost efficient;
- The distribution of docks can be altered based on demand, allowing system optimization at minimal cost;
- Temporary installations are possible, either for pilot projects, or for special occasions; and
- Stations can be removed during winter months to make space for snow accumulation.

A BIXI station module being installed| Source: Canada Bike sharing Guide 2009

From a user point of view, the automated bicycle docks improve use efficiency. Each dock incorporates a key reader, so that a user can bypass the service terminal and come straight to the bicycle dock to rent a bicycle. A user has to wave his key over the key reader or enter a pin code provided by the service terminal. This automatically unlocks the bicycle. The user can remove the bicycle and be on his or her way. While returning the bicycle, the user simply has to insert the bicycle into a dock, wait to hear a “clicking” sound that confirms it is locked, and then walk away. This reduces the transition time, saving a user’s travel time. The bicycles and docks are equipped with a unique anti-theft locking mechanism.

System’s maintenance and repairs are simplified by the modular nature of the bicycle system. One such module within the docking station contains in itself the locking controls for the bikes and other essential components for the functioning of the system. Thus in case of repairs, the module to be repaired can be replaced by an identical one to save on time elapsed. The locking system is based on a high tech energy efficient actuator used in the medical sector.

Service Terminal powered by solar panels | Source: IBI

Service terminals installed into the modular station are operated by a touch screen. Each service terminal also includes a key reader, which allows users to review account details and usage charges. A card slot for payment accepts credit and debit cards. A card dispenser dispenses temporary use cards/passes for short-terms users. A button is installed on to the service terminal to notify the maintenance team of any defect/ damage.

Period of Subscription	Annual	Monthly (30 Days)	Occasional (24 Hours)
Rates	$ 82.50	$ 31.25	$ 5.00

Members are eligible for the following use rates (2013 rates):

Duration	0 - 45 min	46 – 60 min	61 – 90 min	+ 30 min
Rates	0	$1.75	$3.50	$7.00

Casual users have to register at the service terminal, where they have to pay the security deposit and access fee via a credit card. The security deposit amount of $250 is placed on the credit card for a period of 10 days. Two types of accesses are possible (2013 rates):

Period of Access	72 hour	24 hour
Rates	$ 15	$ 7

Casual users are eligible for the following use rates (2013 rates):

Duration	0 - 30 min	31 – 60 min	61 – 90 min	+ 30 min
Rates	0	$1.75	$3.50	$7.00

Credit card payment is essential to maintain user accounts of casual users. Each credit card is allowed to purchase a maximum of two accesses at a time. On successful registration, the user is provided with an unlocking code that is to be inserted at the bicycle dock before the bicycle is unlocked.

The system encourages users to take multiple rides in the day, for free, as long as they dock the cycles every 30 - 45 mins depending on user type. Bicycle stations in Montreal are located every 300 m, which makes this an easy condition to follow. Such a condition helps to keep bicycle in circulation at all times. However, the need to dock cycles every half an hour may seem cumbersome to tourists, who are not familiar with Montreal.

Integration with Public Transportation – OPUS and BIXI

STM, Montreal's public transit system is working towards generating a more responsible and integrated mode of transportation for the city. There have been efforts in the direction of partnering with local active modes of transportation in the city, such as BIXI and carpooling system.

Commuters are provided with lucrative offers such as on annual subscription to Opus & BIXI, one is discounted $ 60. Other offers exist as well where one can pay a monthly fare for the OPUS card and receive a 50% off on the BIXI monthly fare. Another offer incorporates the bus service, carpooling services and an integration of the BIXI.

According to a latest report from American Public Transportation Association (APTA), by skipping the use of private cars and using public transportation, one could save up to US$ 832 a month, and US$ 9,986 annually, assuming about 20,000 km driven annually, an average mileage of 10 km per litre (21 miles per gallon), maintenance charges, parking taxes and licence registration charges.

On the other hand, if the PBS system is used as a first mile and last mile connectivity to transit, one would have to spend just $ 90 monthly – the monthly fare for an Opus pass (bus & metro) is $ 78 and the monthly pass for BIXI is $ 31. With the STM scheme put in place, BIXI would offer a discount of $ 15 to connect the user to the transit system, therefore amounting to a total monthly expenditure of $ 90 on commuting. For students and senior citizens the offer is much more attractive as the combined monthly fare works out to be $ 48, which as a comparison, is only a quarter of monthly car parking fares. It is no surprise, therefore, that after the implementation of BIXI, Montreal saw an increase of 16% in the daily usage of public transportation.

Finance

BIXI was initially planned to run without any public funding. The City of Montreal provided an initial capital investment of $15 million, which was to be used for product development, initial implementation and marketing. Thereafter the system was to be sustained on the revenues earned from user fees, corporate sponsorships and advertising licenses.

The Stationnement de Montreal, a city-owned quasi-public agency responsible for parking management in Montreal, was selected to execute and operate BIXI as a self-financing system. A sponsorship deal was worked with Rio Tinto Alcan, who provided the aluminium for the cycles, as well as provided funding for BIXI operations. Another partnership with a media agency, Astral Media Outdoor, enabled generation of revenue through sale of advertising rights. The City of Montreal has assumed financial risk, such that profits generated by the system would also accrue to the city.[38] Operating costs for the full program was estimated to be approximately $1,200/bicycle/year for the duration of the 10 year contract.

As the BIXI bicycle system gained popularity in 2011, the Stationnement de Montreal created the Public PBS Company (PBSC) to implement, operate, manage, develop, and commercially exploit the innovative design of the Montreal BIXI. At present, PBSC, also owned by the city of Montreal, provides public bike system solutions, a.k.a. the BIXI, to a number of cities across the globe. The table below shows the information related to the Revenue Model for Montreal BIXI system.

Summary table for Revenue System

Component	Montreal, CANADA - BIXI	
	Applicability	**Present Status**
User Fee	●	• The first half hour-free; • The second half hour -C$1.75; • The third half hour - an additional C$3.50 • Each half hour afterwards - an additional C$7.00.
Membership fee	●	CDN$5 for a day, CDN$31 for a month, CDN$82 for the whole season
Advertisement fee	●	NI
Sponsorship	●	Rio Tinto Alcan; Astral Media Outdoor (AMO).
Retail revenue	⊙	No Retail Revenue
Subsidy from Government	●	City of Montreal initially funded $15 million at the start.
Parking Revenue	⊙	No Parking Revenue
Operator & Ownership	All the revenue is earned by Public Bike Sharing Company (PBCS)-public owned agency.	
● **(Yes)** ⊙ **(No)**		

Financial Turmoil

Montreal's BIXI system business model has notoriously proven to be financially unsustainable. Since its launch, the BIXI has never made a profit. In 2011, the city of Montreal bailed out BIXI with a $108 million package, including $37 million loan to cover BIXI's deficit, and $71 million in loan guarantees to spend on its export enterprise.[39]

According to recent estimates, the PBSC is $42 million in debt, including a $6.5 million deficit and $5 million in outstanding payments[40]. There is uncertainty over the PBSC's ability to continue operations in Montreal, and its effects are being felt in other cities which have purchased BIXI systems from PBSC or have PBSC operated BIXI systems. Vancouver, where a BIXI system was planned for implementation

early 2014, may have to cancel their plans altogether.

Many believe BIXI's failure is because it wasn't considered a public transport system from the beginning, which would have ensured financial guarantee for its operations through public subsidies. The overreliance on sponsorship and user generated revenues has meant the undoing of BIXI. By contrast, New York's Citi Bike system, which also uses the BIXI bicycle system, has been launched and implemented without any public expenditure, solely relying on sponsorship money. However, whether this trend will continue in New York, as the planned expansion of the system is implemented, is to be seen. A bicycle advocacy group, Transportation Alternatives, conducted a survey recently of 1500 Citi Bike users. 91% of these users professed support for utilizing tax money to subsidise the expansion of the system, if required.

In a similar vein, many are hoping that the PBSC can restructure itself in time, and adopt a more sustainable financial model, before it is forced to shut down one of the foremost PBS systems in North America.

Implementation

The Montreal BIXI was part of the transportation plan for the City, which aimed at encouraging active transportation. The program is executed by the city's parking authority, Stationnement de Montréal. BIXI operates for less than two thirds of the year, shutting down service for 4 - 5 months during winter. Being a modular system, installation, operation and maintenance are all functions of the BIXI system, discussed in the first half of the case study. Before shutting down for winter, the modular docking station platforms are simply carried away and stored in a protected area. When it is time to open again in the spring, the platforms are re-installed in the same or modified locations. The real-time monitoring capabilities of the BIXI design help keep tab on the status of all the attached hardware. Users are expected to alert the maintenance team about bicycle failures by pressing the red "fault" button on the bicycle docks where they lock the dysfunctional cycle. These alerts are immediately transmitted to the data centre and maintenance personnel are dispatched to collect the respective station modules or bicycles and replace them with functional hardware. Minor repairs may also be completed on site.

Regular maintenance checks are also conducted, where maintenance staffs visit station locations at pre-assigned times for regular checks.

Besides a data centre, the BIXI back office also includes a call centre, subscriber management, automated call routing and information management cells.

Redistribution System

Redistribution is facilitated through real-time information of bicycle and station status. Redistribution trucks carry cycles from crowded bicycle station location to empty ones. This is an essential activity, especially to maintain availability of bicycles at busy destinations during peak hours.

Marketing and Promotion

BIXI's marketing strategy has been quite strategic in terms of attracting users, creating a brand identity, crafting an image and securing the people's appeal.

Pre-launch promotional campaigns were introduced to the city before the system launch to gain the interest of the citizens by the following methods:

- Online contest to find an appropriate name for the new PBS system;
- Demonstrating the functioning of the system on the streets of Montreal with the help of animators;
- The "Founding members Campaign" invited people to subscribe early and become the founding members of BIXI. The first 2000 members would be offered a variety of exciting prizes and 'exclusive privileges';
- Mayor inaugural ride on the system official christening of the system as BIXI. With the perceived support from the city authorities, the system got more grounds to be a reliable system for the people; and

- A public tribute to the bike system was marked by the "BIXI Anthem" created by a rap group in Montreal in 2010, which was widely acclaimed by the people.

Adding to its quick popularity, BIXI was awarded the 2010 GOOD DESIGN Awards and ranked 19th in Time Magazine's 50 Best Inventions of 2008. These accreditations put BIXI as a brand image on a global front.

Benefits and Challenges

BIXI bike sharing encouraged the people to shift from personal cars to BIXI. Despite of the rigorous efforts by Montreal to spread awareness of the system in different directions, the system faced some unforeseeable challenges.

Benefits

It has been estimated that over 11% of people living in Montreal had used the system at least once by the end of 2010. The following table shows that a majority of the BIXI users shifted from public transport. The rate at which people moved from other modes including private cars and taxis was much slower. But the encouraging news is that there were more people shifting from personal cars to BIXI in 2010 compared to 2009. Based on the figures below, the author estimates that even a 10% modal shift from motor vehicles to BIXI would result in 1964 fewer automobile trips per day.[41]

Modal Shift Prevalence of People Using PBSP

Estimated Modal Shift	2009	2010
From Personal Bicycle	23.61%	21.75%
From Walking	18.04%	21.41%
From Public Transit	50.43%	40.91%
From Taxi	--	5.80%
From Motor Vehicle	7.92%	10.13%
PBSP Users	8.10%	11.01%

Source: Fuller et al. International Journal of Behavioural Nutrition and Physical Activity 2013 10:66 doi:10.1186/1479-5868-10-66

Challenges Faced

The following challenges were faced by Montreal to run BIXI:

- **Theft and Vandalism**

Within 2 months of its launch in 2009, an average of one in every five bikes was reported damaged, and 15% of the bike racks were found to be defective. Like every other city, Montreal's PBS system too, could not escape vandalism. After the initial damages, Stationnement de Montreal resorted to testing its prototype designs and reinforced the racks. Radio Frequency Identification (RFID) technology allows the tracking of users thereby reducing chances of theft.

- **Functional for only half a year**

Canada experiences long, cold winters with temperatures below -10-15 ºC. Because of this, the BIXI system shuts down, thus losing out on the potential to generate revenues for 5-6 months.

- **The Uphill Slope**

The BIXI network of stations and service areas includes the plateau as well. People generally would prefer to pick up a cycle to go downtown than to cycle uphill. This behavioural pattern leaves plateau stations empty and docks in the downtown area filled during peak hours. The lack of availability results in fewer plateau residents using the system during off peak hours. Redistribution of cycles therefore needs to be performed at a higher frequency.

- **IT system defects**

A common complaint from many users is that the sleek IT driven user interface breaks down often, providing incorrect information on the availability of stations and cycles. Absence of staff at stations results in more delays and time wastage for users. Overall the reliability of the system has decreased.

- **Financial Woes**

Speculations are running high on the final outcome of this unusual combination of financial, legal dismay and a project that is successfully turning the masses towards active and public transportation not just in Montreal, but other cities across the world.

It is speculated that BIXI may be bought by Serco, a British company that runs London's bike share, or taken up by the Montreal Transit Authority.

Lessons Learned for Indian Context

Following is a list of lessons learned from the BIXI experiment:

- The BIXI is an excellent demonstration of the potential of a good modular design. The flexibility of the modular design has helped the Montreal BIXI adapt to changing needs, be they seasonal or developmental. The ease of installing or moving station platforms saves money on marginal costs during expansion;
- The coverage of the scheme and station locations is optimally placed to cover a majority of the origin-destinations. This has resulted in fine-grained high density station coverage in the city centre. Bicycle and empty docks availability when and where needed plays a big role in the popularity of the system;
- A number of complaints in Montreal deal with the condition of cycling paths, which acts as a detractor to use of the BIXI. The maintenance and upkeep of cycling infrastructure is extremely important maintain interest in cycling in general and the PBS system in particular;
- An important lesson learned from the Montreal BIXI case study is the importance of a robust business model. Instead of being considered a private system, it should be considered a public transportation system for the benefit of the masses, thus being eligible for government subsidies; and
- The marketing strategy of involving the community in naming the system was successful in creating ownership as well as creating awareness.

Summary of Indian case study based on system design, revenue generation and business models

CITY	SYSTEM NAME	SYSTEM DESIGN						REVENUE GENERATION				IMPLEMENTING AGENCY	
		Contextual docking station location	Automated system	ITS integration	Coverage area	Multi-modal Integration	System Time	Advertisement	User fees	Private investment	Government subsidies	Oversight Agency	O & M
London, UK	Barclay	✓	✓	✓	65 sq.km		24 hrs	✓	✓	✓	✓	Government	Private
Lyon, France	Velo'v	✓	✓	✓	63 sq.km	✓	24 hrs	✓	✓	✓	✓	Government	Private
Montreal, Canada	Bixi	✓	✓	✓	82 sq.km	✓	24 hrs	✓	✓	✓	✓	Government	Government
Mexico City, Mexico	EcoBici	✓	✓	✓	NA		6:00 to 00:30	✓	✓	✓	✓	Government	Private
Changwon, South Korea	Nubija		✓	✓	NA		24 hrs	✓	✓	✓	✓	Government	Government

Summary of International Public Bike Sharing Schemes

The information for the case studies are categorized based on: coverage area, fleet size and trip generated:

PUBLIC BIKE SHARING SCHEMES BASED ON COVERAGE AREA

Sl. No.	City / Country		System Name	Launch Year	Population			
					Total Population (Million)	Total Area Of The City (Sq. Km)	Coverage Area (Sq. Km)	Total Population Density (Sq. Km)
1	Melbourne	Australia	Melbourne Bicycle Share	2010	1.3	451	16	2894
2	Vienna	Austria	Citybicycle Wien	2003	1.07	415	31.6	423
3	Brussels	Belgium	Villo	2009	1.1	161	84.4	6832
4	Belfort	California	Optymo	2013	0.05	17	-	2932
5	Montreal	Canada	Bixi	2009	1	432	90	3823
6	Laval	Canada	Vélitul	2010	0.05	34	_	1486
7	Budapest	China	Bubi	2014	1.7	525	20.4	3238
8	Chicago	China	Divvy	2013	2.7	606	84.4	4455
9	Guangzhou	China	Guangzhou Bicycle Sharing	2010	8.5	3843	263	2218
10	Hangzhou	China	Hangzhou Public Bicycle	2008	2.4	16847	125	1214
11	Aspen	Colorado	We-cycle	2013	0.006	9	-	740
12	Denver	Colorado	B Cycles	-	-	-	-	-
13	Copenhagen	Denmark	Bycyklen	1995	0.6	77	17	7383
14	Aalborg	Denmark	City Bicycle	2009	-	-	-	-
15	London	England	Barclay Bicycle Hire	2010	8.3	1572	65 / to be extended up to 103	5281
16	Broward County	florida	Broward Bcycle	2011	0.18	3		536575
17	Lyon	France	Vélo'v	2005	0.04	45	60	10079
18	Paris	France	Vélib'	2007	2.9	135	113	21197
19	Rennes	France	Le Vélo STAR since 2009	2009	0.04	704	34	588
20	Amiens	France	Vélam	2008	1.07	-	-	-
21	Avignon	France	Vélopop'	2009	0.09	65	-	1392
22	Besançon	France	Vélocité	2007	0.12	65	-	1845
23	Bordeaux	France	VéloCub	2010	0.07	529	-	1374
24	Caen	France	Véol	2008	0.01	26	-	4233
25	Calais	France	Vél'in	2010	0.07	34	-	2386
26	Cergy-Pontoise,	France	VélO2	2009	0.019	87	-	2267
27	Créteil	France	Cristolib	2010	0.09	11	-	7920

Sl. No.	City / Country		System Name	Launch Year	Population			
					Total Population (Million)	Total Area Of The City (Sq. Km)	Coverage Area (Sq. Km)	Total Population Density (Sq. Km)
28	Dijon	France	Vélodi	2008	0.015	40	-	3753
29	Dunkerque	France	Dk'vélo	2013	0.09	44	-	2082
30	Grenoble	France	Métro Vélo Box	2010	0.04	541	-	808
31	La Rochelle	France	Yélo	2009	0.07	28	-	2634
32	Lille	France	V'Lille	2011	1.1	40	-	29230
49	Lorient	France	VéLO	2012	0.06	17	-	3284
50	Marseille	France	Le Vélo	2007	0.085	241	-	3535
51	Montpellier	France	Vélomagg'	2007	0.04	434	-	976
52	Mulhouse	France	Vélocité	2007	0.1	22	-	5085
53	Nancy	France	VélOstan'lib	2008	-	-	-	-
54	Nantes	France	Bicloo	2008	0.028	65	-	4416
55	Nice	France	Vélo Bleu	2009	0.034	72	-	4784
56	Pau	France	IDEcycle	2010	0.07	32	-	2533
57	Perpignan	France	BIP	2008	0.01	68	-	1737
58	Rouen	France	Cy'clic	2007	0.01	21	-	5218
59	Saint-Etienne	France	Vélivert	-	0.017	80	-	2126
60	Toulouse	France	Vélôtoulouse	2007	0.04	118	-	3781
61	Vannes	France	Vélocéa	2009	0.05	32	-	1634
62	Velenje	France	System Bicy	2012	0.03		-	
63	Berlin	Germany	Next bike since 2009	2011	3.5	892	19.85	3926
64	Hamburg	Germany	StadtRAD Hamburg	2009	1.7	755	-	2252
65	Karlsruhe	Germany	Call a bicycle Karlsruhe bis 2014, then Nextbicycle	2007	0.03	-	-	-
66	Luxembourg	Germany	Vél'oh!	-	-	-	-	-
67	Munich	Germany	Nextbicycle	2011	1.3	310	-	4194
68	Strasbourg, Germany	Germany	Vél'hop	2010	0.3	78	-	3489
69	Astana	Kazakh-stan	Astana Bicycle	2014			13.5	
70	Minneapolis	Minnesota	Nice ride	2010	0.04	151	91	2534
71	Charlotte	North Carolina	Charlotte Bcycle	-	0.07	771	-	1028
72	Oslo	Norway		_	-	-	-	-
73	Columbus, Ohio	Ohio	CoGo	2013	-	-	-	-
74	Warsaw	Poland	Veturilo	2012	1.7	517	-	3306
75	Ljubljana	Slovenia	Bicike(LJ)	2011	-	-	-	-
76	Barcelona, Spain	Spain	Bicing	2005	1.6	102	43.59	15892

Sl. No.	City / Country		System Name	Launch Year	Population			
					Total Population (Million)	Total Area Of The City (Sq. Km)	Coverage Area (Sq. Km)	Total Population Density (Sq. Km)
77	Boston	Massachu-setts	Hubway	2011	0.06	232	39	2783
78	Chattanooga	Tennessee	Bicycle Chattanooga	-	0.17	380	-	448
79	Austin	Texas		-	0.08	704	-	1258
80	Fort Worth	Texas	Fort Worth Bicycle Sharing	2013	0.7	904	-	877
81	Mexico	USA	EcoBici	2010	8.8	1485	19	5960
82	New York	USA	CitiBicycle	2013	19.6	1214	32	16187
83	Washington	USA	Capital bicycleshare	2010	0.06	177	70	3652
84	Orléans	USA	Vélo	2007	0.1	45	-	3170

PUBLIC BIKE SHARING SCHEMES BASED ON FLEET SIZE & STATIONS

Sl. No.	City	Country	System Name	Fleet Size				Stations			
				Total No. Of Bicycles	Bicycles Per 1000 Population	Bicycles Per 1000 Population (Itdp Planning Guide)	Average Bicycles Per Station	No. of Stations	Total No.of Docks	Avg. No.of Docks Per Station	Docks Per Cycle
1	Melbourne	Australia	Bicing	6,000	9	4	14	420	10,053	24	2
2	Vienna	Austria	StadtRAD Berlin	1,600	1		11	150		0	0
3	Brussels	Belgium	Hubway	1,300	12	6	9	140	2,357	17	2
4	Belfort	California	Villo!	3,625	6	3	11	329	7,837	24	2
5	Laval	Canada	Bubi	1,100	17		15	76	1,518	20	1
6	Montreal	Canada	Divvy	3,000	8	17	10	300	5,232	17	2
7	Guang-zhou,	China	Bycyklen	1,000	8	-	50	20		0	0
8	Hangzhou,	China	Guangzhou bicyclesharing	5,000	9	-	44	113	2,298	20	1
9	Aspen	Colorado	Hangzhou Public Bicycle	80,000	527	0	27	3,000	-	-	-
10	Denver	Colorado	Barclay Bicycle Hire	10,000	1	1	14	730	19,505	27	2
11	Aalborg	Denmark	Vélov'	4,000	7	9	12	345	6,684	19	2
12	Copenha-gen	Denmark	Melbourne Bicycle Share	540	12	1	11	51	871	17	2
13	London	England	EcoBici	3,600	32	4	13	275	7,347	27	2
14	Broward County	Florida	Nice ride	1,550	7	81	9	174	2,934	17	2
15	Amiens	France	Bixi	5,200	15	227	11	460	9,276	20	2
16	Avignon	France	CitiBicycle	6,000	12	10	18	332	11,192	34	2
17	Besançon	France	Vélib'	20,000	8		11	1,800	38,754	22	2
18	Bordeaux	France	Le Vélo STAR since 2009	900	45	2	11	84	1,709	20	2
19	Caen	France	Citybicycle Wien	1,400	105	-	12	116	2,750	24	2
20	Cergy-Pontoise	France	Capital bicycleshare	1,800	7	84	9	200	5,474	27	3
21	Créteil	France	City Bicycle	200	-	-	10	21		0	0
22	Dijon	France	Vélam	313	2	-	12	26	501	19	2
23	Dunkerque	France	We-cycle	100	15	-	8	13	-	0	0
24	Grenoble	France	Astana Bicycle	200	-	-	5	40	-	0	0

Sl. No.	City	Country	System Name	Fleet Size				Stations			
				Total No. Of Bicycles	Bicycles Per 1000 Population	Bicycles Per 1000 Population (itdp Planning Guide)	Average Bicycles Per Station	No. of Stations	Total No.of Docks	Avg. No.of Docks Per Station	Docks Per Cycle
25	La Rochelle	France		100	0	-	7	14	-	0	0
26	Lille	France	Vélopop'	200	2	-	11	18	408	23	2
27	Lorient	France	Optymo	221	4	-	8	27	520	19	2
28	Lyon	France	Vélocité	200	2	-	7	30	395	13	2
29	Marseille	France	VéloCub	1,700	2	-	11	153	2,797	18	2
30	Montpellier	France	Broward Bcycle	275	0	-	12	24	276	12	1
31	Mulhouse	France	Véol	350	3	-	9	40	_	0	0
32	Nancy	France	Vél'in	260	3	-	7	38	534	14	2
33	Nantes	France	VélO2	360	2	-	9	42	889	21	3
34	Nice	France	Charlotte Bcycle	200	0	-	8	24	330	14	2
35	Paris	France	Bicycle Chattanoo-ga	300	2	-	9	33	547	17	2
36	Pau	France	CoGo	300	-	-	10	30	446	15	2
37	Perpignan	France	Cristolib	130	1	-	13	10	250	25	2
38	Rennes	France	B Cycles	700	-	22	8	84	1,258	15	2
39	Rouen	France	Vélodi	400	3	-	10	40	841	21	2
40	Saint-Etienne	France	Dk'vélo	280	3	-	9	30		0	0
41	Toulouse	France	Fort Worth Bicycle Sharing	300	0	-	9	35	465	13	2
42	Vannes	France	Métro Vélo Box	100	0	1 cycle for 130 to 150 resi-dents	6	18	144	8	1
43	Berlin	Germany	StadtRAD Hamburg	1,650	1	-	13	129	2,709	21	2
44	Hamburg	Germany	Call a bicycle Karlsruhe bis 2014, then Nextbicycle	350	1	-	70	5	-	0	0
45	Karlsruhe	Germany	Yélo	300	4	-	6	54	-	0	0

Sl. No.	City	Country	System Name	Fleet Size				Stations			
				Total No. Of Bicycles	Bicycles Per 1000 Population	Bicycles Per 1000 Population (Itdp Planning Guide)	Average Bicycles Per Station	No. of Stations	Total No.of Docks	Avg. No.of Docks Per Station	Docks Per Cycle
46	Luxem-bourg	Germany	Vélitul	100	2	-	11	9	-	0	0
47	Munich	Germany	V'Lille	2,100	2	-	10	211	4,196	20	2
48	Strasbourg	Germany	Bicike(LJ)	300	-	-	8	36	706	20	2
49	Budapest	Hungary	VéLO	200	4	-	20	10	-	0	0
50	Chicago	Illinois	Vél'oh!	700	-	-	10	70	1,327	19	2
51	Astana	Khazak-stan	Le Vélo	1,000	1	Less than 1 cycle for 800 res-idents	8	120	1,627	14	2
52	Boston	Massachu-setts	Vélomagg'	300	1	-	6	51	624	12	2
53	Minneap-olis	Minnesota	Vélocité	680	6	-	17	39	598	15	1
54	Charlotte	North Car-olina	Nextbicycle	300	0	-	10	30	-	0	0
55	Oslo	Norway	VélOstan'lib	250	_	-	9	29	561	19	2
56	Columbus	Ohio	Bicloo	950	3	-	9	103	1,843	18	2
57	Warsaw	Poland	Vélo Bleu	1,750	5	-	10	175	2,734	16	2
58	Ljubljana	Slovenia	Vélo+	350	2	-	11	33		0	0
59	Velenje	Slovenia	-	700	-	-	7	99	1,477	15	2
60	Barcelona	Spain	IDEcycle	200	3	-	10	20		0	0
61	Chattanoo-ga	Tennessee	BIP	150	1	-	10	15		0	0
62	Austin	Texas	Cy'clic	250	2	-	12	21	416	20	2
63	Fort Worth	Texas	Vélivert	300	2	Less than 1 cycle for 800 res-idents	9	34	655	19	2
64	Mexic	USA	Vél'hop	1,100	4	-	55	20	505	25	1
65	New York	USA	Vélôtoulouse	2,600	6	-	9	283	5,453	19	2
66	Orléans	USA	Vélocéa	174	3	-	7	25	321	13	2
67	Washing-ton	USA	System Bicy	25	1	-	5	5	40	8	2
68	Calais	France	Veturilo	1,120	1	-	20	57	19	0	0

PUBLIC BIKE SHARING SCHEMES BASED ON TRIPS GENERATED

Sl. No.	City	Country	System Name	Trips					
				Total Trips Per Day	Total Trips Per Bicycle Per Day	Average Trip Length / Day / Bicycle	Trips/ 1000 Residents	Trips/ Million Residents	Trips Per Year
1	Melbourne	Australia	Bicing	47,000	8	average trip is 15 minutes duration and 3 km long	29	29,375	14,439,902 (2011) ; 40,000 daily journeys in 2012, 11,000,000 trips per year
2	Brussels	Belgium	Hubway	1,835	1	-	3	1,147	617,388 rides in 2011 & 2012. , average of 308,694 per year
3	Belfort	California	Villo!			-		-	1,412,000
4	Laval	Canada	Bubi	2,352	2	-	1	1,470	average of 858,694 per year (1,717,389 trips from the beginning to 31, december, 2013)
5	Montreal	Canada	Divvy	6,400	2	-	2	4,000	2300000 (between june 2013 and july 2014)
6	Guangzhou	China	Bycyklen			-		-	-
7	Hangzhou	China	Guangzhou Bicycle-Sharing	20,000	4	-	2	12,500	-
8	Aspen	Colorado	Hangzhou Public Bicycle	325,000	4	average trip 23 minutes	133	203,125	-
9	Denver	Colorado	Barclay Bicycle Hire	29,900	3		4	18,688	-
10	Aalborg	Denmark	Vélov'	33,200	8	6 km	73	20,750	-
11	Copenhagen	Denmark	Melbourne Bicycle Share	433	1	2 km (within municipality)	0	271	-
12	Broward County	Florida	Nice ride	-	-	-	-	-	217,530 trips in 2011
13	Amiens	France	Bixi	21,000	4	6.7	13	13,125	
14	Avignon	France	CitiBicycle	40,000	7		2	25,000	
15	Besançon	France	Vélib'	110,000	6	45.2	38	68,750	35 millions in 2013
16	Bordeaux	France	Le Vélo STAR since 2009	2,147	2		5	1,342	

Sl. No.	City	Country	System Name	Trips					
				Total Trips Per Day	Total Trips Per Bicycle Per Day	Average Trip Length / Day / Bicycle	Trips/ 1000 Residents	Trips/ Million Residents	Trips Per Year
17	Caen, France	France	Citybicycle Wien	2,000	1		11	1,250	790,084 (2013) (http://www.academia.edu/7701280/Ten_years_of_bicycle-sharing_in_Vienna_-_An_exploration_into_subjective_user_choices)
18	Calais	France	Capital bicycleshare	-	-	4.6	-	-	1,103,598 trips in 2011
19	Lyon	France	VéloCub	-	-	-	-	-	2,2 millions
20	Nice	France	Bicycle Chattanooga	-	-	-	-	-	In its first six months of operation, the system has provided 12,600 rides. (average 25,200 trips in the first year) (http://www.bicyclechattanooga.com/blog/2014/04/10/chattanooga-bicycle-share-lessons-for-smaller-cities)
21	Perpignan	France	B Cycles	913	1	-	-	571	-
22	Toulouse, France	France	Métro Vélo Box	-	-	-	-	-	1,150,000 rental days in the year 2013 56,000 rides in 2010 (+44% from 2002 to 2010)
23	Vannes, France	France	StadtRAD Hamburg	3,560	2	-	-	2,225	1,300,000 in 2011
24	Oslo	Norway	Bicloo	1,600	2	-	6	1,000	-
25	Warsaw	Poland	Vélo+	-	2	-	-	-	141,000 trips in 2011
26	Ljubljana	Slovenia		-	-	285.7	-	-	-
27	Washington	USA	Veturilo	8,000	7	-	5	5,000	-

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- http://www.cityofboston.gov/bikes/share.asp
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APPENDIX C:

PBS SPECIFICATIONS

Components of PBS

The Public Bike Sharing Schemes typically comprise of the following components:

- Hardware- bicycles, docking station, terminals and control room
- Software- system access and user registration; and
- Redistribution mechanism

1 HARDWARE

BICYCLE

FRAME	
Velib	Made of aluminium; Weighs 22.5 kg; 3 gears
BIXI	Made of steel and aluminium; Weighs 20 kg; 3 gears
Barcelona	Made of steel and aluminium; Weighs 16.8 kg; 3 gears
Copenhagen	Made of steel and aluminium; Weighs 23 kg; 3 gears
Mexico	Made of steel and aluminium; Weighs 14.5 kg; 3 gears
PBSC	Made of aluminium; Weighs 20 kg; 3 gears
Cyclocity	Made of steel; Weighs 22.5 kg;
ATCAG, Bangalore	1 gear
Namma, Bangalore	1 gear
CHAIN BOX	
Velib	Chain not covered
BIXI	Chain box as well as hidden cabling to reduce the prospects of oil stains and vandalism
Barcelona	Not Present
Copenhagen	Chain not covered
Mexico	Chain not covered
PBSC	Covered to prevent rust and protect rider's clothing
Cyclocity	Chain not covered
ATCAG, Bangalore	No
Namma, Bangalore	No

BRAKES	
Velib	Hub Brakes Front and rear brakes built into the wheel hubs
BIXI	Rim Brakes not used, external wires absent. Hub Brakes can be seen
Barcelona	Gear hub with an internal brake incorporated, the front brake is a standard brake of the V-Brake variety.
Copenhagen	Front Disc Brake
Mexico	Internal front and rear brakes for greater safety
PBSC	Internal front and rear brakes for greater safety
Cyclocity	Hub brakes, allows progressive and effective braking even in wet weather
ATCAG, Bangalore	Caliper
Namma, Bangalore	Caliper
WHEEL AND TUBE	
Velib	26 inches; Super rear wheel chain guard to protect clothing
BIXI	Special puncture resistant, filled with nitrogen
Barcelona	The back wheel is of a similar size to a mountain bike and the front wheel is smaller, of a similar size to a foldable bike wheel.
Copenhagen	19 inch; Tires are puncture-proof – guaranteed for 15,000 km.
Mexico	-
PBSC	-
Cyclocity	26 inches
ATCAG, Bangalore	-
Namma, Bangalore	-

STAND	
Velib	Double Kickstand at the center
BIXI	Side stand
Barcelona	Side stand
Copenhagen	Double side kickstand
Mexico	Side stand
PBSC	-
Cyclocity	Double kick stand at centre
ATCAG, Bangalore	Side stand
Namma, Bangalore	Side stand
SAADLE	
Velib	Adjusting saddle height
BIXI	Adjusting saddle height
Barcelona	-
Copenhagen	The saddle is adjusted via gas pressure.
Mexico	Adjustable seat
PBSC	Adjustable seat
Cyclocity	Adjustable seat
ATCAG, Bangalore	No adjustable seat
Namma, Bangalore	No adjustable seat
SAFETY	
Velib	Anti-theft device with built-in key
BIXI	-
Barcelona	-
Copenhagen	Cables and light are built into the frame to prevent vandalism.
Mexico	cables and derailleur covered
PBSC	Anti-theft system
Cyclocity	Basket fitted with a lock which secures the bike during the short stops. The handlebars are fitted with non-slip grids to provide more stability
ATCAG, Bangalore	No locking system
Namma, Bangalore	locking system
Cyclocity	one-piece handlebar
ATCAG, Bangalore	No locking system
Namma, Bangalore	Locking system

HANDLE	
Velib	The handle has specific instructions about using the Bicycle. Wide handlebars for greater stability
BIXI	One-piece handlebar
Barcelona	Handlebars have a special shape which includes a bag carrier
Copenhagen	Handlebars have a special shape which includes a bag carrier
Mexico	Handlebars have a special shape which includes a bag carrier
PBSC	One-piece handlebar
Cyclocity	One-piece handlebar
ATCAG, Bangalore	Simple handlebar
Namma, Bangalore	Simple handlebar
LIGHTS	
Velib	The front and rear lights are always on when the bike is in motion, powered by a generator (“dynamo”) in the front hub
BIXI	The front and rear lights are always on when the bike is in motion, powered by a generator (“dynamo”) in the front hub
Barcelona	Red light at the back and white light in front, which both automatically switch on when it gets dark. The lights are charged up at the parking station.
Copenhagen	The bike has front and rear built-in LED lights.
Mexico	Rear and front lights
PBSC	The front and rear lights are always on when the bike is in motion, powered by a generator (“dynamo”) in the front hub
Cyclocity	The front and rear lights are always on when the bike is in motion, powered by a generator (“dynamo”) in the front hub
ATCAG, Bangalore	No
Namma, Bangalore	No

DOCK

Velib	Bollard style automated modular dock
BIXI	Bollard style automated modular dock
Barcelona	Beam style automated fixed dock
Copenhagen	Beam style automated fixed dock
Mexico	Bollard style automated modular dock
PBSC	Bollard style automated modular dock
Cyclocity	Bollard style automated fixed dock
ATCAG, Bangalore	Beam style automated fixed dock
Namma, Bangalore	Fixed docking rack

TERMINALS

Velib	Yes; station map, card reader, information and signage
BIXI	Yes; card reader, information and signage
Barcelona	Yes; station map, card reader, information and signage
Copenhagen	Yes; station map, card reader, information and signage
Mexico	Yes; station map, card reader, information and signage
PBSC	Yes; station map, card reader, information and signage, solar operated
Cyclocity	Yes; station map, card reader, information and signage
ATCAG, Bangalore	Yes; card reader
Namma, Bangalore	No

CONTROL CENTER

Velib	Yes
BIXI	Yes
Barcelona	Yes
Copenhagen	Yes
Mexico	Yes
PBSC	Yes
Cyclocity	Yes
ATCAG, Bangalore	Yes
Namma, Bangalore	No

2 SOFTWARE

SYSTEM ACCESS

REAL TIME STATION STATUS	
Velib	Yes
BIXI	Yes
Barcelona	Yes
Copenhagen	Yes
Mexico	Yes
PBSC	Yes
Cyclocity	Yes
ATCAG, Bangalore	No
Namma, Bangalore	Yes
MAP OF STATION LOCATION	
Velib	Yes
BIXI	Yes
Barcelona	Yes
Copenhagen	Yes
Mexico	Yes
PBSC	Yes
Cyclocity	Yes
ATCAG, Bangalore	No
Namma, Bangalore	Yes
SMART KEY	
Velib	
BIXI	
Barcelona	
Copenhagen	Yes
Mexico	Yes
PBSC	
Cyclocity	
ATCAG, Bangalore	Yes
Namma, Bangalore	No

AUTOMATED SYSTEM	
Velib	Yes
BIXI	Yes
Barcelona	Yes
Copenhagen	Yes
Mexico	Yes
PBSC	Yes
Cyclocity	Yes
ATCAG, Bangalore	Yes
Namma, Bangalore	Yes
TRACKING SYSTEM	
Velib	Yes
BIXI	Yes
Barcelona	Yes
Copenhagen	Yes
Mexico	Yes
PBSC	Yes
Cyclocity	Yes
ATCAG, Bangalore	Yes
Namma, Bangalore	Yes

ONLINE USER REGISTRATION

ONLINE USER REGISTERATION	
Velib	Yes
BIXI	Yes
Barcelona	Yes
Copenhagen	Yes
Mexico	Yes
PBSC	Yes
Cyclocity	Yes
ATCAG, Bangalore	Yes
Namma, Bangalore	Yes

3 REDISTIBUTION MECHANISM

Velib	Yes, Transporting Vehicle
BIXI	Yes, physically/ manually
Barcelona	Yes, Transporting Vehicle
Copenhagen	Yes
Mexico	Yes, Transporting Vehicle
PBSC	Yes, Transporting Vehicle
Cyclocity	-
ATCAG, Bangalore	Yes, physically/ manually
Namma, Bangalore	Yes, physically/ manually

APPENDIX D:

STAFF REQUIREMENT

Staff Requirement for PBS

The staff required to run the operation of PBS depends on:

- Type of System: Manual/ Semi-Automated/ Automated
- Time duration for which the system remains operational
- Size of the system and its coverage area
- Redistribution requirement

The indicative staff required to run the operations of the system is presented below:

	Staff Resource	Roles and Responsibilities	Indicative Staff Required based on System Size Fleet Size: 500 cycles; 50 Stations; 750 docks		
			Manual	Semi-Automated	Automated
Control Center	Operations Manager	Overall smooth operations and management of the PBS project and customer satisfaction	1	1	1
	Shift In-charge	Shift management for the operations of the PBS with desired service levels	3	3	3
	Control Center Operators	Nodal point of contact for information dissemination; ensure circulation of cycles and monitoring PBS performance	0	5	5
	Customer Service - Call Center	Support customers for queries, information and complaint redressal	0	5	5
	Administration	Support routine office administration and project functions	2	2	2
	Human Resources	Recruitment, training, payroll and other HR related functions	3	3	2
	Marketing Manager	Marketing, advertisement and public outreach of PBS	1	1	1
	Accounts	Accounting, cash management and bank transfers	2	2	2
Field Operations	Station Attendant	Support the customers in issuance and receiving of cycles; ensure minimum cycles are maintained in coordination with Control Centre	120	120	0
	Point -of Sale Operators	Distribution of smart cards/passes and collection of cash and refunds	0	12	12
	Driver	Driving redistribution vehicles and circulation of cycles	12	12	12
	Helper	Support redistribution vehicle driver in shifting cycles	12	12	12
Support System	IT Support	Maintenance and upkeep of IT and other automated system deployed on the project	0	5	5
	Workshop Mechanics	Maintenance and repair of cycles	5	5	5
	Guard	Security of the premises and material in the workshop, stores and Control Centre	4	4	4
	Cleaner	Regular cleaning of cycles and docking station	11	11	11
Total Staff Required			**176**	**203**	**82**

APPENDIX D: STAFF REQUIREMENT

Following are the key assumptions for the two system sizes based on manual or automated PBS system. These assumptions and the exact operations team requirements should be determined by the city based on their requirements.

ASSUMPTIONS:

Parameter	System 1
Fleet Size	500 cycles; 50 stations
Number of Docks	750
Number of Redistribution Vehicles	5
Number of operating shifts	2
Control Center along with workshop space and storage	1
Point of Sale Locations	5
Relieving Staff	20%

APPENDIX E:

TERMS OF REFERENCES

Task 1: Project Inception

A PBS system must fit into a city's larger mobility vision. In most cities around the world, PBS implementation has been preceded by the implementation of other measures to improve the cycling environment as part of a city-wide strategy for sustainable mobility. It is important to identify the goals of a city with respect to PBS, such that complementary measures could be implemented simultaneously to ensure success. In this task, the consultant will evaluate and determine the viability of deploying a bicycle sharing system. The task will utilize available secondary data to identify key components of the city's PBS scheme. The objectives of this task are to:

- Collect, compile and review available data to understand the city's existing and projected transportation scenarios.
- Conduct stakeholder consultations to understand the goals, objectives and priorities related to implementation of the PBS scheme.
- Determine the service area and present best practices that are closely related to city's conditions.
- Assess the existing resources, capacity and opportunities to plan, implement and monitor PBS.
- Evaluate the feasibility of the Public Bicycle Sharing Scheme in the city.

This task will include the following activities:

Task 1.1: Project Coordination/ Kick-off Meeting

At this meeting, data sources will be identified, roles and responsibilities will be clarified, protocols will be established, and work program modifications will be discussed. Also important to be determined at this meeting are the key stakeholders, the approach to public engagement and the pre-conditions for public and political ownership and approval. During this phase, the consultant will also conduct meetings with key stakeholders to discern the critical issues and aspirations associated with the PBS detailed project report.

Task 1.2: Existing Conditions Inventory and Review of Available Data

The consultant will conduct a site reconnaissance visit to gauge the physical conditions of the city. Additionally, the consultant will examine existing and planned bicycle infrastructure, compile available data and analyze planning documents pertinent to bicycle infrastructure, including but not limited to:

- City's Development Plan
- Comprehensive Mobility Plan
- Mass transit Proposals
- NMT Improvement Plans

In addition, the consultant will identify the activity centres and transportation network that will be supportive for the implementation of a bicycle sharing scheme in the short term as well as opportunities for expansion in the long-term. The details such as topography, climate, etc. shall also be considered which impacts the design of the system.

Task 1.3: Review of Best Practices

In this activity, the consultant will compile and present best practices from India and around the world, showcasing the following components:

- **System Planning:** Components of PBS including types of bicycle share systems possible, network of stations, siting criteria, design parameters, bicycle components;
- **Infrastructure:** technology used, system size, integration with transit systems, security systems;
- **Program Management:** Costs, Business or Financial Models, Bicycle Redistribution

- **Implementation:** Institutional arrangements, fare integration, branding, advocacy, user information, marketing, maintenance, monitoring and evaluation.

Task 1.4: Identify Preliminary Coverage Area

The consultant will work closely with the city officials to clearly define the coverage area for the PBS based on the data available. The general area will integrate with any of the city's planned cycle tracks, public bus service routes and key activity nodes in the planning area.

Task 1.5: Stakeholder Meetings

The consultant will conduct meetings with key implementing stakeholders to discuss the following topic areas:

- Vision for the PBS system
- Integration with the Master plan's vision
- Integration with other modes of transport and NMT infrastructure
- Co-ordination and Oversight
- Potential Funders/ Financers

TASK 1 DELIVERABLES:

- Kick-off Meeting
- Stakeholder Meetings
- Project Inception Report

Task 2: PBS Station Sizing, System Planning and Design

Based on the data collected in Task 1, the consultant will conduct a demand estimation for the potential PBS scheme in the city. Utilizing the data, the consultant will further fulfill the following objectives of this task:

- Refine the coverage area incorporating relevant comments shared during the workshop.
- Provide a projection for the potential size, scale and phasing of a PBS system
- Develop conceptual system plan and detailed design elements
- Identify implementation considerations for PBS
- Define risks and challenges for implementing PBS systems design and potential mitigation strategies to minimize the risks

This task will include the following activities:

Task 2.1: Station Sizing

Based on the review of data compiled related to the modal share, land use analysis, transit service assessment, planned travel pattern of the study area, stakeholder interviews and evaluation of existing conditions, the consultant will determine the following parameters of the proposed PBS system:

- Potential size and scale of the system which include: Number of cycle stations, location of cycle stations and number of bicycles required.
- User groups most likely to participate in the PBS scheme
- Primary trip purposes

As the concept of PBS is in its nascent stages in the Indian context, the primary surveys of travel pattern could be supported with the secondary data and also standard parameters utilized for station sizing.

Task 2.2: System Planning and Design

Defining the appropriate PBS system size is critical to determine the popularity of the project right from the beginning. The system size if excessively estimated would definitely get the operations running into losses whereas if undermined, would lose even the potential users due to the unavailability of bicycles at peak hours, which is when it's most needed. Based on the demand analysis (and also considering the scope of future expansion), the consultant will then create a conceptual operation plan and detailed design components including the following components:

- Creating a network of stations
- Integration with NMT infrastructure and bus routes/transit stops
- Estimations of bicycles at different stations
- Design of bicycles and helmets
- Docking station design
- Bicycle depot
- Redistribution arrangements of bicycles
- Maintenance requirement design for bicycles
- Use of Intelligent Transport Systems (ITS) for fare collection, access and operations (cycle locking, smart cards, fare integration, central monitoring/control, PIS-apps &websites, management information system)
- Human Resources requirements

Task 2.3: Operational Plan

Operations of public bicycle share system are critical as it services the final end purpose to the user. The conceptual operational plan will be prepared which includes the following items,

- Service Level Standards and Benchmarks and their monitoring procedure
- Manual and automated operational alternatives
- Fare Structure Design and provisions for passes and discounts for special categories and renewal of the same
- Recommendations on registering the users
- User information requirements
- Bicycle redistribution
- Incident management measures
- Operating personnel training requirements

TASK 2 DELIVERABLES:

- Station Sizing Details
- Conceptual Operational Design and Requirements
- Systems Planning and Design of Components

Task 3: Business and Financial Plan

A strategic business plan shall be created for the designed public bicycle share system based on the planned operations and different components of systems. The plan should discuss,

- Institutional arrangements to implement and manage PBS;
- System monitoring, evaluation, optimization and expansion
- Costs, Revenues of System and Financing Options

Task 3.1: Institutional arrangements to implement and manage PBS

Propose institutional alternatives that will ultimately ensure proper coordination between the project implementing unit and other external organizations during the implementation and operationalizing phases. Various stakeholders in the implementation and operation of PBS need to identified and roles/responsibilities of each stakeholder need to be clearly defined. At minimum, it should identify institutional arrangements and roles and responsibilities for:

- Planning/designing body
- Project Implementation Unit
- Operating and management body
- Enforcing body
- Private sector

Task 3.2: System monitoring, evaluation, optimization and expansion

The periodic evaluation of the system (before and after) and thus taking actions (changes, modifications, improvements to the system) to achieve the benchmarks is necessary to successfully operate the PBS system. The scope for further expansion of the system and corresponding requirements and the way for scaling up or modification should also be suggested.

Task 3.3: Costs, Revenues of System and Financing Options

Financial analysis need to be performed considering all the financial costs and revenues to maximize the internal rate of returns by trying the different possible alternatives of financing, fares, investment returns period, and components of systems, etc.

- **Capital Costs** including bicycles and helmets, stations, ITS Infrastructure [including control center], depot, redistribution units, and project implementation management
- **Operation and Maintenance Costs** including preventive, periodic and breakdown (repair) maintenance of bicycles; maintenance of stations; human resources; redistribution; marketing and outreach; passenger information services; bicycle insurances; Point of Sale (POS).
- **Revenues from different sources or various financing options** along with the recommendations/steps to avail them can be suggested. Various revenues or financing options can include below but not limited to:
    - User Fees
    - Carbon Credits (as per applicability)
    - Advertisements/Sponsors
    - Funding from Government bodies (city, state, MoUD)
    - Loans or grants from financial institutions
    - PPP (Public Private Partnerships)

Task 3.4: Branding Strategy

The following components will be analyzed as part of the branding and community outreach:

- Branding design of PBS
- Advocacy, communications, building media support and social marketing of PBS
- Internal and External Marketing (Capacity building of government officials, media, operators, and other allied agencies and also the users)
- Outreach Plan (before, during and after the implementation)

TASK 3 DELIVERABLES:

- Business and Financial Plan

Task 4: Work Plan and Final Report

Once the components of system, financial and operational plans are finalized, the work plan needs to be defined. As part of work plan the following activities need to be addressed,

- Identifying the different tasks/activities from conception to the implementation and required durations for the same
- Implementation challenges or constraints and overcoming strategies
- Project Gantt chart showing the sequence of activities and time lines for each activity and key mile stones for the project
- Phasing of the project in different of periods and corresponding stations and size of the system

TASK 4 DELIVERABLES:

- Final DPR